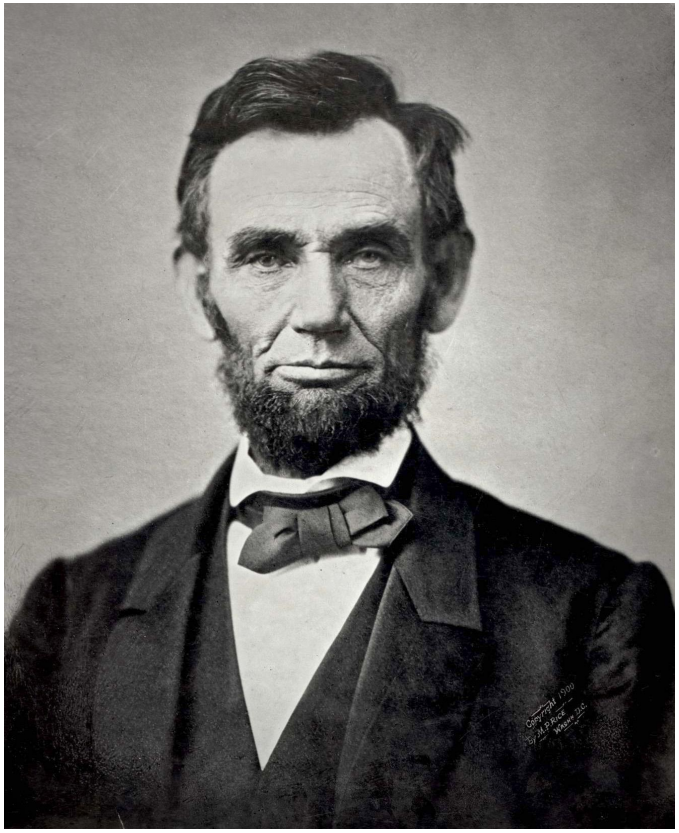
Timber origin tracking tools
DNA fingerprinting

