UDC 001.9
DOI https://doi.org/10.32782/2308-6971/2024.1.13

CITESWOODID – A CAPABLE APP BASED IDENTIFICATION TOOL FOR LAW ENFORCEMENT OFFICERS AROUND THE GLOBE (CITES LISTED TIMBERS)

Many (tropical) woods are traded across borders and are subject to various protective regulations. The most important and successful international species protection convention is the Washington Convention on the Protection of Species (CITES) (Convention on the International Trade in Endangered Species of Wild Fauna and Flora) and its implementation in the European Union by help of the Species Protection Regulation (EC) No. 338/97 (with the implementing regulations) as well as its practical enforcement and punishment by help of national legislation. While commercial woods and timber were initially only listed to a small extent in CITES appendices (especially mahogany [CITES II - first listing in 1992], Rio rosewood [CITES I - first listing in 1992]), they are gradually being listed in CITES because of the loss of habitat and targeted deforestation. After the 19th CITES Conference of the Parties as of 2022, 53 wood species or higher taxa are listed in CITES.

This background paper introduces the utilization of the CITESwoodID app/program and explains its practical application, the probe preparation of controlled wood / timber. In addition, it provides an insight into new wood anatomy research and findings to identifying traded wood and new developments in the area of species protection law for wood, which are becoming increasingly relevant for the customs administrations of the European Union and around the globe. It should consequently lead to an improvement in the detection rate of illicit traded woods and timbers worldwide within the framework of the World Customs Organization.

Key words: Wood, Timber trade, Customs controls, Wood controls, Timber controls, CITES, Wood anatomy, App based identification, Law enforcement, Database, World Customs Organization.

JEL Classification: E26, F14, F53, K33, K34, K42, Q37.

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Introduction. Many (tropical) woods are traded across borders and are subject to various protective regulations. The most important and successful international species protection convention is the Washington Convention on the Protection of Species (CITES) (Convention on the International Trade in Endangered Species of Wild Fauna and Flora) and its implementation in the European Union by help of the Species Protection Regulation (EC) No. 338/97 (with the implementing regulations) as well as its practical enforcement and punishment with the help of national legislation. While commercial woods were initially only listed to a small extent in CITES appendices (*Swietenia mahagoni* [CITES II – first listing in 1992], *Dalbergia nigra* [CITES I – first listing in 1992]), they are gradually being listed in CITES because of the loss of habitat and targeted deforestation. After the 19th CITES Conference of the Parties as of 2022, 53 wood species or higher taxa are currently listed in CITES.

The author of this background paper had the opportunity to take part in the two-day "International Work-shop on Identification on CITES-protected timbers" of Germany's Federal Agency for Nature Conservation (BfN), which took place from September 14th to 15th, 2023 at the federally owned German Thünen Institute for Wood Research in Hamburg (Johann Heinrich von Thünen Institute – Federal Research Institute for Rural Areas, Forestry and Fisheries, URL: https://www.thuenen.de/en/thuenen-institute/about-us/the-institute,

abbreviation TI) which has been held in English for European customs administrations and other affected environmental authorities. International participants from France, the Netherlands, Switzerland and Italy were present.

This background paper introduces the utilization of the CITESwoodID app/program and explains its practical application. In addition, it provides an insight into new research approaches to identifying traded wood and new developments in the area of species protection law for wood, which are becoming increasingly relevant for the customs administrations of the European Union and around the globe. It should consequently lead to an improvement in the detection rate of illicit traded woods and timbers worldwide within the framework of the World Customs Organization.

The app / program CITESwoodID. The app / program CITESwoodID was developed by the BfN in Germany by help of tax funding with the aim of being able to identify the tree species listed in CITES using simple means by employees of customs authorities, other environmental law enforcement authorities (e.g. nature conservation authorities) and the timber industry who work in species protection enforcement.

The idea is not new – a first version was published as a CD-ROM PC program in 2008 (Koch/Richter/Schmitt, 2008, Koch/Richter/Schmitt, 2011). The idea of the collection of wood anatomy data in a database is not new and goes way back to 1980.

The new app is particularly designed for mobile devices and it works offline. It is currently available in both the Apple App Store (iOS) and the Google Play Store, but there are also other versions, such as Windows versions for tablets or notebooks and Apple versions for tablets or notebooks. The app can be accessed directly at the URL: https://www.citeswoodid.app (BfN, 2023). It is offered in various language versions – in addition to German, English, French and Spanish and is aimed not only at the German user market but at the entire European Union and, far beyond, at a global user base.

