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Scientific testing techniques & technologies to support origin and species identification

This guide will help you identify the origins and species of products and commodities in order to halt deforestation and illegal trade.

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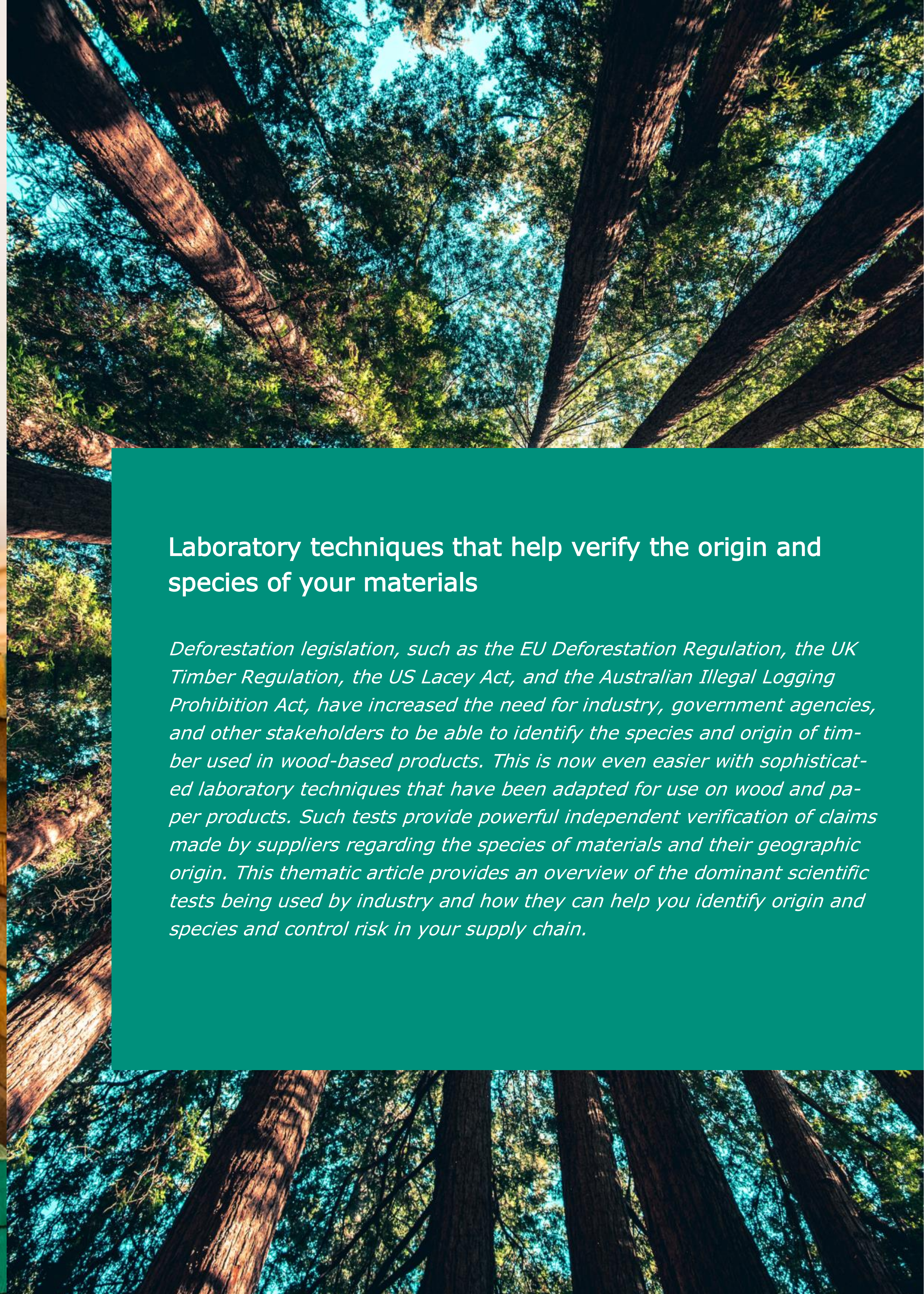


Laboratory techniques that help verify the origin and species of your materials

Deforestation legislation, such as the EU Deforestation Regulation, the UK Timber Regulation, the US Lacey Act, and the Australian Illegal Logging Prohibition Act, have increased the need for industry, government agencies, and other stakeholders to be able to identify the species and origin of timber used in wood-based products. This is now even easier with sophisticated laboratory techniques that have been adapted for use on wood and paper products. Such tests provide powerful independent verification of claims made by suppliers regarding the species of materials and their geographic origin. This thematic article provides an overview of the dominant scientific tests being used by industry and how they can help you identify origin and species and control risk in your supply chain.

Introduction

The following guide outlines the scientific testing methods which are available for the EUDR commodities including palm oil, soy, timber, rubber, cattle, cocoa and coffee. Further, this guide also discusses the key methods used for timber and the laboratories to contact for further information.

The European Union Deforestation Regulation (EUDR) stipulates that companies placing relevant products onto — or exporting them from — the EU market must establish due diligence systems, ensuring that these products are deforestation-free.

The regulation also includes requirements for the identification of the geographic location of production or harvesting (timber) down to the level of individual farm or forest plots.

