



# How scientific testing can support companies to comply with Due Diligence requirements of the EUDR?

Webinar: 28<sup>th</sup> April 2023



LIFE - Support EUTR II - LIFE18 GIE/DK/000763



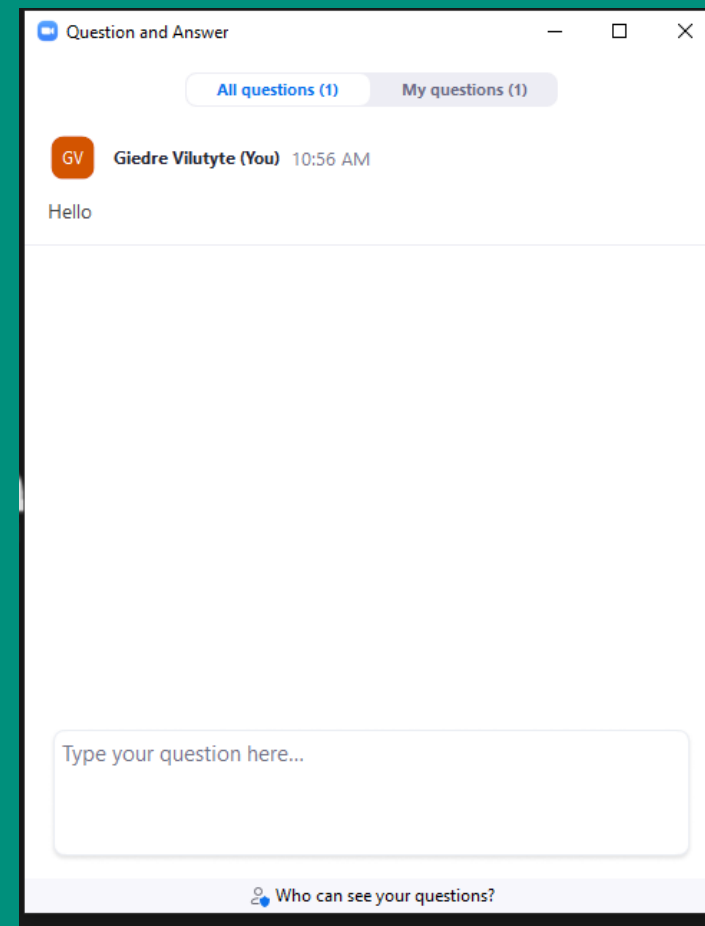
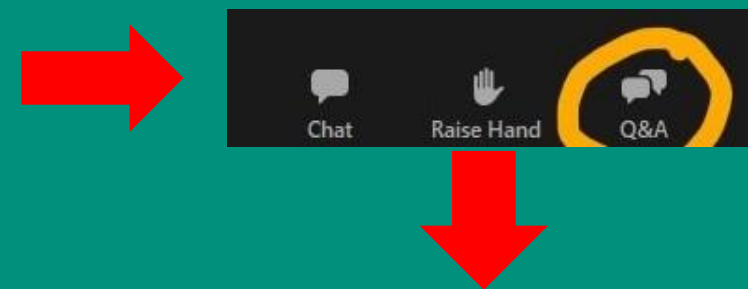
- The presentation will be made available after the webinar
- The Webinar will be recorded – we will only publish recordings of the presentation.
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- All attendees are in listen only mode.



- You may ask questions in writing via the 'Q&A function' during the webinar.
- We'll do our best to answer as many questions as possible during the webinar and Q&A session.



# How to ask questions



Open the 'Question and Answer' option and write your question in the field



**Rosie Sibley**

Senior Responsible  
Sourcing Specialist -  
Preferred by Nature



**Bogdan Buliga**

Senior Responsible  
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**Charles Watkinson**

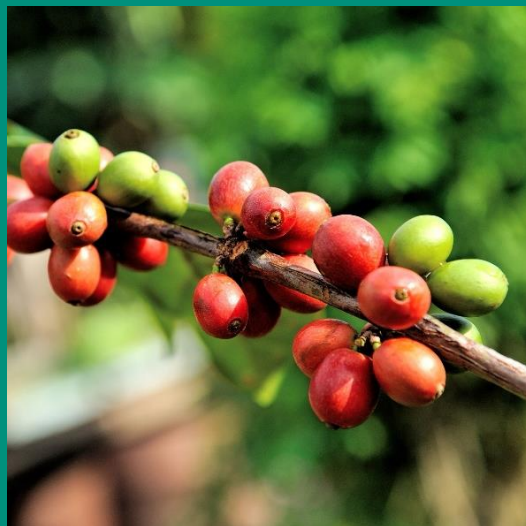
Geographic Origin  
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Source Certain

Time	Topic
12:50 – 13:00	Participants check-in on webinar platform
13:00 – 13:10	Welcome note & introduction to speakers and practicalities
13:10 – 13:30	Overview of Scientific testing <ul style="list-style-type: none"><li>• What are the different testing methods?</li><li>• What are their benefits, limitations and how can these be addressed?</li></ul>
13:30 – 13.45	Beyond timber – what's possible for other commodities?
13:45 – 14:05	Best practices for testing When to conduct testing? <ul style="list-style-type: none"><li>- Case examples of companies using testing for compliance</li></ul>
14:05 – 14:30	Questions & Answers session



# About Preferred by Nature

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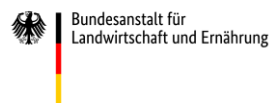


# LIFE Legal Wood

EUTR knowledge, tools and training

The LIFE Legal Wood project is funded by the European Union's LIFE programme

LIFE Legal Wood



LIFE - Support EUTR II - LIFE18 GIE/DK/000763





# Overview: Scientific testing





# What does EUDR say? Article 18

2. *The checks on operators and non-SME traders may also include, where appropriate, in particular where the examinations referred to in paragraph 1 have raised questions:*
- (a) on-the-ground examination of relevant commodities *or of the relevant* products with a view to ascertaining their correspondence with the documentation used for exercising due diligence;
  - (b) *examination of corrective measures taken under Article 24;*
  - (c) any technical and scientific means adequate to determine *the species or* the exact place where the relevant commodity or relevant product was produced, including *anatomical, chemical or DNA analysis;*
  - (d) any technical and scientific means adequate to determine whether the relevant *products* are deforestation-free, including Earth observation data such as from the Copernicus programme and tools *or from other publicly or privately available relevant sources;* and
  - (e) spot checks, including field audits, including where appropriate in third countries, *provided that such third countries agree,* through cooperation with the administrative authorities of *those* third countries.

EUDR does not  
mandate operators  
and non-SME traders  
to conduct tests.

However, it may be  
worth considering  
performing tests.



## Screening

- *E.g., roadside breathalyser*
- Xylotron
- Xylorix
- Near Infrared Spectroscopy

Aim is to stop something to submit to Forensics.

## Forensics

- *E.g., breathalyser at police station*
- Wood anatomy testing
- Stable isotope analysis
- DART-TOF-MS
- DNA

Aim is to reach a definitive conclusion.