Prof. Andy Lowe

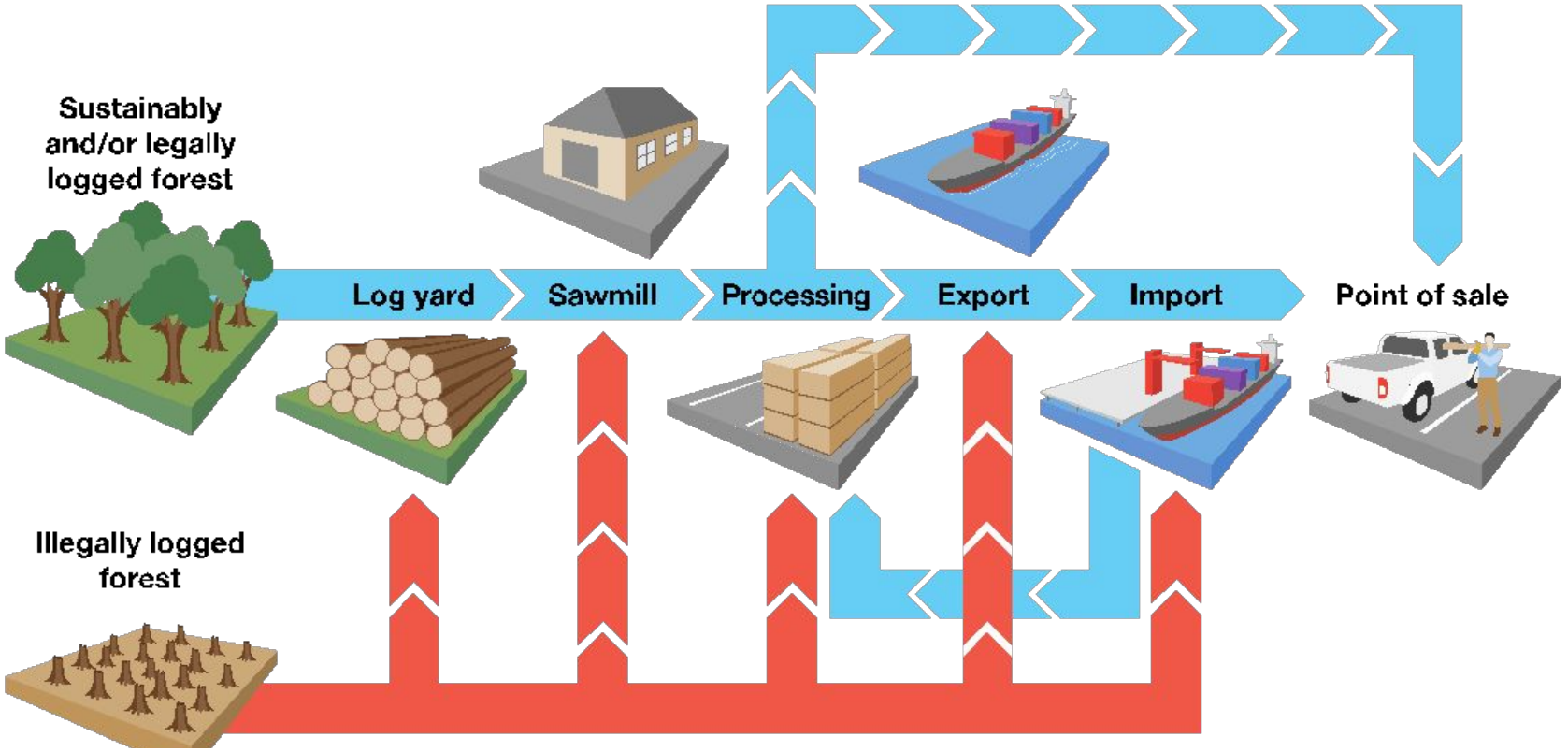
THE UNIVERSITY of ADELAIDE

@ProfALowe

SOURCE: CIAT INTERNATIONAL CENTER FOR TROPICAL AGRICULTURE

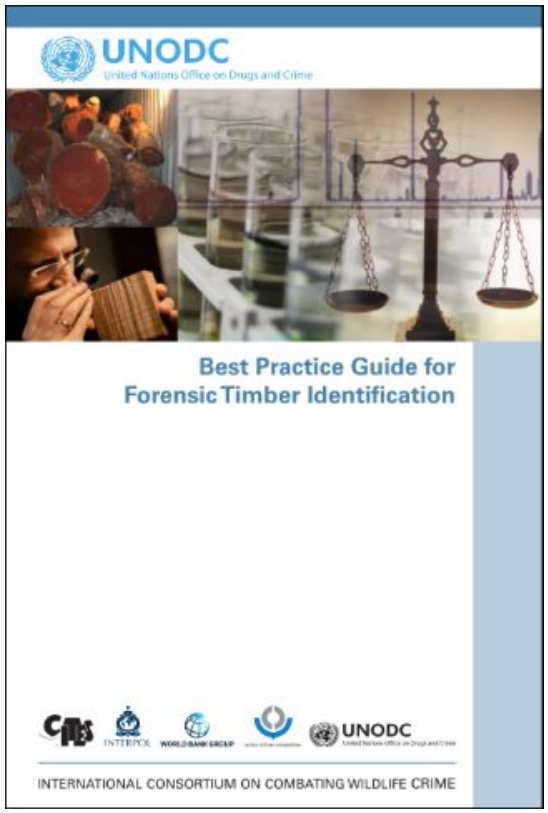


Abraham Lincoln
“Law without enforcement is just good advice”



International Consortium on Combating Wildlife Crime

Source: Dormontt et al (2015) *Biological Conservation*. Lowe et al (2016) *BioScience*



What can forensic timber identification offer law enforcement?

Table A8.1 Method capabilities

Identification need	Wood anatomy	Machine vision	Dendro-chronology	Mass spectrometry	Near infrared spectroscopy	Stable isotopes	Radiocarbon	Genetics
Genus	Yes	Yes	No	Yes	Yes	No	No	Yes
Species	Occasionally	Occasionally	No	Yes	Yes	No	No	Yes
Provenance	Occasionally	Unknown	Occasionally	Yes	Yes	Yes	No	Yes
Individuals	No	No	Yes	No	No	No	No	Yes
Age	No	No	Yes — with growth rings	No	No	No	Yes	No

Opportunities for Improved Transparency in the Timber Trade through Scientific Verification