Scientific methods like Stable Isotope Ratio Analysis (SIRA) can often verify the general locations where commodities have been grown. However, the resolution of these techniques usually cannot pinpoint geography at the farm level. This is due to either the limitations of current scientific methods or the reference material available. Nevertheless, these technologies can serve as effective mitigation tools within a company's due diligence system. The technologies and methods for testing that are available are outlined below:

Genetic Analysis: Techniques like DNA barcoding can determine the species and occasionally the geographic origin of a product (i.e. for Oak). This method is especially useful for commodities derived from animals or plants, such as timber or meat.

Stable Isotope Ratio Analysis: Isotopic ratios can vary by geography. Scientists can infer a commodity's geographic origin by analysing these ratios.

Trace Element Analysis: Soil and water composition vary worldwide, influencing the products grown in these regions. By comparing the trace metal and elemental "fingerprint" of a commodity to a known database of profiles, its origin can be deduced.

Remote Sensing: Satellites can monitor land use changes in near real-time, aiding in tracking the movement of commodities from farm or forest to market. This can help identify illegal deforestation or other unsustainable practices.

Blockchain Technology: Though not strictly scientific, blockchain technology can secure a transparent record of a commodity's journey from origin to consumer, simplifying the verification of sustainability or deforestation-free production claims.

The technologies currently available have both strengths and limitations, and none of them provide a complete traceability solution.

However, combining multiple methods with due diligence can help ensure robust and reliable systems for verifying the origin of commodities — a crucial aspect of the EUDR.

The level of traceability for each commodities differs, see below a summary for each commodity:

Palm Oil: Grown across Southeast Asia, Africa and South America, the origin of palm oil can potentially be determined through Trace Element Analysis and Stable Isotope Ratio Analysis. However, due to the extensive processing and blending that palm oil undergoes, tracing is complex.

Currently, it is very difficult to trace products that contain palm oil. However, it's possible with adequate reference material to identify when palm oil comes from a country that is not declared as a source.

Soy: A major crop in the Americas, specifically in Brazil, the United States and Argentina. It is possible to trace soybeans using Trace Element analysis, Isotopic methods, and possibly DNA analysis.

Wood: Wood origin and species can be identified using DNA barcoding, DART Spectrometry, or traditional Wood Anatomy. Trace element analysis and Stable Isotope analysis can provide more information about a wood's geographic origin.

Rubber: Natural rubber, primarily from the rubber tree, is grown in Southeast Asia, Africa and South America.

The origin of rubber can potentially be traced using similar methods to those for palm oil, but it faces some limitations.

Cattle: It could be possible to determine the geographic origin of cattle through Stable Isotope Ratio Analysis, DNA barcoding, and even analysis of the Gut Microbiome.

Cocoa: Mainly grown in West Africa, particularly in Côte d'Ivoire and Ghana. It is possible for cocoa to be traced through Isotopic and Elemental analysis methods. However, adequate reference material is required for analysis.

Coffee: Arabica and Robusta, the two main types of coffee, are grown in different regions and could be distinguished using Trace Element analysis and DNA analysis. Furthermore, the Stable Isotope Ratios in coffee can indicate its geographic origin.

It is important to remember that these testing techniques are still developing. Tracing the origin of these commodities remains complex due to factors such as extensive global supply chains, the blending of products from different origins, a lack of reference databases, and the limited resolution of current traceability methods.

Therefore, tracing origins and species should be paired with other approaches like remote sensing and the implementation of other traceability solutions to support origin identification.

Timber Testing Techniques

Timber: which risks can be detected using testing techniques?

Conducting due diligence on timber supply chains can be tricky. To ensure your products are not at risk of including illegal timber, a range of factors need to be assessed. Among these are the risks associated with the tree species included in products and the origin of the wood. This is now even more critical with EU regulation requiring identification of the origin of the plot of land from where the wood was harvested.

Further, species and origin information are often key to indicating legal non-compliance because high-value and endangered species are more at risk of illegal harvesting, and some countries and regions are well-known for corruption and poor law enforcement. When collecting information to indicate the legality of your timber products, it is necessary to rely on supplier statements and supporting documentation.

Laboratory techniques provide verification of supplier claims and give you improved confidence that your supplier's statements are true and that their documents are legitimate.

There are many new scientific testing methods becoming available to the timber sector with the underlying technologies improving as additional reference datasets become available. Here we explore the three most prevalent commercially available methods:

1 **Wood Anatomy** (macro- and microscopic) analysis (Species)

- ⇒ Traditional Wood Anatomy
- ⇒ Machine Vision Identification

2 **DNA Analysis** (species and origin)

