

## **ANNEX 7**

### **Report on the blind test results**



# ITTO-Project PD 620/11 M; Rev. 1

## Blind Test Evaluation Report

### WWF Germany

# ITTO-Project PD 620/11 M; Rev. 1

## Blind Test Evaluation Report

### WWF Germany

The project "Development and implementation of a species identification and timber tracking system in Africa with DNA fingerprints and stable isotopes" (funded by the International Tropical Timber Organization (ITTO)) focuses on various economically important African timber tree species. Within the project, WWF Germany was contracted to carry out a blind test to generate independent verification and check the efficiency and practical performance of the different methods.

## Table of contents

|       |                                                                        |    |
|-------|------------------------------------------------------------------------|----|
| 1     | Introduction .....                                                     | 3  |
| 2     | Wood sampling .....                                                    | 4  |
| 2.1   | Wood samples from standing trees.....                                  | 4  |
| 2.1.1 | Sampling procedure.....                                                | 4  |
| 2.2   | Sawn wood samples .....                                                | 6  |
| 3     | Blind test design.....                                                 | 7  |
| 3.1   | Blind test design, part I (species identification).....                | 7  |
| 3.2   | Blind test design, part II (verification of the declared origin) ..... | 8  |
| 3.3   | Blind test design Ayou ( <i>Triplochiton scleroxylon</i> ).....        | 10 |
| 3.4   | Blind test design Iroko ( <i>Milicia excelsa</i> ) .....               | 11 |
| 3.5   | Blind test design Sapelli ( <i>Entandrophragma cylindricum</i> ).....  | 12 |
| 4     | Results .....                                                          | 13 |
| 4.1   | Results part I (species identification) .....                          | 13 |
| 4.1.1 | Wood anatomy (Thünen Institute).....                                   | 13 |
| 4.1.2 | DNA barcoding (Plant Genetic Diagnostics GmbH).....                    | 16 |
| 4.2   | Results part II (verification of declared origin).....                 | 18 |
| 4.2.1 | DNA fingerprinting; Ayou (University of Adelaide).....                 | 18 |
| 4.2.2 | DNA fingerprinting; Iroko (Thünen Institute of Forest Genetics).....   | 20 |
| 4.2.3 | DNA fingerprinting; Sapelli (Thünen Institute of Forest Genetics)..... | 21 |
| 4.2.4 | Stable Isotopes; Ayou (JR/HBLFA Francisco Josephinum) .....            | 23 |
| 4.2.5 | Stable Isotopes; Iroko (Agroisolab GmbH) .....                         | 25 |
| 4.2.6 | Stable Isotopes; Sapelli (FERA Science Ltd.) .....                     | 27 |
| 5     | Summary and overview of the blind test results.....                    | 28 |
| 6     | List of tables .....                                                   | 29 |
| 7     | List of figures.....                                                   | 29 |
| 8     | List of appendices.....                                                | 29 |
| 9     | Appendix.....                                                          | 30 |

# 1 Introduction

The ITTO project "Development and implementation of a species identification and timber tracking system in Africa with DNA fingerprints and stable isotopes" focuses on various economically important African timber tree species. Within the project, WWF Germany was contracted to carry out a blind test to generate independent verification and check the efficiency and practical performance of the different methods. The conditions were fixed in two documents:

- Memorandum of understanding (MoA; 3/2013; Appendix 1)
- Additional Instructions for the blind test of the ITTO-Africa project (2/2015; Appendix 2)

The blind test consisted of two parts:

**Part I:** species identification (21 African timber species;  
Methods: wood anatomy, DNA barcoding)

**Part II:** verification of the declared origin (3 African timber species;  
Methods: DNA fingerprinting, stable isotope method).

According to the MoA specification WWF delivered the agreed number of analysable samples (see expert opinions attached). In agreement with TI (Thünen Institute; Großhansdorf, Germany) the parties agreed to cut down the number of samples (see Additional Instructions for the blind test of the ITTO-Africa project from 2/2015; appendix 2).

For **part I**, the Plant Genetic Diagnostics GmbH (Großhansdorf, Germany) conducted the genetic work and the Institute of Wood Research at the Thünen Institute (TI; Bergedorf, Germany) carried out an anatomical analysis of the wood samples.

For **part II**, genetic work was done by the Institute of Forest Genetics at the TI and by University of Adelaide (Australia); and the work on stable isotopes was done by JR/HBLFA Francisco-Josephinum (HBLFVienna, Austria), AgroIsolab GmbH (Jülich, Germany) and by the Food and Environment Research Agency (FERA; York, UK).

In agreement with TI, WWF Germany organized external funding from **World Resources Institute (WRI)** to allow blind test sampling in Africa from standing trees. This request of WWF is based on the conviction that specifically for part II of the blind test results are more expressive and solid if blind test samples derived from authentic material from standing trees taken with GPS-data on site. The WWF blind test comprised of two different material types: 1. wood samples collected from standing trees in the field and 2. sawn wood taken from forest management units (see also chapter "Wood sampling")

In agreement with TI, WWF Germany engaged **Philipps-University Marburg** (Germany) in a subcontract to provide a collection of wood samples required for both blind test parts. To fulfil the project conditions, Philipps-University Marburg additionally signed a confidentiality agreement.

To verify that the blind test samples provided by Philipps-University Marburg were consistent with the agreed species (part II), WWF arranged a **third party verification** (wood anatomy) - which confirmed the declared species identity (Appendix 4: Sample A\_DRC\_2014 identical with BT\_2014\_19 (*Entandrophragma cylindricum*); Sample B\_DRC\_2014 identical with RM\_2014\_42 (*Nauclea diderichii*)).

In agreement with TI WWF deposited all questions and results of the blind test at the German Federal Ministry of food and agriculture before the blind test st.

## 2 Wood sampling

One goal of the test was to create questions close to real cases “...Both tests should be done using saw timber or equal treated material in order to keep it close to the later practical application of the developed tools...” (MoA). On the one hand there was a need to use sawn wood with comparable characteristics to real products. On the other hands there was a need to reach highest quality concerning knowledge about the origin (authentic samples). WWF ranges only samples taken in the field with GPS-data as “A-quality” (see appendix 8).

### 2.1 Wood samples from standing trees

Between May and November 2014, Philipps-University Marburg collected wood samples for both blind test parts in two different African countries: Democratic Republic of Congo (DRC) and Ghana. The sampling was carried out by two employees from Philipps-University Marburg: Kristina Osen and Sören Kaack supported by several institutions that provided logistic support and official authorizations – see Table 1.

Additionally, WWF collected samples from various cooperating partners supported by internal and external timber experts to full fill all test requirements. All involved partners agreed to maintain strict confidentiality on the identity of the species and the geographic origin of the material. According to the signed agreement Philipps-University Marburg did not pass additional reference samples, information about the blind test or the involved laboratories to any third party.

Table 1: List of cooperating partners

|                                                                                                                                  |
|----------------------------------------------------------------------------------------------------------------------------------|
| <b>Partners in DRC:</b>                                                                                                          |
| WWF – DRC                                                                                                                        |
| Direction de la gestion forestière du MECNT - Ministère de l'environnement, conservation de la nature, tourisme                  |
| ICCN - Institut Congolais pour la Conservation de la Nature                                                                      |
| INERA - Institut National pour l'Etude et la Recherche Agronomiques                                                              |
| Logging companies: Sodefor - Société de Développement Forestier and CFT - Compagnie Forestière de Transformation                 |
| Field assistant Mr. Bernard Ikati Lisongi (Ir. Eaux et Forêts et Gestion des ressources naturelles de la Université de Kinshasa) |
| <b>Partners in Ghana:</b>                                                                                                        |
| Forestry Commission, RMSC – Resource Management Support Center                                                                   |
| Crops Research Institute Kumasi (for the export licence)                                                                         |

For part I, Philipps-University Marburg collected 59 samples of different genera out of the 21 target species in DRC and Ghana: *Millettia laurentii*; *Terminalia superba*; *Pterocarpus soyauxii*; *Pipdadeniastrum africanum*; *Nauclea diderrichii*; *Milicia excelsa*; *Khaya anthotheca*; *Guibourtia spp.*; *Erythrophleum suaveolens*; *Erythrophleum ivorense*; *Entandrophragma utile*; *Entandrophragma cylindricum*; *Entandrophragma angolense*; *Baillonella toxisperma*; *Aucoumea klaineana*; *Lophira alata*; *Cylicodiscus gabunensis*; *Milicia regia*; *Aningeria robusta*; *Khaya ivorensis*; *Afzelia pachyloba*; *Afzelia bipindensis*.

For part II, Philipps-University Marburg collected 73 wood samples of the three target species *Milicia excelsa*, *Entandrophragma cylindricum* and *Triplochiton scleroxylon*. For *Milicia excelsa*, 23 samples were collected in DRC and 3 samples were collected in Ghana. For *Entandrophragma cylindricum*, 20 samples were collected in DRC and 3 samples in Ghana. For *Triplochiton scleroxylon*, 24 samples were collected in Ghana (see Figure 2).

#### 2.1.1 Sampling procedure

The identity of the target trees was always double-checked by the involved sample takers (trained biologists) and national forest experts on the ground. For the actual sample taking, all cambium material was thoroughly removed from the unambiguously identified target tree, and wood samples were taken with hammer and chisel or with a driller. To prevent any possible mixing of sampling material from different tree individuals, sampling tools like chisel and auger were thoroughly cleaned after each sample taking to entirely remove possible remaining materials from the previously sampled tree. Additionally, GPS data for each target tree was recorded. Pictures were taken from each sample site and tree.



Figure 1: Picture of blind test sampling Philipps-University Marburg; Example blindtest ID “RM\_2014\_42” (*Nauclea diderrichii*; Bilinga); equal to ID “B\_DRC\_2014” - Appendix 4

All sample material was sun- and air-dried and stored in paper bags. Those paper bags were packed in plastic bags with silica gel to keep the samples dry and prevent fungi infection. Each sample was stored in an individual bag and marked with a clear ID, so there was no likelihood of material confusion at any given time. Finally, the dry samples (humidity < 10%) were sent to the corresponding labs for downstream analysis.

The sample amount for part I was collected as follows:

DNA: approx. 75 g of fresh wood material, corresponding to a volume of approx. 2 cm x 5 cm x 10 cm, about the size of a cigarette box. Material was collected either with a chisel or with a driller and comprised both sapwood and heartwood.

Wood anatomy: solid wood cube – minimum the size 1 cm<sup>3</sup>. Material was collected with a chisel and comprised both sapwood and heartwood.

The sample amount for part II was collected as follows:

DNA and stable isotope samples (sample taking was identical): approx. 75 g of wet wood material, corresponding to a volume of approx. 2 cm x 5 cm x 10 cm, about the size of a cigarette box. Material was collected either with a chisel or with a driller and comprised both sapwood and heartwood with a mean depth of 8 – 10 cm.

Wood anatomy: solid wood cube – minimum the size 1 cm<sup>3</sup>. Material was collected with a chisel and comprised both sapwood and heartwood.

For every target tree, Philipps-University Marburg collected two samples, with one sample from each batch to be kept in Marburg. These additional sample batches were collected for several reasons: a) for safety reasons in case the original batch were to be damaged or lost and b) for further analysis approaches in the future, after successful completion of the blind test.



## 2.2 Sawn wood samples

### Blind test part I:

To complete the set of the 21 target species of part I of the blind test (species verification) WWF purchased sawn wood and veneer samples from three different reliable wood traders. In total, 25 test samples were collected for part I, which included 11 wood samples taken directly from trees, 11 sawn wood samples and 3 veneer samples.

### Blind test part II:

The set of 60 blind test samples (3 species x 10 blind test samples) included 6 sawn wood samples (3 x 2). Sawn wood samples were also collected by WWF in order to provide a blind test that reflects the requirements of a realistic investigation set up (as most questionable timber in the trade has been treated and processed similarly). The samples were provided by reliable forest concessionaires and collected on their saw mill sites. Only samples from clearly trackable logs with proven origin were taken. For all samples taken into account, the granted minimum information of origin is the FMU (Forest Management Unit). This was verified by a forestry specialist and in each case by at least one WWF-representative. In cases where the exact GPS coordinates of the standing tree were known, these were given. In cases where only the FMU was known, GPS coordinates of a point near the centre of the FMU were given. As no selected FMU was larger than 30 km in diameter, any tree in the respective FMU is not further away from that centre point than 15 km. All samples were cut from larger timber pieces with hand held saws. Any side of the sample thus received a fresh cut with a thoroughly cleaned saw, minimizing any possibility of contamination (e.g. with extrinsic sawdust). Sawn wood samples were collected via WWF in Cameroon, Congo Brazzaville and Gabon.

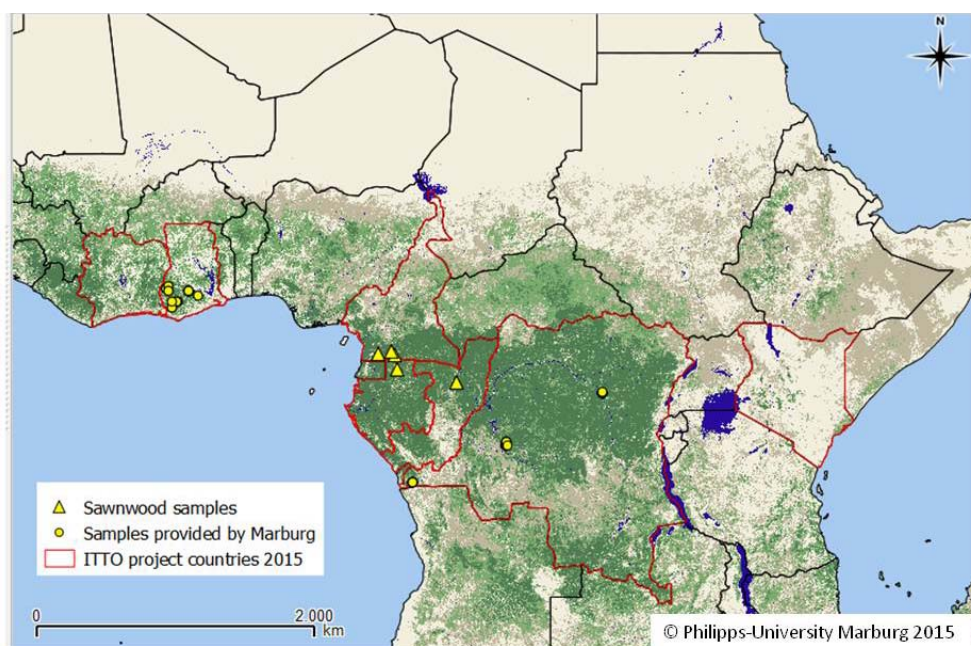


Figure 2: Sample taking locations for *Milicia excelsa*, *Entandrophragma cylindricum* and *Triplochiton scleroxylon* in ITTO project countries provided by University of Marburg (yellow dots) and WWF (yellow triangles).

### 3 Blind test design

For both blind test approaches (part I & II) WWF's strategy was to combine basic, middle and more demanding tasks. Another goal was to create questions close to real cases "...Both tests should be done using saw timber or equal treated material in order to keep it close to the later practical application of the developed tools..." (MoA).

#### 3.1 Blind test design, part I (species identification)

Within the project scope, the entire species spectrum covered the following 21 target species: *Afzelia* spp., *Aningeria robusta*, *Aucoumea klaineana*, *Baillonella toxisperma*, *Cylicodiscus gabunensis*, *Entandrophragma angolense*, *Entandrophragma cylindricum*, *Entandrophragma utile*, *Erythrophleum ivorense*, *Erythrophleum suaveolens*, *Guibourtia* spp., *Khaya* spp., *Lophira alata*, *Milicia excelsa*, *Milicia regia*, *Millettia laurentii*, *Nauclea diderrichii*, *Pericopsis elata*, *Pterocarpus soyauxii*, *Terminalia superba* and *Triplochiton scleroxylon*.

The set of samples for the blind test approach included 25 samples from the species spectrum bearing true/false declarations. In agreement with TI, WWF Germany included all 21 target species into the set of declarations to make sure that in case of DNA analysis there was a chance use to use all markers developed during the ITTO-project. According to the MoA agreement the idea was to verify the given species declaration.

Samples were taken partly from the field according to the above mentioned protocol and complemented with samples from reliable wood traders.

Table 2: Blind test, part I – 25 blind test samples; Black columns: information sent to the labs with the question to verify the declared species; Red columns: Real species

| ID         | Blind test declaration             | Real species<br>(Scientific name)  | Real species<br>(Common name) |
|------------|------------------------------------|------------------------------------|-------------------------------|
| RM_2014_03 | <i>Milicia excelsa</i>             | <i>Millettia laurentii</i>         | Wenge                         |
| RM_2014_04 | <i>Erythrophleum ivorense</i>      | <i>Erythrophleum suaveolens</i>    | Tali                          |
| RM_2014_13 | <i>Khaya ivorensis</i>             | <i>Khaya anthotheca</i>            | Khaya                         |
| RM_2014_37 | <i>Erythrophleum suaveolens</i>    | <i>Erythrophleum ivorense</i>      | Tali                          |
| RM_2014_39 | <i>Entandrophragma utile</i>       | <i>Aucoumea klaineana</i>          | Ocumé                         |
| RM_2014_42 | <i>Entandrophragma angolense</i>   | <i>Nauclea diderrichii</i>         | Bilinga                       |
| RM_2014_45 | <i>Afzelia pachyloba</i>           | <i>Afzelia bipindensis</i>         | Afzelia                       |
| RM_2014_48 | <i>Entandrophragma cylindricum</i> | <i>Entandrophragma angolense</i>   | Tiama blanc                   |
| RM_2014_49 | <i>Aningeria robusta</i>           | <i>Baillonella toxisperma</i>      | Moabi                         |
| RM_2014_59 | <i>Aucoumea klaineana</i>          | <i>Afzelia pachyloba</i>           | Afzelia                       |
| RM_2014_60 | <i>Cylicodiscus gabunensis</i>     | <i>Entandrophragma utile</i>       | Sipo                          |
| X2-57      | <i>Pterocarpus soyauxii</i>        | <i>Pericopsis elata</i>            | Afromosia                     |
| X2-58      | <i>Baillonella toxisperma</i>      | <i>Aningeria robusta</i>           | Anigre                        |
| X2-59      | <i>Afzelia bipindensis</i>         | <i>Afzelia africana</i>            | Afzelia                       |
| X2-65      | <i>Guibourtia ehie</i>             | <i>Guibourtia tessmannii</i>       | Bubinga                       |
| X2-66      | <i>Millettia laurentii</i>         | <i>Milicia excelsa</i>             | Iroko / Kambala               |
| X2-67      | <i>Khaya grandiflora</i>           | <i>Khaya ivorensis</i>             | Khaya                         |
| X2-68      | <i>Milicia regia</i>               | <i>Milicia excelsa</i>             | Iroko / Kambala               |
| X2-69      | <i>Terminalia superba</i>          | <i>Terminalia superba</i>          | Limba                         |
| X2-74      | <i>Pericopsis elata</i>            | <i>Pterocarpus soyauxii</i>        | Padouk                        |
| X2-75      | <i>Nauclea diderrichii</i>         | <i>Aucoumea klaineana</i>          | Okoumé                        |
| X2-76      | <i>Khaya ivorensis</i>             | <i>Entandrophragma cylindricum</i> | Sapelli                       |
| X2-78      | <i>Triplochiton scleroxylon</i>    | <i>Triplochiton scleroxylon</i>    | Abachi / Ayou                 |
| X2-79      | <i>Pericopsis elata</i>            | <i>Cylicodiscus gabunensis</i>     | Okan                          |
| X2-81      | <i>Lophira alata</i>               | <i>Lophira alata</i>               | Azobé or Bongossi             |



### 3.2 Blind test design, part II (verification of the declared origin)

The project focussed on the 3 target species Iroko (*Milicia excelsa*), Sapelli (*Entandrophragma cylindricum*) and Ayou (*Triplochiton scleroxylon*). In order to design the blind test on origin, the scope of available reference material was one decisive parameter, as only reference material taken during the ITTO project was accepted for labs to do the blind test interpretation.

The available reference material was sampled independently from WWF's blind test approach during the first part of the ITTO-project and consists of 5400 leaf, cambium and wood samples from ten countries linked to part I and part II of the blind test [ITTO-tropical forest update 24/1]. From these samples, 828 analysable reference samples were available for the stable isotope method. 3324 analysable reference samples from the comparable number of populations were available for DNA labs.