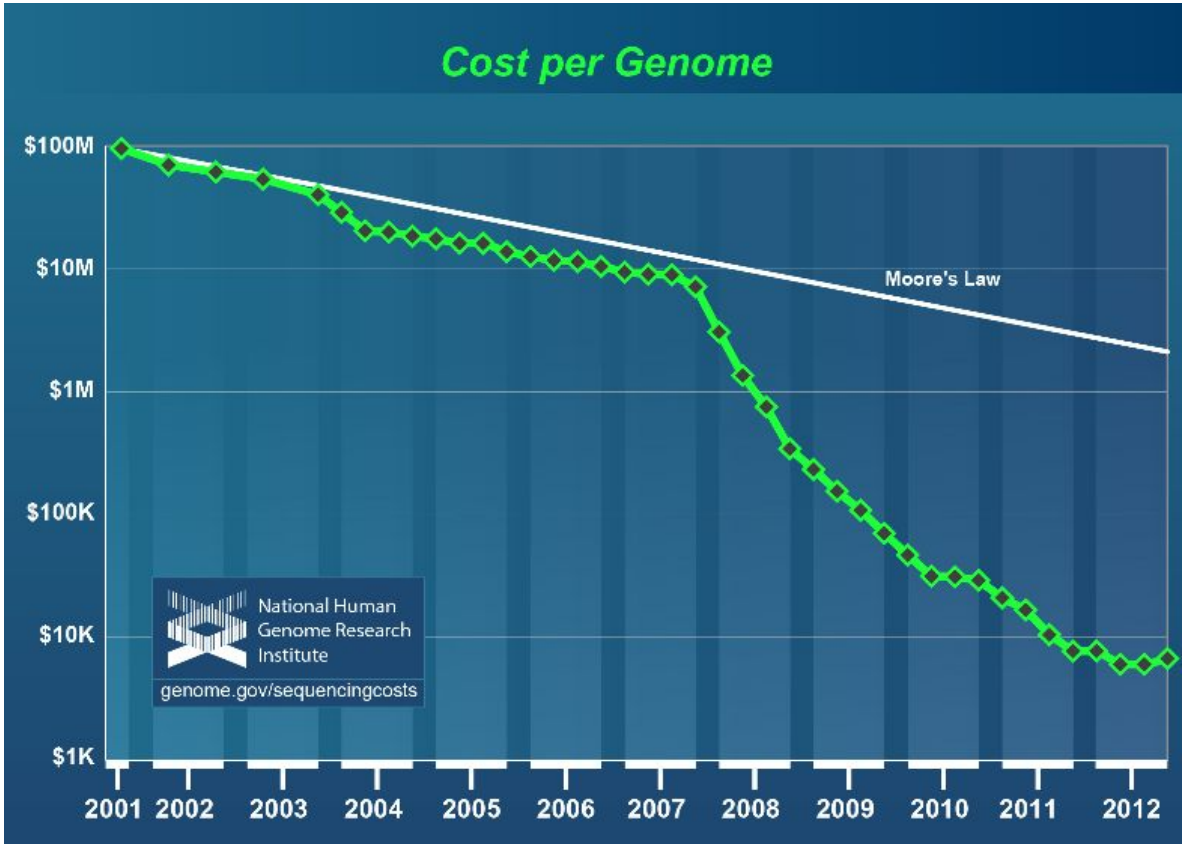
ANDREW J. LOWE, ELEANOR E. DORMONTT, MATTHEW J. BOWIE, BERND DEGEN, SHELLEY GARDNER, DARREN THOMAS, CAITLIN CLARKE, ANTO RIMBAWANTO, ALEX WIEDENHOEFT, YAFANG YIN, AND NOPHEA SASAKI

In May 2014, the Member States of the United Nations adopted Resolution 23/1 on "strengthening a targeted crime prevention and criminal justice response to combat illicit trafficking in forest products, including timber." The resolution promotes the development of tools and technologies that can be used to combat the illicit trafficking of timber. Stopping illegal logging worldwide could substantially increase revenue from the legal trade in timber and halt the associated environmental degradation, but law enforcement and timber traders themselves are hampered by the lack of available tools to verify timber legality. Here, we outline how scientific methods can be used to verify global timber supply chains. We advocate that scientific methods are capable of supporting both enforcement and compliance with respect to timber laws but that work is required to expand the applicability of these methods and provide the certification, policy, and enforcement frameworks needed for effective routine implementation.