3 **Mass Spectrometry (species and origin)**

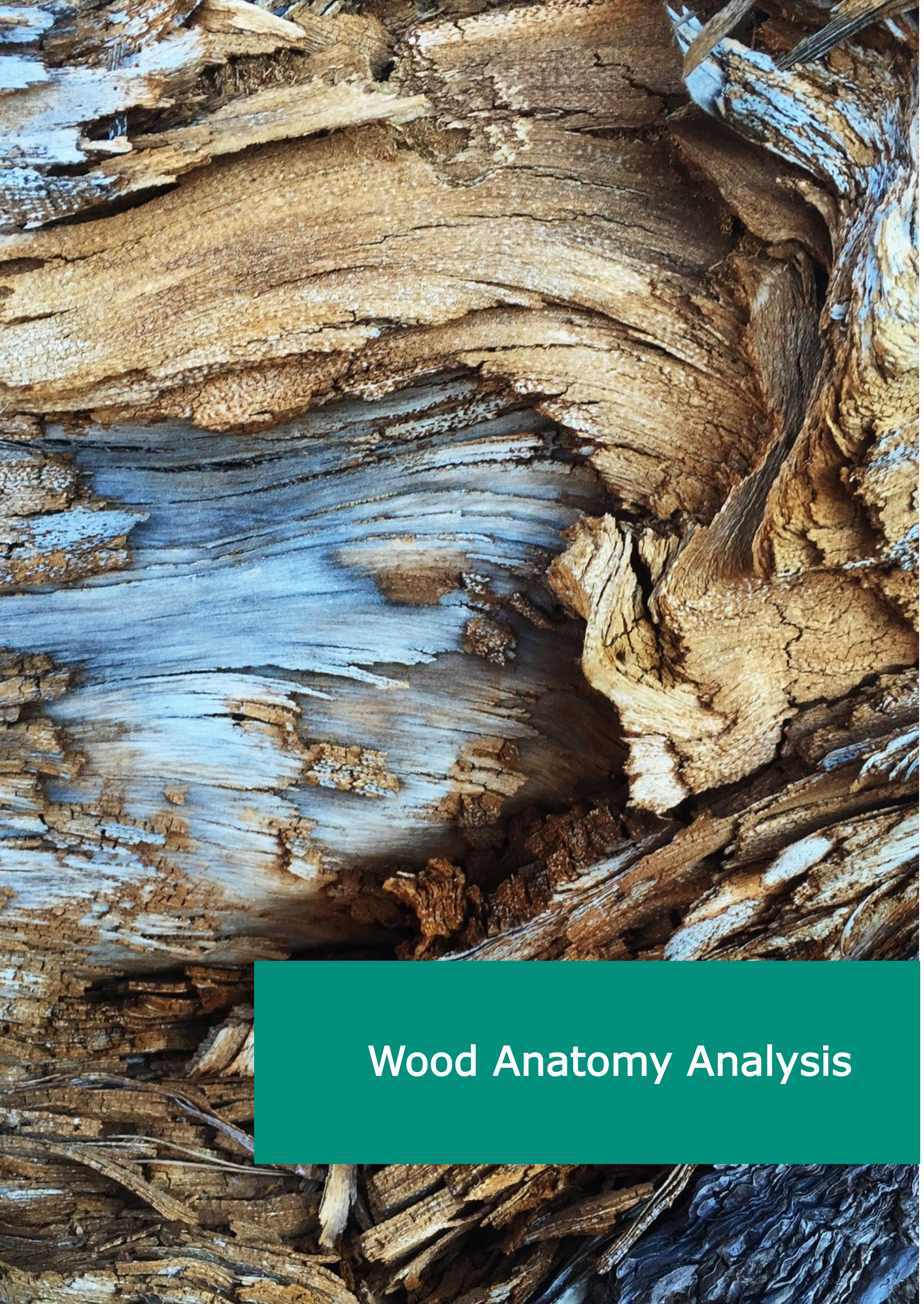
- ⇒ DART-TOFMS (species identification)
- ⇒ Stable Isotope Ratio Analysis (SIRA) (Origin)
- ⇒ Trace Element Analysis (Origin)

The selection of technique depends on the type of product being tested, the information you are seeking to verify (origin or species) and the capacity of the technology.

A critical component to understand is the degree of precision that is required. For example, in relation to genus or species, or the granularity of origin information required (FMU, region, or country).

It should be noted that the precision and validity of the results are not guaranteed and rely on a range of factors such as the number of samples provided, the level of processing of the wood (mixing, heating, glueing, staining, etc.) and the availability of reference datasets.

When undertaking such tests, it is important to clearly outline your needs to the laboratory and to ask about the benefits and limitations of their methods in relation to the questions you are asking. Preferred by Nature can support you in understanding the advantages and limitations of testing, which test will be most beneficial, and helping you to ask the right questions.



Wood Anatomy Analysis

1. Wood Anatomy Analysis

Wood Anatomy analysis uses characteristic differences in wood grain, pores and colour to verify timber at the genus or species level.

Generally, wood can be identified at the level of genus and sometimes species based on macroscopic wood anatomy. Observations of wood are taken in three planes – transverse, radial, and tangential – to create a 3D model of the wood structure.

Differences in structural elements between samples can be identified and used to determine the genus or species of the wood by comparing the structure to libraries of reference material. Reference databases are expanding, and some are freely accessible online, for example CITESwoodID and Insidewood.