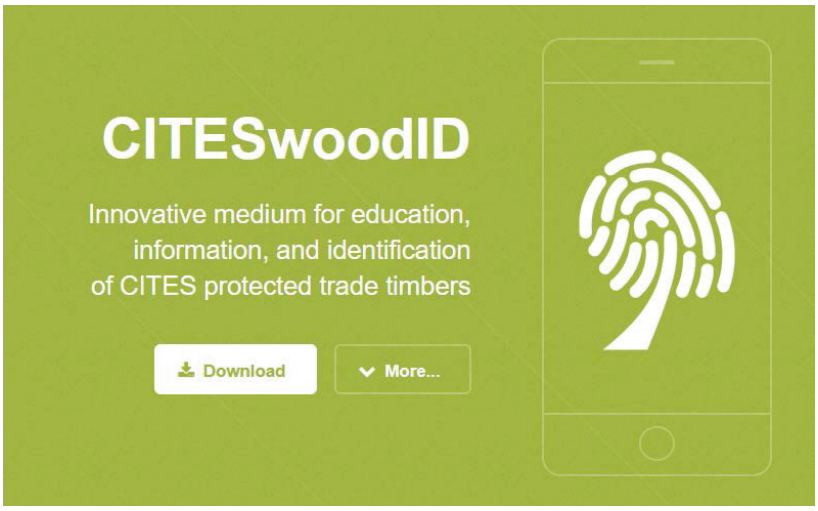

Figure 1. Download page on the Internet

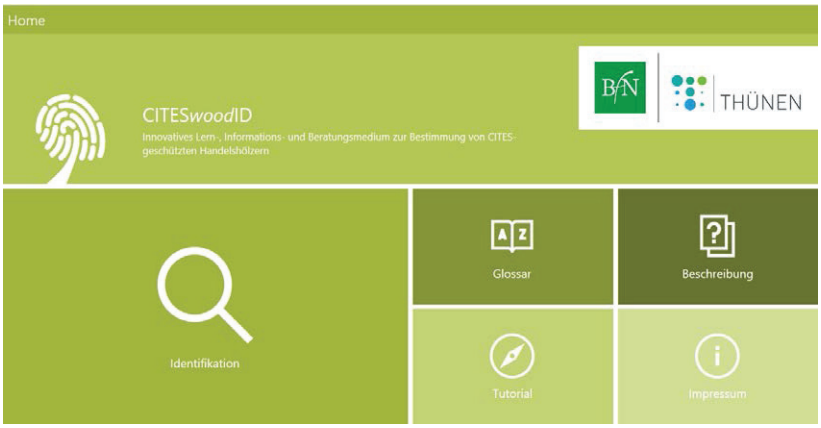

Figure 2. CITESwoodID home screen

The start screen offers five different windows to choose from. The author tested both a mobile Android version on the smart phone as well as a Windows version and an Apple version on the tablet – all three versions work smoothly, but the larger screen width is easier on the eyes and better suited for identification using images. One tile offers a brief introduction to the app (tutorial) and one tile describes the creation of the app, responsibility and exclusion of rights (legal notice).

35 important terms that are important for identifying the wood are explained in the "Glossary", e.g. parenchyma, fiber, early wood, wood – ring-pored, etc. A brief introduction to wood identification and wood anatomy is given in the "Description" tile. In particular, the anatomy of the tree is explained. In addition, the different cutting planes through the wood are explained.

The main part of the CITESwoodID app is the large "Identification" tile. In its current version, the CITESwoodID represents 53 CITES-listed woods (e.g. afzelia, mahogany, Rio rosewood, ramin and rosewood) that are traded internationally as raw wood or in finished products (BfN, 2023). In addition, 32 commercial woods are listed in the app that can be confused with the CITES-listed genera and species – so-called look-alike species (BfN, 2023). One advantage of the CITESwoodID app (which is currently available in version 1.1.1) is the ability to quickly adapt to any new CITES listings of other tree species that may be introduced in the future.

Preparation of a wood sample and its exploration. The technique described here is used to prepare samples for examination with a magnifying glass (so-called hand magnifier). All you need is a small piece of the wood to be analyzed, a sharp knife – preferably a cutter (from the hardware store, etc.) and the CITESwoodID app. A straight cut surface must be made for sample preparation. Only smooth surfaces show the structures of the wood anatomy in detail. It should be noted that magnifying glasses are included in the basic equipment of the customs administrations and are essential for the examination of samples by customs officers who take samples. Sharp knives and cutters are very cheap products and can be supplied on demand.