Keywords: certification, illegal logging, scientific verification, timber trade, wood identification

Lowe et al 2016, Bioscience

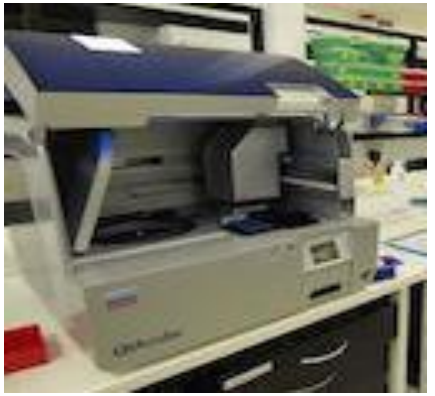
DNA analysis now cheaper and quicker than ever before



Advanced DNA, Identification and Forensic Facility

Specialised analysis for service and casework provision

adiff@adelaide.edu.au



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Flinders UNIVERSITY

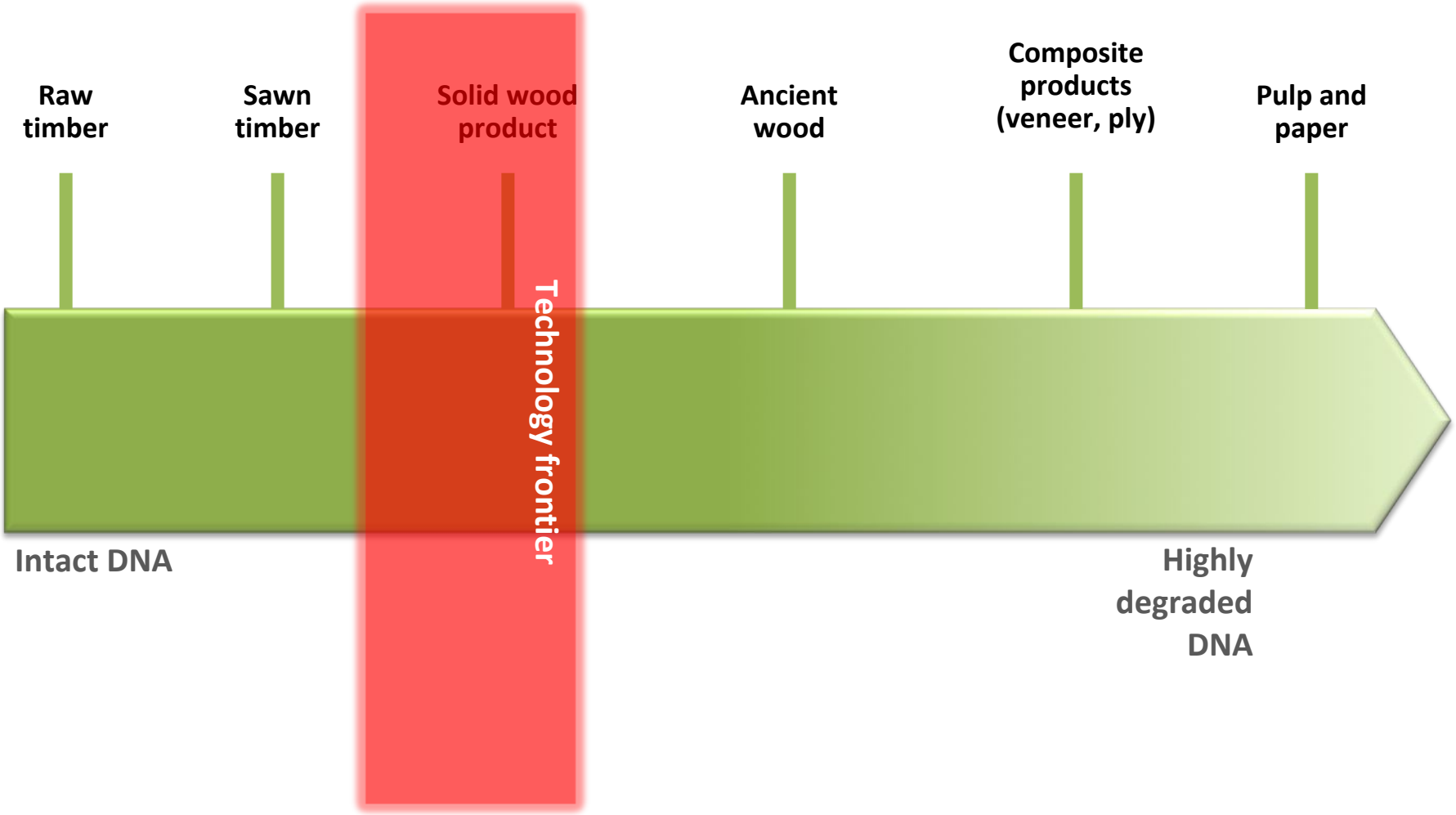
ANZPAA
Australia New Zealand Policing Advisory Agency