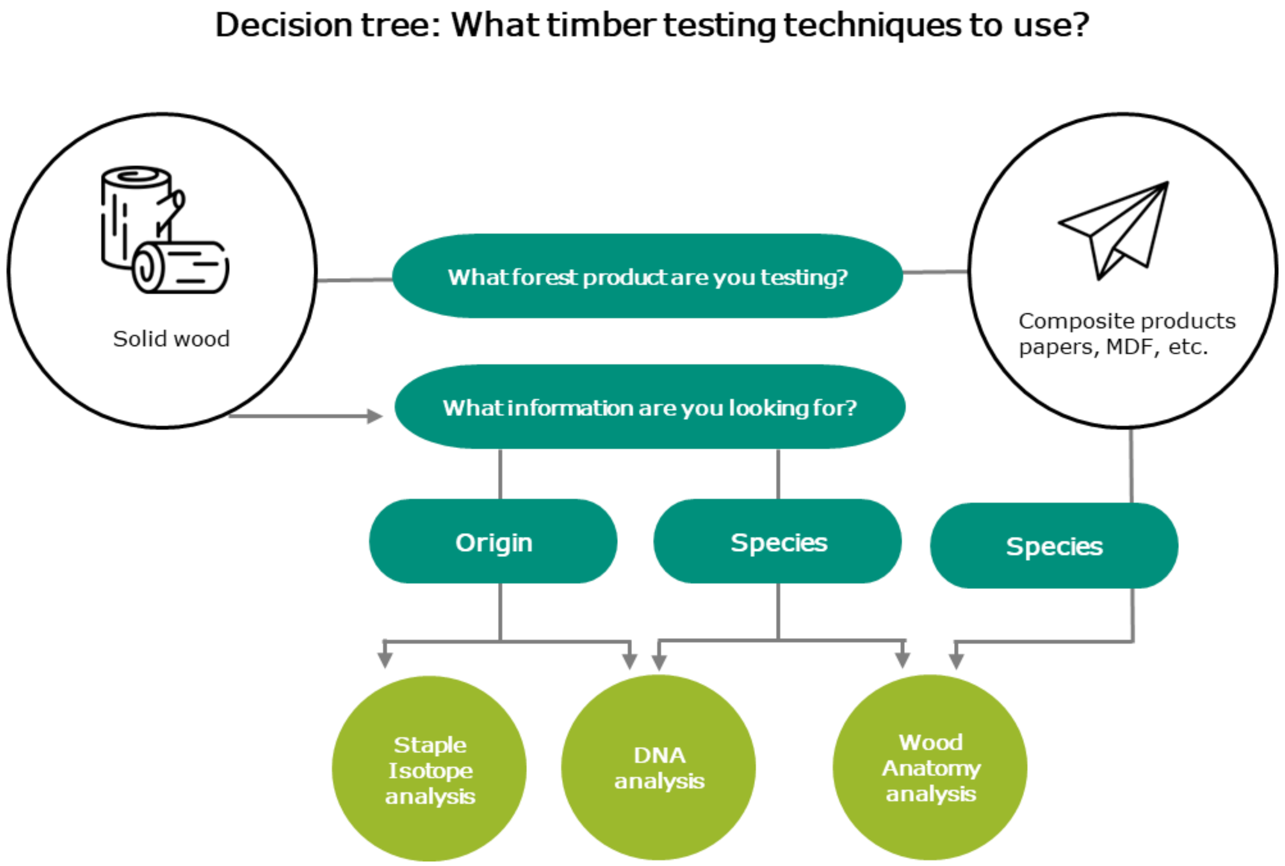


Figure 1: Timber testing techniques based on World Resources Institute's original graphic from this blogpost http://www.wri.org/blog/2015/09/4-cutting-edge-technologies-catch-illegal-loggers (WRI, 2015)

Guide to Macroscopic Analysis

1.1 Macroscopic Analysis

Macroscopic analysis involves using the wood grain and larger anatomical features of wooden samples with the unaided eye or a hand lens. The technique is quick to conduct and is very useful for providing at least an indication of the possible species group involved.

This requires a high level of expertise, so it is important to check the qualifications of the party doing the analysis. For example, red and white oak species can be distinguished using the naked eye by looking at the end grain (transverse plane).

The pores found in the growth rings of red oak species are open and porous, while white oaks have pores that are plugged with tyloses.[3]

Pores can be studied to distinguish East Indian rosewood (Dalbergia latifolia) from Brazilian rosewood (Dalbergia nigra). East Indian rosewood has about twice as many pores per square inch as Brazilian rosewood. Figures 2 and 3 below from the Wood Database[4] show the differences, with Brazilian rosewood having well-spaced pores and Indian rosewood having much more densely packed pores.[5]

Figure 2: Brazilian rosewood

Figure 3: East Indian rosewood

Similarly, when looking at the transverse plane of oak, it may be possible to see small dark brown streaks (called ‘rays’). Red oak species usually have short rays of between 3—13 millimetre (mm) (though occasionally up to 25mm in length), whereas white oak species have much longer rays, frequently exceeding 19mm.

The visibility of distinguishable elements with the naked eye or hand lens, however, places restrictions on macroscopic techniques.

This method is only suitable for identifying genus rather than species. It can only be used for solid wood products, not for composite products (e.g., MDF, OSB, paper), due the processing which degrades the wood grain. Origin cannot be determined by macroscopic analysis.