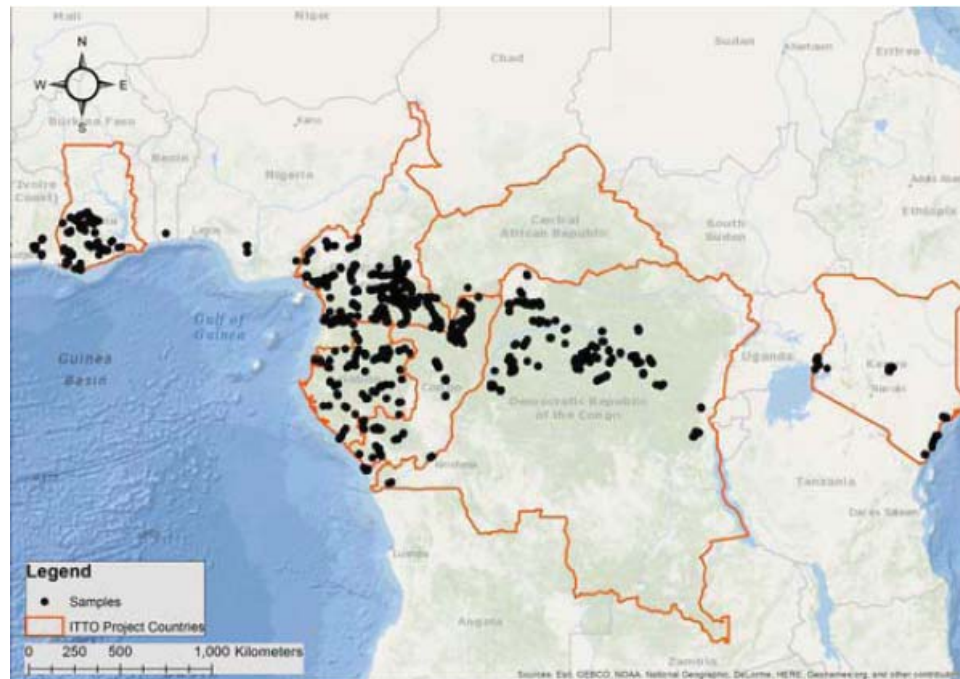


Figure 3: Distribution of reference sampling locations (5400 samples; ten countries) of the tree tropical African timber species [source: ITTO-tropical forest update 24/1]

In 2015, TI and WWF jointly agreed to only include those countries into the blind test design (list of possible right or wrong declared countries), that count with a minimum set of at least 20 usable reference samples. As a result the list of possible countries of origin includes:

- Ayou (*Triplochiton scleroxylon*)
  - o Cameroon
  - o Congo Brazzaville
  - o Côte d'Ivoire
  - o DRC
  - o Ghana
- Iroko (*Milicia excelsa*)
  - o Cameroon
  - o DRC
  - o Gabon
  - o Ghana
  - o Kenya
- Sapelli (*Entandrophragma cylindricum*)
  - o Cameroon
  - o Congo Brazzaville
  - o DRC
  - o Ghana

WWF designed the blind test in a way that every participating lab received a collection of samples from one or more of the tree target species with different declared origins. In every sample package WWF included the same number of samples and the same number of basic, middle or more

difficult questions in matters of country and region to stress the distance of declared and real origin as a crucial parameter. (Background information: According to the EU Timber Regulation (EUTR), affected companies have to declare at least the country of origin or, in cases of different risk levels within a country, the region or the Forest Management Unit (FMU)).

In cases where labs only answered the question on the country level, the degree of difficulty is easier than the one predicted in WWF's column. Example:

Table 3: Example to explain the logical framework of the blind test

| ID          | Declared country | Declared Region | Declared Origin (GPS)             | WWF: Declaration is true/false (Country/Region) | WWF: Real Country of Origin | WWF: Real Origin GPS_X | WWF: Real Origin GPS_Y | WWF: Distance [km]; Declared/real | WWF: predicted level of difficulty |
|-------------|------------------|-----------------|-----------------------------------|-------------------------------------------------|-----------------------------|------------------------|------------------------|-----------------------------------|------------------------------------|
| BT_2014_533 | Ghana            | South-East      | N6.3;<br>W0.022<br>(80 km radius) | r/f                                             | Ghana                       | N 5.57883              | W 2.25545              | 270                               | m                                  |

Declared origin is Ghana – real country of origin is also Ghana. The predicted middle degree of difficulty (“m”) deduce from a wrongly declared region inside Ghana. In case a lab could only answer the question on the country level but not the regional question, the first part of the question was solved (basic level of difficulty) but the trickier challenge (country AND region; predicted middle level of difficulty) was not accomplished.

WWF guarantees that in all cases where the declared country coordinates are wrong, these declarations are at least 150 km away from the correct place of origin.

In agreement with TI, WWF Germany chose only false declarations inside a country in case the country was correctly declared. The region was described precisely via GPS and radius.

### 3.3 Blind test design Ayou (*Triplochiton scleroxylon*)

Table 4: Blind test, part II; 10 blind test samples (Ayou) Black columns: information sent to the labs with the question to verify the declared origin; Red columns: Real origin, distance and prediction of difficulty (b = basic; m = middle; d = more difficult) concerning combined question country and region.

| ID          | Declared country | Declared Region | Declared Origin (GPS)          | WWF: Declaration is true/false (Country/Region) | WWF: Real Country of Origin | WWF: Real Origin GPS_X | WWF: Real Origin GPS_Y | WWF: Distance [km]; Declared/real | WWF: predicted level of difficulty |
|-------------|------------------|-----------------|--------------------------------|-------------------------------------------------|-----------------------------|------------------------|------------------------|-----------------------------------|------------------------------------|
| BT_2014_533 | Ghana            | South-East      | N6.3; W0.022 (80 km radius)    | r/f                                             | Ghana                       | N 5.57883              | W 2.25545              | 270                               | m                                  |
| BT_2014_543 | Cameroon         | North           | N3.15017 E 13.61635 (80 km r.) | f/f                                             | Gabun                       | N 1.630097             | E 12.089700            | 240                               | d                                  |
| BT_2014_547 | DRC              | South-West      | S5; E16 (90 km radius)         | f                                               | Ghana                       | N 6.41525              | W 1.20916              | 2300                              | m                                  |
| BT_2014_551 | Côte d'Ivoire    | South-East      | N5.9; W3.75 (25 km radius)     | f                                               | Ghana                       | N 5.35566              | W 2.26029              | 180                               | d                                  |
| BT_2014_563 | Côte d'Ivoire    | South           | N6; W5 (100 km radius)         | f                                               | Ghana                       | N 6.49586              | W 2.47783              | 280                               | d                                  |
| BT_2014_567 | DRC              | West            | S2; E19 (200 km radius)        | f                                               | Ghana                       | N 6.01586              | W 2.04149              | 2500                              | b                                  |
| BT_2014_568 | Cameroon         | Central         | N3.518 E13.44178 (50 km r.)    | r/f                                             | Cameroon                    | N 2.54425              | E 11.92747             | 200                               | m                                  |
| BT_2014_578 | Cameroon         | West            | N5; E10 (110 km radius)        | f                                               | Ghana                       | N 6.58086              | W 2.38226              | 1400                              | b                                  |
| BT_2014_594 | Ghana            | Central         | N7.75; W0.988 (60 km r.)       | r/f                                             | Ghana                       | N 6.41922              | W 2.37705              | 210                               | d                                  |
| BT_2014_598 | Ghana            | Central - south | N6.4; W1.2 (90 km radius)      | r/r                                             | Ghana                       | N 6.40983              | W 1.20743              | < 10                              | b                                  |

### 3.4 Blind test design Iroko (*Milicia excelsa*)

Table 5: Blind test, part II; 10 blind test samples (Iroko) Black columns: information sent to the labs with the question to verify the declared origin; Red columns: Real origin, distance and prediction of difficulty (b = basic; m = middle; d = more difficult) concerning combined question country and region.

| ID          | Declared country | Declared Region | Declared Origin (GPS)          | WWF: Declaration is true/false (Country/Region) | WWF: Real Country of Origin | WWF: Real Origin GPS_X | WWF: Real Origin GPS_Y | WWF: Distance [km]; Declared/real | WWF: predicted level of difficulty |
|-------------|------------------|-----------------|--------------------------------|-------------------------------------------------|-----------------------------|------------------------|------------------------|-----------------------------------|------------------------------------|
| BT_2014_518 | Gabun            | North-East      | N0.84; E13.85 (40 km radius)   | f                                               | Congo B.                    | N 0.8                  | E 15.95                | 230                               | d                                  |
| BT_2014_526 | Ghana            | South           | N6; W1 (60 km radius)          | r/r                                             | Ghana                       | N 6.41294              | W 1.20957              | 50                                | b                                  |
| BT_2014_527 | DRC              | Central         | S2; E19 (180 km radius)        | r/r                                             | DRC                         | S 3.13563              | E 19.08678             | 130                               | m                                  |
| BT_2014_549 | Kenya            | West            | 0; E35 (100 km radius)         | f                                               | DRC                         | N 0.08401              | E 25.19800             | 900                               | b                                  |
| BT_2014_554 | Gabun            | North           | N1.3; E12.225 (60 km radius)   | f                                               | Cameroon                    | N 2.65853              | E 10.89303             | 230                               | d                                  |
| BT_2014_566 | Kamerun          | South           | N3.5; E12 (100 km radius)      | f                                               | DRC                         | S 5.36783              | E 13.06735             | 1000                              | b                                  |
| BT_2014_569 | DRC              | North-West      | N0.0131; E18.24 (40 km radius) | r/f                                             | DRC                         | S 3.13551              | E 19.08598             | 380                               | m                                  |
| BT_2014_596 | Gabun            | South           | S3.09; E11.1 (50 km radius)    | f                                               | DRC                         | S 5.36419              | E 13.06610             | 400                               | d                                  |
| BT_2014_599 | Ghana            | South-East      | N6.3; E0 (70 km radius)        | r/f                                             | Ghana                       | N 6.00239              | W 2.04507              | 230                               | m                                  |
| BT_2014_600 | DRC              | North-West      | N2; E21 (200 km radius)        | r/f                                             | DRC                         | S 5.37003              | E 13.06686             | 1200                              | d                                  |

### 3.5 Blind test design Sapelli (*Entandrophragma cylindricum*)

Table 6: Blind test, part II; 10 blind test samples (Sapelli) Black columns: information sent to the labs with the question to verify the declared origin; Red columns: Real origin, distance and prediction of difficulty (b = basic; m = middle; d = more difficult) concerning combined question country and region.

| ID          | Declared country  | Declared Region | Declared Origin (GPS)           | WWF: Declaration is true/false (Country/Region) | WWF: Real Country of Origin | WWF: Real Origin GPS_X | WWF: Real Origin GPS_Y | WWF: Distance [km]; Declared/real | WWF: predicted level of difficulty |
|-------------|-------------------|-----------------|---------------------------------|-------------------------------------------------|-----------------------------|------------------------|------------------------|-----------------------------------|------------------------------------|
| BT_2014_510 | Ghana             | South           | N6.4; W1.2 (70 km radius)       | r/r                                             | Ghana                       | N 6.41563              | W 1.20895              | < 10                              | b                                  |
| BT_2014_522 | DRC               | North-West      | N1.55115; E21.07416 (300 km r.) | r/f                                             | DRC                         | S 3.14157              | E 19.08899             | 570                               | d                                  |
| BT_2014_525 | Ghana             | South-East      | N6.3; E0 (75 km radius)         | r/f                                             | Ghana                       | N 6.00600              | W 2.04759              | 230                               | d                                  |
| BT_2014_534 | Kongo Brazzaville | Central/South   | S3; E15 (100 km radius)         | f                                               | DRC                         | S 3.14682              | E 19.09272             | 450                               | d                                  |
| BT_2014_552 | DRC               | North           | N0.45; E25.8 (200 km radius)    | r/r                                             | DRC                         | N 0.08388              | E 25.19451             | 80                                | b                                  |
| BT_2014_557 | DRC               | Central         | S4; E19 (300 km radius)         | r/f                                             | DRC                         | N 0.08143              | E 25.19737             | 800                               | m                                  |
| BT_2014_573 | DRC               | South-West      | S4.77; E16.9 (120 km radius)    | r/f                                             | DRC                         | S 3.14100              | E 19.08616             | 300                               | d                                  |
| BT_2014_577 | Kamerun           | South           | N2.8; E12 (40 km radius)        | r/r                                             | Cameroon                    | N 2.762739             | E 11.747475            | 30                                | b                                  |
| BT_2014_580 | Kamerun           | South-East      | N3.04; E14.5 (90 km radius)     | f                                               | Congo B.                    | N 0.8                  | E 15.95                | 300                               | m                                  |
| BT_2014_592 | Kongo Brazzaville | North           | N0.51544; E16.72308 (120 km r.) | f                                               | DRC                         | S 3.14632              | E 19.09076             | 500                               | m                                  |

## 4 Results

### 4.1 Results part I (species identification)

#### 4.1.1 Wood anatomy (Thünen Institute)

Table 7: Result blind test part I (species identification) – wood anatomy (Thünen Institute; Bergedorf-Germany; Dr. Gerald Koch). Black columns: table sent back from the lab. Red/coloured columns: additional column with WWF's evaluation of the test (green background colour = declared species was verified correctly / species or genus was identified correctly; white background colour = for this species the method is not able to verify or identify on the species level.)

| ID         | Claims on species name<br><i>Deklarierte Holzart</i> | Result of lab<br><i>Testergebnis</i> | Result of the microscopic wood identification (wood anatomy)<br><i>Ergebnis der mikroskopischen Holzartenbestimmung (Holzanatomie)</i> | Comments<br><i>Kommentare</i>                                                                       | WWF blind test:<br><br>Real species | WWF: evaluation of lab results (verification of the declared species)                                               | WWF: blind test evaluation in detail (identified genus) | WWF: blind test evaluation in detail (identified)                                  |
|------------|------------------------------------------------------|--------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|-------------------------------------|---------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------|------------------------------------------------------------------------------------|
| RM_2014_03 | <i>Milicia excelsa</i>                               | false                                | <i>Millettia</i> spp. = Wengé or Panga Panga                                                                                           | correct trade name Wengé / Panga Panga                                                              | <i>Millettia laurentii</i>          | correct                                                                                                             | correct genus identified                                | no result from lab                                                                 |
| RM_2014_04 | <i>Erythrophleum ivorense</i>                        | correct                              | <i>Erythrophleum</i> spp. = Tali                                                                                                       | the individual species within the genus <i>Erythrophleum</i> can't be distinguished microscopically | <i>Erythrophleum suaveolens</i>     | Verification "correct" linked to the genus level because species verification is not possible with this method here | correct genus identified                                | no result from lab because species identification is not possible with this method |
| RM_2014_13 | <i>Khaya ivorensis</i>                               | correct                              | <i>Khaya</i> spp. = Khaya                                                                                                              | the individual species within the genus <i>Khaya</i> can't be distinguished microscopically         | <i>Khaya anthotheca</i>             | Verification "correct" linked to the genus level because species verification is not possible with this method here | correct genus identified                                | no result from lab because species identification is not possible with this method |
| RM_2014_37 | <i>Erythrophleum suaveolens</i>                      | correct                              | <i>Erythrophleum</i> spp. = Tali                                                                                                       | the individual species within the genus <i>Erythrophleum</i> can't be distinguished microscopically | <i>Erythrophleum ivorense</i>       | Verification "correct" linked to the genus level because species verification is not possible with this method here | correct genus identified                                | no result from lab because species identification is not possible with this method |



|            |                                    |         |                                                         |                                                                                               |                                  |                                                                                                                     |                          |                                                                                    |
|------------|------------------------------------|---------|---------------------------------------------------------|-----------------------------------------------------------------------------------------------|----------------------------------|---------------------------------------------------------------------------------------------------------------------|--------------------------|------------------------------------------------------------------------------------|
| RM_2014_39 | <i>Entandrophragma utile</i>       | false   | <i>Aucoumea klaineana</i> = Okoumé                      | correct trade name Okoumé                                                                     | <i>Aucoumea klaineana</i>        | correct                                                                                                             | correct genus identified | correct species identified                                                         |
| RM_2014_42 | <i>Entandrophragma angolense</i>   | false   | <i>Nauclea diderichii</i> = Bilinga                     | correct trade name Bilinga                                                                    | <i>Nauclea diderichii</i>        | correct                                                                                                             | correct genus identified | correct species identified                                                         |
| RM_2014_45 | <i>Afzelia pachyloba</i>           | correct | <i>Afzelia</i> spp. = <i>Afzelia</i>                    | the individual species within the genus <i>Afzelia</i> can't be distinguished microscopically | <i>Afzelia bipindensis</i>       | Verification "correct" linked to the genus level because species verification is not possible with this method here | correct genus identified | no result from lab because species identification is not possible with this method |
| RM_2014_48 | <i>Entandrophragma cylindricum</i> | false   | <i>Entandrophragma angolense</i> = Tiama                | correct declaration Tiama                                                                     | <i>Entandrophragma angolense</i> | correct                                                                                                             | correct genus identified | correct species identified                                                         |
| RM_2014_49 | <i>Aningeria robusta</i>           | false   | <i>Baillonella toxisperma</i> = Moabi                   | correct declaration Moabi                                                                     | <i>Baillonella toxisperma</i>    | correct                                                                                                             | correct genus identified | correct species identified                                                         |
| RM_2014_59 | <i>Aucoumea klaineana</i>          | false   | <i>Afzelia</i> spp. = <i>Afzelia</i>                    | correct trade name <i>Afzelia</i>                                                             | <i>Afzelia pachyloba</i>         | correct                                                                                                             | correct genus identified | no result from lab because species identification is not possible with this method |
| RM_2014_60 | <i>Cylicodiscus gabunensis</i>     | false   | <i>Entandrophragma utile</i> = Sipo                     | correct trade name Sipo                                                                       | <i>Entandrophragma utile</i>     | correct                                                                                                             | correct genus identified | correct species identified                                                         |
| X2-57      | <i>Pterocarpus soyauxii</i>        | false   | <i>Pericopsis elata</i> = Afrormosia                    | correct trade name Afrormosia (CITES-species)                                                 | <i>Pericopsis elata</i>          | correct                                                                                                             | correct genus identified | correct species identified                                                         |
| X2-58      | <i>Baillonella toxisperma</i>      | false   | <i>Pouteria</i> spp. ( <i>Aningeria</i> spp.) = Aningré | correct trade name Aningré                                                                    | <i>Aningeria robusta</i>         | correct                                                                                                             | correct genus identified | no result from lab                                                                 |
| X2-59      | <i>Afzelia bipindensis</i>         | correct | <i>Afzelia</i> spp. = <i>Afzelia</i>                    | the individual species within the genus <i>Afzelia</i> can't be distinguished microscopically | <i>Afzelia africana</i>          | Verification "correct" linked to the genus level because species verification is not possible with this method here | correct genus identified | no result from lab because species identification is not possible with this method |
| X2-65      | <i>Guibourtia ehie</i>             | false   | <i>Guibourtia</i> spp. = Bubinga                        | The wood anatomical characters show best agreement                                            | <i>Guibourtia tessmannii</i>     | correct                                                                                                             | correct genus identified | no result from lab because species identification is                               |

|       |                                 |         |                                              |                                                                                               |                                    |                                                                                                                     |                          |                                                                                    |
|-------|---------------------------------|---------|----------------------------------------------|-----------------------------------------------------------------------------------------------|------------------------------------|---------------------------------------------------------------------------------------------------------------------|--------------------------|------------------------------------------------------------------------------------|
|       |                                 |         |                                              | with Bubinga; the individual species G. ehie = Ovengkol can be excluded                       |                                    |                                                                                                                     |                          | not possible with this method                                                      |
| X2-66 | <i>Millettia laurentii</i>      | false   | <i>Milicia</i> cf. <i>excelsa</i> = Iroko    | correct trade name Iroko                                                                      | <i>Milicia excelsa</i>             | correct                                                                                                             | correct genus identified | correct species identified                                                         |
| X2-67 | <i>Khaya grandiflora</i>        | correct | <i>Khaya</i> spp. = Khaya                    | the individual species within the genus <i>Khaya</i> can't be distinguished microscopically   | <i>Khaya ivorensis</i>             | Verification "correct" linked to the genus level because species verification is not possible with this method here | correct genus identified | no result from lab because species identification is not possible with this method |
| X2-68 | <i>Milicia regia</i>            | correct | <i>Milicia</i> spp. = Iroko                  | the individual species within the genus <i>Milicia</i> can't be distinguished microscopically | <i>Milicia excelsa</i>             | Verification "correct" linked to the genus level because species verification is not possible with this method here | correct genus identified | no result from lab because species identification is not possible with this method |
| X2-69 | <i>Terminalia superba</i>       | correct | <i>Terminalia superba</i> = Limba            | correct declaration                                                                           | <i>Terminalia superba</i>          | correct                                                                                                             | correct genus identified | correct species identified                                                         |
| X2-74 | <i>Pericopsis elata</i>         | false   | <i>Pterocarpus soyauxii</i> = Padouk         | correct trade name Padouk                                                                     | <i>Pterocarpus soyauxii</i>        | correct                                                                                                             | correct genus identified | correct species identified                                                         |
| X2-75 | <i>Nauclea diderrichii</i>      | false   | <i>Aucoumea klaineana</i> = Okoumé           | correct trade name Okoumé                                                                     | <i>Aucoumea klaineana</i>          | correct                                                                                                             | correct genus identified | correct species identified                                                         |
| X2-76 | <i>Khaya ivorensis</i>          | false   | <i>Entandrophragma cylindricum</i> = Sapelli | correct trade name Sapelli                                                                    | <i>Entandrophragma cylindricum</i> | correct                                                                                                             | correct genus identified | correct species identified                                                         |
| X2-78 | <i>Triplochiton scleroxylon</i> | correct | <i>Triplochiton scleroxylon</i> = Abachi     | correct declaration                                                                           | <i>Triplochiton scleroxylon</i>    | correct                                                                                                             | correct genus identified | correct species identified                                                         |
| X2-79 | <i>Pericopsis elata</i>         | false   | <i>Cyclocodiscus gabunensis</i> = Okan       | correct trade name Okan                                                                       | <i>Cyclocodiscus gabunensis</i>    | correct                                                                                                             | correct genus identified | correct species identified                                                         |
| X2-81 | <i>Lophira alata</i>            | correct | <i>Lophira alata</i> = Bongossi              | correct declaration                                                                           | <i>Lophira alata</i>               | correct                                                                                                             | correct genus identified | correct species identified                                                         |

