



# Forensic methods used to verify the declared species and origin of wood

Illegal logging and related trade are huge international problems that are contributing significantly to forest destruction all over the world and as a result also to climate change and the decline in biodiversity. Illegal timber trade is often a form of organised crime, and illegal logging is estimated to account for up to 40% of global timber production. One consequence of this crime is a drop in the price of timber caused by illegal timber, which in turn makes trade with sustainably produced timber more difficult. Technical developments such as electronic tags that are attached to tree trunks after they have been felled and independent certificates have brought improvements and more transparency to the timber trade. However, these developments all lead to the information being passed along the value chain together with the raw material, which gives rise to the potential for manipulation. All the methods described below, some of which are well established and some of which are new, involve properties of the wood that are firmly ingrained in the wood and thus impossible to manipulate. These methods are therefore excellent not as replacements, but as additions to current information systems. They enable the accuracy of existing documents to be verified, which makes the timber trade more transparent. It is also possible, however, to monitor new legal requirements. The WWF believes the development and usage of these methods offer great opportunities for the fight against illegal timber trade and is therefore actively involved in their usage and development.

## Species protection tracker dogs

Having found the use of species protection tracker dogs to be very successful in the area of wild animal and plant trade, the WWF initiated a pilot study to test the possibility of using tracker dogs for wood identification.

It is suspected that particularly valuable wood species are imported together with unprotected but similar-looking wood species. They may be transported in the same containers, for example. For this reason, the pilot study involved two tracker dogs being trained to detect big-leaf mahogany (*Swietenia macrophylla*). The dogs were able to distinguish big-leaf mahogany from other wood species, some of which looked very similar. In the opinion of the WWF, this ability could close a gap in current practices, because there has to be an initial suspicion before officials can seize wood and send it to a laboratory for further examination. Customs or police officers are given a very specific task when it comes to identifying wood species, but it can often be a big challenge, such as when they are confronted with woods that look similar and the wood species declared in the accompanying documents seems plausible - based on the outward appearance anyway.

The following links provide more information:

- [www.traffic.org/non-traffic/non-traffic\\_pub23.pdf](http://www.traffic.org/non-traffic/non-traffic_pub23.pdf) (Chapter 4 "Timber Detector Dogs")
- WCO News N°73; 2/2014; <http://www.wcoomd.org/en/media/wco-news-magazine/latest.aspx>

## Microscopic wood species identification

Microscopic wood species identification is an established method used routinely to identify wood types, such as those among solid woods, veneers, plywoods, etc.

It consists of a macroscopic and microscopic examination during which the genus (according to the names/groups in EN 13556) and in many cases the species of wood samples can be determined unequivocally based on their anatomical structure. There are experts who are experienced in this area at various institutes in Germany, the UK, the USA, Brazil ... Devices and databases that will be able to be used to identify wood species on the spot in future are currently being developed. The WWF expects the number of options available to increase considerably, which will help customs officers to substantiate an initial suspicion, for example. The WWF has discovered falsely declared wood species in products and at the premises of companies a number of times in the past using this method.

The following links provide more information on microscopic wood species identification:

- <http://www.ti.bund.de/en/startseite/home/thuenen-kompetenzzentrum/serviceleistungen-m.html>
- <http://www.fpl.fs.fed.us/research/centers/woodanatomy/>
- <http://www.africamuseum.be/collections/browsecollections/naturalsciences/earth/xylarium>
- <https://science.naturalis.nl/en/collection/naturalis-collections/botany/>
- <http://www.kew.org/collections/anatslid.html>

## Stable isotopes (origin of wood)

Plants absorb the unevenly distributed isotopes (H, O, N, S, C, etc.) in nature and incorporate them into their structure. The stable isotope method has been the standard method used to verify the declared origin of products in the food sector for many years. Accordingly, the technique is used by six examination authorities as well as numerous private laboratories in Germany to verify the origin of wine, peppers, potatoes, olive oil and beef.