# Xylotron and Xylorix – machine vision wood identification

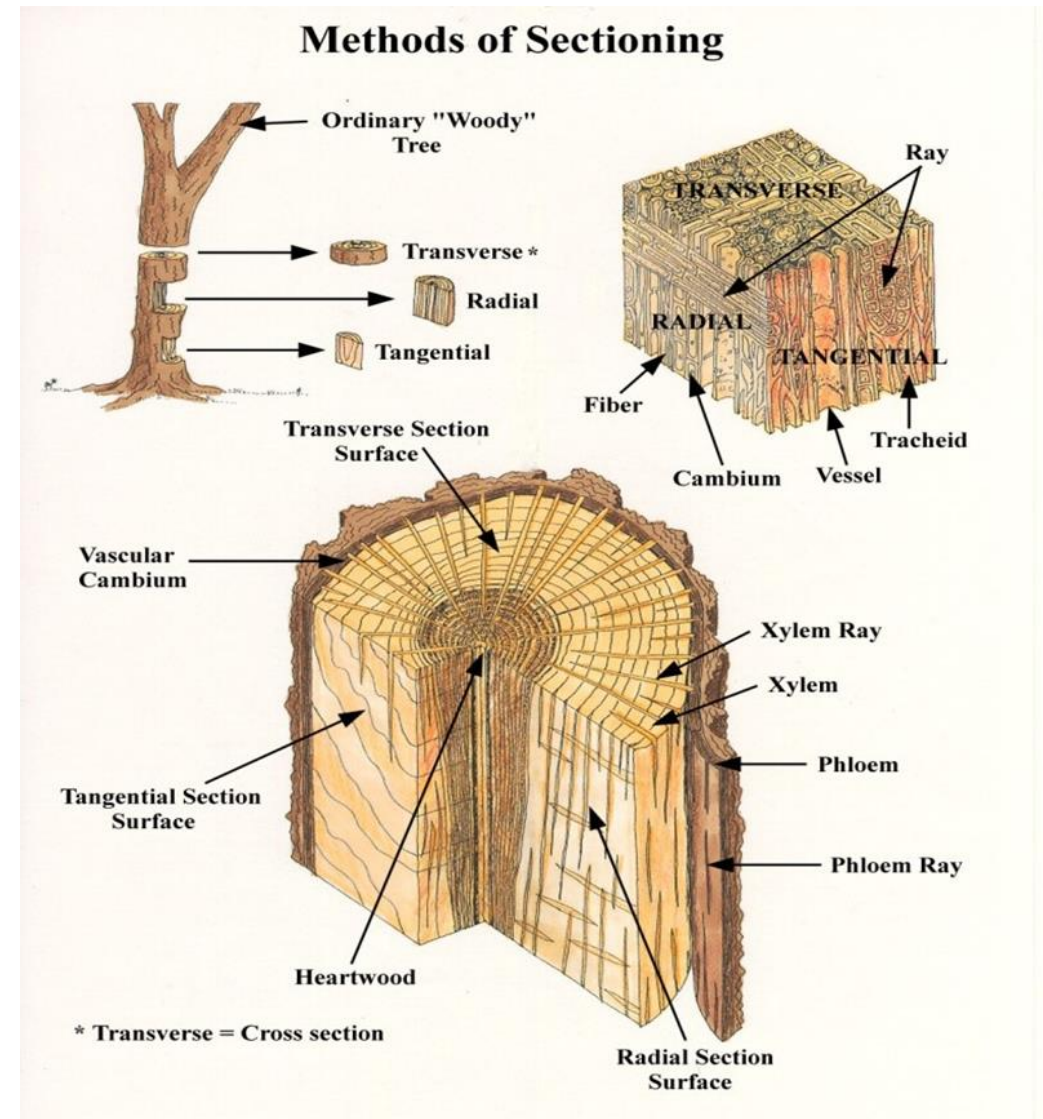


Xylotron (left) has been developed by Dr John Hermanson (University of Washington)  
Xylorix (right), Developed by Agritix is an app to be used with a phone camera and clip-on lens



# Wood anatomy – verifying *what* our wood is

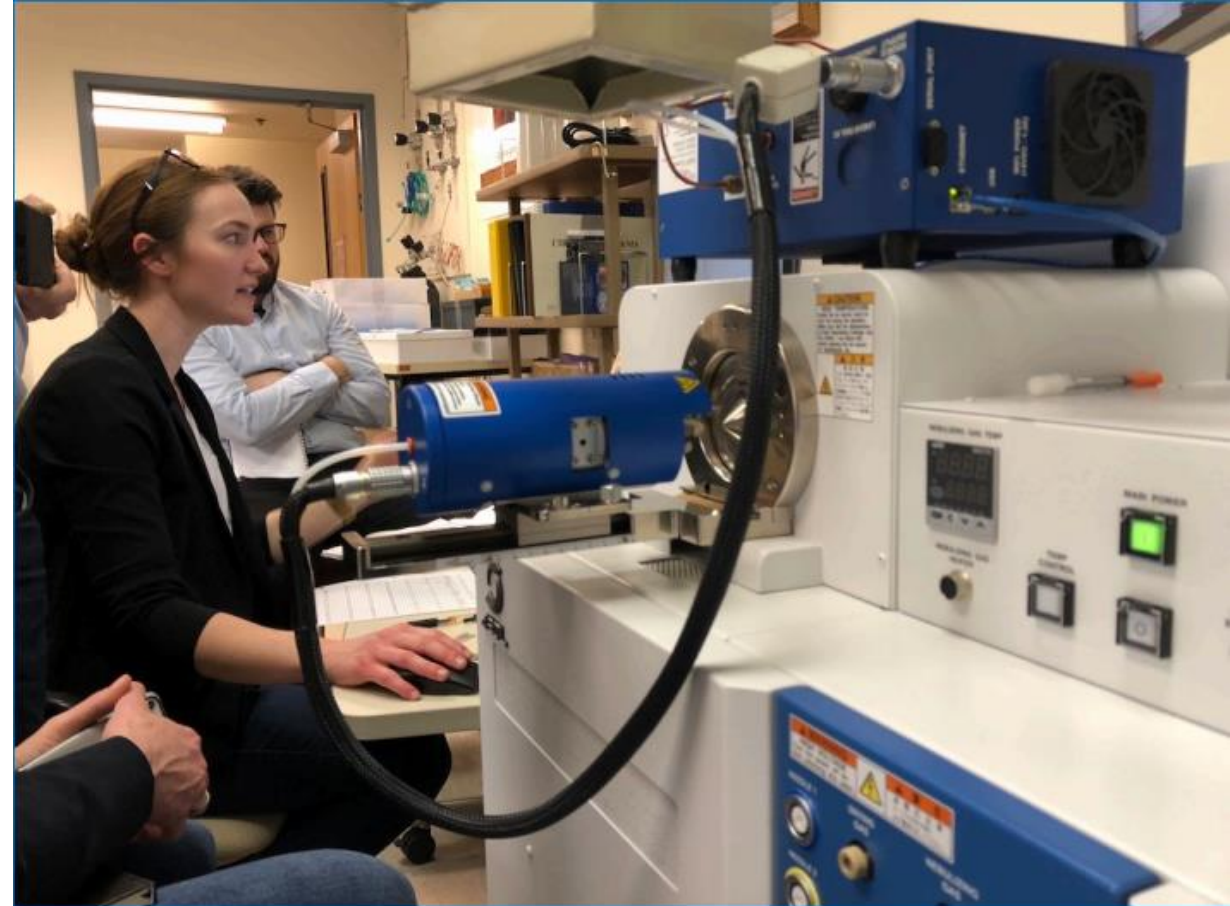
- Requires a trained wood anatomist
- Able to identify wood to **genus** in most cases, **sub-genus** in others, **species** in rarer instances
- Good method for 1st verification before other tests. Relatively inexpensive.





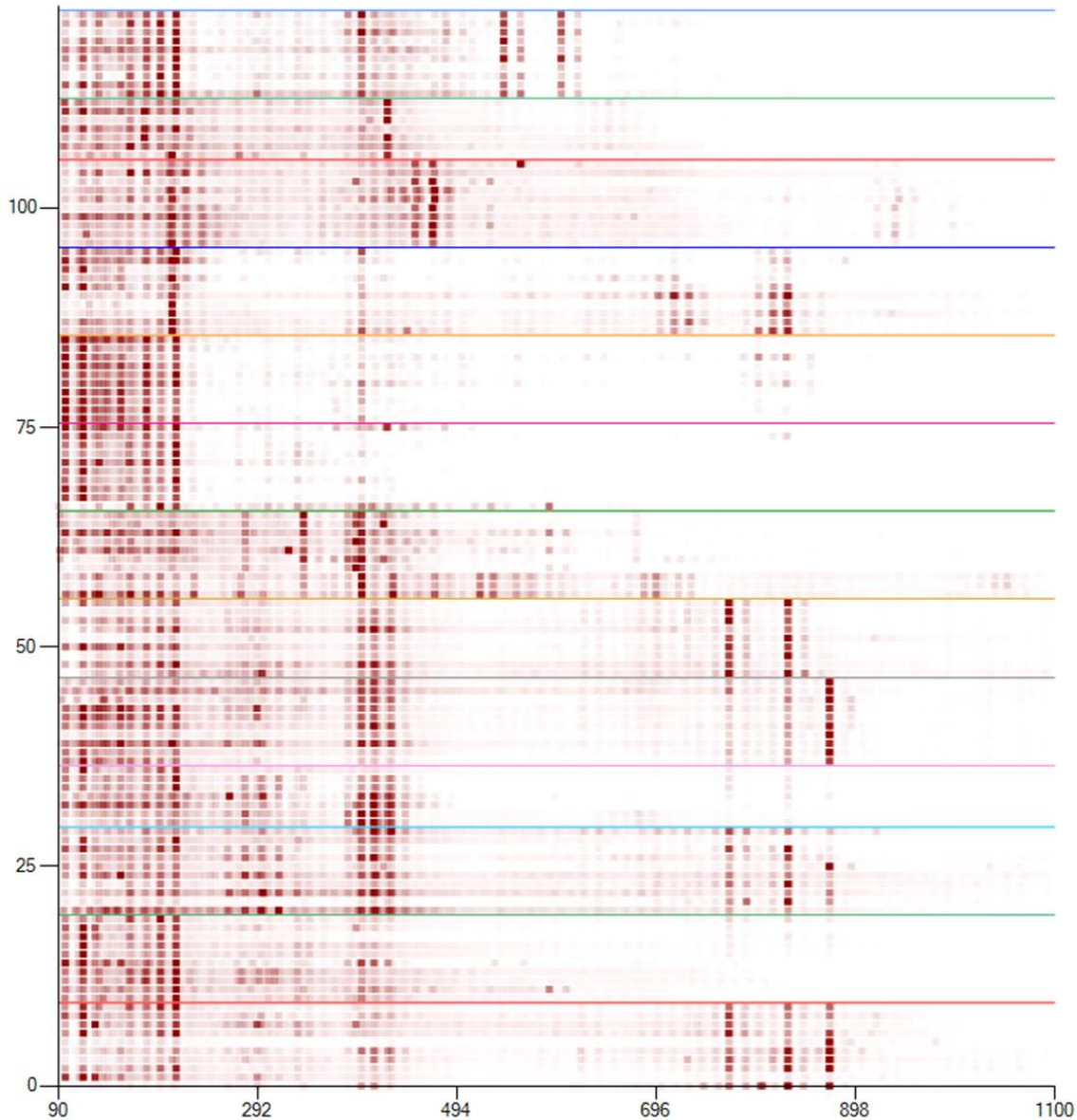
# Chemical tests – examples

- Direct Analysis in Real Time - Time of Flight - Mass Spectrometry (DART-TOF-MS)
- Stable Isotope Ratio Analysis (SIRA)
- Trace element analysis.