#### 4.1.2 DNA barcoding (Plant Genetic Diagnostics GmbH)

Table 8: Result blind test part I (species identification) – DNA barcoding / fingerprinting (Plant Genetic Diagnostics GmbH; Großhansdorf-Germany; Dr. Aki Michael Hölten). Black columns: table sent back from the lab. Red/coloured columns: additional columns with information about real species and WWF's evaluation of the test (green background colour = declared species was verified in the right way; yellow background colour = formally wrong verification, if the species level is considered but all verifications and identifications on the genus level are correct)

| original ID | claim                              | Barcoding- / finger-printing results | final comment                                             | WWF blind test: Real species     | WWF: evaluation of lab results (verification of the declared species)                                                                    | WWF: blind test evaluation in detail (identified genus) | WWF: blind test evaluation in detail (identified) |
|-------------|------------------------------------|--------------------------------------|-----------------------------------------------------------|----------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------|---------------------------------------------------|
| RM_2014_03  | <i>Milicia excelsa</i>             |                                      |                                                           | <i>Millettia laurentii</i>       | no result from lab                                                                                                                       | no result from lab                                      | no result from lab                                |
| RM_2014_04  | <i>Erythrophleum ivorense</i>      | YES / -                              | <i>E. ivorense</i> or <i>E. suaveolens</i>                | <i>Erythrophleum suaveolens</i>  | Formally wrong verification, if the species level is considered but all verifications and identifications on the genus level are correct | correct genus identified                                | undetermined remark about identified species      |
| RM_2014_13  | <i>Khaya ivorensis</i>             |                                      |                                                           | <i>Khaya anthotheca</i>          | no result from lab                                                                                                                       | no result from lab                                      | no result from lab                                |
| RM_2014_37  | <i>Erythrophleum suaveolens</i>    |                                      |                                                           | <i>Erythrophleum ivorense</i>    | no result from lab                                                                                                                       | no result from lab                                      | no result from lab                                |
| RM_2014_39  | <i>Entandrophragma utile</i>       | NO / NO                              | <i>Aucoumea</i>                                           | <i>Aucoumea klaineana</i>        | correct                                                                                                                                  | correct genus identified                                | no result from lab                                |
| RM_2014_42  | <i>Entandrophragma angolense</i>   | NO / NO                              | <i>Nauclea</i>                                            | <i>Nauclea diderichii</i>        | correct                                                                                                                                  | correct genus identified                                | no result from lab                                |
| RM_2014_45  | <i>Afzelia pachyloba</i>           | YES / -                              | <i>Afzelia</i>                                            | <i>Afzelia bipindensis</i>       | Formally wrong verification, if the species level is considered but all verifications and identifications on the genus level are correct | correct genus identified                                | no result from lab                                |
| RM_2014_48  | <i>Entandrophragma cylindricum</i> | - / NO                               | nuclear and chloropl. SNPs match with <i>E. angolense</i> | <i>Entandrophragma angolense</i> | correct                                                                                                                                  | correct genus identified                                | correct species identified                        |
| RM_2014_49  | <i>Aningeria robusta</i>           | YES / -                              | <i>Sapotaceae</i> family                                  | <i>Baillonella toxisperma</i>    | wrong                                                                                                                                    | no result from lab                                      | no result from lab                                |
| RM_2014_59  | <i>Aucoumea klaineana</i>          | NO / -                               | <i>Afzelia</i>                                            | <i>Afzelia pachyloba</i>         | correct                                                                                                                                  | correct genus identified                                | no result from lab                                |
| RM_2014_60  | <i>Cylicodiscus gabunensis</i>     |                                      |                                                           | <i>Entandrophragma utile</i>     | no result from lab                                                                                                                       | no result from lab                                      | no result from lab                                |
| X2_57       | <i>Pterocarpus soyauxii</i>        |                                      |                                                           | <i>Pericopsis elata</i>          | no result from lab                                                                                                                       | no result from lab                                      | no result from lab                                |

|       |                                 |         |         |                                    |                             |                          |                            |
|-------|---------------------------------|---------|---------|------------------------------------|-----------------------------|--------------------------|----------------------------|
|       |                                 |         |         |                                    | (veneer)                    |                          |                            |
| X2_58 | <i>Baillionella toxisperma</i>  |         |         | <i>Aningeria robusta</i>           | no result from lab (veneer) | no result from lab       | no result from lab         |
| X2_59 | <i>Afzelia bipendensis</i>      |         |         | <i>Afzelia africana</i>            | no result from lab          | no result from lab       | no result from lab         |
| X2_65 | <i>Guibourtia ehie</i>          | NO / -  | Nauclea | <i>Guibourtia tessmannii</i>       | correct                     | wrong                    | no result from lab         |
| X2_66 | <i>Milletia laurentii</i>       |         |         | <i>Milicia excelsa</i>             | no result from lab          | no result from lab       | no result from lab         |
| X2_67 | <i>Khaya grandiflora</i>        |         |         | <i>Khaya ivorensis</i>             | no result from lab          | no result from lab       | no result from lab         |
| X2_68 | <i>Milicia regia</i>            |         |         | <i>Milicia excelsa</i>             | no result from lab          | no result from lab       | no result from lab         |
| X2_69 | <i>Terminalia superba</i>       | YES / - |         | <i>Terminalia superba</i>          | correct                     | correct genus identified | correct species identified |
| X2_74 | <i>Pericopsis elata</i>         |         |         | <i>Pterocarpus soyauxii</i>        | no result from lab          | no result from lab       | no result from lab         |
| X2_75 | <i>Nauclea diderichii</i>       |         |         | <i>Okoumea klaineana</i>           | no result from lab          | no result from lab       | no result from lab         |
| X2_76 | <i>Khaya ivorensis</i>          |         |         | <i>Entandrophragma cylindricum</i> | no result from lab          | no result from lab       | no result from lab         |
| X2_78 | <i>Triplochiton scleroxylon</i> |         |         | <i>Triplochiton scleroxylon</i>    | no result from lab          | no result from lab       | no result from lab         |
| X2_79 | <i>Pericopsis elata</i>         |         |         | <i>Cyclodiscus gabunensis</i>      | no result from lab          | no result from lab       | no result from lab         |
| X2_81 | <i>Lophira alata</i>            |         |         | <i>Lophira alata</i>               | no result from lab          | no result from lab       | no result from lab         |

## 4.2 Results part II (verification of declared origin)

General remark: WWF blind test comprised two levels, firstly declaration on country level and secondly declaration on regional level. It was obligatory to answer the question on country level as this is always the minimum declaration for affected companies e.g. according to EUTR.

### 4.2.1 DNA fingerprinting; Ayou (University of Adelaide)

Table 9: Result blind test part II (verification of declared origin); Ayou; DNA fingerprinting (University of Adelaide; Australia; Prof. Andrew Lowe). Black columns: table sent back from the lab; Red/coloured additional columns – 1. real country of origin and information if the declaration of country/region was true/false; columns 2. and 3. show WWF's evaluation of the test; Main task: verification of the declared country; Evaluation: green = verification of the declared country/region correct, yellow = verification of the declared country/region undetermined, red = verification of the declared country/region false.

| ID          | Claimed country of origin | result of lab (country)                          | result of lab (region)            | Notes                  | WWF: real country; r/f country/region | WWF: blind test evaluation (country) | WWF: blind test evaluation (region) |
|-------------|---------------------------|--------------------------------------------------|-----------------------------------|------------------------|---------------------------------------|--------------------------------------|-------------------------------------|
| BT_2014_533 | Ghana                     | uncertain - matched to Ivory Coast/Ghana cluster | uncertain - matched within 500 km | sequinom success = 96% | Ghana<br>r/f                          |                                      |                                     |
| BT_2014_543 | Cameroon                  | confirmed                                        | confirmed - within 120 km         | sequinom success = 94% | Gabun<br>f/f                          |                                      |                                     |
| BT_2014_547 | DRC                       | rejected                                         | rejected                          | sequinom success = 93% | Ghana<br>f/f                          |                                      |                                     |
| BT_2014_551 | CIV                       | confirmed                                        | confirmed matched within 250 km   | sequinom success = 97% | Ghana<br>f/f                          |                                      |                                     |
| BT_2014_563 | CIV                       | confirmed                                        | confirmed matched within 100 km   | sequinom success = 97% | Ghana<br>f/f                          |                                      |                                     |
| BT_2014_567 | DRC                       | rejected                                         | rejected                          | sequinom success = 97% | Ghana<br>f/f                          |                                      |                                     |
| BT_2014_568 | Cameroon                  | confirmed                                        | confirmed - matched within 200 km | sequinom success = 97% | Cameroon<br>r/f                       |                                      |                                     |
| BT_2014_578 | Cameroon                  | rejected                                         | rejected                          | sequinom success = 96% | Ghana<br>f/f                          |                                      |                                     |
| BT_2014_594 | Ghana                     | uncertain - matched to Ivory Coast/Ghana cluster | uncertain - matched within 350 km | sequinom success = 93% | Ghana<br>r/f                          |                                      |                                     |
| BT_2014_598 | Ghana                     | confirmed                                        | uncertain - matched within 150 km | sequinom success = 96% | Ghana<br>r/r                          |                                      |                                     |

Table 10: Number of analysable reference samples for Ayau (University of Adelaide):

| Country list reference samples | Number of reference samples |
|--------------------------------|-----------------------------|
| Cameroon                       | 154                         |
| Congo B.                       | 45                          |
| Côte d'Ivoire                  | 208                         |
| DRC                            | 123                         |
| Ghana                          | 122                         |
|                                | 652                         |

#### 4.2.2 DNA fingerprinting; Iroko (Thünen Institute of Forest Genetics)

Table 11: Result blind test part II (verification of declared origin); Iroko; DNA fingerprinting (TI of Forest Genetics; Großhansdorf-Germany; Dr. Céline Blanc-Jolivet). Black columns: table sent back from the lab; Red/coloured additional columns – 1. real country of origin and information if the declaration of country/region was true/false; columns 2. and 3. show WWF's evaluation of the test; Main task: verification of the declared country; Evaluation: green = verification of the declared country correct, red = verification of the declared country false.

| ID          | Declared Country | Claim on region within country | Final conclusion TI | Comments       | WWF: real country; r/f country/region | WWF: blind test evaluation (country) | WWF: blind test evaluation (region) |
|-------------|------------------|--------------------------------|---------------------|----------------|---------------------------------------|--------------------------------------|-------------------------------------|
| BT_2014_526 | Ghana            | N6; W1 (60 km Radius)          | confirmed           |                | Ghana<br>r/r                          |                                      | no result from lab                  |
| BT_2014_600 | DRC              | N2; E21 (200 km Radius)        | rejected            |                | DRC<br>r/f                            |                                      | no result from lab                  |
| BT_2014_566 | Cameroon         | N3.5; E12 (100 km Radius)      | confirmed           |                | DRC<br>f/f                            |                                      | no result from lab                  |
| BT_2014_596 | Gabon            | S3.09; E11.1 (50 km Radius)    | confirmed           |                | DRC<br>f/f                            |                                      | no result from lab                  |
| BT_2014_554 | Gabon            | N1.3; E12.225 (60 km Radius)   | confirmed           |                | Cameroon<br>f/f                       |                                      | no result from lab                  |
| BT_2014_549 | Kenya            | O; E35 (100 km Radius)         | rejected            | Central Africa | DRC<br>f/f                            |                                      | no result from lab                  |
| BT_2014_569 | DRC              | N0.0131; E18.24 (40 km Radius) | rejected            |                | DRC<br>r/f                            |                                      | no result from lab                  |
| BT_2014_527 | DRC              | S2; E19 (180 km Radius)        | confirmed           |                | DRC<br>r/r                            |                                      | no result from lab                  |
| BT_2014_518 | Gabon            | N0.84; E13.85 (40 km Radius)   | rejected            |                | Congo-Brazz.<br>f/f                   |                                      | no result from lab                  |
| BT_2014_599 | Ghana            | N6.3; E0 (70 km Radius)        | rejected            | Ivory Coast    | Ghana<br>r/f                          |                                      | no result from lab                  |

Table 12: Number of analysable reference samples for Iroko (TI):

| Country list reference samples | Number of reference samples |
|--------------------------------|-----------------------------|
| Cameroon                       | 306                         |
| Congo B.                       | 260                         |
| Côte d'Ivoire                  | 101                         |
| DRC                            | 412                         |
| Gabon                          | 252                         |
| Ghana                          | 46                          |
| Kenya                          | 103                         |
|                                | 1480                        |



#### 4.2.3 DNA fingerprinting; Sapelli (Thünen Institute of Forest Genetics)

Table 13: Result blind test part II (verification of declared origin); Sapelli; DNA fingerprinting (Thünen Institute of Forest Genetics; Großhansdorf-Germany; Dr. Céline Blanc-Jolivet). Black columns: table sent back from the lab; Red/coloured additional columns – 1. real country of origin and information if the declaration of country/region was true/false; columns 2. and 3. show WWF's evaluation of the test; Main task: verification of the declared country; Evaluation: green = verification of the declared country/region correct, red = verification of the declared country/region false.

| ID          | Declared Country | Claim on region within country     | Final conclusion Country | Final conclusion region | Comments                                                | WWF: real country; r/f country/region | WWF: blind test evaluation (country) | WWF: blind test evaluation (region)                                  |
|-------------|------------------|------------------------------------|--------------------------|-------------------------|---------------------------------------------------------|---------------------------------------|--------------------------------------|----------------------------------------------------------------------|
| BT_2014_552 | DRC              | N0.45;E25.8 (200km Radius)         | rejected                 | rejected                |                                                         | DRC r/r                               |                                      |                                                                      |
| BT_2014_577 | Cameroon         | N2.8;E12 (40km Radius)             | confirmed                | confirmed               |                                                         | Cameroon r/r                          |                                      |                                                                      |
| BT_2014_510 | Ghana            | N6.4;W1.2 (70km Radius)            | confirmed                | confirmed               |                                                         | Ghana r/r                             |                                      |                                                                      |
| BT_2014_592 | Congo. B.        | N0.51544;E 16.72308 (120km Radius) | confirmed                | confirmed               |                                                         | DRC f/f                               |                                      |                                                                      |
| BT_2014_573 | DRC              | S4.77;E16.9 (120km Radius)         | confirmed                | rejected                | Orientale region most likely                            | DRC r/f                               |                                      |                                                                      |
| BT_2014_557 | DRC              | S4;E19 (300km Radius)              | rejected                 | rejected                |                                                         | DRC r/f                               |                                      | Formally right but possibly it is an artefact of a consecutive fault |
| BT_2014_580 | Cameroon         | N3.04;E14.5 (90km Radius)          | rejected                 | rejected                | likely region of origin between West Cameroon and Ghana | Congo B. f/f                          |                                      |                                                                      |
| BT_2014_525 | Ghana            | N6.3;E0 (75km Radius)              | confirmed                | confirmed               |                                                         | Ghana r/f                             |                                      |                                                                      |
| BT_2014_534 | Congo Brazz.     | S3;E15 (100km Radius)              | confirmed                | rejected                | North region                                            | DRC f/f                               |                                      |                                                                      |
| BT_2014_522 | DRC              | N1.55115;E 21.07416 (300km Radius) | rejected                 | rejected                |                                                         | DRC r/f                               |                                      | Formally right but possibly it is an artefact of a consecutive fault |

Table 14: Number of analysable reference samples for Sapelli (TI):

| Country list reference samples | Number of reference samples |
|--------------------------------|-----------------------------|
| Cameroon                       | 434                         |
| Congo B.                       | 141                         |
| Côte d'Ivoire                  | 25                          |
| DRC                            | 487                         |
| Gabon                          | 36                          |
| Ghana                          | 69                          |
|                                | 1192                        |

#### 4.2.4 Stable Isotopes; Ayou (JR/HBLFA Francisco Josephinum)

Table 15: Result blind test part II (verification of declared origin); Ayou; Stable Isotopes (JR/HBLFA Francisco Josephinum; Wieselburg-Austria; Dr. Micha Horacek). Black columns: table sent back from the lab; Red/coloured additional columns – 1. real country of origin and information if the declaration of country/region was true/false; columns 2. and 3. show WWF's evaluation of the test; Main task: verification of the declared country; Evaluation: green = verification of the declared country correct, red = verification of the declared country false.

| ID                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Dec-lared Origin | Inter-ter-pre-tati-on | Remarks                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | WWF: real coun-try of origin | WWF: blind test evalua-tion (coun-try) | WWF: blind test evaluation (region) |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|-----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|----------------------------------------|-------------------------------------|
| BT_2014_578                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Camer oon        | NO                    | Declared origin of blind test sample is outside of regions covered by reference samples. As Sr-isotope value is very high (and thus also not in agreement with the Sr-isotopes of Mount Cameroon) we assume an incorrect declaration. Origin perhaps Cote d'Ivoire?                                                                                                                                                                                                                         | Ghana f/f                    |                                        | no result from lab                  |
| BT_2014_594                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Ghana            | YES                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Ghana r/f                    |                                        | no result from lab                  |
| BT_2014_567                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | DRC              | YES                   | Declared origin of blind test sample is far away from regions covered by reference samples, therefore no information is available for that region. Still, the results are in agreement with reference sample values (except for the Sr-isotope value). As Sr-isotopes are dominated by the bedrock (geology) and we do not have any Sr-isotope information from the declared origin we have no evidence against the declared origin. An alternative origin might be Ghana or Cote d'Ivoire. | Ghana f/f                    |                                        | no result from lab                  |
| BT_2014_568                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Camer oon        | YES                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Camer oon r/f                |                                        | no result from lab                  |
| BT_2014_598                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Ghana            | YES                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Ghana r/r                    |                                        | no result from lab                  |
| BT_2014_547                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | DRC              | YES                   | Declared origin of blind test sample is far away from regions covered by reference samples, therefore no information is available for that region. Still, the results are in agreement with reference sample values (except for the Sr-isotope value). As Sr-isotopes are dominated by the bedrock (geology) and we do not have any Sr-isotope information from the declared origin we have no evidence against the declared origin.                                                        | Ghana f/f                    |                                        | no result from lab                  |
| BT_2014_543                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Camer oon        | YES                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Gabun f/f                    |                                        | no result from lab                  |
| BT_2014_563                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Ivory Coast      | YES                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Ghana f/f                    |                                        | no result from lab                  |
| BT_2014_533                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Ghana            | YES                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Ghana r/f                    |                                        | no result from lab                  |
| BT_2014_551                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Ivory Coast      | YES                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Ghana f/f                    |                                        | no result from lab                  |
| General remarks [HBLFA]: The reference data set for Ayous only contains the data of 167 instead of intended 210 reference samples (more than 20% less than planned). Of the 167 reference samples around 25% (and perhaps even more as relevant data are missing) have been taken from non-adult (juvenile) trees with diameters of 20cm and less. Furthermore, the reference samples have been collected in 3 ways: A) drill core material, B) tree shavings and C) tree bark. Only the first kind of sample is in accordance with the sampling protocol. Analysis of other sample material (B and C) influences the results obtained. This clearly is visible for example for the tree bark material (e.g. see reference values for Congo d18O-values clearly giving other numbers than the rest of the samples) and differences are also observed between materials A and B. As sampled sites should be characterized by 3-4 trees it becomes obvious that the data set is extremely limited - even for samples within the investigated regions. To our estimate the data set is too small to differentiate between regions within countries. |                  |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                              |                                        |                                     |