There are already extensive stable isotope databases available in Europe. Examples include the hen's egg database created by KAT, the most important egg inspection body in Germany and neighbouring EU countries, the pig meat database developed by BPEX in the UK and the German customs' caviar database. In 2013, the German customs' caviar database was successfully recognised as an instrument that could be used to confirm cases of caviar fraud (see below). The stable isotope method is currently the only origin method implemented in the European regulation on the verification of wine (Commission Regulation (EC No 2729/2000).

Initiated by WWF Germany, several projects supported by the DBU (Deutsche Bundesstiftung Umwelt - German Environmental Foundation) were launched in 2004 to start usage of the method for wood as well.

It is now used routinely for wood and is even used for ivory too.

In 2013, the American EIA (Environmental Investigation Agency) used the isotope method to have the results of their investigation into illegal timber from Russia, which had been obtained using analytical methods, confirmed independently.

The following links provide more information on the isotope method:

- <http://www.agroisolab.de/e-index.htm>
- [http://wwf.panda.org/what\\_we\\_do/how\\_we\\_work/conservation/forests/news/successes/?199198/uncovering-forests-tell-tale-fingerprints](http://wwf.panda.org/what_we_do/how_we_work/conservation/forests/news/successes/?199198/uncovering-forests-tell-tale-fingerprints)
- <http://eia-global.org/campaigns/forests-campaign/liquidating-the-forests/>
- [http://www.wwf.de/fileadmin/fm-wwf/Publikationen-PDF/2013\\_WWF\\_Report\\_Illegal\\_Caviar\\_Trade\\_in\\_Bulgaria\\_and\\_Romania.pdf](http://www.wwf.de/fileadmin/fm-wwf/Publikationen-PDF/2013_WWF_Report_Illegal_Caviar_Trade_in_Bulgaria_and_Romania.pdf) (p. 19)

## DNA analysis (species and origin of wood)

Genetics can be used in several ways to support the fight against illegal timber trade. As with the isotope method, the results of a genetic origin analysis are able to verify a declared origin. They are derived through the identification of gene sequences, which differ for each species according to region. A number of projects have demonstrated the potential of this method. Furthermore, once a wood's species-specific markers have been identified, the genetics can be used to determine its species unequivocally.

If genetic tree-specific mapping has been carried out, the genetic fingerprint can also be used to verify the details of the origin of an individual tree down to the place where it was logged. The procedure can, for example, be used for very valuable woods, for which every logging location is recorded.

The following links provide more information:

- <http://www.ti.bund.de/en/startseite/home/thuenen-kompetenzzentrum/serviceleistungen.html>
- [http://www.wwf.de/fileadmin/fm-wwf/Publikationen-PDF/Fingerprinting\\_conf\\_rep\\_EN.pdf](http://www.wwf.de/fileadmin/fm-wwf/Publikationen-PDF/Fingerprinting_conf_rep_EN.pdf)
- [http://www.wwf.de/fileadmin/user\\_upload/Bilder/Final\\_Report\\_project\\_DBU\\_WWF\\_wood\\_fingerprinting\\_11\\_2011.pdf](http://www.wwf.de/fileadmin/user_upload/Bilder/Final_Report_project_DBU_WWF_wood_fingerprinting_11_2011.pdf)
- <http://www.doublehelixtracking.com/>
- <http://www.adelaide.edu.au/adelaidean/issues/46461/news46561.html>

## NIR - Near infrared (species and origin of wood)

NIR is an analytical method involving short-wave infrared light in which molecules are made to vibrate by electromagnetic radiation and reflect specific spectra as a result. NIR is a very versatile method that basically reflects the chemical composition of products. It is a well-established way of determining the water content in substances. According to publications on the usage of NIR for wood, NIR is now able to produce concrete evidence of the content, species and origin of wood now as well. Unlike the genetic and isotope methods, however, NIR has not yet undergone extensive testing as a standalone method for wood.

There is one case (a WWF project on tropical woods) in which NIR was used as an additional parameter to improve spatial resolution. The stable isotope method (physical fingerprint) and the NIR method (chemical fingerprint) in particular are expected to complement each other synergistically in future. This is currently being tested in various projects.