DART-TOF-MS being used at the Fish and Wildlife Service laboratory in Ashland, OR by Dr. Cady Lancaster.  
Image credit: Roger Young and Dr Ed Espinoza

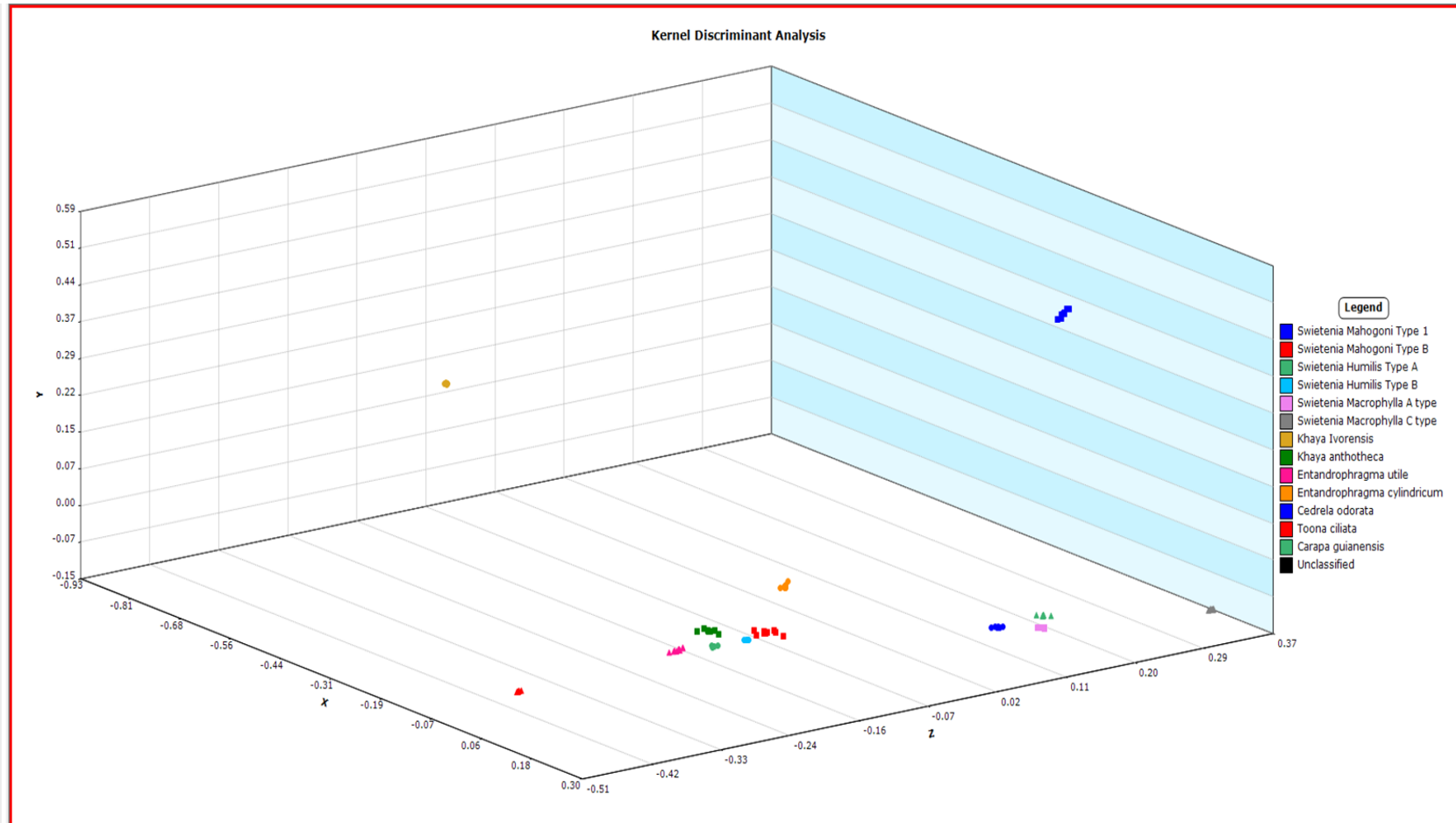
# DART-TOF-MS – used for species verification



- Carapa guianensis
- Toona ciliata
- Cedrela odorata
- Entandrophragma cylindricum
- Entandrophragma utile
- Khaya anthotheca
- Khaya Ivorensis
- Swietenia Macrophylla C type
- Swietenia Macrophylla A type
- Swietenia Humilis Type B
- Swietenia Humilis Type A
- Swietenia Mahogoni Type B
- Swietenia Mahogoni Type 1

Heatmap of  
chemical spectra  
from different  
timbers that are  
often called  
‘Mahogany’

# DART-TOF-MS – used for species verification



Plot showing  
clear separation  
of the different  
species





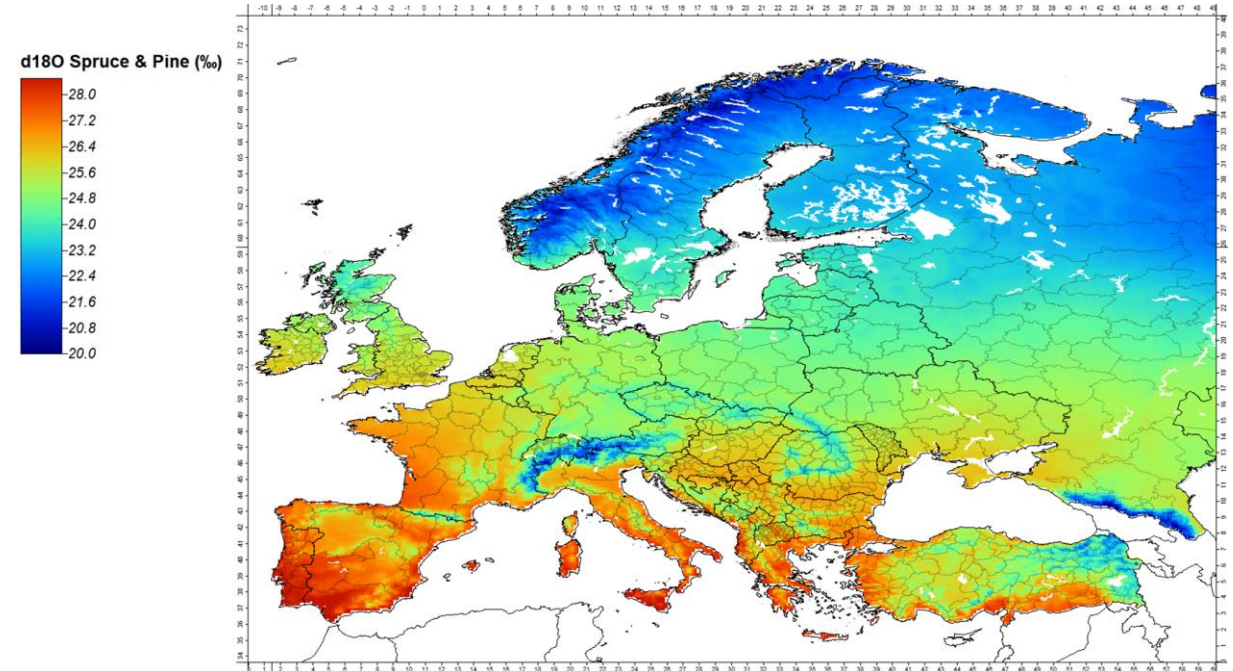
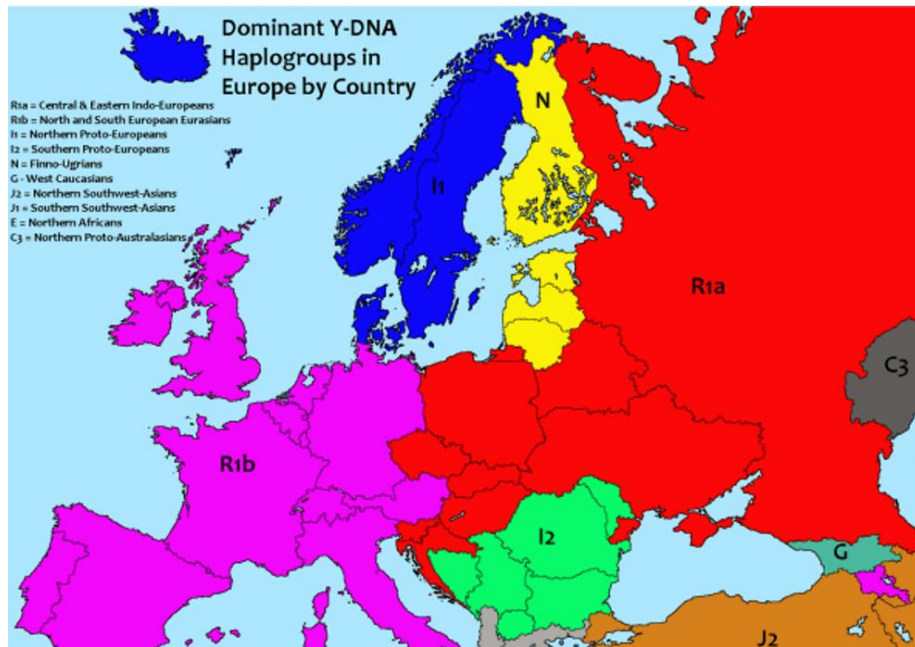
# DNA, Stable Isotopes and Trace Elements for origin