Table 16: Number of analysable reference samples for Ayoy (HBLFA):

| <b>Country list reference samples</b> | <b>Number of reference samples</b> | <b>comment</b>                   |
|---------------------------------------|------------------------------------|----------------------------------|
| Côte d'Ivoire                         | 27                                 |                                  |
| Cameroon                              | 41                                 |                                  |
| Ghana                                 | 34                                 |                                  |
| DRC                                   | 46                                 |                                  |
| Congo B.                              | 0                                  | 19 bark samples - not analysable |
|                                       | 148                                |                                  |

#### 4.2.5 Stable Isotopes; Iroko (Agroisolab GmbH)

Table 17: Result blind test part II (verification of the declared origin); Iroko; Stable Isotopes (Agroisolab GmbH; Jülich-Germany; Dr. Markus Boner). Black columns: table sent back from the lab; Red/coloured additional columns – 1. real country of origin and information if the declaration of country/region was true/false; columns 2. and 3. show WWF's evaluation of the test; Main task: verification of the declared country; Evaluation: green = verification of the declared country/region correct, red = verification of the declared country/region false.

| Code        | Declared country | Result, country level                | Result, regional level | Remarks                                                                                                                                                                                                                                 | WWF: real country; r/f country/region | WWF: blind test evaluation (country) | WWF: blind test evaluation (region)            |
|-------------|------------------|--------------------------------------|------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|--------------------------------------|------------------------------------------------|
| BT_2014_526 | Ghana            | Yes, Poor confidence from origin     | (Yes)                  | Samples show signatures which are difficult to predict the origin. Nevertheless an origin from Ghana is still likely. The next best alternative is: Cameroon. Numbers of references in that region is too small to evaluate the region. | Ghana<br>r/r                          |                                      |                                                |
| BT_2014_600 | DRC              | Yes, Good confidence from origin     | No                     | Next alternative: Cameroon                                                                                                                                                                                                              | DRC<br>r/f                            |                                      |                                                |
| BT_2014_566 | Cameroon         | No, Low confidence from Cameroon     | /                      |                                                                                                                                                                                                                                         | DRC<br>f/f                            |                                      | no analysis because country-level already „no“ |
| BT_2014_596 | Gabon            | Yes Poor confidence from origin      | (Yes)                  | The origin from Gabon is still likely. A significant prediction is not possible with that sample. Next alternative: RCB / Cameroon: 30 % Numbers of references (n=4) in that region is too small to evaluate the region.                | DRC<br>f/f                            |                                      |                                                |
| BT_2014_554 | Gabon            | No, Low confidence from Gabon        | /                      |                                                                                                                                                                                                                                         | Cameroon<br>f/f                       |                                      | no analysis because country-level already „no“ |
| BT_2014_549 | Kenya            | No, Excluded to be from origin Kenya | /                      |                                                                                                                                                                                                                                         | DRC<br>f/f                            |                                      | no analysis because country-level already „no“ |
| BT_2014_569 | DRC              | Yes, Poor confidence from origin     | (Yes)                  | Overlapping between DRC and Cameroon. Nevertheless origin from DRC is more likely. No direct reference samples available. Therefore the sample is hard to evaluate                                                                      | DRC<br>r/f                            |                                      |                                                |
| BT_2014_527 | DRC              | (No), Poor confidence from origin    | /                      | Overlapping between DRC and Gabon. Therefore only weak probability. Currently an origin from Gabon is more likely.                                                                                                                      | DRC<br>r/r                            |                                      | no analysis because country-level already „no“ |

|             |       |                               |   |                                                                           |                 |  |                                                |
|-------------|-------|-------------------------------|---|---------------------------------------------------------------------------|-----------------|--|------------------------------------------------|
| BT_2014_518 | Gabon | No, Low confidence from Gabon | / |                                                                           | Congo B.<br>f/f |  | no analysis because country-level already „no“ |
| BT_2014_599 | Ghana | No, Low confidence from Ghana | / | Numbers of references in that region is too small to evaluate the region. | Ghana<br>r/f    |  | no analysis because country-level already „no“ |

Table 18: Number of analysable reference samples for Iroko (Agroisolab GmbH)

| Country list reference samples | Number of reference samples | Comments                                   |
|--------------------------------|-----------------------------|--------------------------------------------|
| Cameroon                       | 52                          |                                            |
| Congo B.                       | 73                          | 10 samples bark or thin branches with bark |
| Côte d'Ivoire                  | 28                          | 2 samples from bark                        |
| DRC                            | 141                         | 8 samples from bark and one thin branch    |
| Gabon                          | 94                          |                                            |
| Ghana                          | 40                          |                                            |
| Kenya                          | 25                          |                                            |
|                                | 453                         |                                            |

#### 4.2.6 Stable Isotopes; Sapelli (FERA Science Ltd.)

Table 19: Result blind test part II (verification of the declared origin); Iroko; Stable Isotopes (FERA Science Ltd.; York-UK) - Result based on reference data collected inside ITTO project and techniques contracted inside the ITTO project (isotopes only). Black columns: table sent back from the lab; ; Red/coloured additional columns – 1. real country of origin and information if the declaration of country/region was true/false; columns 2. and 3. show WWF's evaluation of the test; Main task: verification of the declared country; Evaluation: green = verification of the declared country/region correct, red = verification of the declared country/region false.

| ID-number   | declared country of origin | Y/N result concerning the declaration of origin: COUNTRY | Y/N result concerning the declaration of origin: REGION | WWF: real country; r/f country/region | WWF: blind test evaluation (country) | WWF: blind test evaluation (region) |
|-------------|----------------------------|----------------------------------------------------------|---------------------------------------------------------|---------------------------------------|--------------------------------------|-------------------------------------|
| BT_2014_552 | DRC                        | Correct                                                  | Correct                                                 | DRC<br>r/r                            |                                      |                                     |
| BT_2014_577 | Cameroon                   | Correct                                                  | Correct                                                 | Cameroon<br>r/r                       |                                      |                                     |
| BT_2014_510 | Ghana                      | Correct                                                  | Correct                                                 | Ghana<br>r/r                          |                                      |                                     |
| BT_2014_592 | Congo B.                   | Correct                                                  | Correct                                                 | DRC<br>f/f                            |                                      |                                     |
| BT_2014_573 | DRC                        | Correct                                                  | Not correct                                             | DRC<br>r/f                            |                                      |                                     |
| BT_2014_557 | DRC                        | Correct                                                  | Not correct                                             | DRC<br>r/f                            |                                      |                                     |
| BT_2014_580 | Cameroon                   | Correct                                                  | Correct                                                 | Congo B.<br>f/f                       |                                      |                                     |
| BT_2014_525 | Ghana                      | Correct                                                  | Correct                                                 | Ghana<br>r/f                          |                                      |                                     |
| BT_2014_534 | Congo B.                   | Correct                                                  | Correct                                                 | DRC<br>f/f                            |                                      |                                     |
| BT_2014_522 | DRC                        | Correct                                                  | Correct                                                 | DRC<br>r/f                            |                                      |                                     |

Table 20: Number of analysable reference samples for Sapelli (FERA Science Ltd.)

| Country list reference samples | Number of reference samples |
|--------------------------------|-----------------------------|
| Cameroon                       | 39                          |
| Congo (B.)                     | 29                          |
| DRC                            | 119                         |
| Ghana                          | 17                          |
| Côte d'Ivoire                  | 11                          |
| Gabon                          | 12                          |
|                                | 227                         |

## 5 Summary and overview of the blind test results

Table 21: Summary of the results from blind test part I, species verification

| Method                | Verification of the declared species (Main question of ITTO blind test)     | Identification at family level | Identification at genus level | Identification at species level |
|-----------------------|-----------------------------------------------------------------------------|--------------------------------|-------------------------------|---------------------------------|
| <b>Wood anatomy</b>   | 72 % correct and 28 % correct with limitation (as far as the method allows) | 100 % correct                  | 100 % correct                 | 56 % correct                    |
|                       |                                                                             |                                |                               | 44 % no result from lab         |
| <b>DNA bar-coding</b> | 24 % correct and 8 % correct with limitation                                | 32 % correct                   | 28 % correct                  | 8 % correct                     |
|                       | 64 % no result from lab                                                     | 64 % no result from lab        | 64 % no result from lab       | 88 % no result from lab         |
|                       | 4 % wrong                                                                   | 4 % wrong                      | 8 % wrong                     | 4 % uncertain                   |

Table 22: Summary of the results from blind test part II declaration of origin

| Type           | Species | Institute     | Basic level -country- (Main question of ITTO blind test) | Advanced level -region- |
|----------------|---------|---------------|----------------------------------------------------------|-------------------------|
| <b>DNA</b>     | Ayou    | Adelaide      | 50 % correct                                             | 30 % correct            |
|                |         |               | 20 % uncertain                                           | 30 % uncertain          |
|                |         |               | 30 % wrong                                               | 40 % wrong              |
| <b>DNA</b>     | Iroko   | TI            | 40 % correct                                             | No results from lab     |
|                |         |               | 60 % wrong                                               |                         |
| <b>DNA</b>     | Sapelli | TI            | 50 % correct                                             | 50 % correct            |
|                |         |               | 50 % wrong                                               | 20 % consecutive fault  |
|                |         |               |                                                          | 30 % wrong              |
| <b>Isotope</b> | Ayou    | Josephinum    | 50 % correct                                             | No results from lab     |
|                |         |               | 50 % wrong                                               |                         |
| <b>Isotope</b> | Iroko   | Agroisolab    | 70 % correct                                             | 20 % correct            |
|                |         |               | 30 % wrong                                               | 60 % no analysis        |
|                |         |               |                                                          | 20 % wrong              |
| <b>Isotope</b> | Sapelli | FERA          | 70 % correct                                             | 50 % correct            |
|                |         |               | 30 % wrong                                               | 50 % wrong              |
|                |         | “inside” ITTO |                                                          |                         |



## 6 List of tables

|           |                                                                                                   |    |
|-----------|---------------------------------------------------------------------------------------------------|----|
| Table 1:  | List of cooperating partners .....                                                                | 4  |
| Table 2:  | Blind test, part I – 25 blind test samples; .....                                                 | 7  |
| Table 3:  | Example to explain the logical framework of the blind test .....                                  | 9  |
| Table 4:  | Blind test, part-II; 10 blind test samples (Ayou) .....                                           | 10 |
| Table 5:  | Blind test, part-II; 10 blind test samples (Iroko) .....                                          | 11 |
| Table 6:  | Blind test, part-II; 10 blind test samples (Sapelli) .....                                        | 12 |
| Table 7:  | Result blind test part I (species identification) – wood anatomy .....                            | 13 |
| Table 8:  | Result blind test part I (species identification) – DNA barcoding / fingerprinting ..             | 16 |
| Table 9:  | Result blind test part II (verification of declared origin);<br>Ayou; DNA fingerprinting .....    | 18 |
| Table 10: | Number of analysable reference samples for Ayou (University of Adelaide): .....                   | 19 |
| Table 11: | Result blind test part II (verification of declared origin);<br>Iroko; DNA fingerprinting .....   | 20 |
| Table 12: | Number of analysable reference samples for Iroko (TI): .....                                      | 20 |
| Table 13: | Result blind test part II (verification of declared origin);<br>Sapelli; DNA fingerprinting ..... | 21 |
| Table 14: | Number of analysable reference samples for Sapelli (TI): .....                                    | 22 |
| Table 15: | Result blind test part II (verification of declared origin);<br>Ayou; Stable Isotopes .....       | 23 |
| Table 16: | Number of analysable reference samples for Ayou (HBLFA): .....                                    | 24 |
| Table 17: | Result blind test part II (verification of the declared origin);<br>Iroko; Stable Isotopes .....  | 25 |
| Table 18: | Number of analysable reference samples for Iroko (Agroisolab GmbH) .....                          | 26 |
| Table 19: | Result blind test part II (verification of the declared origin);<br>Iroko; Stable Isotopes .....  | 27 |
| Table 20: | Number of analysable reference samples for Sapelli (FERA Science Ltd.) .....                      | 27 |
| Table 21: | Summary of the results from blind test part I, .....                                              | 28 |
| Table 22: | Summary of the results from blind test part II .....                                              | 28 |

## 7 List of figures

|           |                                                                                                                                      |   |
|-----------|--------------------------------------------------------------------------------------------------------------------------------------|---|
| Figure 1: | Picture of blind test sampling Philipps-University Marburg; .....                                                                    | 5 |
| Figure 2: | Sample taking locations for <i>Milicia excelsa</i> , <i>Entandrophragma cylindricum</i> and<br><i>Triplochiton scleroxylon</i> ..... | 6 |
| Figure 3: | Distribution of reference sampling locations .....                                                                                   | 8 |

## 8 List of appendices

|            |                                                                                 |
|------------|---------------------------------------------------------------------------------|
| Appendix 1 | Memorandum of understanding (MoA between TI and WWF)                            |
| Appendix 2 | Additional Instructions for the blind test of the ITTO-Africa project (TI; WWF) |
| Appendix 3 | Philipps-University Marburg confidentiality agreement                           |
| Appendix 4 | Third party blind test sample verification (wood anatomy)                       |
| Appendix 5 | Expert opinion - general requirements to a blind test (German)                  |
| Appendix 6 | Expert opinion – analysability of samples with mould - DNA (German)             |
| Appendix 7 | Expert opinion – analysability of samples with mould – Isotopes (German)        |
| Appendix 8 | Authenticity__blind_test_samples (German)                                       |

## Contact:

Johannes Zahnen  
 Biodiversity  
 WWF Germany  
 Reinhardtstr. 14  
 D-10117 Berlin  
 Direkt: +49 (30) 311 777–252  
[Johannes.zahnen@wwf.de](mailto:Johannes.zahnen@wwf.de)

## 9 Appendix

Thünen-Institut (VW) · Bundesallee 50 · 38116 Braunschweig

World Wild Fund for Nature/WWF  
Herrn Johannes Zahnen  
Reinhardtstraße 14  
10117 Berlin

## Verwaltung

Vivien Steinel  
Ass. jur.  
Bundesallee 50  
38116 Braunschweig  
Fon 0531 596-1259  
Fax 0531 596-1299  
vivien.steinzel@ti.bund.de  
www.ti.bund.de

Ihr Zeichen/Ihre Nachricht vom:

Unser Zeichen/Unsere Nachricht vom:

Datum  
11.03.2013

### Memorandum of Agreement im Rahmen des Projekts PD 620/11 M (Rev. 1)/ITTO

Sehr geehrter Herr Zahnen,

anbei übersende ich Ihnen zwei Exemplare der o. g. Vereinbarung. Bitte lassen Sie ein Exemplar durch Herrn Heinrich gegenzeichnen und senden dieses zu meinen Händen zurück.  
Vielen Dank.

Mit freundlichen Grüßen  
Im Auftrag



Vivien Steinel

# MEMORANDUM OF AGREEMENT

between

Johann Heinrich von Thünen-Institute (TI),  
Federal Research Institute for Rural Areas, Forestry and Fisheries  
Bundesallee 50  
D-38116 Braunschweig, Germany

hereinafter referred to as **EXECUTING AGENCY (EA)**

and

World Wild Fund for Nature, Germany (WWF/Germany)  
Reinhardtstraße 14  
D-10117 Berlin, Germany

hereinafter referred to as **COLLABORATING AGENCY (CA)**

ON THE IMPLEMENTATION OF THE PROJECT **PD 620/11 M (Rev. 1)** of

**The International Tropical Timber Organization (ITTO)**

***“Development and implementation of a species identification and timber tracking system in Africa with DNA fingerprints and stable isotopes”***

We, the undersigned authorized representatives of EA and CA; endorse this agreement as the formal document guiding project implementation by both agencies in accordance with the Project Agreement.

## **SECTION 1. GENERAL RESPONSIBILITIES**

EA is the Executing Agency for the project. It will be in charge of general management and administration of all Project activities, and will also be directly responsible for reporting all results to ITTO. It will be responsible for receiving, disbursing, and managing all funds released by ITTO to the project in accordance with ITTO's rules and regulations.

## **SECTION 2. SPECIAL RESPONSIBILITIES OF THE CA**

CA will be a Collaborating Agency for the project implementation. According to the project proposal it shall be responsible for:

- a) Activity 1.4: Sampling for the blind testing 50 wood samples belonging to 21 taxa (*Afzelia* spp., *Aningeria robusta*, *Aucoumea klaineana*, *Baillonella toxisperma*, *Cylicodiscus gabunensis*, *Entandrophragma angolense*, *Entandrophragma cylindricum*, *Entandrophragma utile*, *Erythrophleum ivorense*, *Erythrophleum Suaveolens*, *Guibourtia* spp., *Khaya* spp., *Lophira alata*, *Milicia excelsa*, *Milicia. Regia*, *Millettia laurentii*, *Nauclea diderrichii*, *Pericopsis elata*, *Pterocarpus soyauxii*, *Terminalia superb* and *Triplochiton scleroxylon*) to test the DNA barcodes and wood anatomical tools for species identification.

For this sampling, the country of origin does not matter. It is important to provide wood samples of the 21 taxa but also others that either belongs to the same genus or that are very similar in terms of wood anatomy. The material should be labelled only with numbers and a wrong or false claim on the species name and send to EA.

- b) Activity 2.9: Sampling for the blind testing of 60 wood samples to test the power of the genetic and isotopic reference data base to control claims on the country of origin

The 60 wood samples of this test should be composed of 20 wood samples of each of the three species *Milicia excelsa*, *Entandrophragma cylindricum* and *Triplochiton scleroxylon*. The samples should partly be from the seven African countries (Cameroon, Central African Republic, Democratic Republic of Congo, Republic of Congo, Gabon, Ghana and Kenya.) and partly from other countries. The samples should include material with correct and false declarations (claims) on the country of origin. All three target species should be covered, but the 20 samples for each species do not need to come from 20 different locations. The material should be labelled only with numbers, the correct species name and a wrong or false claim on the country of origin. The material should be sent to EA for further distribution.

Both tests should be done using saw timber or equal treated material in order to keep it close to the later practical application of the developed tools.

CA agrees to deploy the necessary personnel to provide management, administrative, and technical support in project implementation in accordance with the work-plan. CA is aware that very strict confidentiality should be maintained on the identity of the species and the geographic origin of the material. Especially this information on species and origin should not be known or given to the any of the project partner.

The CA needs to organise the material according to the above requirements, distribute it with correct and false claims to the EA, receive the results of the labs, compare it with the correct species or country of origin and make a short report on the outcomes for the EA.

### SECTION 3. ACCEPTENCE

CA has to accept the work described in Section 2. and to deliver an evaluation of the blind test. Additional comments to the evaluation or interpretation from others than the CA can be done as long as it is distinguishable to the CA's text. Any change of the CA's blind test evaluation (see sentence 1) has to be confirmed by CA.

### SECTION 4. REMUNERATION AND CONTRACT PERIOD

A maximum amount of 20,000 US\$ is reserved for the activities of the CA during the contract period 01.04.2013 to 30.09.2014. The agreed remuneration is only due for the proper performance and there are no additional claims for remuneration or fees exceeding the total sum.

The first payment of 10,000 US\$ will be made by the EA on 15.04.2013, a second payment of 5,000 US\$ will be made when 75% of the total sampling of sections 2a and 2b is completed. A final payment of 5,000 US\$ will be done after the submission of a final report detailing the achievement of the sampling objectives and the results of the blind tests. The payment will be done according to invoices from the CA. The payment will be done in Euros: the official UN exchange rate of 1 January 2012 (USD 1 = EURO 0.774) will be applied.

For the preparation of cost statements the CA shall provide the EA with proofs of spent budget. The CA shall keep strict budgetary control over the funds allocated to it and keep such funds, until the time of their actual disbursement, with a bank of commonly recognized high reputation. The CA will keep all original invoices for the cost statements to be prepared for the ITTO by the EA.

If the actual costs of the activities of the CA are less than is provided for in the project budget under this Agreement, the balance remaining unspent on completion of the Project, shall be returned to the EA.

