SmartwoodID

Smart classification of Congolese timbers

PROJECT DESCRIPTION

A substantial part of the timber trade is still illegal and illegal logging is the most profitable biodiversity crime. UN Environment estimates that illegal logging and the associated timber trade counts up from 50 to 152 billion USD per year. Illegal logging involves a high risk of irreversible damage to forests since it often involves overexploitation of highly sought after, sometimes protected, species. Timber regulations are already active (CITES, FLEGT, EUTR), but implementation and enforcement are a challenge. Currently, Belgium has the negative connotation of being the 'hub of illegal timber trade'. 27.5% of the total imports of primary tropical timber products into the 28 countries of the European Union are imported via Belgium (mainly via the port of Antwerp). Wood identification is crucial in the enforcement process when it comes to verify whether the shipment corresponds with the products mentioned on the accompanying documents. For this reason, there is a growing demand for timber identification tools that can be applied by law enforcement officers.

The Tervuren xylarium is the Belgian governmental collection of wood samples. It is an internationally renowned part of the federal scientific heritage, housed by the Royal Museum for Central Africa. It comprises reference material of 13 000 different botanical species. One of the growing actual functions of the collection is supporting forensic research through verification of a species' identity. The most common technique of timber identification is a wood anatomical assessment. Wood species have indeed characteristic features at different microscopical magnifications. However, some of those features are highly variable, which hampers the development of classical dichotomy identification keys that can be used by non-specialists. Moreover, many features seen on wood surfaces are to be understood as artifacts (fissures, traces of mechanical damage, fungi and insect attacks) and are not always easy to distinguish from diagnostic characteristics for the untrained eye. Machine Learning methods are likely to be able to assist the wood identification process for non-specialists. The Tervuren xylarium offers the most complete assemblage of reference material for the development of new wood identification approaches, especially concerning Central-African timber species.

The project aims at automating part of the wood identification process by applying artificial intelligence techniques for the analysis of wood anatomical images of timber species of the Democratic Republic of the Congo. The tree flora of Central Africa comprises 3013 species, 27 of these belong to the class 1 commercial timber species of the DRC and are actually intensively logged and traded, 20 to class 2 (have potentially a big commercial value), 44 to class 3 (are considered to be promoted) and 879 to class 4 (commercial value is not yet known). The project uses xylarium samples of all the species of the four classes and takes advantage of the power of modern deep learning approaches. The project relies on expert wood anatomical descriptions which will serve as annotated training data to develop the software. The project strengths include the large number of African species that constitute the research material, the application of deep learning techniques on this species assemblage and a large database of standardized descriptions that will become available at the end of the project.

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The strongest impact is expected to be in the domain of policy and public services. Legal timber trade enforcement officers in different countries develop sampling strategies that result in an ever-increasing inflow of wood fragments to be identified, what stimulates the need for development of more efficient timber identification techniques. SmartwoodID aims at improving both identification success and speed by non-experts. The project will also have a clear economic impact. Timber trade and commerce is a major economic sector, with illegal logging and associated illegal timber trade being the most profitable natural resource crime. SmartwoodID will offer the perspective of a higher number of resolved crimes, by improving wood identification techniques, which are major tools in fighting illegal timber trade. Scientific knowledge, capacities and skills will be improved through (1) new and refined descriptions of wood species and (2) the development of a user-friendly interface that will contribute to capacity building in wood anatomical identifications. The project will have strong consequences for the future management of the Tervuren wood collection.

An expected result of the first work package are the original expert annotations of microscopic and mesoscopic images of transverse surfaces of almost 1000 Congolese wood species. Work package 2 develops an image processing pipeline for semi-automated annotation of microscopic and mesoscopic wood sections. Work package 3 will produce a user-friendly interface.

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LINKS

https://congobasincarbon.africamuseum.be/