The following links provide more information:

- [http://www.wwf.de/fileadmin/user\\_upload/Bilder/Final\\_Report\\_project\\_DBU\\_WWF\\_wood\\_fingerprinting\\_11\\_2011.pdf](http://www.wwf.de/fileadmin/user_upload/Bilder/Final_Report_project_DBU_WWF_wood_fingerprinting_11_2011.pdf) (chapter 5.4.5)
- [http://www.globaltimbertrackingnetwork.org/fileadmin/templates/globaltimbertrackingnetwork.org/upload/Regional\\_Workshop\\_for\\_Asia\\_Pacific\\_Oceania/YaNa\\_Liu.pdf](http://www.globaltimbertrackingnetwork.org/fileadmin/templates/globaltimbertrackingnetwork.org/upload/Regional_Workshop_for_Asia_Pacific_Oceania/YaNa_Liu.pdf)
- [http://www.globaltimbertrackingnetwork.org/fileadmin/templates/globaltimbertrackingnetwork.org/upload/Regional\\_Workshop\\_Americas/Near\\_Infrared\\_Spectroscopy\\_alternative\\_method\\_for\\_theaccurate\\_botanical\\_identification\\_of\\_similar\\_wood\\_species.pdf](http://www.globaltimbertrackingnetwork.org/fileadmin/templates/globaltimbertrackingnetwork.org/upload/Regional_Workshop_Americas/Near_Infrared_Spectroscopy_alternative_method_for_theaccurate_botanical_identification_of_similar_wood_species.pdf)
- <http://ffp.up.poznan.pl/pdf/40/Folia%20Forestalia%20Pol%2040-4%20Sandak%20et%20al.pdf>

## Remote sensing

Employing genetics, isotopes or NIR to determine an origin will reach its limits when it comes to small-scale infringements, which could be logging more than the permitted amount or logging outside of a concession area's boundaries, for example. The analysis of satellite images can provide helpful information here, however: As soon as access roads or routes are spotted to parts of a concession area in which, according to management plans, logging is prohibited, or small amounts of logging are detected outside of a concession area's boundaries, on-site checks can be carried out to help substantiate the initial suspicion. There are known cases in which remote sensing has been able to reveal illegal land appropriation or suspected logging outside a concession area (see below).

Conversely, the increasing use of this technology means much more targeted patrols will be able to take place in locations where there are current indications of infringements. Recency is becoming more and more important as far as remote sensing is concerned, because pictures are becoming cheaper and cheaper (free in some cases) and are available at frequent intervals.

Remote sensing can also be used for a variety of processes, such as identifying the degree of degradation in forest areas and measuring CO<sub>2</sub> storage.

The different possibilities offered by the use of remote sensing are an area WWF Germany focuses heavily on.

The following links provide more information:

- [http://wwf.panda.org/what\\_we\\_do/where\\_we\\_work/greatermekong/our\\_solutions/landscape\\_conservation\\_in\\_the\\_greater\\_mekong\\_region/responsible\\_forest\\_management\\_trade/?207264/learning-session-7-satellite-data-for-redd-mrv](http://wwf.panda.org/what_we_do/where_we_work/greatermekong/our_solutions/landscape_conservation_in_the_greater_mekong_region/responsible_forest_management_trade/?207264/learning-session-7-satellite-data-for-redd-mrv)
- [http://news.mongabay.com/2011/1004-hance\\_dole\\_satellite.html](http://news.mongabay.com/2011/1004-hance_dole_satellite.html)
- <http://www.globalforestwatch.org/>

## Paper fibre analyses

“Tropical rainforest trees are felled to produce German children's books” is the conclusion two WWF studies came to in 2009 and 2012. Laboratories found mixed tropical hardwood (MTH) in the paper. MTH is a group of wood fibres used in paper and reconstituted wood products like chipboard. The fibres traditionally used to make paper include woods from temperate and boreal regions, plantation woods (usually eucalyptus or acacia for paper), cotton, straw and sugar cane. These established and well-known fibres, including the tropical plantation fibres, can be identified by laboratories as a matter of routine. Experience shows that tropical woods from natural forests occur as a mixture of many different species, the genera of which can sometimes be identified by certified laboratories using reference-based microscopy. The presence of such a mixture of different genera and species (collectively MTH), some of which are unknown, indicates that it probably consists of woods from tropical natural forests. The identification of an unknown wood species found in the paper in large amounts points to cultivated areas like plantations (not MTH).