These tests can be conducted internally by a staff member with proper training. Alternatively, most laboratories offering microscopic testing can also provide macroscopic analysis.

1.2 Microscopic Analysis

Microscopic identification involves looking at small anatomical structures of wood, such as tracheids and vessels, using a light microscope or more recently, optical instruments that use artificial intelligence models to identify species or genus.

Microscopic analysis is usually adequate to identify a wood sample to the genus or sub-genus level but not to the level of individual species. This means, for example, a sample could be identified as oak (Genus: *Quercus*) or as one of the white oak species (e.g., *Quercus alba*, *Q. robur, Q. ilex*, etc.), but cannot be identified as to which of the white oak species it is. It would not be possible to identify if the species were *Quercus alba* or *Quercus robur*. Machine learning devices offer the potential to improve the ability to distinguish between the white oak species and other species that cannot be distinguished by the human eye.

The utility of microscopic testing was demonstrated in a study conducted by the UK Competent Authority for the EU Timber Regulation[6] in 2005. They looked at 13 samples of Chinese plywood purchased from UK companies using microscopic testing and found that the species contained within nine of the samples did not match the species declaration supplied by the company (Pillet & Sawyer, 2015).

Microscopic analysis can be used for most solid wood specimens, including very thin veneer layers (thickness <0.20 mm) and wood chips.

It can also be used for some composite products (e.g., plywood, chipboard, and oriented strand board). The utility of microscopic analysis is possible but limited for products in which the structural elements required for identification are very small and for products that have been significantly physically or chemically altered.

This includes particleboard, wood-plastic composites, paper, wood flour, and some types of fibreboard. The Centre for Wood Anatomy Research of the US Forest Products Laboratory is currently working to improve microscopic techniques for these product types (Wiedenhoeft, 2014).

Anatomical uniqueness is also a limiting factor for microscopic analyses. Closely related timber species can be mistaken due to similar wood anatomical patterns and structures e.g., Swietenia species (WWF, 2011).

The limitations of Microscopic analysis have led to the use of new technologies that can provide more accurate data on species. Direct Analysis in Real Time (DART) and Time-of-Flight Mass Spectrometry (TOFMS) can be used to confirm species claims for wood products. DART-TOFMS only requires a small sample (the size of a toothpick) and produces results within seconds. This allows identification to be done quickly and inexpensively.

Wood from different species has a characteristic composition that produces a diagnostic spectrum. By comparing these distinctive spectra to a database that the U.S. National Fish and Wildlife Forensic Lab has created, it is possible to classify unknown wood samples. This database, known as the Forensic Spectra of Trees Database (ForeST©), is made up of tree species from around the world.

Recently, scientists have also developed optical instruments that use artificial intelligence models to identify species or genus of wood products, including charcoal. For example, the Xylotron is a machine-vision-based wood identification system that uses a custom-designed wood imaging device (the Xyloscope), image analysis, and statistical processing software run from a laptop/notebook. With it, users can identify over 150 species of wood more accurately than trained law enforcement personnel. Another example of this type of technology is the Xylorix that can be used with a smartphone.

These Artificial Intelligence (AI) tools are limited to the species reference data that is used to train the underlying models. However, these models are expanding rapidly with Xylorix already available on the commercial market.

When to use this microscopic analysis

- ⇒ When the origin does not need to be verified.
- ⇒ For groups of species that have unique anatomical features.
- ⇒ When a broad distinction between species groups is acceptable.
- ⇒ For analysis of composition products (paper, MDF, OSB, and solid woods).

Limitations

- ⇒ Only used to identify species (not origin).
- ⇒ Only used to identify broad groups of species (e.g., white oaks vs. red oaks).
- ⇒ Composite products with very small particles may not be able to be tested (e.g., wood flour, some MDF, particleboard, etc.)

Cost

- ⇒ Costs for microscopic analysis depends on whether you are seeking to test a solid wood or composite product. Test prices typically range from EUR 80–150 per sample for solid wood samples and EUR 120–150 per sample for composite products.

- ⇒ DART Mass spectrometry costs approximately EUR 90 per sample tested and only requires a small sliver of wood, the size of a toothpick.

DNA Analysis

DNA Analysis

DNA analysis compares genetic sequences between timber samples to determine the species or origin of the wood.

Just as humans share more of our DNA in common with chimpanzees than other animals, trees and other plants that are mostly related share more similar DNA. The DNA sequence of timber can be compared using genetic techniques.

These can provide information on how similar two test samples are to each other and can compare a test sample to known samples in a reference library. Note that current reference libraries are limited. There are three main ways DNA analysis can be used, listed in grey below:

One key benefit of DNA analysis is that species and geographical origins can be identified with great accuracy, when reference data exists. DNA analysis can typically identify samples to the species level (e.g., *Quercus mongolica*) while microscopic testing can typically only identify the genus (e.g., *Quercus spp*.) or sub-genus level (e.g., white oaks).

This is useful when a company wishes to distinguish between closely related species—for example, to verify that a supplier only uses US oak and not Chinese oak in their supply chains.

Species identification: Where the aim is to distinguish one species (or group of species) from another species (or group of species).