- Investigates genetic lineage of a tree/once-living object (population genetics)
- Associated with geographical origin
- Differentiation by DNA markers



- Investigates the origin of the elements in the timber
- Directly related to geographical origin
- Differentiation by isotope values







- Can go "back to stump"
- Used to convict lumber thieves (Big Leaf Maple)
- Can be directed at species as well as origin


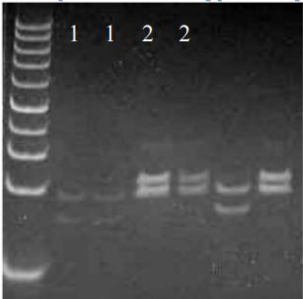
THÜNEN

Glued oak timber is declared as "Siberian oak"



Mongolian oak ref  
European oak ref

wood samples



The piece of timber is composed of a mixture of European and Mongolian oak

Credit: Prof. Andy Lowe, U. of Adelaide, and the Von Thunen Institute - Timber origin tracking tools DNA fingerprinting

SMART NEWS

## For the First Time, Tree DNA Was Used to Convict Lumber Thieves in Federal Investigation

Genetic evidence showed that two men illegally chopped down and sold valuable bigleaf maple trees inside Olympic National Forest

 Alex Fox  
Correspondent  
July 14, 2021

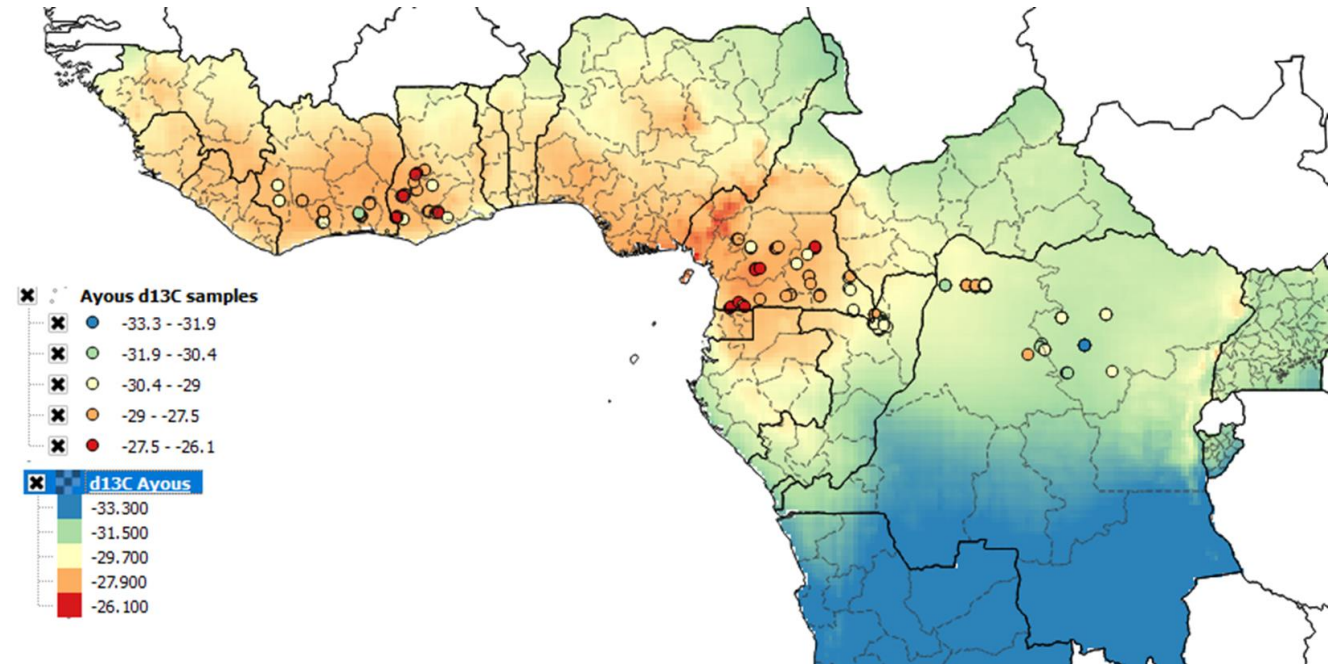


The Maple Fire photographed burning up Jefferson Ridge in Olympic National Forest, Washington. In court documents, prosecutors alleged that men convicted of illegal logging in the National Forest may have started the Maple Fire. USDA Forest Service

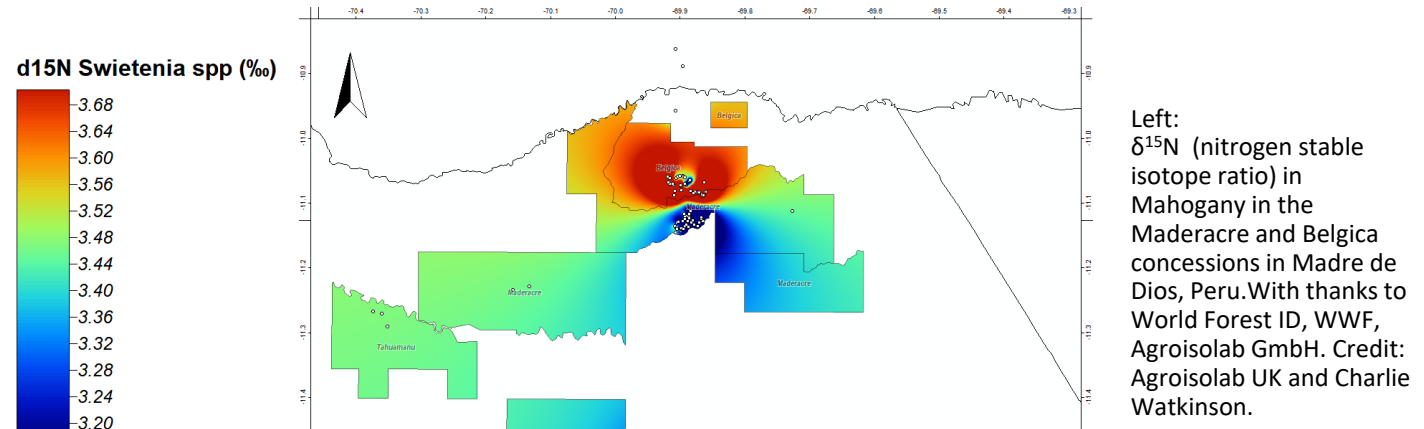




- Broad geographic databases in many types of wood (oak, spruce, pine, larch, ash, birch, teak, obeche, iroko, mahogany, okoume etc.)
- Dictated by climate – highly predictable meaning we don't have to collect as many samples.
- Examples of location specificity between neighbouring concessions e.g. (Madre de Dios, Peru – Maderacre and Belgica concessions)



Above:  $\delta^{13}\text{C}$  (Carbon stable isotope ratio) forecast in *Triplochiton scleroxylon*. Credit: Dr. Micha Horacek, Francisco Josephinum Institute, Agroisolab UK and Charlie Watkinson.







- Looks at trace metals and elements
- Highly location specific – able to go down to 8km specificity in case studies.
- Inexpensive per sample analysis – method is very high-throughput and scalable.
- Able to analyse tiny samples with ease.
- Service specific to supply chains.