The use and approval of CITESwoodID for customs administrations is necessary for the successful on spot inspection and control of woods and it makes sense, especially since it is an app for successful species protection enforcement financed by the federal administration and tax revenue.

Step by step identification of timbers. A step-by-step procedure is required to identify the wood. In addition to the magnifying glass (ideally 8 – 10x magnification) and the sharp cutter knife, our eyes and nose are important because the color and grain of the wood and the smell (strong smell present or not) may play a role in its identification – visual and olfactory tests.

Other information available to customs authorities is important – where does the wood come from (which continent)? Commercial documents and information provided by the applicant are therefore also helpful for determining or excluding certain tree species and wood.

The following steps are required to prepare a wood:

1. Make a cross section with a cutter knife (a small cut of approx. 1 x 2 cm is usually sufficient (other levels rarely have to be cut as well).
2. Use a magnifying glass (8 – 10x magnification required).
3. Sufficient natural light.

A scientifically sound account of the preparation of a wood sample for hand-held magnifying glass examination has been published in the relevant literature (Wiedenhoeft, 2011). The identification begins with the list of properties (so-called "best features").

With each selection of one of the 47 characteristics available for selection, woods can be excluded and on the right side (the results) fewer possible outcomes are given, so that the initial 85 woods are reduced step by step.

Certain characteristics are included in the characteristics list, which are aimed more at wood and customs laboratories and are not carried out by customs officials in the first on spot inspection of the wood:

- alcohol extract (coloring),
- alcohol extract (fluorescence),
- aqueous extract,
- burning test on splinters,
- foam test,
- Core materials (whether washable in water).

Figure 3. List of properties (so-called "best features")

A basic knowledge of wood anatomy is of great importance. A brief introduction of wood anatomy is given in the "description", but is not enough. A short introduction of around 30 minutes was given in the CITESwoodID workshop.

Example 1: Hardwoods (hardwoods) have pores that are clearly visible in cross section. Softwoods (softwoods) lack these clearly visible pores.

Example 2: In temperate zones, the seasons prevail and trees have clearly visible annual rings in cross-section. In the tropics there are no seasons. Therefore the annual rings are missing.

Illicit Timber Trade Worldwide. A look at the published trade data on the global illegal timber trade shows that it is both informative and frightening. Tropical forests in South America, Africa and Southeast Asia are being cut down at great speed (Figure 4) (Estoque et. al., 2022).