### SECTION 5. REPORTING REQUIREMENTS

EA shall be responsible for preparing and submitting to ITTO all progress reports, technical reports, and completion report in accordance with the project document and project agreement. It shall also submit to ITTO needed financial statements on use of projects funds and at the end of the project a final statement of account for ITTO and counterpart funds audited by recognized independent auditors appointed by EA in consultation with ITTO.

CA shall assist in the reporting requirements by providing data, cost statements and information as needed. This Agreement shall take effect upon signing by both agencies.

#### SECTION 6. USE OF PLANT MATERIAL AND DATA

The EA and CA agree that the material collected for the blind test will be sent to the EA which then sends the material to the agencies responsible for these tests. The collected material and data collected will be used for the purpose of the ITTO project (PD 620/11 M (Rev. 1)) and derived publications. EA and CA will be included in the authors list of all derived publications.

#### SECTION 7. LIABILITY

The EA is discharged from every liability both to a third party and to CA's losses caused by the fulfilment of this contract.

#### SECTION 8. WITHDRAWAL

The EA can withdraw from the contract if CA does not meet the deadline for production as agreed in Section 4 neither an adequate respite or if he does not remedy deficiencies in a stipulated period. In case of withdrawal from the contract all the carried out and accepted work will be paid according to the relation of the total and usable work.

#### SECTION 9. ALTERATIONS OF/AMENDMENTS TO THE CONTRACT

Any changes, modifications and amendments to this contract must be in writing. Should any provision of this contract be or become invalid, this shall not affect the validity of the remaining provisions of the contract.

#### SECTION 10. JURISDICTION

Venue shall be Braunschweig (Germany)

|                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                  |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>On behalf of the Executing Agency</p> <p>Prof. Dr. Folkhard Isermeyer<br/>- President of the Thünen-Institute-</p> <p>Date: 11. 03. 2013<br/>Place: Braunschweig</p> <p>Signature:</p>  | <p>On behalf of the Collaborating Agency</p> <p>Christoph Heinrich<br/>- Executive Officer Conservation WWF<br/>Germany-</p> <p>Date: 25. 03. 2013<br/>Place: Berlin</p> <p>Signature:</p>  |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

## **Additional Instructions for the blind test of the ITTO-Africa project (Agreed between Thünen-Institute and WWF in Berlin the 27/02/2015)**

The blind test will be done with 50% of the samples compared to the WWF-MoA contract (3/2013). The other 50% of the samples has been collected by Gersyn Services (G2S). This means from each of the two collections 25 of the 50 samples for the tests of species declarations will be taken and for each of the three species *Entandrophragma cylindicum* (Sapelli), *Milicia excelsa* (Iroko) and *Triplochiton scleroxylon* (Ayous) 10 samples for the tests on declared country of origin will be used.

WWF and G2S will be responsible for two independent blind tests (including test on species and origin). The organisations will provide the Thünen-Institute of Forest Genetics with the list of samples that have been selected for the test. They will provide a table with the sample number and declared tree species for the species test and with the declared country of origin and partly with GPS coordinates combined with a radius that describes a region or with a description of the region in case of G2S. The claims are a mixture of true and false declarations. In case of false declarations of the origin of the WWF samples, false and true origins have to be at least 150 km away from each other.

For a fair test we need to ensure that the two alternative laboratories get samples from the same tree individual, of same quality, same consistence and with the same claimed species or declared origin respectively. G2S delivered the Thünen-Institute for each sample a single piece of saw timber. WWF will (via the University of Marburg) provide most of the samples in kind of saw timber or chiselled from trees in the forest. Each of the samples will be divided in 4 portions of approx. 10g. Each of the involved laboratories will get a set of samples (a full set of the Part II blind test (origin) will go to Thorsten Hinrichs; Ministry BMEL; one full set will go to Bernd Degen TI; three sets á 10 samples (Sapeli, Iroko, Ayou) will go to three different isotope labs and three sets will go to the two genetic lab). There are four blind test samples from the WWF set (sawn wood) without additional reference material at the University of Marburg. WWF will inform Bernd Degen about the samples ID numbers so he can send the samples to the University of Marburg. One complete set will be kept as back up reference at the Thünen-Institute and one complete set of each samples will be sent to Thorsten Hinrichs at the Federal Ministry of Food and Agriculture (BMEL) as reference samples, in case anyone doubts on the identity of the samples. For Part I of the blind test



(species) Bernd Degen ordered the set of 50 samples given by WWF to Gerald Koch. WWF will select from the list 25 out of these 50 samples for the species test. Bernd Degen will forward these 25 samples to Plant Genetic Diagnostics GmbH for the genetic species test. The WWF samples with claims on the origin will be taken from the samples stored at the University of Marburg. The selection of the 10 samples per species should include only those with country claims with at least 20 reference samples (DNA and isotopes). Also from the WWF samples 4 pieces per sample will be created and distributed in the same way as the samples from G2S.

The laboratories can only check claims for which the tools and reference data have been developed in frame of the ITTO project.

This means each of the samples for the species test can be any species but should have a claim on one of the following 21 alternative taxa: *Afzelia* spp., *Aningeria robusta*, *Aucoumea klaineana*, *Baillonella toxisperma*, *Cylicodiscus gabunensis*, *Entandrophragma angolense*, *Entandrophragma cylindricum*, *Entandrophragma utile*, *Erythrophleum ivorense*, *Erythrophleum suaveolens*, *Guibourtia* spp., *Khaya* spp., *Lophira alata*, *Milicia excelsa*, *Milicia regia*, *Millettia laurentii*, *Nauclea diderrichii*, *Pericopsis elata*, *Pterocarpus soyauxii*, *Terminalia superb* and *Triplochiton scleroxylon*.

For the samples of the test on declared country of origin the declared origin should be from the list of the following countries:

*Milicia excelsa* (Iroko): Ghana, DRC, Cameroun, Gabon, Kenya

*Entandrophragma cylindricum* (Sapelli): Cameroun, Ghana, DRC, Congo Brazzaville

*Triplochiton scleroxylon* (Ayous): Cameroun., Ghana, DRC, Congo Brazzaville, Ivory coast

The claims on the country/region of origin are either right or wrong. For the WWF samples is guaranteed that the declared country or GPS coordinates that are wrong, are at least 150 km away from the correct place of origin.

Before the analysis of blind test samples starts, WWF and G2S will send the list of claims of the selected samples together with the solution on the true tree species or the true origin to Thorsten Hinrichs at the Federal Ministry of Food and Agriculture (BMEL).



The laboratories analysing the blind test samples should check if the declaration is correct or not. The result of these analyses is for each sample and question (species; origin) a “yes” or “no”. With regard to origin, the labs should verify both the declared country of origin and if given the declared region of origin. They can provide comments on the results. The tests need to be done with the data collected in frame of the ITTO project. In addition the laboratories can provide a second test result for each sample using additional reference samples and /or additional variables (e.g. other isotopes, gene markers, other techniques like NIR). The second test result need to be clearly labelled and identified.

In order to guarantee complete transparency the reference data used for the blind test and the method of data analysis should be provided to any of the involved partners (provider of blind test samples, involved laboratories, and executive agency of the project) including a description of the laboratory methods, statistical approach, used software and formulas. The data should be provided to these parties in a form that experts could recalculate and confirm the analytical approach and conclusions. BMEL stores the samples for a period of one year after the end of the project.

WWF and G2S will – independent from each other - provide the Thünen-Institute of Forest Genetics a short report with the evaluation of the blind test on the comparison of the laboratories result and the true tree species or the true origin. The report should clearly state which results have been generated with reference data of the ITTO project and which result have been elaborated by the laboratories using additional reference data and / or analysed variables.

## RAHMENKOOPERATIONSVEREINBARUNG # 14266

Zwischen dem

**WWF Deutschland**  
Reinhardtstraße 14  
10117 Berlin

vertreten durch Sylvia Becker

- im folgenden „**WWF**“ genannt -

und der

**Philipps-Universität Marburg**  
Biegenstraße 10  
35032 Marburg

vertreten durch die Präsidentin

Ausführende Stelle:

Prof. Dr. Nina Farwig und Prof. Dr. Birgit Ziegenhagen  
FB Biologie  
Karl-von-Frisch-Straße 8  
35032 Marburg

- im folgenden „**UMR**“ genannt -

- WWF und UMR werden im Folgenden einzeln oder gemeinsam  
auch als „Kooperationspartner“ bezeichnet -

gültig. Eine weitere Kooperationsvereinbarung oder eine schriftliche Vertragsverlängerung bleibt davon unberührt.

5.2 Jeder Kooperationspartner ist berechtigt die Vereinbarung mit einer Frist von 6 Monaten zu kündigen. Eine Kündigung aus wichtigem Grund unter Beachtung der gesetzlichen Bestimmungen bleibt unberührt.

5.3 Die Kündigung hat schriftlich zu erfolgen.

## 6. Geheimhaltung

6.1 Die Kooperationspartner verpflichten sich, geheimhaltungspflichtige Informationen und Gegenstände, die geheimhaltungspflichtige Informationen enthalten, wie z.B. Unterlagen, Muster, Materialproben, welche ihnen im Rahmen der Kooperation evtl. vom anderen Kooperationspartner offenbart werden, streng vertraulich zu behandeln, sie Dritten ohne vorherige schriftliche Zustimmung des offenbarenden Kooperationspartners nicht zugänglich zu machen und nur solchen Mitarbeitern des Kooperationspartners zugänglich zu machen, die diese für die Durchführung der im Rahmen dieses Vertrages zu erbringenden Arbeiten benötigen. Darüber hinaus werden sie die ihnen vom jeweils anderen Kooperationspartner offenbarten geheimhaltungspflichtigen Informationen ausschließlich zur Durchführung der Forschungsarbeiten unter dieser Vereinbarung verwenden.

6.2 Die Pflicht zur Geheimhaltung und Nichtverwertung entfällt für Informationen

- a) die sich zum Zeitpunkt ihrer Übermittlung nachweislich im Besitz des die Information empfangenden Kooperationspartners befanden;
- b) die zum Zeitpunkt der Übermittlung öffentlich bekannt waren;
- c) die nach dem Zeitpunkt ihrer Übermittlung ohne Verschulden des die Information empfangenden Kooperationspartners öffentlich bekannt werden;
- d) die der die Information empfangende Kooperationspartner nach ihrer Übermittlung durch den offenbarenden Kooperationspartner von einem Dritten erwirbt, sofern dieser Dritte nicht dem offenbarenden Kooperationspartner gegenüber zur Geheimhaltung verpflichtet ist und ein Recht zu einer derartigen Weitergabe hat.

6.3 Alle geheimhaltungspflichtigen Informationen wird der empfangende Kooperationspartner sorgfältig aufbewahren, vor jeder Einsichtnahme Dritter schützen und auf Verlangen jederzeit - spätestens aber bei Beendigung dieser Vereinbarung - dem offenbarenden Kooperationspartner übergeben.

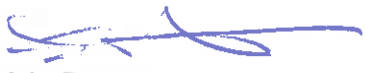
6.4 Die Geheimhaltungspflichten enden fünf Jahre nach Beendigung dieser Vereinbarung gemäß Ziffer 5.

Für den WWF Deutschland

Für die Philipps-Universität Marburg

Berlin, den 23.04.14

Marburg, den 06. Mai 2014

  
Sylvia Becker  
Kaufmännische Geschäftsleitung

  
Prof. Dr. Katharina Krause  
- Präsidentin der Philipps-Universität Marburg -

Berlin, den 23.04.14

Marburg, den 08.05.2014

  
Annette Heiß  
Referentin Kaufm. Projektabwicklung

  
Prof. Dr. Nina Farwig  
- Verantwortliche Wissenschaftlerin

Marburg, den 08.05.2014

  
Prof. Dr. Birgit Ziegenhagen  
- Kooperierende Wissenschaftlerin -

Anhang 1: Probenprotokoll: Isotopes, DNA and wood anatomy;  
Mandatory methodology and scientific procedures agreed upon by Project Partners  
Anhang 2: Budget  
Anhang 3: Projektbeschreibung

Institut für Holztechnologie Dresden · Zellescher Weg 24 · 01217 Dresden · Germany

Herrn Johannes Zahnen  
Forstpolitik/Unternehmenskooperation  
WWF Deutschland  
Reinhardtstraße 18  
D-10117 Berlin

Institut für Holztechnologie Dresden  
gemeinnützige GmbH  
Zellescher Weg 24  
01217 Dresden

Tel.: +49 351 4662 270  
Fax: +49 351 4662 211  
Bjoern.weiss@ihd-dresden.de  
[www.ihd-dresden.de](http://www.ihd-dresden.de)

Dresden, 10.02.2015

## Untersuchungsbericht Auftrags-Nr.: 1215022

|                             |                                                                                                                                                                                                                                         |
|-----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Auftrag:</b>             | Mikroskopische Holzartenbestimmungen an zwei Proben aus der Demokratischen Republik Kongo                                                                                                                                               |
| <b>Auftrag vom:</b>         | 30.01.2015                                                                                                                                                                                                                              |
| <b>Auftraggeber (AG):</b>   | Herr Johannes Zahnen, Forstpolitik/Unternehmenskooperation, WWF Deutschland, Reinhardtstraße 18, D-10117 Berlin<br>über<br>Philipps-Universität Marburg, Naturschutzbiologie, Frau Kristina Osen, Karl-von-Frisch-Str. 8, 35043 Marburg |
| <b>Auftragnehmer (AN):</b>  | Institut für Holztechnologie Dresden gemeinnützige GmbH (IHD)                                                                                                                                                                           |
| <b>Verantw. Bearbeiter:</b> | Dipl.-Ing. (FH) Björn Weiß                                                                                                                                                                                                              |



Dr. W. Scheiding  
Ressortleiter Biologie/Holzschutz

Der Untersuchungsbericht enthält 8 Seiten einschließlich 13 Fotos. Jede auszugsweise Vervielfältigung bedarf der schriftlichen Genehmigung des IHD. Die Untersuchungsergebnisse beziehen sich ausschließlich auf das untersuchte Material.



## 1 Auftrag

Das Institut für Holztechnologie gemeinnützige GmbH wurde beauftragt, mikroskopische Holzartenbestimmungen an zwei Proben aus der Demokratischen Republik Kongo durchzuführen.

## 2 Untersuchungsmaterial

Die beiden Holzproben wurden von Frau Kristina Osen im Mai 2014 in der Demokratischen Republik Kongo genommen und zur Untersuchung gesandt (Foto 1).

Probenbezeichnungen:

A\_DRC\_2014: *Entandrophragma cylindricum* (Handelsname: Sapelli; Familie Meliaceae),

B\_DRC\_2014: *Nauclea diderichii* (Handelsname: Bilinga; Familie Rubiaceae).

Probenabmessungen: jeweils etwa 60 mm lang, 30 mm breit und 5 mm dick.

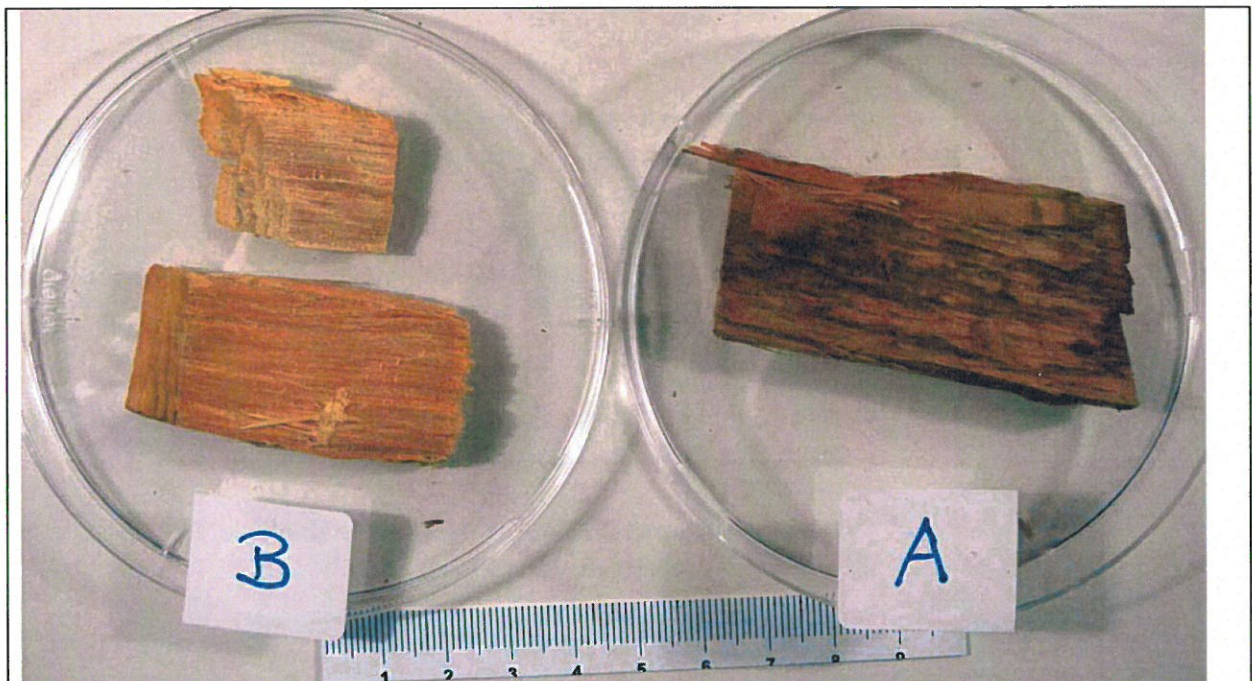


Foto 1: Untersuchungsmaterial Probe A und B

## 3 Untersuchungsdurchführung

Für die Holzartenbestimmungen wurden vom Untersuchungsmaterial Holzdünnschnitte in den 3 holzanatomischen Hauptschnitttrichtungen angefertigt (Querschnitt: Q, Tangentialschnitt: T, Radialschnitt: R). Die Dünnschnitte wurden mit dem Durchlichtmikroskop „ECLIPSE E-800“ der Firma Nikon, bei Vergrößerungen von 40- bis 600fach untersucht. Anhand der ermittelten Strukturmerkmale wurden die Holzarten bestimmt.

Über die entsprechende Kopplung mit dem Bildverarbeitungssystem „NIS-Elements D3.2“ und der digitalen „Camera DS-Fi1c“ wurden Messungen durchgeführt und Fotos erstellt.

Zum Vergleich dienten Holzdünnschnittpräparate, mikrofotografische Abbildungen, Holzstrukturbeschreibungen und Bestimmungsschlüssel.

**4 Untersuchungsergebnisse****4.1 Probe A**

Folgende Merkmale wurden bei Probe A festgestellt, s. auch Mikrofotos 2-9:

|                |                                                                                                                                                                                                                                                                                                                                                                                                    |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Farbe          | – grau bis rötlich (wahrscheinlich Splintholz); Foto 1                                                                                                                                                                                                                                                                                                                                             |
| Gefäße         | <ul style="list-style-type: none"> <li>– zerstreutporig angeordnet, meist einzeln, auch paarig (Foto 2, 3)</li> <li>– Form rundlich (Foto 4, 5)</li> <li>– wenig zahlreich</li> <li>– Ø etwa 50 ... 115 ... 140</li> <li>– Gefäßtüpfel sehr klein</li> <li>– vereinzelt rote Kernstoffe vorhanden (Foto 5, 8, 9); waschen intensiv bei der Präparation aus</li> </ul>                              |
| Längsparenchym | <ul style="list-style-type: none"> <li>– um die Gefäße (paratracheal-vasizentrisch; par.- vasizentrisch), auch konfluent (Foto 2 - 5)</li> <li>– in weiten Abständen breite tangentiale Bänder, 5 ... 7 Zellen breit; (apotracheal-marginal); Foto 5</li> </ul>                                                                                                                                    |
| Holzstrahlen   | <ul style="list-style-type: none"> <li>– stellenweise stockwerkartig (Foto 8) und stellenweise unregelmäßig angeordnet (Foto 6, 7)</li> <li>– heterogen aufgebaut, mit einer aufrechten Kantenzelle (Foto 7, 9)</li> <li>– Breite 2 ... 6 Zellen, meist 3 bis 4 (Foto 6 - 8)</li> <li>– Höhe: 200 ... 450 ... 660 µm (Foto 7, 8)</li> <li>– vereinzelt Kalziumoxalatkristalle vorhanden</li> </ul> |
| Fasern         | <ul style="list-style-type: none"> <li>– radial angeordnet (Foto 5)</li> <li>– Libriformfasern</li> </ul>                                                                                                                                                                                                                                                                                          |

(Gefäße ... G, Längsparenchym ... LP, Holzstrahlen ... HS, Fasern ... F)

Bestimmte Holzart: die festgestellten Merkmale der Holzprobe A stimmen mit denen von Sapelli (*Entandrophragma cylindricum*) überein.