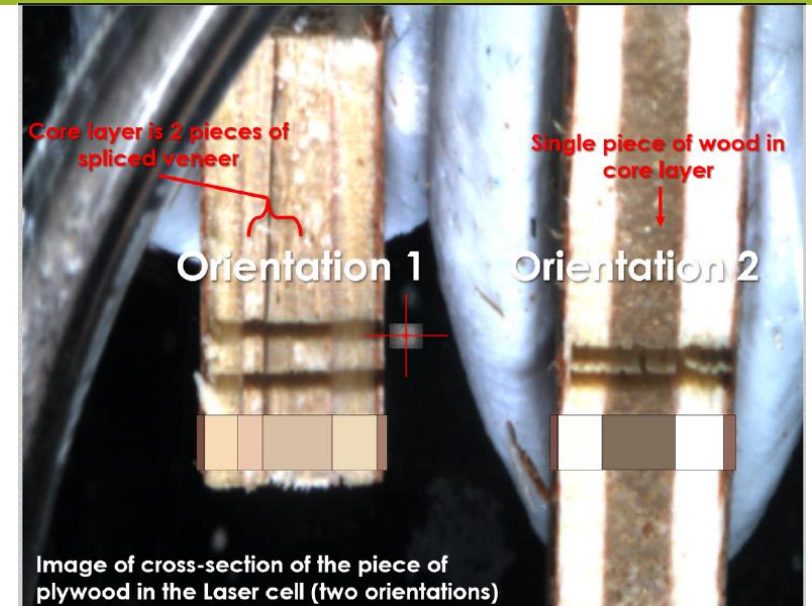
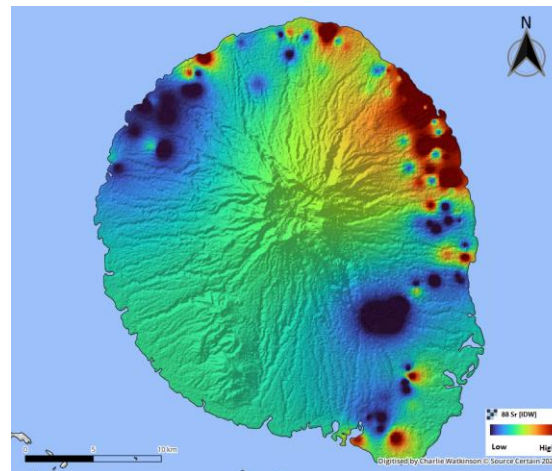
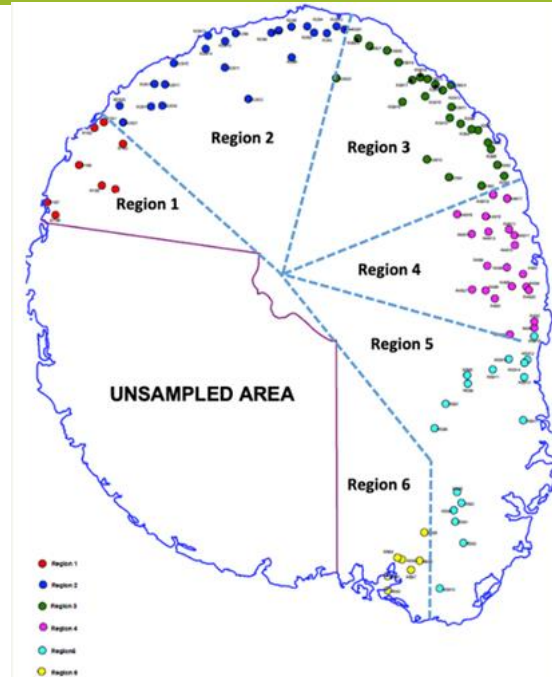
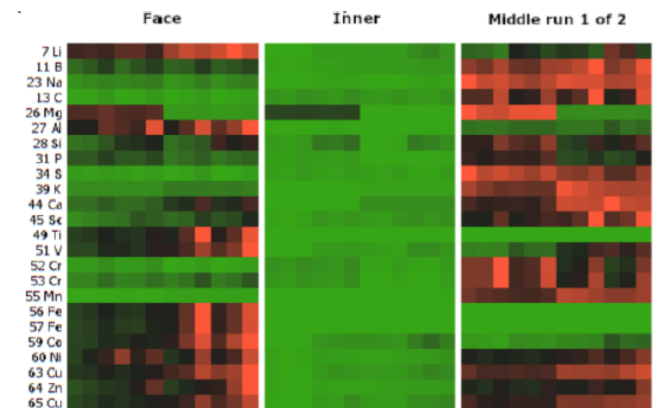
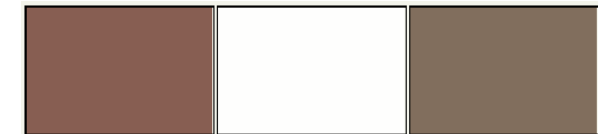


Image of cross-section of the piece of plywood in the Laser cell (two orientations)



Left: Map of Teak reference samples on Kolombangara Island showing Strontium concentration. Right: Plywood and laser ablation ICP-MS heatmap from layers. With thanks to World Forest ID, Kolombangara Forest Products Ltd, and Dr. John Watling



# Beyond timber

# Testing for other agricultural commodities

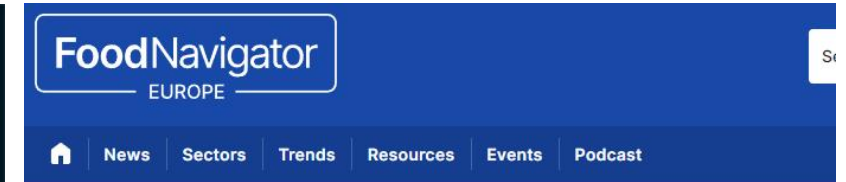
- **Beef** – Country, region and animal identification
- **Soya** – country and regional verification
- **Cocoa** – continent, country, and sub-regional (farm)
- **Coffee** – continent, country, and sub-regional (farm)
- **Palm oil** – Initial study in Malaysia



- Carcass swabbing in slaughterhouses enables retailers to identify product back to individual animals
- Country and region of origin is possible with stable isotope analysis.



<https://www.foodnavigator.com/Article/2019/03/04/M-S-beef-traceability-pays-off-Boosted-sales-and-dramatically-reduced-complaints>

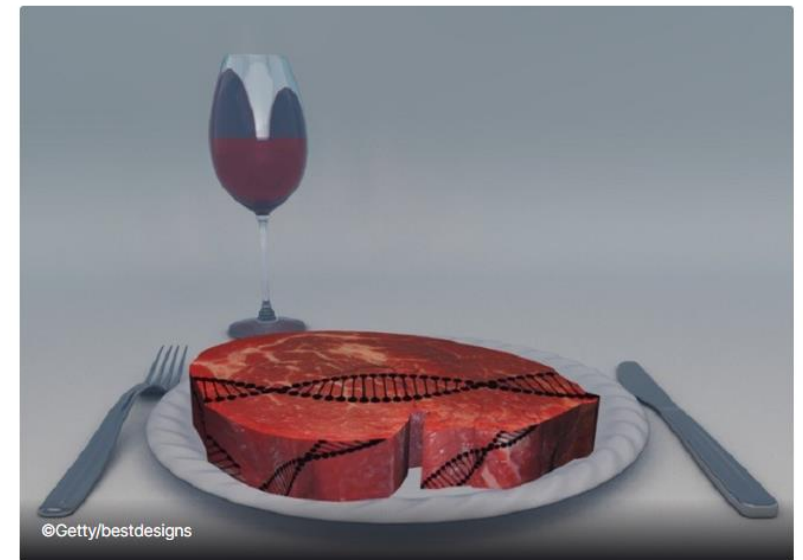


GFSI CONFERENCE 2019

## M&S beef traceability pays off: Boosted sales and 'dramatically' reduced complaints

By Flora Southey

04-Mar-2019 - Last updated on 05-Mar-2019 at 16:57 GMT



RELATED TAGS [Dna](#) [Traceability](#) [Marks & Spencer](#)

- World Forest ID, Kew and Agroisolab project in South American Soya
- Sub-regional verification possible (within and between states in Brazil and Bolivia) with over 90% accuracy
- Other service providers active in soya origin verification



## First comprehensive global Soya-Isotope Database



Bernd Bodiselitsch  
CEO & Founder - Imprint Analytics GmbH

2 articles [+ Follow](#)

August 29, 2016

In cooperation with [Danube Soya](#), Imprint Analytics established a [worldwide isotope database](#) during the last two years. This database includes more than

Imprint Analytics GmbH and Donau Soja  
<https://www.linkedin.com/pulse/first-comprehensive-global-soya-isotope-database-bernd-bodiselitsch/>

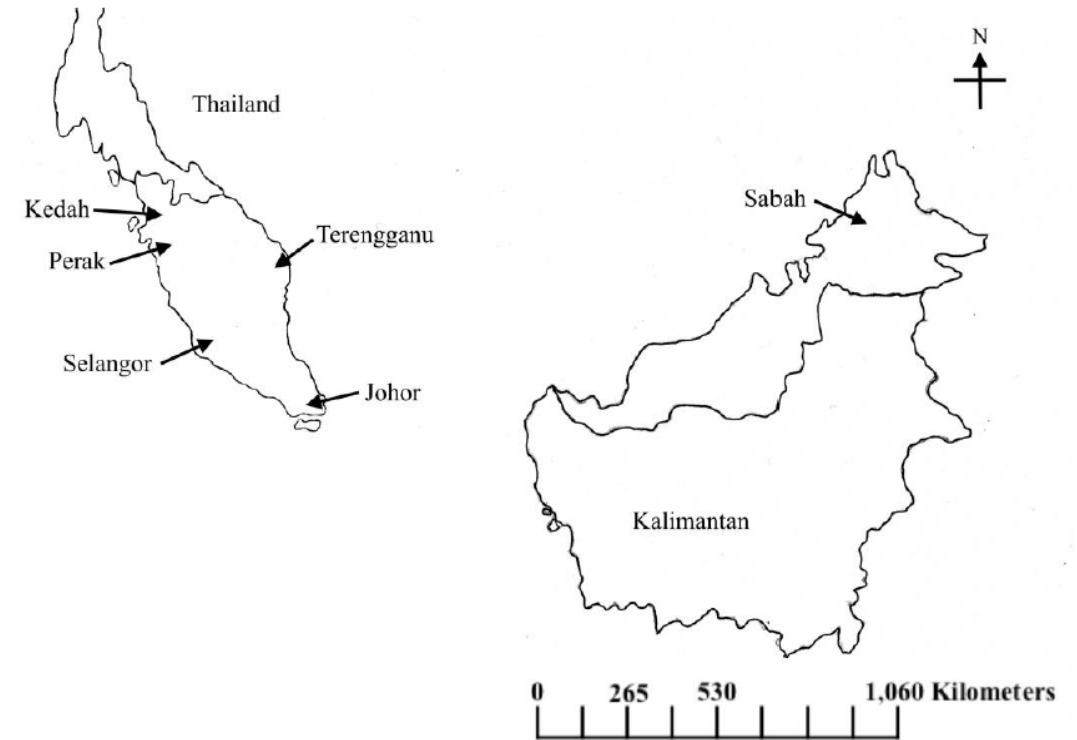


- Universiti Sains Malaysia researchers showed the use of stable isotope analysis for regional verification in Malaysia

Table 2

Misclassification table for predictive model.

