



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

Illegal logging and related trade are huge international problems that significantly contribute to the worldwide destruction of forests, to climate change and biodiversity loss. Illegal timber trade is often organised crime, and illegal logging is estimated to account for up to 40% of the global timber production. Illegal timber causes a drop in timber prices, which in turn hampers the trade with sustainably produced timber. 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, here the information is passed on together with the raw material along the value chain, which leaves room for manipulation. All of the methods described below, both well established and new, involve timber properties that are firmly ingrained in the wood and are therefore impossible to manipulate. These methods do not replace current information systems, but are excellent additions. They enable verification of the accuracy of existing documents, which increases transparency in the timber trade. It is also possible to control new legal requirements. WWF believes that these methods offer great opportunities for combatting illegal timber trade and is therefore actively involved in their development and implementation.

Species protection tracker dogs

Sniffer dogs have proven very successful for detecting illegal wildlife and plant trade. WWF has therefore initiated a pilot study to test the possibility of using sniffer dogs for timber identification.

It is suspected that particularly valuable wood species are imported together with unprotected but similar-looking wood species, i.e. in the same containers. The pilot study therefore trained two sniffer dogs to detect big-leaf mahogany (*Swietenia macrophylla*). The dogs were able to distinguish big-leaf mahogany from other, partly very similar looking wood species. According to WWF, this method could close an enforcement gap, as officials can only seize wood and send it to a laboratory for further examination if an initial suspicion arises. Customs or police officers are specifically tasked with identifying wood species. However, they are faced with a big challenge if they are confronted with wood that looks similar to wood species declared in the accompanying documents.

The following links provide more information:

- 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 identification of wood species

The microscopic identification of wood species is an established method routinely used to identify wood types, such as solid woods, veneers, plywood, etc. It consists of a macroscopic and micro-

scopic 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 exactly based on their anatomical structure. Experienced experts are located in various institutes in Germany, the UK, USA, Brazil ... Devices and databases for future identification of wood species on-site are currently being developed. WWF expects a considerable increase in the number of available options, which will help customs officers to substantiate an initial suspicion. In the past, WWF has used this method to discover falsely declared wood species within companies and products.

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)

Unevenly in nature distributed isotopes (H, O, N, S, C, etc.) are absorbed by plants and incorporated 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.

Extensive stable isotope databases already exist 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 for confirming cases of caviar fraud (see below). The stable isotope method is currently the only origin determination method implemented in the European regulation on the verification of wine (Commission Regulation (EC No 2729/2000). In 2004, WWF Germany initiated several projects, supported by the DBU (Deutsche Bundesstiftung Umwelt - German Environmental Foundation), and aimed at transferring this method to wood. In the meantime, its application to wood and also to elephant ivory has been proven.

In 2013, the American EIA (Environmental Investigation Agency) applied the isotope method to independently verify their investigation results of illegal timber from Russia..

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://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 (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 can verify a declared origin. Gene sequences, which differ regionally within a species, are identified. A number of projects have demonstrated the potential of this method. Furthermore, once a wood's species-specific markers have been identified, genetics can be used to determine its species unequivocally.

If genetic mapping has been carried out on a tree individual level, 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 be used, for example, in the case of very valuable woods, for which every single 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/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 using short-wave infrared light, in which molecules are made to vibrate by electromagnetic radiation and reflect specific spectra. 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 also able to determine the content, species and origin of wood. However, unlike the genetic and isotope methods NIR has not yet undergone extensive testing as a standalone method for wood.

In one case (a WWF project on tropical woods), 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 the 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 (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_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 is limited with regard to small-scale infringements. These could include logging more than the permitted amount or logging outside of a concession area's boundaries. The analysis of satellite images can provide helpful information here: as soon as access roads or paths are spotted within parts of a concession area in which logging is prohibited according to the management plans, 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).

On the other hand, if this technology is used more, patrols can be targeted to control areas where there are current indications of infringements. As images are becoming cheaper and cheaper (in some cases even free) and are available at frequent intervals, it is important that remote sensing is up to date.

Remote sensing can also be used for a variety of processes, such as identifying the degree of degradation in forest areas and measuring CO₂ storage.

One of the foci of WWF Germany lies on the different possibilities offered by the use of remote sensing.

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://news.mongabay.com/2011/1004-hance_dole_satellite.html
- <http://www.globalforestwatch.org/>

Paper fibre analyses

Two WWF studies from 2009 and 2012 conclude that “tropical rainforest trees are felled to produce German children’s books”. Laboratories found mixed tropical hardwood (MTH) in the paper. MTH is a group of wood fibres used in paper and compound 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. Laboratories are able to identify these established and well-known fibres, including tropical plantation fibres, as a matter of routine. Experience shows that tropical woods from natural forests are a mixture of many different species, the genera of which can sometimes be identified by certified laboratories using reference-based microscopy. A mixture of, sometimes unknown, different genera and species (collectively MTH), 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 such as plantations (not MTH). The following links provide more information:

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/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

General information on the methods

The advantage of the genetic fingerprint and the stable isotope method is that the parameters examined are firmly anchored in the wood and cannot be altered. 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. In the past, determining the wood’s origin was one requested piece of information that could not be controlled. Falsely declared information regarding a wood’s species and origin does not actually prove that the wood is illegal, but it is a strong indicator. If a wood’s species and origin are not known or have been falsely declared, it is not possible draw concrete conclusions on the wood’s legality!

In the future, 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.

TRAFFIC

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

In order to monitor international trade with threatened species and develop solutions, 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 in wildlife and plant species and their products is sustainable, 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 activities include critical monitoring of trade in 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 in 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

In case of genetics and isotopes, references are needed that suspicious samples can be compared to or measured against. One important future task will therefore be to create an international reference database that is freely accessible but also protected from unauthorised access. Another important task will be to collect reference samples in partner countries and to combine the analysis results, so that suspicious cases can be dealt with quicker. 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. The International Atomic Energy Agency (IAEA) has already signalled willingness to develop wood standards for the calibration of isotope measurements. This means that isotope laboratories in every country will be able to carry out wood measurements and compare the results.

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

WWF is partner to the GTTN network and 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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