**Mikrofotos Probe A**



Foto 2: Q, Auflicht; Gefäße einzeln oder paarig;  
M 20:1

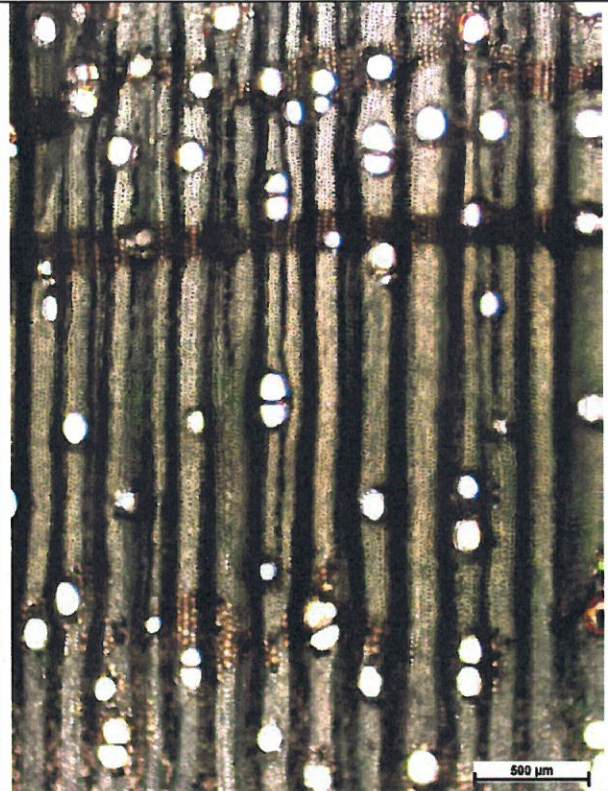


Foto 3: Q, Durchlicht; LP-Band vorhanden  
(apotracheal-marginal); M 40:1



Foto 4: Q; LP auch um die Gefäße (parat-  
racheal-vasizentrisch); M 100:1

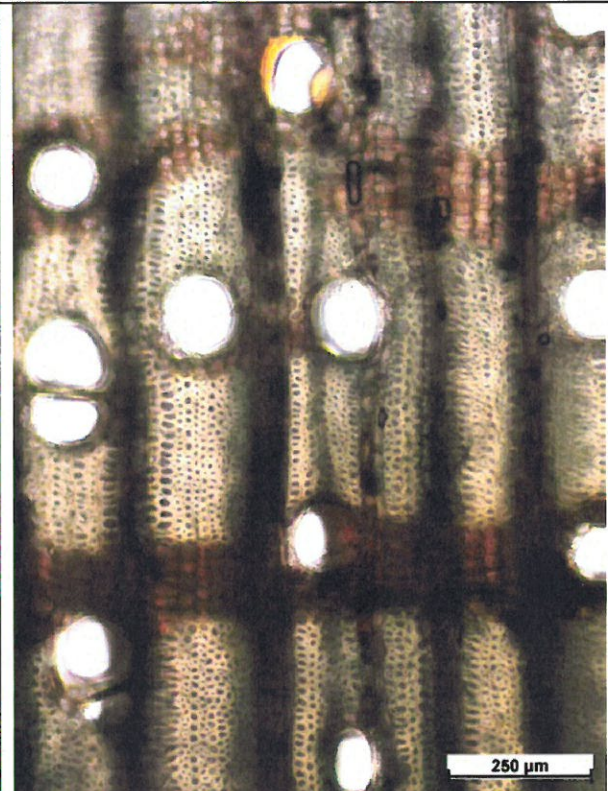


Foto 5: Q; Fasern radial gerichtet; M 100:1





Foto 6: T; HS unregelmäßig und stellenweise mit Stockwerkbau; M 40:1

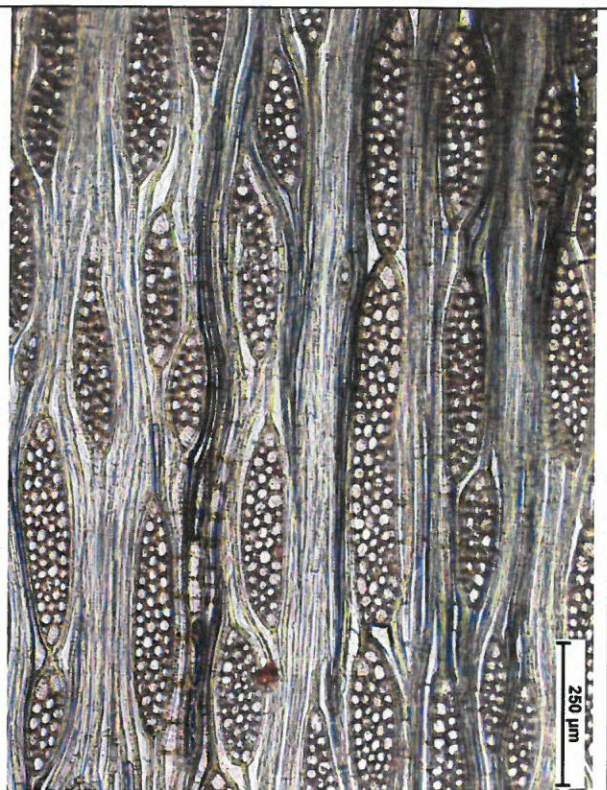


Foto 7: T; HS unregelmäßig angeordnet, M 100:1



Foto 8: T; Bereich mit stockwerkartiger HS-Anordnung; M 100:1

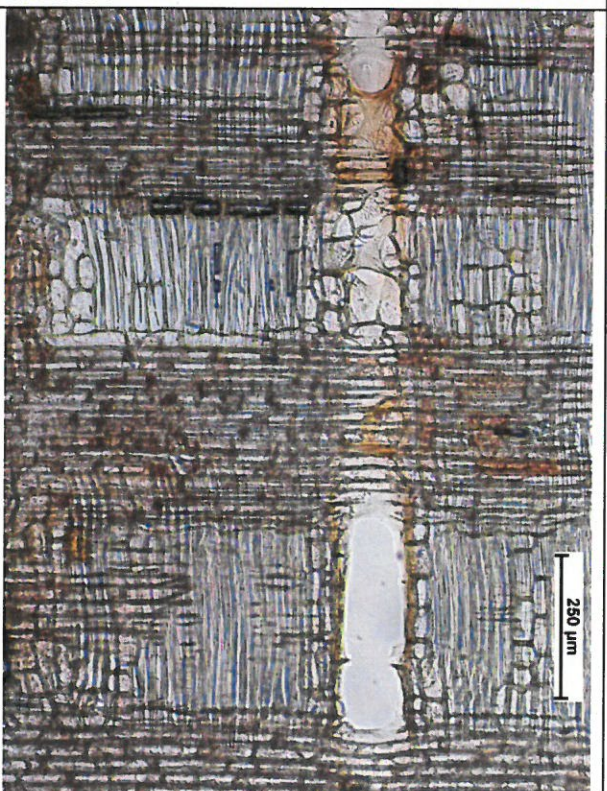


Foto 9: R; HS schwach heterogen aufgebaut; M 100:1



## 4.2 Probe B

Folgende Merkmale wurden bei Probe B festgestellt, s. auch Mikrofotos 10-13:

|                |                                                                                                                                                                                                                                                                                                           |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Farbe          | – gelb                                                                                                                                                                                                                                                                                                    |
| Gefäße         | <ul style="list-style-type: none"> <li>– zerstreutporig angeordnet, meist einzeln, selten auch paarig (Foto 10)</li> <li>– Form leicht oval (Foto 10, 11)</li> <li>– Anzahl gering</li> <li>– <math>\varnothing</math> etwa 80 ... 160 ... 210 <math>\mu\text{m}</math></li> </ul>                        |
| Längsparenchym | – in kurzen tangentialen Linien (apotracheal, tangetial-leiterförmig), Foto 11                                                                                                                                                                                                                            |
| Holzstrahlen   | <ul style="list-style-type: none"> <li>– unregelmäßig angeordnet, heterogen aufgebaut,</li> <li>– 1 bis 4 Zellen breit; einzelne HS sehr unregelmäßig zusammengesetzt, aus ein- und mehrschichtigen Teilen bestehend (Foto 12)</li> <li>– Höhe: 150 ... 1300 ... 1700 <math>\mu\text{m}</math></li> </ul> |
| Fasern         | <ul style="list-style-type: none"> <li>– radial angeordnet (Foto 11)</li> <li>– überwiegend Fasertracheiden</li> </ul>                                                                                                                                                                                    |

(Gefäße ... G, Längsparenchym ... LP, Holzstrahlen ... HS, Fasern ... F)

Bestimmte Holzart: die festgestellten Merkmale der Holzprobe B stimmen mit denen von *Bilinga* (*Nauclea diderichii*) überein.



**Mikrofotos Probe B**

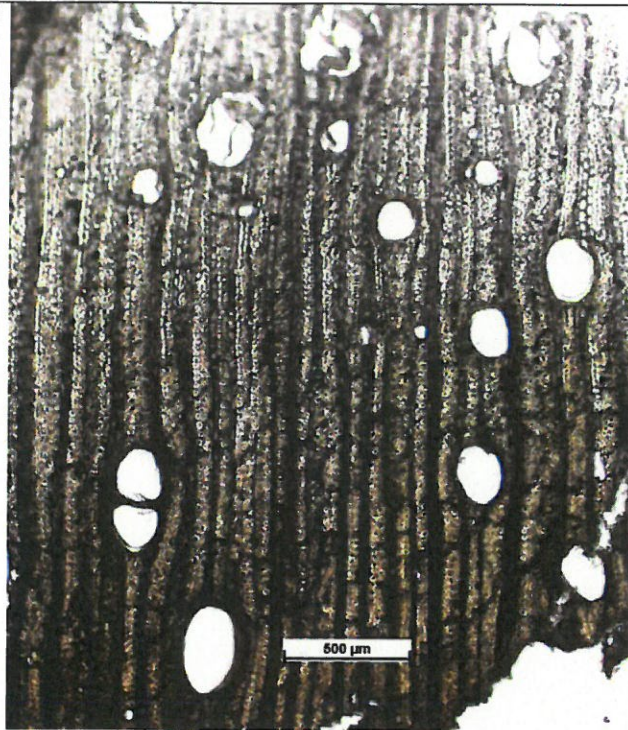


Foto 10: Q, Durchlicht; Gefäße leicht oval; M 40:1

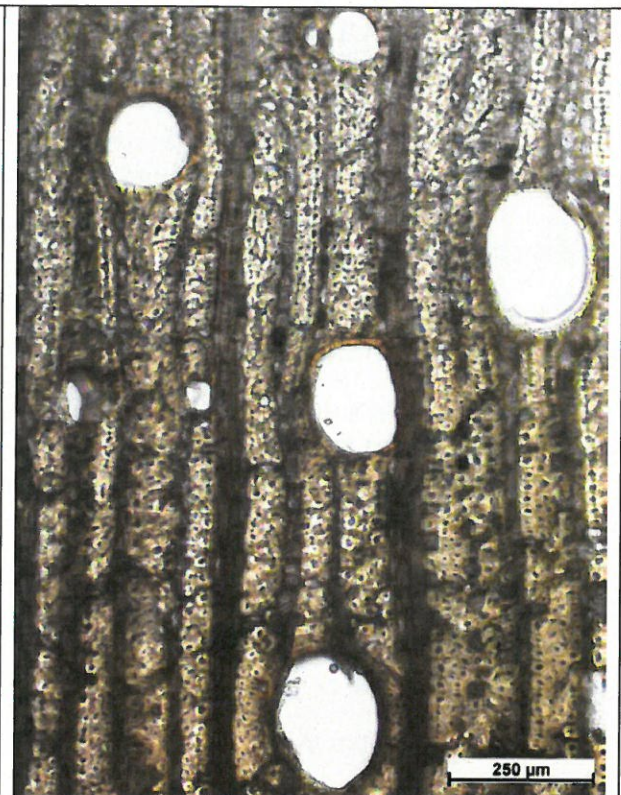


Foto 11: Q, Durchlicht; Fasern radial angeordnet; M 100:1

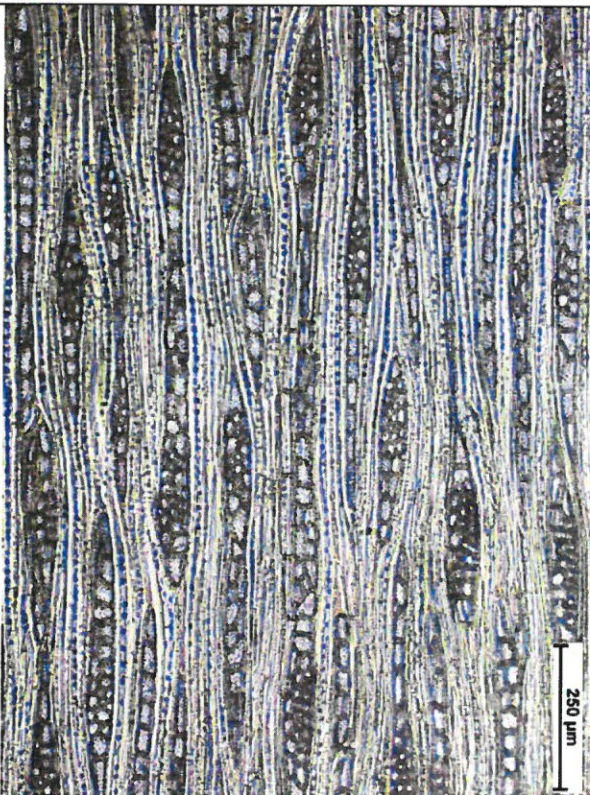


Foto 12: T; HS aus ein- und mehrschichtigen Teilen zusammengesetzt; M 100:1

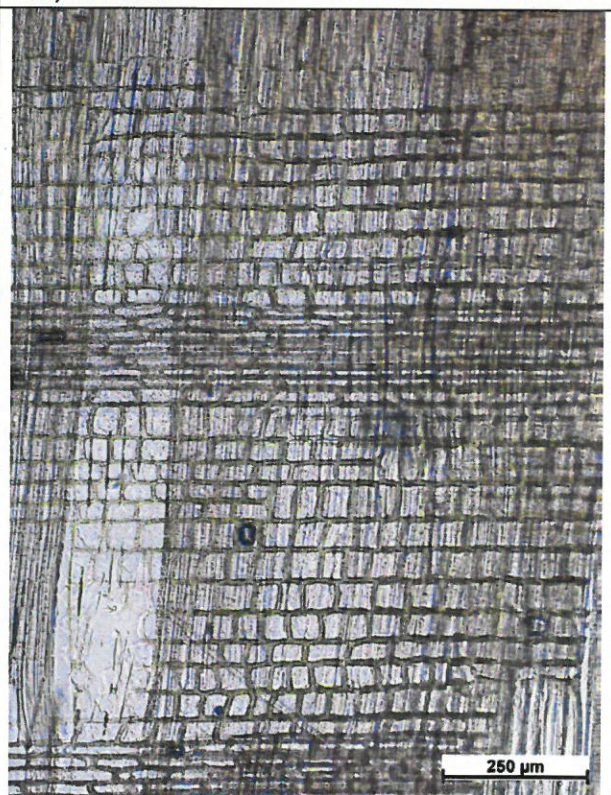


Foto 13: R; HS stark heterogen aufgebaut; M 100:1



## 5 Zusammenfassung

Bei den makroskopischen und mikroskopischen Untersuchungen der beiden zugesandten Proben wurde festgestellt, dass bei Probe A die Holzstrukturmerkmale mit der Holzart Sapelli (*Entandrophragma cylindricum*) übereinstimmen. Als Vergleich hierzu dienten u.a. zahlreiche Abbildungen aus früheren Untersuchungen von Sapelli aus dem Kongo, an denen ebenfalls zu erkennen ist, dass die Holzstrahlen in vielen Bereichen auch unregelmäßig angeordnet sind.

Die festgestellten Holzstrukturmerkmale der Holzprobe B stimmen mit denen von Bilinga (*Nauclea diderichii*) überein.

Entsprechend kann bestätigt werden, dass es sich bei den beiden Holzproben, die von Frau Kristina Osen im Mai 2014 in der Demokratischen Republik Kongo genommen wurden, um Sapelli (*Entandrophragma cylindricum*) und Bilinga (*Nauclea diderichii*) handelt.



Dipl.-Ing. (FH) Björn Weiß  
wiss. Mitarbeiter  
Ressort Biologie/Holzschutz



Philipps-Universität –FB Biologie, 35032 Marburg

Fachbereich Biologie

**Prof. Dr. Birgit Ziegenhagen****Naturschutzbiologie**

Tel. 06421 / 28-26585

Fax 06421 / 28-26588

E-Mail: ziegenha@biologie.uni-marburg.de

**Prof. Dr. Nina Farwig****Naturschutzökologie**

Tel. 06421 / 28-23478

E-Mail: farwig@biologie.uni-marburg.de

Marburg, den 24. November 2014

## To Whom it may concern

### Wissenschaftliche Anforderungen an einen Blindproben test zur Validierung verschiedener Analyseverfahren zur Art- und zur Herkunftsidentifizierung

*Ziel eines Blindproben tests ist es, unterschiedliche Analyseverfahren auf ihre Praxistauglichkeit zu vergleichen. Dabei muss jedes Analyseverfahren von einem unabhängigen Partner durchgeführt werden, d.h. ein Partner für die Holzanatomie, ein Partner für die Genetik und ein Partner für Stabile Isotopen.*

- a) Referenzmaterial zu Blindproben**
- b) Durchführende Partner**
- c) Probeneigenschaften**
- d) Probendecklaration**

**Ad a)** Die Blindproben sollten von einem anderen Partner als das Referenzmaterial gesammelt werden, um unabhängige Proben zu gewährleisten. Während Referenzmaterial so beschaffen sein kann, dass eine einfache und sichere Identifizierung der Art und der Herkunft erfolgen kann, muss bei Blindproben darauf geachtet werden, dass für das jeweilige Verfahren spezifische Ansprüche mit maximaler Herausforderung an die Methode bestehen sollten (siehe Ad c).

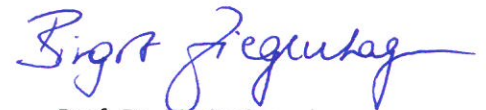
**Ad b)** Die durchführenden Partner der drei verschiedenen Analyseverfahren sollten keinen Austausch über die Blindproben haben, um unabhängig voneinander Stärken und Schwächen der verschiedenen Verfahren herauszuarbeiten. Auch hier gilt für das Probenmaterial, dass eine maximale Herausforderung an die jeweilige Methode bestehen muss (siehe Ad c).

**Ad c)** Um die Stärken und Schwächen der verschiedenen Verfahren zu validieren sind unterschiedliche Probeneigenschaften gefordert. Für die Holzanatomie ist ein massives Stück Holz gefordert, da nur so anatomische Merkmale ersichtlich sind. Weder für die Genetik noch für die stabilen Isotope dürfen größere Holzstücke verwendet werden, die es ansonsten erlauben würden, zusätzlich zum eigentlichen Verfahren holzanatomische Merkmale zu verwenden. Daher sollten hier vorzugsweise Holzspäne, die nach einem standardisierten Protokoll beschafft wurden, genutzt werden. Zudem sollten sie nicht aus Sägemühlen stammen damit keine unerwünschte Kontamination auftreten kann.

**Ad d)** Um die Stärken und Schwächen der verschiedenen Analyseverfahren zu validieren, ist es notwendig, dass die Proben so deklariert werden, dass keine Rückschlüsse über die Herkunft möglich sind. Identische Proben sollten daher unter unterschiedlicher Deklaration an die durchführenden Partner der jeweiligen Verfahren versendet werden.



Prof. Dr. Nina Farwig



Prof. Dr. Birgit Ziegenhagen



Philipps-Universität – Fachbereich Biologie, 35032 Marburg

Fachbereich Biologie

**Prof. Dr. Birgit Ziegenhagen**

**Naturschutzbiologie**

Tel. 06421 / 28-26585

Fax 06421 / 28-26588

E-Mail: [ziegenha@biologie.uni-marburg.de](mailto:ziegenha@biologie.uni-marburg.de)

Az.:

**Prof. Dr. Gerhard Kost**

**Mykologie**

Tel. 06421 / 28-22087

Fax 06421 / 28-22092

E-Mail: [kost@biologie.uni-marburg.de](mailto:kost@biologie.uni-marburg.de)

Marburg, den 24. November 2014

## To Whom it may concern

### **Pilzbefall bei Holzproben und mögliche Schwierigkeiten in der molekularen Taxonomie (Taxon-Referenz-Blindproben)**

*- falls Schimmel einmal unabsichtlich und entgegen aller Gegenmaßnahmen bei der Beschaffung von Holzproben aus den tropischen Regenwäldern auftreten sollte –*

Allgemein gilt zu bedenken, dass auch nicht schimmeliges pflanzliches Gewebe immer pilzliche DNA durch endophytische Pilze enthält (s.u.). Diesem Sachverhalt müssen per se alle genetischen Art-Nachweismethoden Rechnung tragen.