	Members	Correct	East Coast	Northern	Southern	Central
East Coast	1	100.00%	1	0	0	0
Northern	3	100.00%	0	3	0	0
Southern	2	0.00%	0	2	0	0
Central	1	100.00%	0	0	0	1
Total	7	71.43%	1	5	0	1

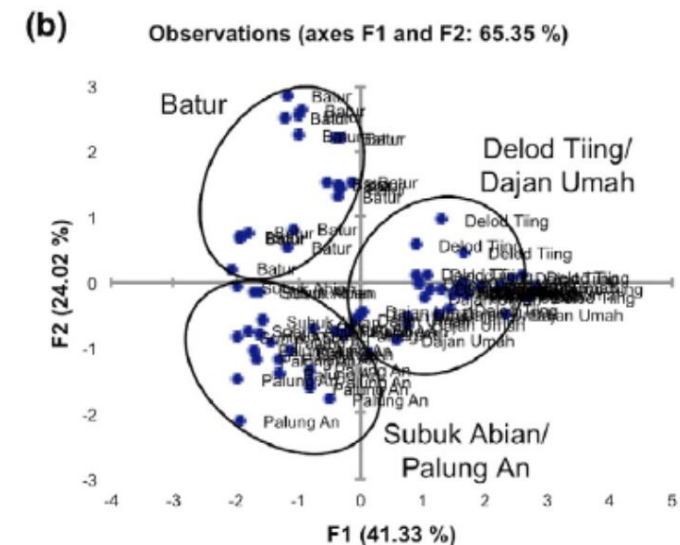


Muhammad, S. A., Seow, E.-K., Mohd Omar, A., Rodhi, A. M., Mat Hassan, H., Lalung, J., Lee, S.-C., & Ibrahim, B. (2018). Variation of  $\delta^2\text{H}$ ,  $\delta^{18}\text{O}$  &  $\delta^{13}\text{C}$  in crude palm oil from different regions in Malaysia: Potential of stable isotope signatures as a key traceability parameter. *Science and Justice*, 58(1), 59–66. <https://doi.org/10.1016/j.scijus.2017.05.008>

- Coffee – separable as low as 1km using trace elements (Valentin and Watling 2013)
- Expanse of Brazilian research on coffee provenance using stable isotope ratios to continent country and region of origin



Valentin, J. L., and R. J. Watling. "Provenance Establishment of Coffee Using Solution ICP-MS and ICP-AES." *Food Chemistry* 141, no. 1 (2013): 98–104. <https://doi.org/10.1016/j.foodchem.2013.02.101>.





- IASMA researchers used trace element analysis to differentiate cocoa by continent of origin.
- 61 samples, 23 countries.
- 100% correct classification (<85% cross validation)

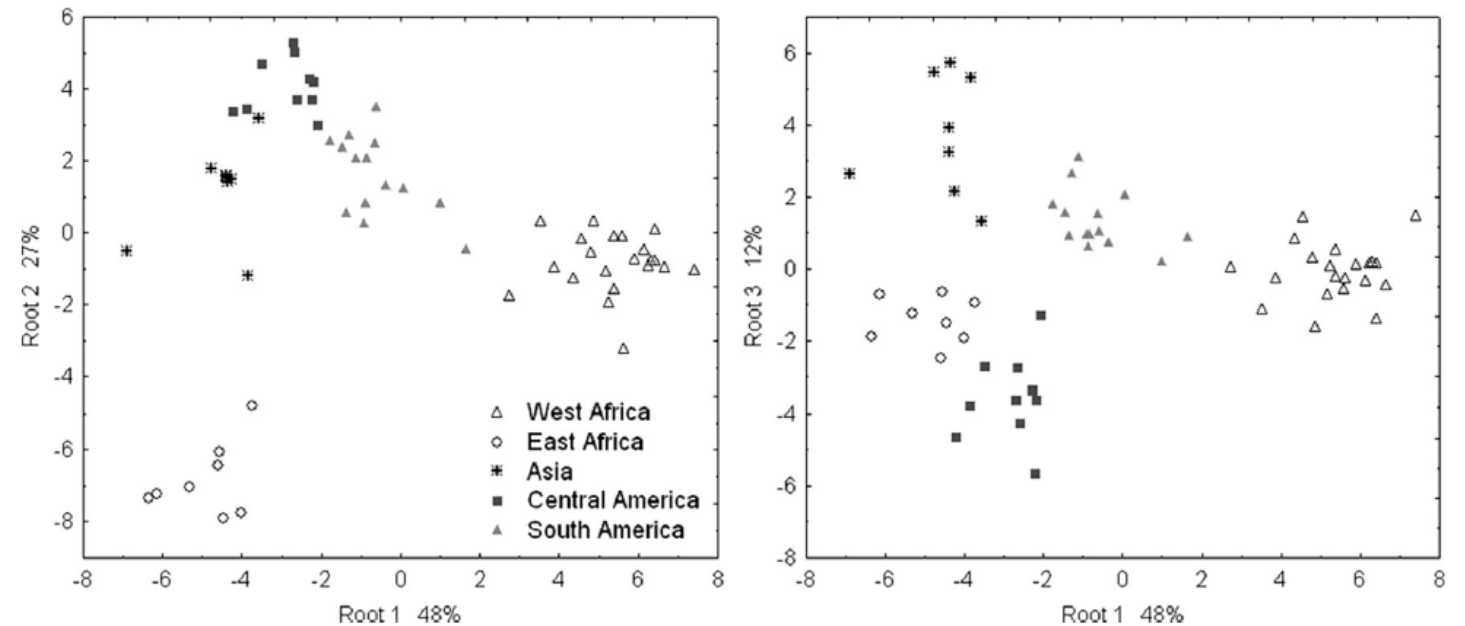


Fig. 2. Score plot of the first three discriminant functions to discriminate cocoa beans of different macroareas.

Bertoldi, D., A. Barbero, Federica Camin, A. Caligiani, and R. Larcher. "Multielemental Fingerprinting and Geographic Traceability of Theobroma Cacao Beans and Cocoa Products." *Food Control* 65 (2016): 46–53. <https://doi.org/10.1016/j.foodcont.2016.01.013>.

- University of Western Australia researchers showed difference in trace elements in cocoa nibs over shorter spatial scales



Figure 3.58 Map of Venezuela showing relative distance between (A)Ocumare, (B)Rio Caribe, (C)Amazonas and (D)Chuao.