Population identification: Where the aim is to identify different populations or sub-populations within a species – usually for the purpose of identifying the country or region of origin. The geographic origin may be verified to the level of a region, country or even concession, depending on the species and available reference datasets.

Individual log identification: Where the aim is to identify the passage of an individual tree through the supply chain from harvest, factory, to end-product. This method can be used to distinguish a particular individual (or clone) from others within the population. This technique is similar to the forensic DNA methods used in criminal courts of law to identify perpetrators of a crime, by identifying the presence of an individual's DNA.

As individual species have unique growing ranges, DNA analysis for species can sometimes provide origin information. For example, *Quercus mongolica* grows only in eastern Asia, so if an oak product is claimed to be of European or North American origin and it is *Quercus mongolica,* then one knows it is a false declaration. This, however, may not work for species grown on plantations.

Plantations are often made up of clones that all have the same DNA sequences. For example, identifying the origin of plantation teak through DNA is unlikely to provide any useful information, unless the clone used is unique to that plantation and the DNA sequence is known.

As with all techniques, genetic analyses rely on the availability of a database of genetic reference material, against which samples can be compared.

Laboratories such as the Thünen Institute (Germany), the University of Adelaide (Australia), and Timtrace (Wageningen University) can provide various DNA testing services today.

In 2011, the German customs authorities seized timber shipments after DNA analysis showed wood samples were mahogany (*Swietenia mahagoni*), a CITES-listed species, rather than the closely related non-CITES-listed species declared by the importer (WWF, 2011).

Population identification has also been used to create a DNA reference library for merbau, using 2,707 samples from Indonesia, Malaysia, and Papua New Guinea (Geach, 2014). Testing of samples against this reference library showed that DNA techniques can be used to determine the concession of harvest for merbau products (to within roughly 50 kilometres of origin) (Double Helix, 2015).

Individual log identification can be used, for example, in the case of very valuable timber species, where the harvest location of each tree is typically recorded.

Individual log identification was used by the Forest Research Institute Malaysia for Ramin (*Gonystylus bancanus*) to match individual logs to the stumps they came from with a 99.9% accuracy (Lee et al., 2014).

The technique was used to convict four people for stealing bigleaf maple in a landmark prosecution under the US Lacey Act.

DNA analysis is an expensive method, in comparison to others, and therefore usually only used for high-value species. For due diligence purposes, the technique could be used where specific harvest permits and plans clearly record the precise GPS location or tagged tree stump. A sample can then be taken from the identified stump at the harvest site and sequenced.

A second sample will then be taken from the purchased product (sawnwood, solid furniture, etc.) and sequenced. A match between the two samples can verify that the product purchased was harvested from the stump declared on harvest documentation. Highly processed products such as pulp, paper, and fibreboard frequently do not contain useable DNA (Crumley, 2014).

DNA techniques are also limited by the amount of reliable DNA for different species. Population identification is limited by the number of reliable genetic reference maps for different species. The spatial resolution of genetic maps is also a limiting factor, which in the future may be improved through the identification of more gene markers within each species.

One of the disadvantages of this technique is the low success rate of extracting testable DNA from wood. DNA will break down because of heat, exposure to mould and bacteria, and chemical treatments. So, a general rule is the more processed the wood, the less DNA it will contain. For example, DNA testing cannot be conducted on paper.

Forensic scientists are continually improving techniques for DNA extraction, so the success rate for extracting DNA from wood products is also improving. Some labs report quite low success rates whereas others, such as the University of Adelaide, report more success[7].

It would therefore seem advisable to understand from the labs their success rates, prior to signing any contract with them.

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When embarking upon DNA testing, it's important to ask the laboratory about the expected success rate for DNA extraction from samples for your products. If the likelihood of extracting usable DNA is low, then it may be worth exploring alternative techniques.

Check

⇒ You should check with different labs to identify if they have the reference data required to conduct tests for your species and origins.

⇒ Laboratories tend to build their own private libraries of known reference samples and sharing of this data is low. World Forest ID is working to build open-sourced DNA datasets, so contact them to find out the status of these datasets.

When to use this method

⇒ When identification of species is required or for identification of harvest (region, country, or concession).

Limitations

⇒ Limited reference data availability (mostly CITES-listed and high-value species) – not all species or origins can be tested.

⇒ The success rate for DNA extraction is low (especially for composite products and old samples).

⇒ Few laboratories offer commercial services, meaning costs are generally high.

⇒ Reference data is usually not open source, where reference data is proprietary samples can not be tested against the data.

Cost

⇒ Costs for DNA analysis vary depending on the aim of the test - costs increase for species identification (lowest), population identification (mid-range), and individual log identification (highest). Test prices typically range from EUR 200 – 600 per sample.

Mass Spectrometry Analysis

Mass Spectrometry Analysis

Mass Spectrometry analysis compares the ratios of elements within timber samples to verify the harvest origin. Two methods can be used for determining origin: **Stable Isotope Ratio Analysis (SIRA)** and **Trace Element Analysis**.

Many elements, such as carbon, hydrogen, oxygen, and nitrogen occur naturally in different forms known as isotopes. These are absorbed and incorporated into the molecular structure of timber as trees grow from soil, water, and air. The Isotopic analysis involves measuring natural variations in the ratio of these isotopes across geographies.