Wenn Holzproben gelegentlichen geringen Schimmelpilzbefall aufweisen, besteht ein äußerst geringes Risiko bei der molekularen Identifizierung des unbekannten Taxons. Die benutzten molekularen Systeme sind in der Regel als hoch spezifisch für Pflanzen zu werten, so dass „kontaminierende pilzliche“ Gewebe nicht erfasst werden. Wenn universelle Systeme (s.u.) verwendet werden sollten, dann besteht zwischen Pflanze und Pilz ein so großer evolutionärer Abstand, dass eine unerwünschte Identifizierung des Pilzes nahezu ausgeschlossen ist. Untersuchungen mit dem Fokus „Tier“ sind da anders zu bewerten auf Grund deren größerer evolutionären Nähe zu den Pilzen.

**a) durch falsch positive Identifizierung (genetische Kontamination durch den Pilz)**

**b) oder durch PCR- Inhibierung (biochemische Interaktion in der PCR).**

■ **Postanschrift:** Philipps-Universität Marburg,  
35032 Marburg

■ **Hausanschrift:**

Karl-von-Frisch-Str. 8, 35043 Marburg

■ **Sekretariat:** Galina Bauer, Tel. 06421 – 28-26586  
E-Mail: [bauerg@staff.uni-marburg.de](mailto:bauerg@staff.uni-marburg.de)

■



**Ad a)** Die DNA-Markersysteme, welche derzeit häufig bei Höheren Pflanzen (inkl. Bäumen), eingesetzt werden, um Arten zuverlässig zu identifizieren, stammen aus

i) der Chloroplasten-DNA. In diesem Fall ist ein falsch positives Ergebnis ausgeschlossen, da Pilze keine Chloroplasten besitzen.

ii) aus der Kern-DNA. Wenn hier Varianten aus Internal Transcribed Spacer (ITS) – Regionen der ribosomalen DNA als Marker eingesetzt werden, sind die pflanzenspezifischen PCR-Primer für bestimmte Untereinheiten designed und nicht komplementär genug zur Pilz-DNA. Lediglich bei der Verwendung universeller für Pflanzen und Tiere gleichermaßen nützlichen Sequenz-Barcodes (s.o.) findet man in 0.3 % aller Fälle einmal pilzlich-endophytische Sequenzen, wobei dikotyle Pflanzenarten ein wesentlich geringeres Sequenz-Kontaminationsrisiko als monokotyle tragen (Yao et al. 2010). Aber dieses ist sicher Stand des Wissens aller Laboratorien, die eine sichere genetische pflanzliche Art-Identifizierung anstreben, wobei solche Systeme dann wohl eher gemieden werden. Für die Nutzung von SNP-Markern bzw. einzelnen Punktmutationen in Kerngenen von Pflanzen gilt, dass es oft schon nicht möglich ist, die PCR-Primer von einer Pflanzenart zur verwandten Art zu übertragen, geschweige denn ist nicht davon auszugehen, dass diese Übertragung zwischen Organismenreichen gelänge bzw. unkontrolliert geschähe. Sollten dennoch pilzliche Sequenz-Kontamination in der PCR amplifiziert werden, sind solche Sequenzen in den Genbanken schnell zu erkennen und zu verwerfen, da es sich vermutlich um extrem konservative Sequenzen handelt, die bereits für viele Organismen unter Angabe der Art und Systematik hinterlegt sind.

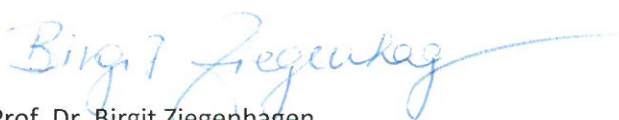
**Ad b)** Eine Inhibierung der PCR durch pilzliche Substanzen ist weniger wahrscheinlich als eine PCR-Inhibierung durch die oft als sehr störend bekannten Sekundärstoffe der Tropenhölzer als solchen.

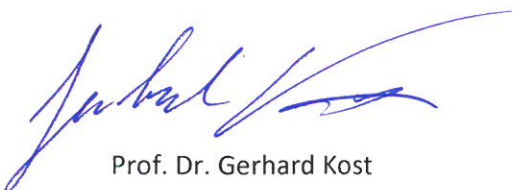
Im Zusammenhang mit Pilzen gibt es interessante Untersuchungen, die beide Systeme „Pilz und Pflanze“ aus einem einzigen DNA-Extrakt spezifisch erreichen. So konnten ohne Probleme in mykorrhizierten verholzten Wurzeln sowohl die Wirtspflanze als auch der Pilz jeweils spezifisch molekulargenetisch angesteuert werden und entsprechende spezifische Informationen aus ein und demselben Extrakt gewonnen werden, ohne irgendeine Kreuzreaktion bzw. biochemische Inhibierung der PCR zu erleben (Donges et al., unveröffentlichte Ergebnisse).

Die vorgenannten Erläuterungen treffen für Blindbeprobungen zu, die einem Arterkennungssystem zugeführt werden sollen. Ähnlich verhält es sich für Systeme die INNERHALB von Baumarten gesicherte Identifizierungen von Herkunft bzw. Provenienzen gewährleisten sollen. Es gilt das für Chloroplasten-DNA-Marker gesagte (siehe oben). Sollten individuumbasierte oder frequenzbasierte Verfahren auf der Grundlage von Kern-Mikrosatelliten-Markern angestrebt werden, ist durch die hohe Spezifität der PCR-Primer keine Kreuzkontamination durch den Pilz zu erwarten.

**Yao, H., Song, J., Liu, C., Luo, k. et al. (2010). Use of ITS2 Region as the Universal DNA Barcode for Plants and Animals. PLOS One, DOI: 10.1371/journal.pone.0013102.**

Sollten die Vertrags-Laboratorien andere als die hier dargestellten genetischen Verfahren verwenden, z.B. andere Markierungssysteme bzw. Verfahren aus dem Methodenkreis der NGS (Next Generation Sequencing) müssten diese vermittelt werden, um auch für diese konkrete Aussagen über Risiken treffen zu können. Auch schließen die mit bestem Wissen oben dargestellten Erläuterungen Wissenslücken nicht aus.

  
Prof. Dr. Birgit Ziegenhagen

  
Prof. Dr. Gerhard Kost

WWF Deutschland  
Herrn Zahnen  
Reinhardstr. 18  
10117 Berlin

23.10.2014

## Beeinträchtigung der Isotopenverhältnisse durch Schimmelbefall

Sehr geehrter Herr Zahnen,

nach dem derzeitigen Kenntnistand ist nicht davon auszugehen, dass die Isotopenmuster des Holzes durch Schimmelbefall beeinträchtigt werden.

Es ist darauf hinzuweisen, dass die Stabil-Isotopentechnik ein Nachweis eines physikalischen Merkmals ist. Dieses lässt sich durch den Schimmelbefall nicht verändern. Im Gegenteil wird gerade diese Besonderheit ausgenutzt Nahrungsweb-Studien durchzuführen.

Mit freundlichen Grüßen,



Dr. Markus Boner  
(Lebensmittelchemiker)

18 Nov 2014

## **Blindtest**

Blindtests dienen dazu, die Aussagekraft einer Methode zu prüfen. Im vorliegenden Projekt Wasserzeichen geht es darum, mit Blindtests zu überprüfen, ob mit der Isotopenanalyse die Aussage zur regionalen Herkunft von Produkten richtig verifiziert werden kann.

Beim Vorgehen ist es unerlässlich, dass die Herkunft der für die Blindtests verwendeten Blindproben zweifelsfrei bekannt ist. Deshalb werden für die Blindtests Proben verwendet, die gemäß dem Verfahren für authentische Referenzproben genommen wurden. Die Probennahme erfolgt bei pflanzlichen Produkten vor der Ernte auf dem Feld. Der Probenahmeort wird zusätzlich durch Bestimmung der GPS-Daten sowie durch Fotos von der beprobten Fläche dokumentiert.

Praxisproben sind für Blindtest nicht geeignet, da bei einer falschen Verifizierung einer Herkunftsaussage durch das Labor nicht ausgeschlossen werden kann, dass die falsche Verifizierung durch die nicht gesicherte Herkunft der Probe bedingt ist.

---

Rolf Mäder  
FiBL Deutschland e.V.  
Forschungsinstitut für biologischen Landbau  
Postanschrift:  
Postfach 90 01 63, 60441 Frankfurt am Main  
Besucheradresse:  
Kasseler Straße 1a, 60486 Frankfurt am Main

Tel: +49 69 7137699-71  
Fax: +49 69 7137699-9  
Mobil: +49 160 8471555  
E-Mail: [Rolf.Maeder@fibl.org](mailto:Rolf.Maeder@fibl.org)

[www.fibl.org](http://www.fibl.org)  
[www.betriebsmittelliste.de](http://www.betriebsmittelliste.de)  
[www.bioC.info](http://www.bioC.info)  
[www.bio-mit-gesicht.de](http://www.bio-mit-gesicht.de)  
[www.oeko-verarbeitung.de](http://www.oeko-verarbeitung.de)

---

## ***“Development and implementation of a species identification and timber tracking system in Africa with DNA fingerprints and stable isotopes”***

### **Wood species and country origin identification blind test**

#### **Brief report on the results**

#### **Background**

Following the sampling realized in different countries in Africa regions in the frame of the ITTO funded project named “Development and implementation of a species identification and timber tracking system in Africa with DNA fingerprints and stable isotopes”, two blind test processes have been conducted in order to determine whether the methods elaborated are able to help identify the species or the country origin of a given piece of timber and which can be used to track timber besides the other timber tracking systems existing on the trade.

The first blind test focused on species identification while the second one focused on country identification.

The collecting of samples has been done from West and Central Africa countries coordinated by the consultancy G2S based in Cameroon.

#### **Objectives**

- Species identification: the result awaited here was to confirm or not that the wood sample tested belongs to the claim species;
- Country identification: the result awaited was to confirm or not the claim made regarding the country of origin of a wood sample.

#### **Methodology of sampling**

Globally, the methodology has been inspired by the terms of reference put at disposal by the project coordinator.

##### *1. Wood sample types*

As suggested by the project, wood samples have been removed from sawn timber in order to realized the blind test on the samples which are as close as possible to the form in which the timber from Africa is more and more sold in European countries (note that the approaches used to test have been developed with cambium samples collected during the sampling on trees) because the laboratories should be more confronted to that form of material when realizing the tests of identification if the method is widely adopted for wood tracking in the timber industry.

##### *2. Species identification*

During the step one, more than 80 wood samples species have been collected from 21 taxa ([list attached in annex 1](#)) in Ghana, Cameroon and Gabon. From that set of samples, 50 have been selected and tagged with code number before being sent to the project coordinator directly from Ghana and Cameroon. Preferably, the samples were collected from sawmills but some have been collected from chain sawmilling operations due to the fact that the concerned species were not found sawed at sawmills (some are generally sold in logs by the logging companies).

From the 50 samples sent to the project coordinator, a list of 25 have finally been issued by consultancy organizations involved (Ghana and Cameroon) and communicated to the project coordinator for testing in laboratories to confirm or not the claim done by the consultancy organizations.

The headings of the final excel file sent were: order number, code numbers, claims on species names, true species names ([see the list attached in annex 2](#)).

### 3. Country level identification

Around 75 wood samples have been collected from 3 species (*Milicia excelsa*, *Triplochiton scleroxylon*, *Entandrophragma cylindricum*) in sawmills (majority) and chain sawmilling operations in Ghana, Ivory coast, Cameroon, Congo republic, CAR, DRC and Gabon. From that set of samples, 60 have been selected and tagged for testing purposes.

The samples collected in West Africa have been sent to G2S in Cameroon (in charge of sampling in Central Africa) in order to finalize the samples tagging process and send all the samples together directly from Cameroon to the project coordinator. At the end of selection process, a list of 30 samples has finally be issued by consultancy organizations and communicated to the project coordinator for testing in laboratories to confirm or not the claim done by the consultancy organizations.

As the necessary tools (genetic markers...) were not identify/developed for some target species coming from some countries, it has been agreed that for those species and countries, the true solution (true country origin) couldn't choose/select/concern them but they could be selected/chose among the claims on country origin so that the test can confirm or not the claim.

The headings of the final excel file sent were: order number, code numbers, species names, claims on country, claims on region within the country (for some countries), true country origin (see the list attached in annex 3).

## Results

The results are presented in 2 steps:

- Step 1: species identification results by laboratory and method/approach used
- Step 2: country origin identification by laboratory and method/approach used

### 1. Species identification results

#### Legend for understanding

|  |                                                                                                   |
|--|---------------------------------------------------------------------------------------------------|
|  | Laboratory answer correct when compare to the claim                                               |
|  | Laboratory not correct when compare to the claim                                                  |
|  | No answer given by the laboratory regardless the reason or no claim provided by the sampling team |

#### 1.1. Wood anatomy approach

The laboratory answer is assessed compare to the claim made for each species (ToR) and at the genus level because the method can't enable to identify the species for some timber species. This help to have a unique approach of evaluation for all the samples (timber species) sent to the laboratory.

**Table 1:** results of the species identification based on wood anatomy method- Gerald KOCK



|                     | anatomy approach_Gerald KOCK       |                                  |                   |                          |                                                                                                                      |
|---------------------|------------------------------------|----------------------------------|-------------------|--------------------------|----------------------------------------------------------------------------------------------------------------------|
| Sample code numbers | Claims on species names            | True species names               | Laboratory answer | Sampling team evaluation | Comments                                                                                                             |
| G2S_S_1.0           | <i>Guibourtia ehie</i> .           | <i>Afzelia africana</i>          | Claim False       | correct                  |                                                                                                                      |
| G2S_S_1.5           | <i>Baillonella toxisperma</i>      | <i>Afzelia</i> spp               | Claim False       | correct                  |                                                                                                                      |
| G2S_S_2.0           | <i>Khaya anthotheca</i>            | <i>Khaya ivorensis</i>           | Claim True        | correct                  | the individual species with the genus Khaya can't be distinguished microscopically                                   |
| G2S_S_3.5           | <i>Baillonella toxisperma</i>      | <i>Baillonella toxisperma</i>    | Claim True        | correct                  |                                                                                                                      |
| G2S_S_5.0           | <i>Entandrophragma cylindricum</i> | <i>Entandrophragma angolense</i> | Claim False       | correct                  |                                                                                                                      |
| G2S_S_8.0           | <i>Entandrophragma candollei</i>   | <i>Entandrophragma utile</i>     | Claim False       | correct                  |                                                                                                                      |
| G2S_S_8.5           | <i>Entandrophragma cylindricum</i> | <i>Entandrophragma utile</i>     | Claim False       | correct                  | but the species name given is not matching with the name given sampling team (verification going on)                 |
| G2S_S_10.0          | <i>Milicia excelsa</i>             | <i>Erythrophleum suaveolens</i>  | Claim False       | correct                  |                                                                                                                      |
| G2S_S_11.5          | <i>Guibourtia</i> spp.             | <i>Guibourtia</i> spp.           | Claim True        | correct                  |                                                                                                                      |
| G2S_S_13.0          | <i>Lophira alata</i>               | <i>Lophira alata</i>             | Claim True        | correct                  |                                                                                                                      |
| G2S_S_13.5          | <i>Lophira alata</i>               | <i>Lophira alata</i>             | Claim True        | correct                  |                                                                                                                      |
| G2S_S_14.0          | <i>Erythrophleum suaveolens</i>    | <i>Milicia excelsa</i>           | Claim False       | correct                  |                                                                                                                      |
| G2S_S_15.0          | <i>Milicia regia</i>               | <i>Milicia regia</i>             | Claim True        | correct                  | the individual species with the genus Milicia can't be distinguished microscopically                                 |
| G2S_S_16.5          | <i>Millettia laurentii</i>         | <i>Millettia laurentii</i>       | Claim True        | correct                  |                                                                                                                      |
| G2S_S_18.5          | <i>Khaya</i> spp                   | <i>Pericopsis elata</i>          | Claim False       | correct                  |                                                                                                                      |
| G2S_S_20.0          | <i>Terminalia superba</i>          | <i>Terminalia superba</i>        | Claim True        | correct                  |                                                                                                                      |
| G2S_S_21.5          | <i>Pterocarpus soyauxii</i>        | <i>Pterocarpus soyauxii</i>      | Claim True        | correct                  |                                                                                                                      |
| G2S_S_24.0          | <i>Triplochiton scleroxylon</i>    | <i>Triplochiton scleroxylon</i>  | Claim True        | correct                  |                                                                                                                      |
| G2S_S_25.5          | <i>Entandrophragma utile</i>       | <i>Mansonia altissima</i>        | Claim False       | correct                  |                                                                                                                      |
| G2S_S_30.5          | <i>Triplochiton scleroxylon</i>    | <i>Triplochiton scleroxylon</i>  | Claim True        | correct                  |                                                                                                                      |
| G2S_S_33.5          | <i>Erythrophleum ivorense</i>      | <i>Lovoa trichiloides</i>        | Claim False       | correct                  |                                                                                                                      |
| G2S_S_35.5          | <i>Afzelia</i> spp                 | <i>Afzelia</i> spp               | Claim True        | correct                  |                                                                                                                      |
| G2S_S_38.5          | <i>Nauclea diderrichii</i>         | <i>Nauclea diderrichii</i>       | Claim False       | not correct              | the laboratory confirm that the sample received is not from that species (verification with another lab is going on) |
| G2S_S_41.5          | <i>Aningeria robusta</i>           | <i>Mansonia altissima</i>        | Claim False       | correct                  |                                                                                                                      |
| G2S_S_47.5          | <i>Cylicodiscus gabunensis</i>     | <i>Cylicodiscus gabunensis</i>   | Claim True        | correct                  |                                                                                                                      |