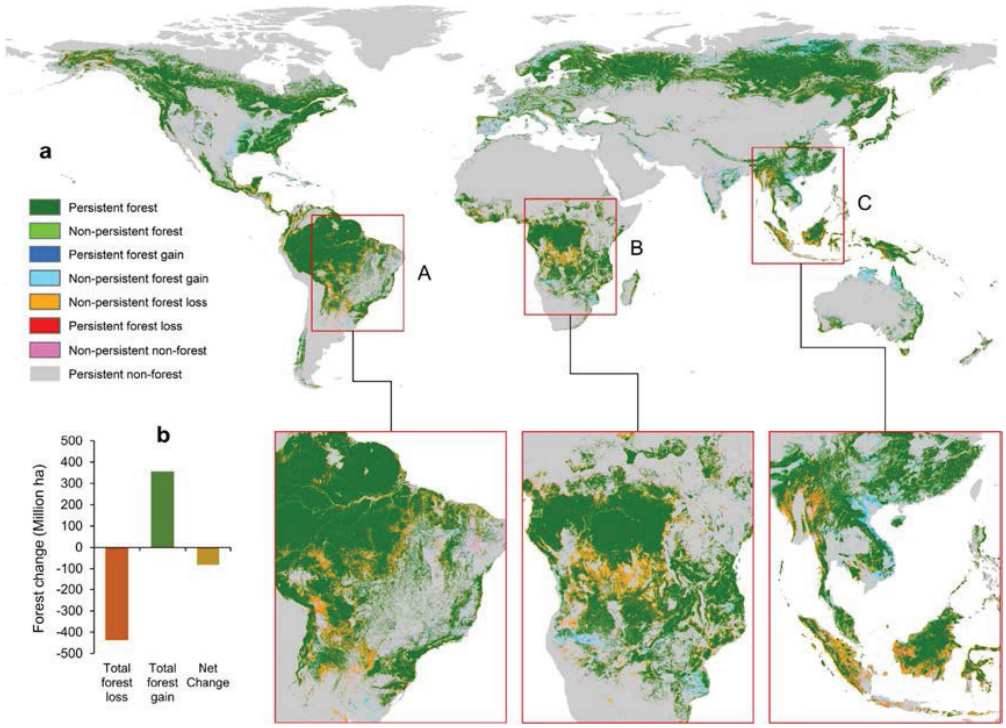

Figure 4. Global forest loss of primary forests between 1960 and 2019

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Natural habitats for plants and animals – entire ecosystems – are lost forever. One driver of deforestation is the harvest of high-priced woods, another is land reclamation for other agricultural purposes (palm oil plantations, soy cultivation, cattle breeding, aquaculture).

INTERPOL estimates that the global trade in illegally traded timber amounts to US$152 billion annually and the NGO WWF estimates that 16 to 19% of the timber imported into the EU comes from illegal sources (Yeoung, 2022). Globally, according to WWF, the proportion of illegally traded wood is around 30 % and in individual developing countries and countries of origin the proportion is actually up to 90 %, depending on the local situation (WWF, 2021).

In many cases, the TI's wood botanists prepare wood anatomical forensic reports, which are used to provide evidence to prosecute wood smugglers and organized crime (Koch/Haag/Heinz/Richter/Schmitt, 2015).

Further legal developments apart from conservation law. In addition to the CITES listing other EU legal developments have to be taken into account since 2010 – namely the implementation of the Tropical Timber Regulation (EU) No. 995/2010 on the obligations of market participants who participate in the global trade of wood and place wood products on the market (this regulation affects wood importers and domestic nature conservation authorities, but not the customs administration), as well as the newly created Regulation (EU) 2023/1115 on the provision of certain raw materials and products that are linked to deforestation and forest degradation, on the Union market and their export from the Union as well as to repeal Regulation (EU) No. 995/2010 – this new deforestation regulation will largely come into force on December 30, 2024 and must be checked by the customs authorities.

This new regulation for prohibited goods controls and monitors the import of wood, coffee, cocoa, rubber, soy, cattle and oil palm, as well as goods made from them, which may be created and benefited by deforestation and is intended to protect the natural primary forests in the countries of origin and origin.

New wood scientific developments that are of importance for law enforcements. At the CITESwoodID workshop, the TI gave some doctoral students (and post-docs) the opportunity to present new scientific findings that they developed as part of their doctoral theses and that are useful for species protection enforcement and the EU customs administrations of great importance are:

– Plywood and wood fiber boards can now be identified not only with regard to the outer layers (the so-called cover wood), but also the inner layers of wood and, in the case of wood fiber boards, the small pieces of wood can be identified at the level of the genus or species (Sieburg-Rockel/Koch/Kaschuro/Helmling/Olbrich, 2019 and Sieburg-Rochel/Koch, 2020).

– Illegally felled wood is processed into paper, especially in Southeast Asia, directly near the felling area. Greenpeace has published corresponding results for Ramin (*Gonystylus spp*., CITES II / App. B EU) (Greenpeace, 2018). Paper and its content and makeup can now be precisely identified based on micro-components of the wood used. The TI working group responsible for this topic has published an atlas of the structural elements of tropical wood species, which can be used, among other things, to identify components of wood in paper (Helming/Olbrich/Heinz/Koch, 2018).

– The type of wood can be identified using a rapid DNA test by the TI if it is a known wood (possibly CITES-listed wood). The process is based on extracted DNA, which must be multiplied using PCR (molecular biological laboratory diagnostics) – the result is available after 24 hours (this is very fast for an exact wood analysis and can be carried out with many problems at the same time) (UNDOC, 2016).

– Charcoal particles in millimeter size are sufficient to determine the type of wood (Haag et. al., 2021 and Haag et. al., 2020). Charcoal is a product that is produced as a "by-product" of deforestation in many tropical forests and is exported.

– Artificial intelligence and machine learning are used experimentally for automated wood species determination (Koch/Koch, 2021a, Koch/Koch, 2021b and Nieradzik et. al., 2023). Individual types of wood can already be reliably identified – but a comprehensive application will still require years of data collection and development.