This means that two trees growing in the same area will take up a similar amount of water and nutrients from the environment and incorporate them into their timber as they grow. They will have similar isotope signatures and trace element concentrations to each other, but different signatures compared to trees grown hundreds or thousands of miles away. In this way, Isotopes and Trace Elements can mark where a particular tree has been absorbing its water, air, and nutrients.

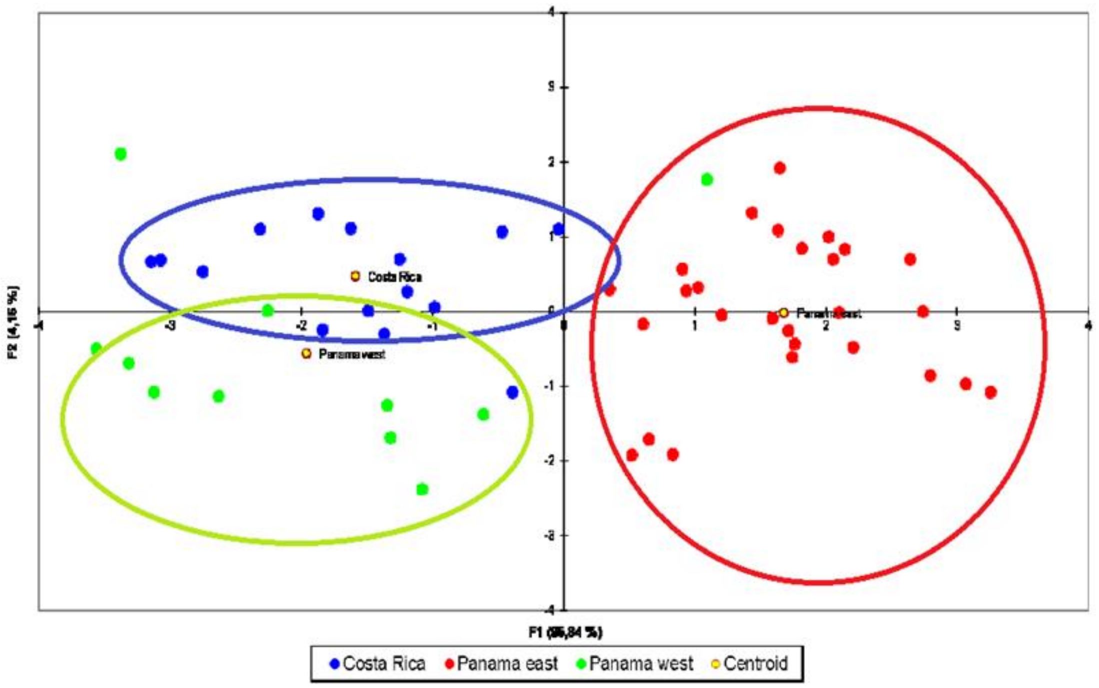

Figure 4: Isotope analysis showing regional differences in teak (re-printed with permission from WWF Germany, 2011

This is true not only for tree species but all living organisms because all organisms take in elements from their surroundings as part of their growing processes. Figure 4 shows the stable isotope signatures of timber samples from different areas of Central America.

While SIRA has relatively recently been applied to timber, it has been used for years to identify the provenance of eggs, wine, cattle, caviar, fish, and other products of the food industry. Trace Element analysis has been used in court cases to prove the origin of stolen gold as well as timber and agricultural products.

SIRA was used as part of WWF's 2015 'Forests Campaign'. Timber products were purchased from 17 companies in the UK and tested. The lab used Isotopic analysis to determine the origin of products. Eight out of 26 products tested contained wood with a different origin than declared by the suppliers (WWF, 2015).

Currently, reference data to identify origin is available for the species shown in Figure 5.

The Environmental Investigation Agency used this technique to show those oak products being sold in the US and EU came from a particular species of oak (*Quercus mongolica*) that had been harvested in the Russian Far East, where illegal logging is rampant (EIA, 2013).

Laboratories conducting SIRA include Agroisolab and the Reston Stable Isotope Laboratory (RSIL) (CITES, 2014).

A lab in Australia called Source Certain, performs Trace Element analysis.

Merbau *(Intsia spp.)*	Indonesia, Malaysia, Papua New Guinea
Iroko (*Milicia spp.)*	Ghana, Ivory Coast, Central African Republic, Democratic Republic of Congo, Republic of Congo, Cameroon, Gabon, Kenya
Oak (*Quercus spp.)*	Amur region (China/Russia), USA, Croatia, Germany
Larch (*Larix spp.)*	W. Europe, Russia, China, Japan
Sapele (*Entandrophragma cylindricum)*	Cameroon, Republic of Congo, Democratic Republic of Congo
Mahogany	Congo, Costa Rica, Democratic Republic of Congo, Ecuador, Ghana, Honduras, India, Java, Panama, Peru
Teak (*Tectona grandis)*	Brazil, Costa Rica, Ghana, Honduras, India, Indonesia, Java, Laos, Myanmar (Burma), Panama, Papua New Guinea, Vietnam
Ash (*Fraxinus spp.)*	Amur region (China/Russia)
Spruce (*Picea spp.)*	Austria, Belarus, Finland, Germany, Norway, Poland, Russia, Sweden
Cedar	Solomon Islands
Bintangor (*Calophyllum spp.)*	Solomon Islands
Rosewood (*Dalbergia spp)*	Brazil, Madagascar

Figure 5: Available reference data for identifying origin

Check

⇒ Check with different labs to identify if they have the reference data required to conduct tests for your species and origins. Laboratories tend to build their own private libraries of known reference samples and sharing of this data is low.