## 1.2. Barcoding and fingerprinting approach

Table 2: results of the species identification based on barcoding method- plant genetics diagnosis

| Barcoding approach_plant genetic_Aki |                                    |                                  |                             |                          |                                                                                 |
|--------------------------------------|------------------------------------|----------------------------------|-----------------------------|--------------------------|---------------------------------------------------------------------------------|
| Sample code numbers                  | Claims on species names            | True species names               | Laboratory answer_barcoding | Sampling team evaluation | Comments                                                                        |
| G2S_S_1.0                            | <i>Guibourtia ehie</i> .           | <i>Afzelia africana</i>          | <i>claim wrong</i>          | <i>correct</i>           |                                                                                 |
| G2S_S_1.5                            | <i>Baillonella toxisperma</i>      | <i>Afzelia spp</i>               | <i>claim wrong</i>          | <i>correct</i>           |                                                                                 |
| G2S_S_2.0                            | <i>Khaya anthotheca</i>            | <i>Khaya ivorensis</i>           | <i>claim wrong</i>          | <i>correct</i>           |                                                                                 |
| G2S_S_3.5                            | <i>Baillonella toxisperma</i>      | <i>Baillonella toxisperma</i>    | <i>claim wrong</i>          | <i>incorrect</i>         | sequence not in the reference data set according to the laboratory              |
| G2S_S_5.0                            | <i>Entandrophragma cylindricum</i> | <i>Entandrophragma angolense</i> | <i>no answer</i>            |                          | according to the lab: no DNA amplification                                      |
| G2S_S_8.0                            | <i>Entandrophragma candollei</i>   | <i>Entandrophragma utile</i>     | <i>claim wrong</i>          | <i>correct</i>           |                                                                                 |
| G2S_S_8.5                            | <i>Entandrophragma cylindricum</i> | <i>Entandrophragma utile</i>     | <i>no answer</i>            |                          | according to the lab: low DNA quality or DNA markers do not work on this sample |
| G2S_S_10.0                           | <i>Milicia excelsa</i>             | <i>Erythrophleum suaveolens</i>  | <i>claim wrong</i>          | <i>correct</i>           |                                                                                 |
| G2S_S_11.5                           | <i>Guibourtia spp.</i>             | <i>Guibourtia spp.</i>           | <i>claim true</i>           | <i>correct</i>           |                                                                                 |
| G2S_S_13.0                           | <i>Lophira alata</i>               | <i>Lophira alata</i>             | <i>claim wrong</i>          | <i>incorrect</i>         |                                                                                 |
| G2S_S_13.5                           | <i>Lophira alata</i>               | <i>Lophira alata</i>             | <i>no answer</i>            |                          | according to the lab: low DNA quality or DNA markers do not work on this sample |
| G2S_S_14.0                           | <i>Erythrophleum suaveolens</i>    | <i>Milicia excelsa</i>           | <i>no answer</i>            |                          | according to the lab: low DNA quality or DNA markers do not work on this sample |
| G2S_S_15.0                           | <i>Milicia regia</i>               | <i>Milicia regia</i>             | <i>claim true</i>           | <i>correct</i>           |                                                                                 |
| G2S_S_16.5                           | <i>Millettia laurentii</i>         | <i>Millettia laurentii</i>       | <i>no answer</i>            |                          | no DNA amplification                                                            |
| G2S_S_18.5                           | <i>Khaya spp</i>                   | <i>Pericopsis elata</i>          | <i>no answer</i>            |                          | no DNA amplification                                                            |
| G2S_S_20.0                           | <i>Terminalia superba</i>          | <i>Terminalia superba</i>        | <i>claim true</i>           | <i>correct</i>           |                                                                                 |
| G2S_S_21.5                           | <i>Pterocarpus soyauxii</i>        | <i>Pterocarpus soyauxii</i>      | <i>claim wrong</i>          | <i>incorrect</i>         |                                                                                 |
| G2S_S_24.0                           | <i>Triplochiton scleroxylon</i>    | <i>Triplochiton scleroxylon</i>  | <i>claim true</i>           | <i>correct</i>           |                                                                                 |
| G2S_S_25.5                           | <i>Entandrophragma utile</i>       | <i>Mansonia altissima</i>        | <i>claim wrong</i>          | <i>correct</i>           |                                                                                 |
| G2S_S_30.5                           | <i>Triplochiton scleroxylon</i>    | <i>Triplochiton scleroxylon</i>  | <i>claim true</i>           | <i>correct</i>           |                                                                                 |
| G2S_S_33.5                           | <i>Erythrophleum ivorense</i>      | <i>Lovoa trichiloides</i>        | <i>claim wrong</i>          | <i>correct</i>           |                                                                                 |
| G2S_S_35.5                           | <i>Afzelia spp</i>                 | <i>Afzelia spp</i>               | <i>claim wrong</i>          | <i>incorrect</i>         |                                                                                 |
| G2S_S_38.5                           | <i>Nauclea diderrichii</i>         | <i>Nauclea diderrichii</i>       | <i>no answer</i>            |                          | no DNA amplification                                                            |
| G2S_S_41.5                           | <i>Aningeria robusta</i>           | <i>Mansonia altissima</i>        | <i>claim wrong</i>          | <i>correct</i>           |                                                                                 |
| G2S_S_47.5                           | <i>Cylicodiscus gabunensis</i>     | <i>Cylicodiscus gabunensis</i>   | <i>claim true</i>           | <i>correct</i>           |                                                                                 |



## 2. Country origin identification results

### Legend for understanding

|  |                                                                                                   |
|--|---------------------------------------------------------------------------------------------------|
|  | Laboratory answer correct when compare to the claim                                               |
|  | Laboratory not correct when compare to the claim                                                  |
|  | No answer given by the laboratory regardless the reason or no claim provided by the sampling team |

### 2.1. Isotope approach

Table 3: results of the country origin identification based on isotopic approach- FERA-Donarski

| Isotope approach_FERA_James DONARSKI |                             |                   |                     |                                                         |                          |          |                                      |                                                         |                          |                                                                                                            |
|--------------------------------------|-----------------------------|-------------------|---------------------|---------------------------------------------------------|--------------------------|----------|--------------------------------------|---------------------------------------------------------|--------------------------|------------------------------------------------------------------------------------------------------------|
| Sample code numbers                  | Species                     | Claims on country | True country origin | laboratory answer_country_isotope (claim true or false) | Sampling team evaluation | Comments | Claim on region within country       | laboratory answer_country_isotope (claim true or false) | Sampling team evaluation | Comments                                                                                                   |
| G2S_O_ E4                            | Entandrophragma cylindricum | Ghana             | Ghana               | Yes                                                     | correct                  |          | no claim on region                   |                                                         |                          |                                                                                                            |
| G2S_O_ E6                            | Entandrophragma cylindricum | DRC               | Cameroon            | Yes                                                     | not correct              |          | South-West (Bandundu province)       | No                                                      | incorrect                | as it's incorrect at country level, the answer given at region level is automatically considered incorrect |
| G2S_O_ E8                            | Entandrophragma cylindricum | Cameroon          | Cameroon            | Yes                                                     | correct                  |          | South (Sangmelima)                   | Yes                                                     | correct                  |                                                                                                            |
| G2S_O_ E11                           | Entandrophragma cylindricum | Congo             | Congo               | Yes                                                     | correct                  |          | North region                         | Yes                                                     | correct                  |                                                                                                            |
| G2S_O_ E13                           | Entandrophragma cylindricum | Congo             | Congo               | Yes                                                     | correct                  |          | North region                         | Yes                                                     | correct                  |                                                                                                            |
| G2S_O_ E14                           | Entandrophragma cylindricum | Congo             | Congo               | Yes                                                     | correct                  |          | North region                         | Yes                                                     | correct                  |                                                                                                            |
| G2S_O_ E18                           | Entandrophragma cylindricum | DRC               | DRC                 | Yes                                                     | correct                  |          | North-West (Equateur province)       | Yes                                                     | correct                  |                                                                                                            |
| G2S_O_ E20                           | Entandrophragma cylindricum | DRC               | DRC                 | Yes                                                     | correct                  |          | North-West (Equateur province)       | Yes                                                     | correct                  |                                                                                                            |
| G2S_O_ E22                           | Entandrophragma cylindricum | DRC               | DRC                 | Yes                                                     | correct                  |          | South-West (Bandundu province)       | No                                                      | incorrect                |                                                                                                            |
| G2S_O_ E24                           | Entandrophragma cylindricum | DRC               | DRC                 | Yes                                                     | correct                  |          | North-East region (Orientale region) | Yes                                                     | correct                  |                                                                                                            |



Table 4: results of the country origin identification based on isotopic approach- Agroisolab-BONER

|                     |                        | Isotope approach_Agroisolab_BONER |                     |                                                         |                          |          |                                   |                                                         |                          |                                                                                                                            |
|---------------------|------------------------|-----------------------------------|---------------------|---------------------------------------------------------|--------------------------|----------|-----------------------------------|---------------------------------------------------------|--------------------------|----------------------------------------------------------------------------------------------------------------------------|
| Sample code numbers | Species                | Claims on country                 | True country origin | laboratory answer_country_isotope (claim true or false) | Sampling team evaluation | Comments | Claim on region within country    | laboratory answer_country_isotope (claim true or false) | Sampling team evaluation | Comments                                                                                                                   |
| G2S_O_M1            | <i>Milicia Excelsa</i> | Ghana                             | Ghana               | Yes                                                     | correct                  |          | no claim on region                |                                                         |                          |                                                                                                                            |
| G2S_O_M4            | <i>Milicia Excelsa</i> | Gabon                             | Congo               | No                                                      | correct                  |          | North east region                 | No                                                      | correct                  |                                                                                                                            |
| G2S_O_M5            | <i>Milicia Excelsa</i> | DRC                               | Congo               | No                                                      | correct                  |          | North-West (Equateur province)    | No                                                      | correct                  |                                                                                                                            |
| G2S_O_M6            | <i>Milicia Excelsa</i> | Cameroon                          | CAR                 | Yes                                                     | incorrect                |          | South-west                        | Possible                                                | incorrect                | A significant evaluation of the closer region could only be estimated, because the numbers of reference is too small (n=3) |
| G2S_O_M7            | <i>Milicia Excelsa</i> | Gabon                             | CAR                 | No                                                      | correct                  |          | North region                      | No                                                      | correct                  |                                                                                                                            |
| G2S_O_M10           | <i>Milicia Excelsa</i> | Gabon                             | DRC                 | Yes                                                     | incorrect                |          | North region (Oyem)               | No                                                      | incorrect                | as it's incorrect at country level, the answer given at region level is automatically considered incorrect                 |
| G2S_O_M12           | <i>Milicia Excelsa</i> | DRC                               | DRC                 | Yes                                                     | correct                  |          | North center (Orientale province) | Yes                                                     | correct                  |                                                                                                                            |
| G2S_O_M14           | <i>Milicia Excelsa</i> | Cameroon                          | Gabon               | Yes                                                     | incorrect                |          | Center region (Mbalmayo)          | no answer                                               |                          | according to the lab the Numbers of references it too small to evaluate the region (n=3))                                  |
| G2S_O_M15           | <i>Milicia Excelsa</i> | Gabon                             | Cameroon            | No                                                      | correct                  |          | Center-West region                | No                                                      | correct                  |                                                                                                                            |
| G2S_O_M20           | <i>Milicia Excelsa</i> | Cameroon                          | Cameroon            | Yes                                                     | correct                  |          | South region (Ebolowa)            | no answer                                               |                          | according to the lab the Numbers of references it too small to evaluate the region (n=3))                                  |



Table 5: results of the country origin identification based on isotopic approach- HBLFA-HORACEK

|                     |                                 | Isotope approach_HBLFA_HORACEK |                     |                                                         |                          |                                                       |                                |                                                         |                          |                                                       |
|---------------------|---------------------------------|--------------------------------|---------------------|---------------------------------------------------------|--------------------------|-------------------------------------------------------|--------------------------------|---------------------------------------------------------|--------------------------|-------------------------------------------------------|
| Sample code numbers | Species                         | Claims on country              | True country origin | laboratory answer_country_isotope (claim true or false) | Sampling team evaluation | Comments                                              | Claim on region within country | laboratory answer_country_isotope (claim true or false) | Sampling team evaluation | Comments                                              |
| G2S_O_T1            | <i>Triplochiton scleroxylon</i> | Ghana                          | Ghana               | Yes                                                     | correct                  |                                                       |                                |                                                         |                          | no claim on region                                    |
| G2S_O_T3            | <i>Triplochiton scleroxylon</i> | Ghana                          | Ghana               | Yes                                                     | correct                  |                                                       |                                |                                                         |                          | no claim on region                                    |
| G2S_O_T6            | <i>Triplochiton scleroxylon</i> | Cameroon                       | Congo               | Yes                                                     | incorrect                |                                                       | South region (Ebolowa)         | no answer                                               |                          | Answer at regional level not mentioned                |
| G2S_O_T7            | <i>Triplochiton scleroxylon</i> | Congo                          | Congo               | no answer                                               | —                        | not enough reference samples provided (less than 20). | North region                   | no answer                                               |                          | not enough reference samples provided (less than 20). |
| G2S_O_T9            | <i>Triplochiton scleroxylon</i> | DRC                            | Cameroon            | No                                                      | correct                  |                                                       | North-West (Equateur province) | no answer                                               |                          | Answer at regional level not mentioned                |
| G2S_O_T11           | <i>Triplochiton scleroxylon</i> | Cameroon                       | Cameroon            | Yes                                                     | correct                  |                                                       | East region (Bertoua)          | no answer                                               |                          | Answer at regional level not mentioned                |
| G2S_O_T13           | <i>Triplochiton scleroxylon</i> | Cameroon                       | Cameroon            | Yes                                                     | correct                  |                                                       | South region                   | No                                                      | incorrect                |                                                       |
| G2S_O_T15           | <i>Triplochiton scleroxylon</i> | Cameroon                       | Cameroon            | Yes                                                     | correct                  |                                                       | South region                   | No                                                      | incorrect                |                                                       |
| G2S_O_T16           | <i>Triplochiton scleroxylon</i> | Cameroon                       | Cameroon            | Yes                                                     | correct                  |                                                       | South region                   | No                                                      | incorrect                |                                                       |
| G2S_O_T18           | <i>Triplochiton scleroxylon</i> | Cameroon                       | Cameroon            | Yes                                                     | correct                  |                                                       | East region (Mbang)            | no answer                                               |                          | Answer at regional level not mentioned                |





## 2.2. Genetic approach

Table 6: results of the country origin identification based on genetic approach- Adelaide-Andrew

|                     |                                 |                   |                     | genetic approach_Adelaide_Andrew                        |                          |                                                                               |                                |                                                         |                          |                                                                               |
|---------------------|---------------------------------|-------------------|---------------------|---------------------------------------------------------|--------------------------|-------------------------------------------------------------------------------|--------------------------------|---------------------------------------------------------|--------------------------|-------------------------------------------------------------------------------|
| Sample code numbers | Species                         | Claims on country | True country origin | laboratory answer_country_isotope (claim true or false) | Sampling team evaluation | Comments                                                                      | Claim on region within country | laboratory answer_country_isotope (claim true or false) | Sampling team evaluation | Comments                                                                      |
| G2S_O_T1            | <i>Triplochiton scleroxylon</i> | Ghana             | Ghana               | <i>no answer</i>                                        |                          | sequinom success < 90%, sample quality not high enough for robust conclusions | no claim                       |                                                         |                          |                                                                               |
| G2S_O_T3            | <i>Triplochiton scleroxylon</i> | Ghana             | Ghana               | Yes                                                     | correct                  |                                                                               |                                |                                                         |                          |                                                                               |
| G2S_O_T6            | <i>Triplochiton scleroxylon</i> | Cameroon          | Congo               | <i>no answer</i>                                        |                          | sequinom success < 90%, sample quality not high enough for robust conclusions | South region (Ebolow a)        | no answer                                               |                          | sequinom success < 90%, sample quality not high enough for robust conclusions |
| G2S_O_T7            | <i>Triplochiton scleroxylon</i> | Congo             | Congo               | <i>no answer</i>                                        |                          | sequinom success < 90%, sample quality not high enough for robust conclusions | North region                   | no answer                                               |                          | sequinom success < 90%, sample quality not high enough for robust conclusions |
| G2S_O_T9            | <i>Triplochiton scleroxylon</i> | DRC               | Cameroon            | No                                                      | correct                  |                                                                               | North-West (Equateur province) | No                                                      | correct                  |                                                                               |
| G2S_O_T11           | <i>Triplochiton scleroxylon</i> | Cameroon          | Cameroon            | Yes                                                     | correct                  |                                                                               | East region (Bertoua)          | Yes                                                     | correct                  |                                                                               |
| G2S_O_T13           | <i>Triplochiton scleroxylon</i> | Cameroon          | Cameroon            | Yes                                                     | correct                  |                                                                               | South region (Ebolow a)        | Yes                                                     | correct                  |                                                                               |
| G2S_O_T15           | <i>Triplochiton scleroxylon</i> | Cameroon          | Cameroon            | <i>no answer</i>                                        |                          | sequinom success < 90%, sample quality not high enough for robust conclusions | South region (Ebolow a)        | no answer                                               |                          | sequinom success < 90%, sample quality not high enough for robust conclusions |
| G2S_O_T16           | <i>Triplochiton scleroxylon</i> | Cameroon          | Cameroon            | <i>no answer</i>                                        |                          | sequinom success < 90%, sample quality not high enough for robust conclusions | South region (Ebolow a)        | no answer                                               |                          | sequinom success < 90%, sample quality not high enough for robust conclusions |
| G2S_O_T18           | <i>Triplochiton scleroxylon</i> | Cameroon          | Cameroon            | No                                                      | incorrect                |                                                                               | East region (Mbang)            | No                                                      | incorrect                |                                                                               |

Table 7: results of the country origin identification based on genetic approach- Thunen-Celine



| genetic approach_Thunen_Celine |                                    |                   |                     |                                                         |                          |                                                              |                                |                                                         |                          |                                                              |
|--------------------------------|------------------------------------|-------------------|---------------------|---------------------------------------------------------|--------------------------|--------------------------------------------------------------|--------------------------------|---------------------------------------------------------|--------------------------|--------------------------------------------------------------|
| Sample code numbers            | Species                            | Claims on country | True country origin | laboratory answer_country_isotope (claim true or false) | Sampling team evaluation | Comments                                                     | Claim on region within country | laboratory answer_country_isotope (claim true or false) | Sampling team evaluation | Comments                                                     |
| G2S_O_E4                       | <i>Entandrophragma cylindricum</i> | Ghana             | Ghana               | No                                                      | incorrect                |                                                              | no claim                       |                                                         |                          |                                                              |
| G2S_O_E6                       | <i>Entandrophragma cylindricum</i> | DRC               | Cameroon            | No                                                      | correct                  |                                                              | South-West (Bandundu province) | No                                                      | correct                  |                                                              |
| G2S_O_E8                       | <i>Entandrophragma cylindricum</i> | Cameroon          | Cameroon            | Yes                                                     | correct                  |                                                              | South (Sangmelima)             | Yes                                                     | correct                  |                                                              |
| G2S_O_E11                      | <i>Entandrophragma cylindricum</i> | Congo             | Congo               | no answer                                               |                          | not enough loci, bad DNA quality according to the laboratory | North region                   | no answer                                               |                          | not enough loci, bad DNA quality according to the laboratory |
| G2S_O_E13                      | <i>Entandrophragma cylindricum</i> | Congo             | Congo               | Yes                                                     | correct                  |                                                              | North region                   | Yes                                                     | correct                  |                                                              |
| G2S_O_E14                      | <i>Entandrophragma cylindricum</i> | Congo             | Congo               | Yes                                                     | correct                  |                                                              | North region                   | Yes                                                     | correct                  |                                                              |
| G2S_O_E18                      | <i>Entandrophragma cylindricum</i> | DRC               | DRC                 | No                                                      | incorrect                |                                                              | North-West (Equateur province) | No                                                      | incorrect                |                                                              |
| G2S_O_E20                      | <i>Entandrophragma cylindricum</i> | DRC               | DRC                 | No                                                      | incorrect                |                                                              | North-West (Equateur province) | No                                                      | incorrect                |                                                              |
| G2S_O_E22                      | <i>Entandrophragma cylindricum</i> | DRC               | DRC                 | Yes                                                     | correct                  |                                                              | South-West (Bandundu province) | Yes                                                     | correct                  |                                                              |
| G2S_O_E24                      | <i>Entandrophragma cylindricum</i> | DRC               | DRC                 | Yes                                                     | correct                  |                                                              | North-East (Orientale region)  | Yes                                                     | correct                  |                                                              |



Table 8: results of the country origin identification based on genetic approach- Thunen-Celine

| genetic approach_Thunen_Celine |                        |                   |                     |                                                         |                          |          |                                    |                                                         |                          |          |
|--------------------------------|------------------------|-------------------|---------------------|---------------------------------------------------------|--------------------------|----------|------------------------------------|---------------------------------------------------------|--------------------------|----------|
| Sample code numbers            | Species                | Claims on country | True country origin | laboratory answer_country_isotope (claim true or false) | Sampling team evaluation | Comments | Claim on region within country     | laboratory answer_country_isotope (claim true or false) | Sampling team evaluation | Comments |
| G2S_O_M1                       | <i>Milicia Excelsa</i> | Ghana             | Ghana               | Yes                                                     | correct                  |          |                                    |                                                         |                          |          |
| G2S_O_M4                       | <i>Milicia Excelsa</i> | Gabon             | Congo               | No                                                      | correct                  |          | North east region                  | no answer                                               |                          |          |
| G2S_O_M5                       | <i>Milicia Excelsa</i> | DRC               | Congo               | Yes                                                     | incorrect                |          | North-West (Equateur province)     | no answer                                               |                          |          |
| G2S_O_M6                       | <i>Milicia Excelsa</i> | Cameroon          | CAR                 | Yes                                                     | incorrect                |          | South-west                         | no answer                                               |                          |          |
| G2S_O_M7                       | <i>Milicia Excelsa</i> | Gabon             | CAR                 | Yes                                                     | incorrect                |          | North region                       | no answer                                               |                          |          |
| G2S_O_M10                      | <i>Milicia Excelsa</i> | Gabon             | DRC                 | No                                                      | correct                  |          | North region (Oyem)                | no answer                                               |                          |          |
| G2S_O_M12                      | <i>Milicia Excelsa</i> | DRC               | DRC                 | Yes                                                     | correct                  |          | North center (center of Orientale) | no answer                                               |                          |          |
| G2S_O_M14                      | <i>Milicia Excelsa</i> | Cameroon          | Gabon               | Yes                                                     | incorrect                |          | Center region (Mbalmayo)           | no answer                                               |                          |          |
| G2S_O_M15                      | <i>Milicia Excelsa</i> | Gabon             | Cameroon            | No                                                      | correct                  |          | Center-West region                 | no answer                                               |                          |          |
| G2S_O_M20                      | <i>Milicia Excelsa</i> | Cameroon          | Cameroon            | Yes                                                     | correct                  |          | South region (Ebolowa)             | no answer                                               |                          |          |