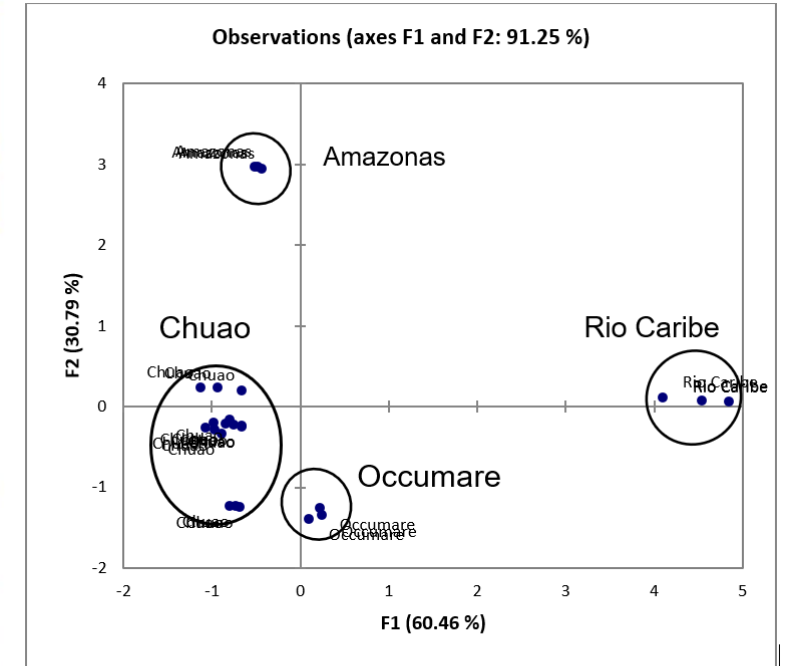
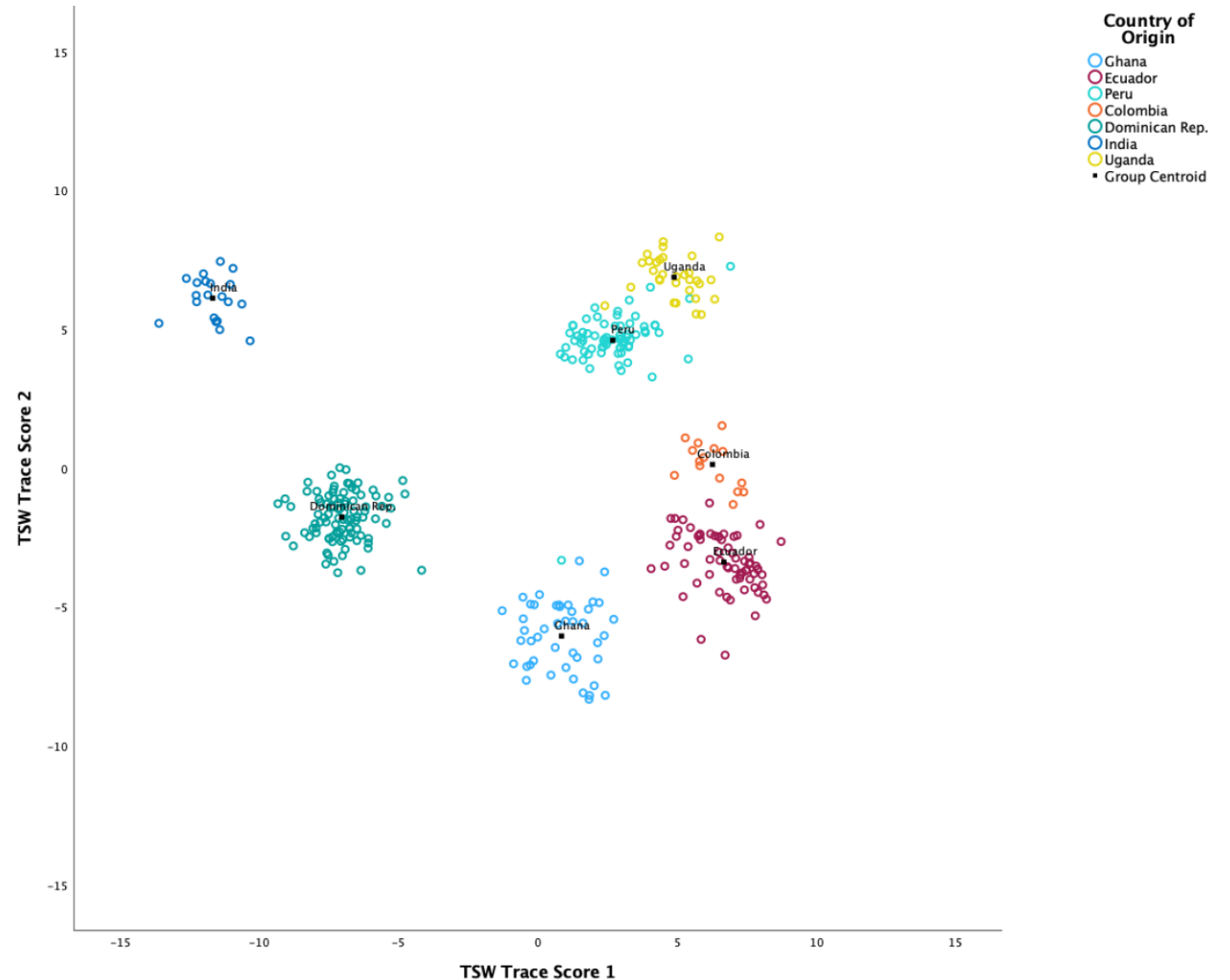


Figure 3.57 PCA plot showing separation of Venezuelan cocoa beans by region of origin using Ge, Rb, Mo, Cd and Tl.

Credit: Wan Lin Ng, John Watling, Gary Lee



- In press – Source Certain study on single origin chocolate bars reveals country of origin can be identified by Trace Element analysis
- < 300 bars tested



Plot showing how trace element data from bars of chocolate groups by country of origin. Credit: Rachel Scadding

# Verifying deforestation free sourcing

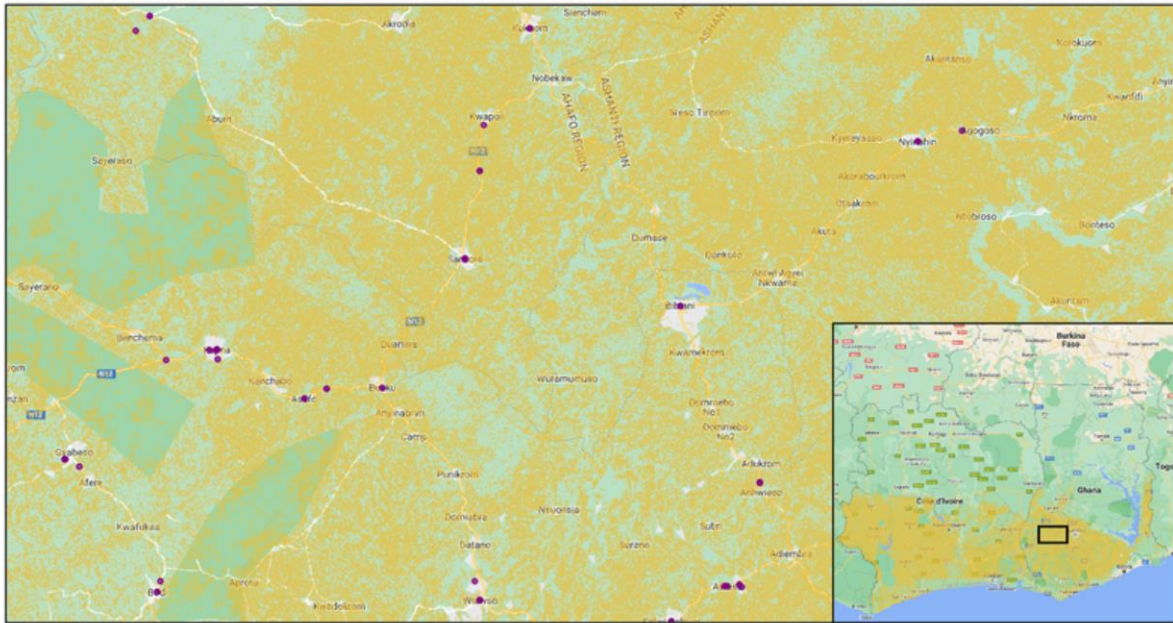
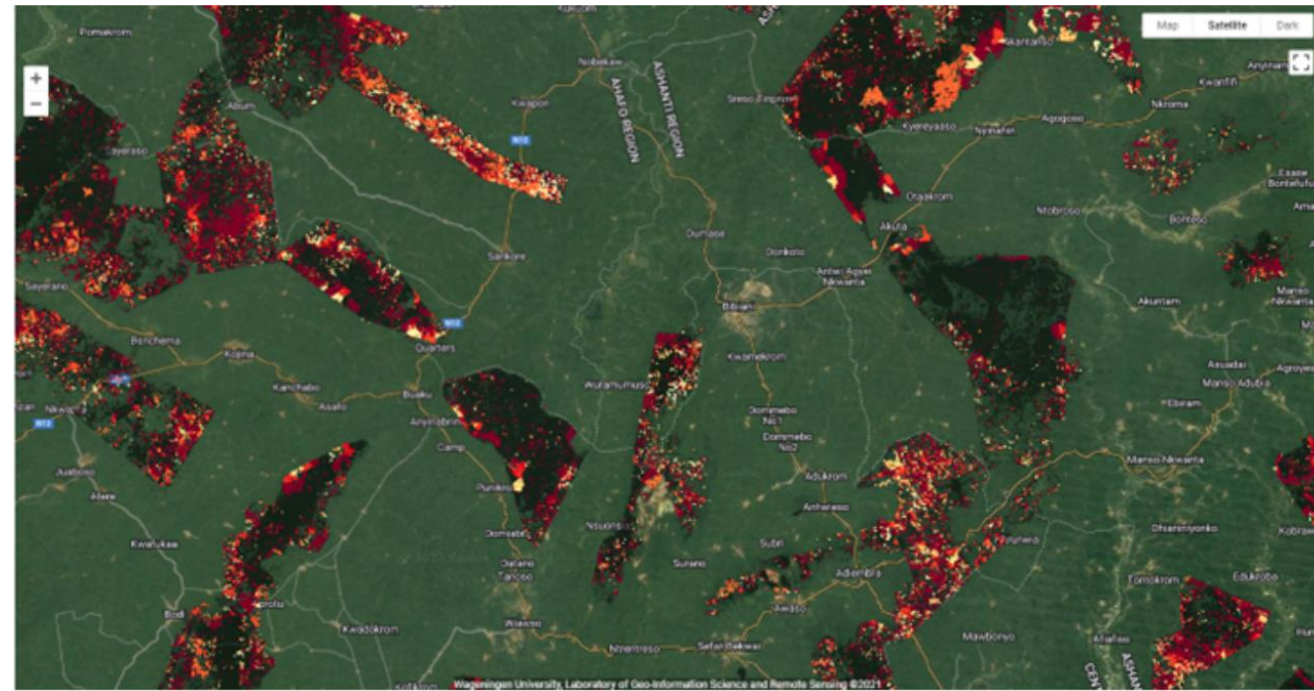


Figure 1. Cocoa farms (yellow) and co-operatives (purple markers) surrounding Bibiani in the Ashanti region of Ghana. Source: Mighty Earth cocoa accountability map (<https://www.mightyearth.org/cocoa-accountability/>)

- Cocoa is an industry built on smallholder production
- Could be between 90 000 and 180 000 farms in this area (Ghana)
- Should scientific testing even attempt 'back to farm' or is ensuring that a product came from deforestation free areas enough?