⇒ World Forest ID is building open -sourced libraries for DART and SIRA. Contact them for up-to-date information on reference datasets and labs that can conduct the analysis.

Limitations

SIRA can only help identify the origin of products, not the species. However, as verifying the origin of the harvest is key to determining low risk for some supply chains, Isotope analysis is an extremely useful assessment tool.

SIRA is not possible on complex composite products such as paper, MDF, chipboard, etc. It is most often applied to solid wood products and very thin veneers (<0.5 mm) may not be possible to test.

However, it is better to check with laboratories which products they can and cannot analyse.

⇒ Only used to identify origin (not species).

⇒ Limited reference data is available – not all origins can be tested.

⇒ Composite products (MDF, paper) cannot be tested.

⇒ Few laboratories offer commercial services, meaning the price is often high.

⇒ Reference data is not necessarily open source.

⇒ Where identification of the harvest origin is required (region, country, or concession).

Cost

⇒ Costs for SIRA depend on the spatial scale – regional level (lowest), country level (mid-range), and concession level (highest). Test prices typically range from EUR 400– 750 per sample.

4. List of laboratories

Which laboratories currently offer the timber testing services discussed above?

There are a number of commercial, government, and semi-government authorities which offer testing services for timber and paper samples. Some of these laboratories are shown in in the table.

This list below is non-exhaustive, especially for wood anatomy testing, which is conducted by many laboratories around the world.

Questions to ask laboratories

Before engaging with laboratories, it is recommended to ask the following questions to understand whether it is possible to achieve the results needed:

⇒ Which species can you determine origin for?

⇒ What and how many reference samples of that species are available? And what percentage of the spatial range for the species is included in the reference data set?

⇒ Is the reference data open source or proprietary? And are protocols publicly available?

⇒ What is the level of detail that can be determined for origin? (Country, sub national, concession level?)

⇒ Do you use AI/forced classification models to interpret the results?

Scientific Testing Laboratories	
Wood Anatomy (macroscopic and microscopic)	
Royal Botanic Gardens Kew (UK)	http://www.kew.org/
Thünen Institute (Germany)	https://www.thuenen.de/en/
Wood ID Lab (Italy)	http://www.woodidlab.it/
Test-Tech (UK)	http://www.test-tech.co.uk/
IPS Testing (USA)	https://ipstesting.com/
Forest Research Institute Malaysia (FRIM) (Malaysia)	http://www.frim.gov.my/
DNA Analysis	
Royal Botanic Gardens Kew (UK)	http://www.kew.org/
Thünen Institute (Germany)	https://www.thuenen.de/en/
Naturalis Biodiversity Centre (Netherlands)	http://www.naturalis.nl/
FERA	http://fera.co.uk/
Forest Research Institute Malaysia (FRIM)	http://www.frim.gov.my/
IBL (Forestry Research Institute) (Poland)	http://www.ibles.pl/
Australian Centre for Evolutionary Biology and Biodiversity, University of Adelaide	http://www.adelaide.edu.au/directory/andrew.lowe
DoubleHellix	http://www.doublehelixtracking.com/
DART Mass Spectrometry Analysis	
Agroisolab (UK & Germany)	http://www.agroisolab.com/
FERA	http://fera.co.uk/
Reston Stable Isotope Laboratory	http://isotopes.usgs.gov/
SourceCertain (Trace Element)	https://www.sourcecertain.com/
TimTrace—Wageningen University	https://www.wur.nl/en/show/timtrace.htm; https://www.timtrace.nl/

Want to know more?

This document is a part of the Preferred by Nature project "LIFE Legal Wood" The project is supported by the EU LIFE Programme and involves 13 partner organisations from six key timber-importing countries: Italy, France, Belgium, Germany, Spain, and the Netherlands.

The project aims to raise awareness and improve the implementation of the European Timber Regulation (EUTR), which prohibits the trade of illegal timber in the EU market.

In addition to the EUTR, the project has also focused on the EU deforestation regulation* (EUDR), which prohibits businesses from placing products or commodities that are linked to deforestation, forest degradation, or that have been produced illegally.

For more information about the EUDR, please click here.

On the LIFE Legal Wood project website you can find tools, recorded trainings and guides about EUTR and EUDR. Visit the website on www.EUTR.info or by scanning the QR code below:

**Regulation (EU) 2023/1115 of the European Parliament and of the Council of 31 May 2023 on the making available on the Union market and the export from the Union of certain commodities and products associated with deforestation and forest degradation and repealing Regulation (EU) No 995/2010).*

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Notes

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