The following links provide more information:

- [http://wwf.panda.org/about\\_our\\_earth/search\\_wwf\\_news/?176641/tropical-forests-are-dying-for-german-childrens-books](http://wwf.panda.org/about_our_earth/search_wwf_news/?176641/tropical-forests-are-dying-for-german-childrens-books)
- [http://wwf.panda.org/wwf\\_news/press\\_releases/?207141/tropical-pulp-still-a-long-way-from-fiction-in-german-childrens-books](http://wwf.panda.org/wwf_news/press_releases/?207141/tropical-pulp-still-a-long-way-from-fiction-in-german-childrens-books)
- <http://www.wri.org/blog/qa-fiber-testing-paper-and-lacey-act>
- [http://ran.org/sites/default/files/turning\\_the\\_page\\_on\\_rainforest\\_destruction.pdf](http://ran.org/sites/default/files/turning_the_page_on_rainforest_destruction.pdf)

## General information on the methods

The advantage of the genetic fingerprint and the stable isotope method is the fact that the parameters examined are firmly anchored in the wood and therefore unchangeable. This is the main and most significant difference between these two methods and classic information systems, where information is hammered into the tree trunk, and electronic chips (RFID) that are attached to the tree trunk. The wood's origin is one of the pieces of information requested in the past, but it has not been possible to check it until now. Falsely declared information regarding a wood's species and origin does not actually prove that the wood is illegal, but it is a strong indication that this is the case. If a wood's species and origin are not known or have been falsely declared, it is not possible to draw a concrete conclusion regarding the wood's legality!

The further development of methods and the **combination** of different methods are expected to lead to even more accurate results when it comes to identifying a wood's species and origin in the future.

## TRAFFIC

Interpol has estimated the global value of illegally traded wild species to be approximately 19 billion US dollars per year (excluding wood and fish). The economic damage caused by illegal timber trade is estimated to be about 15 billion US dollars per year.

To monitor international trade with threatened species and develop solutions, the WWF founded the international species conservation programme TRAFFIC in conjunction with the International Union for Conservation of Nature (IUCN) in 1976. TRAFFIC's purpose is to ensure that international trade involving living wild animal and plant species and their products only occurs in a sustainable manner, is conducted in compliance with national and international agreements and laws, and does not lead to the extinction of species. TRAFFIC has 25 offices on five continents and is the globally recognised expert organisation in this area.

Examples of TRAFFIC's duties include the critical monitoring of trade involving protected species and developing innovative solutions that enable sustainable, legal and transparent trade. With regard to international timber trade, TRAFFIC has worked on drawing up legality guidelines, examined trade flows and supported, among others, governments and international trade associations with the enforcement of legal regulations for many years.

The following links provide more information:

- <http://www.traffic.org/timber-trade/>

## International reference database / Global Timber Tracking Network

Genetics and isotopes need references that suspicious samples can be compared to or measured against. One important task of the future will therefore be to create an international reference database that is freely accessible but protected from unauthorised access. Another important task will be to collect reference samples in partner countries and putting the analysis results together, so that suspicious cases can be dealt with more quickly. An international database like the one mentioned above is currently being created with the help of financial support from Germany. The international organisation Bioversity International, which is headquartered in Rome, will be responsible for launching it when it is ready.

The International Atomic Energy Agency (IAEA) has already said it is prepared to develop some wood standards so that isotope measurements can be calibrated. This means that isotope laboratories in every country will be able to take part in carrying out wood measurements and comparing the results.

Global Timber Tracking Network (GTTN), an international network headquartered in Malaysia, is a dialogue platform for wood identification and tracking methods.

The WWF is a partner of the GTTN network and is a member of the advisory board involved in the creation of the international database.

The following links provide more information:

- <http://www.globaltimbertrackingnetwork.org/home/>
- <http://www.biodiversityinternational.org/>

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