RADD Forest distance alters around Bibiani, Ashanti, Ghana. Note that most forest disturbance alerts appear in protected areas such as forest reserves as opposed to agricultural areas. Illegal towns and villages call 'campements' develop in national parks and protected forests. Cocoa from these areas breaches Article 3b of EUDR. <https://nrtwur.users.earthengine.app/view/raddalert>



- The new EUDR regulation requires geolocation down to 4 ha
- Scientific testing does not to provide that level of resolution
- However, scientific testing can be a useful means of verification to include in a company's DD system as a means of verifying geolocation data.
- Other technology such as blockchain will be valuable for passing on data on geolocation, however these systems cannot prevent fraud taking place by the parties that originate the data.





# Best practices for testing





# How can Operators use testing?

1

An Operator identifies products for sampling and test required.

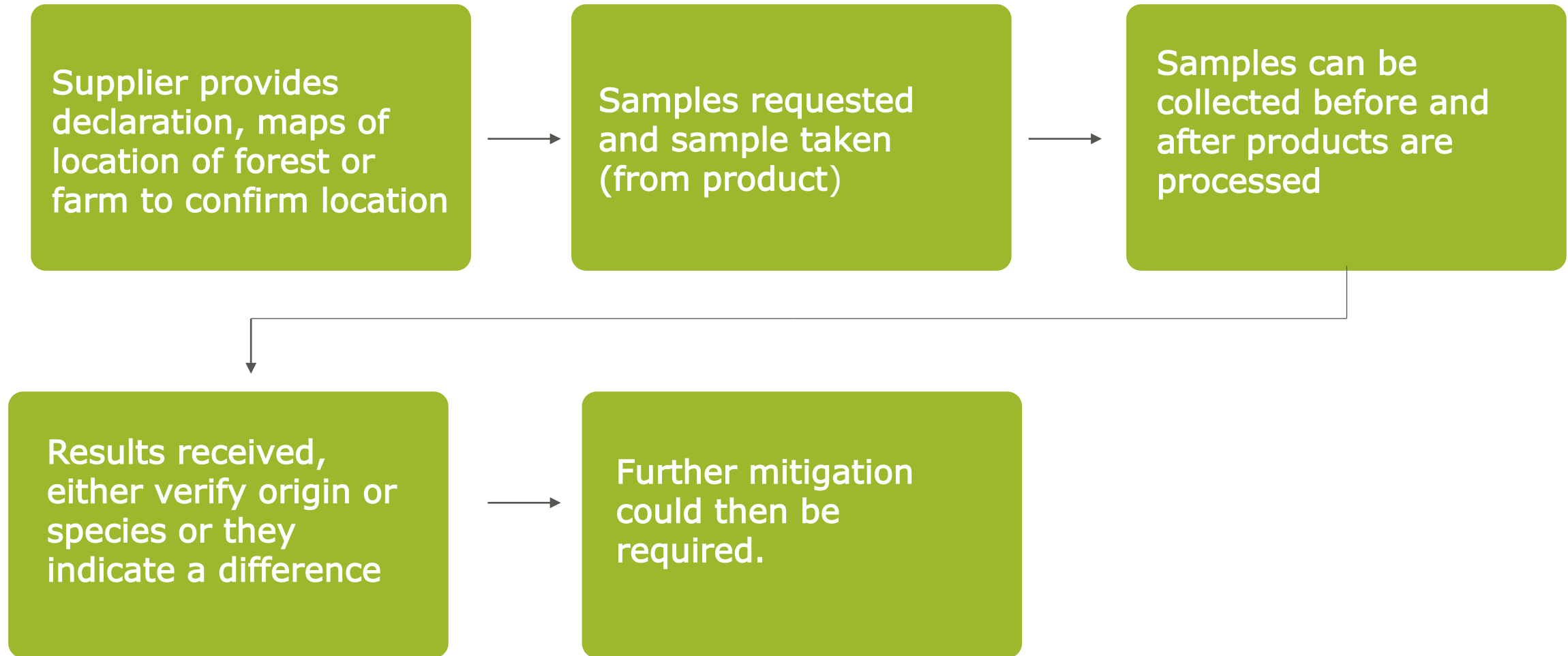
Based on either *day-by-day* or *sampling*, depending on the level of risk

2

Or third party recommends scientific testing and identifies test required.

- Testing can *help identify non-conformities* in a supplier declaration, and identify where further mitigation is needed
- Testing can support *supplier documentation*

# Testing process





# Scenarios for testing



## BEST CASE



High-risk species such as Oak and Ash to confirm origin from the US & Canada.  
Note: some species do not have reference material.



Composite product



## WORST CASE



Paper and related materials



# When to test?



When new product lines are introduced



When a company in the supply chain changes



When there are concerns about supplier claims



When products contain different components or species



When products contain high-risk species from different origins



When concerns are raised by a 3rd parties/NGOs



# Testing limitations



Lack of reference data in labs  
(lack of transparency / uncertainty)



Destruction of sample  
material in processing /  
composites



Location of testing lab /  
testing before and after



Species (genus/species)  
usefulness



% Probability Results vs  
Perception of definitive science



Trace species



**Testing is a tool and should not be the end goal of  
Due Diligence**





# Exploring case studies



## DDS summary:

- Management system and procedures developed
- Implement a day-to-day measures: Supply chain mapping; conducting desk risk assessment of each source used in the product
- Implement additional measures: On-site audit at the factory with the focus on risk of mixing and volume reconciliation; Timber testing

Ash logs from the USA

Factory located in China



# Case Study: Ash from USA

USDA United States Department of Agriculture Animal and Plant Health Inspection Service

Phytosanitary Certificate Issuance & Tracking System (PCIT)

### Certificate Details

View Certificate | Back

**Certificate Details**

Status: ISSUED  
Certificate Name: Phytosanitary Certificate  
Certificate Number: [REDACTED]  
Place of Issue: West Mifflin, Pennsylvania  
Date Issued: [REDACTED]  
Date Inspected: [REDACTED]  
Issuer Party: APHIS  
Authorized Officer: Michelle Zamberry

**Export and Import Details**

Export Country: USA  
Import Country: China  
Point Of Entry: [REDACTED]  
Means of Conveyance: Ocean Vessel

**Commodity Details**

Commodities List								
	Common Name	Botanical Name	Part	Quantity	Unit	Number of Packages	Package Description	Certified Origin(s)
1.	White ash	Fraxinus americana	Kiln dried lumber	29.635	Cubic Meters	12	Bundles	Pennsylvania, USA
2.	White ash	Fraxinus americana	Kiln dried lumber	29.101	Cubic Meters	11	Bundles	Pennsylvania, USA
3.	White ash	Fraxinus americana	Kiln dried lumber	28.608	Cubic Meters	12	Bundles	Pennsylvania, USA

**Treatment Details**

N/A

**Additional Certificate Details**

Additional Declarations: N/A  
Additional Official Phytosanitary Information: N/A


USDA | APHIS | Export Program Manual | Help/Contact Us

One result of desk risk assessment:  
Phytosanitary certificate check in the USA – online database






# Case Study: Ash from USA

Sample Details:		Analysis information:	
Sample(s):	1/2	Methods:	AIL-1.1c (2015-02)
Sampling by:		Parameter:	$\delta^2\text{H}$ , $\delta^{18}\text{O}$ , $\delta^{13}\text{C}$ , $\delta^{34}\text{S}$
The results refer to provided samples.		Remark:	
The following information in the table was given by customer: sample, declaration.			

Results of Analysis:							
No.	Sample	Decl.	$\delta^2\text{H}_{\text{org}}$ [‰] v.s. vsmow	$\delta^{18}\text{O}_{\text{org}}$ [‰] v.s. vsmow	$\delta^{13}\text{C}$ [‰] v.s. VPDB	$\delta^{34}\text{S}$ [‰] v.s. VCDT	Origin Evaluation
1	Solid Timber - Fraxinus americana Supplier:	USA	-91.1 +/- 1.7	21.9 +/- 0.6	-24.3 +/- 0.1	1.5 +/- 0.4	

\* +/- total combined single standard uncertainty

**Quick evaluation:**

-  = likely to be from declared origin
-  = doubts, has to be verified with further information
-  = unlikely, based on current evidence the sample is evaluated as mislabeled with respect to its provenance

**Remark:** As the USA is a large area with broad variations in stable isotopes it may improve future interpretations if it is possible to narrow down the declared origin to a smaller geographic subunit such as a State, this would allow for a greater ability to spot mis-declared origins as the range of potential signatures would be narrower.

## Interpretation:

- Test sample 1 has relatively depleted  $\delta^2\text{H}$  and  $\delta^{18}\text{O}$  isotope values. Such depletions are to be expected for an origin from northern regions in the USA. However, as there is also overlapping in the isotope signature to an Eastern European origin, an origin from Eastern Europe cannot be excluded in total. Therefore, the local narrowing of the sample to a North-U.S. origin should be briefly confirmed.
- However, an origin from China / Russia is unlikely.

**Conclusion:** Sample 1: Within the current state of knowledge, an origin from Northern regions of USA is likely.

Timber testing  
result

# Questions and discussion