– More and more new and lesser-known (tropical) wood species are entering the market – it is important to keep an eye on these and advance their wood anatomical and chemical characterization in order to monitor the extent of trade in these woods and ultimately the respective endangerment status of the trees in the country of origin to understand (Haag, 2019).

– Basic research in the field of wood anatomy and wood identification is of course not only carried out by the TI in Hamburg, but worldwide. Other approaches and background contributions should be

mentioned here as examples (Low et al., 2023, De Palacios et. al., 2020, Gasson/Baas/Wheeler, 2011, Schmitz et. al., 2019).

Conclusion. At the two-day international workshop on identifying CITES-listed wood, a computer-based CITESwoodID app was presented that enables controlling officials in customs authorities and employees in other nature conservation authorities to easily identify wood for the first time in control situations. This CITESwoodID app is available free of charge in four languages (German, English, French and Spanish) in the Apple App (iOS) Store and Google Play Store. It should be used in order to be able to make initial findings about the wood found during sampling and in control situations.

The use of the CITESwoodID app does not replace expert reports in public prosecutor's proceedings and in this respect it does not constitute evidence or an expert report that can be used in court. However, it can provide clarity in practical dealing with unclear situations.

In addition to the CITESwoodID app presented here, the TI also offers another, more extensive database: the macroHOLZdata app (also available in the Apple App Store and the Google Play Store) with 153 included wood species or higher taxa of the mainly traded woods (also with CITES protection status, if applicable) – the 53 currently listed woods are therefore also included (Koch, 2022).

The TI "Commercial Timbers" database contains 409 commercially used tree species with their wood anatomical characteristics (TI, 2023).

And at the end a helpful note for the practical use in the backoffice: All data contained in CITESwoodID is also available online on the Internet at the URL: https://www.delta-intkey.com/citeswood/de/index.htm – however, navigation is more difficult and unstructured (Richter/Gembruch/Koch, 2014).

This consequent utilization of this new CITESwoodID app based technique should lead to more successful customs controls and better results in controls in illicit trans-border timber trade worldwide not only but also by customs authorities. The WCO network should also lead to a better capacity building of customs officers with the CITESwoodID app.

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CITESWOODID – ЕФЕКТИВНИЙ ЗАСТОСУНОК ІДЕНТИФІКАЦІЇ ДЛЯ ПРАВООХОРОНЦІВ ПО ВСЬОМУ СВІТУ (ПОРОДИ ДЕРЕВИНИ ЗАХИЩЕНІ CITES)

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Багато видів (тропічної) деревини є об'єктами міжнародної торгівлі і підпадають під дію різних захисних норм. Найбільш важливою та ефективною міжнародною конвенцією щодо захисту видів є Вашингтонська конвенція про захист видів (CITES) (Конвенція про міжнародну торгівлю видами дикої фауни і флори, що перебувають під загрозою зникнення) та її імплементація в Європейському Союзі за допомогою Регламенту про захист видів (ЄС) № 338/97 (з підзаконними актами), а також її практичне застосування та покарання за допомогою національного законодавства. Хоча ділова деревина і лісоматеріали спочатку були лише

незначною мірою перелічені в додатках до CITES (особливо червоне дерево [CITES II – перше внесення у 1992 році], палісандр ріо [CITES I – перше внесення у 1992 році]), вони поступово потрапляють до CITES через втрату ареалів і цілеспрямовану вирубку лісів. Після 19-ї Конференції Сторін CITES, станом на 2022 рік, до CITES занесено 53 види порід деревини або вищих таксонів.

У цій довідковій статті представлено використання застосунку/програми CITESwoodID та пояснюється його практичне застосування та підготовка зразків контрольованої деревини/лісоматеріалів. Крім того, в ній розглядаються нові дослідження анатомії деревини та результати ідентифікації деревини, що є предметом торгівлі, а також новели в галузі законодавства про охорону видів деревини, які стають дедалі актуальнішими для митних адміністрацій Європейського Союзу та всього світу. Використання застосунку може призвести до підвищення рівня виявлення незаконної торгівлі деревиною та лісоматеріалами у всьому світі в рамках Всесвітньої митної організації.

Ключові слова: деревина, торгівля деревиною, митний контроль, контроль деревини, контроль лісоматеріалів, CITES, анатомія деревини, ідентифікація за допомогою застосунку, правоохоронні органи, база даних, Всесвітня митна організація.