agrf
Australian Genome Research Facility Ltd

Australian Government
Australian Research Council

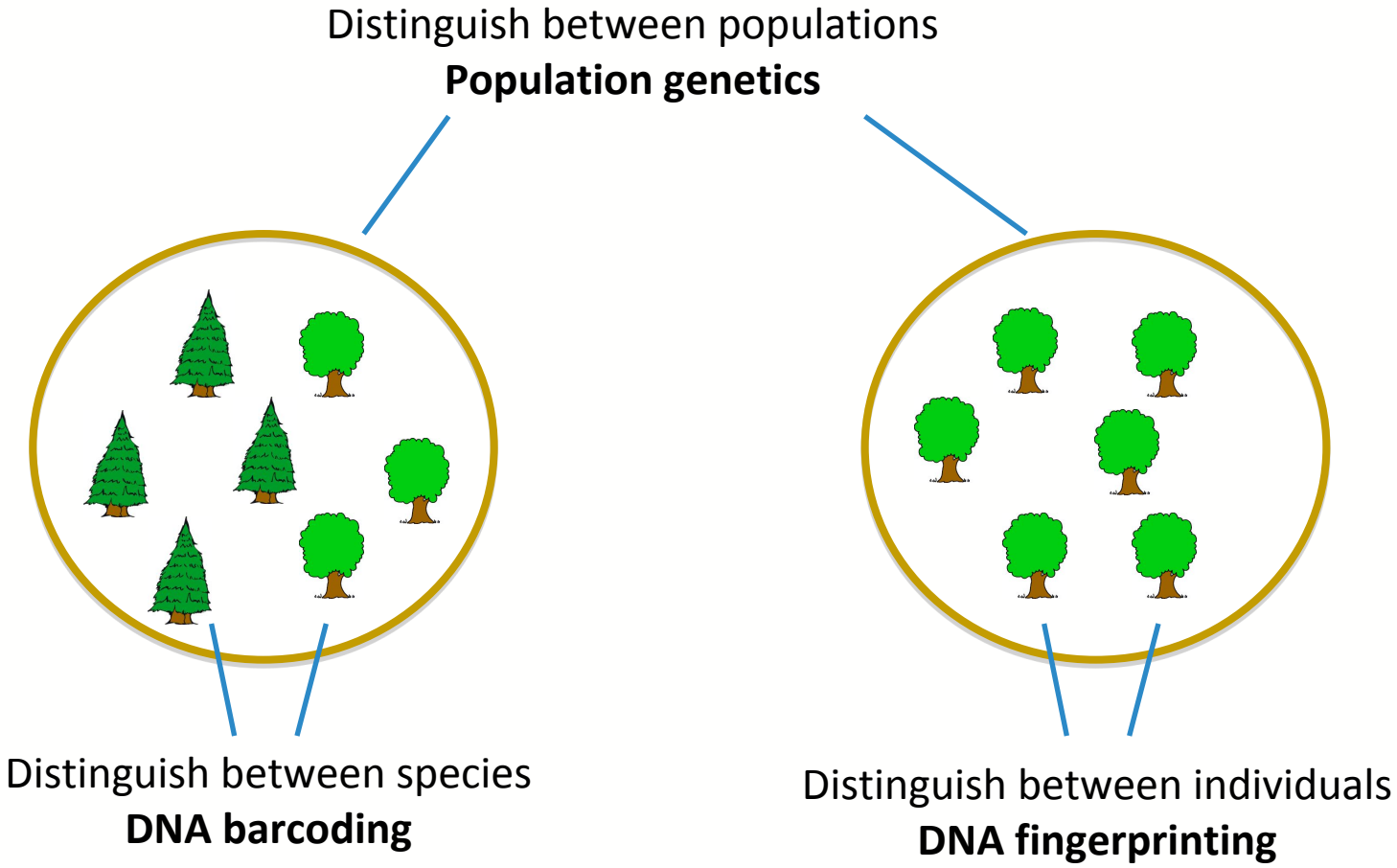
AUSTRALIAN MUSEUM

DNA extraction

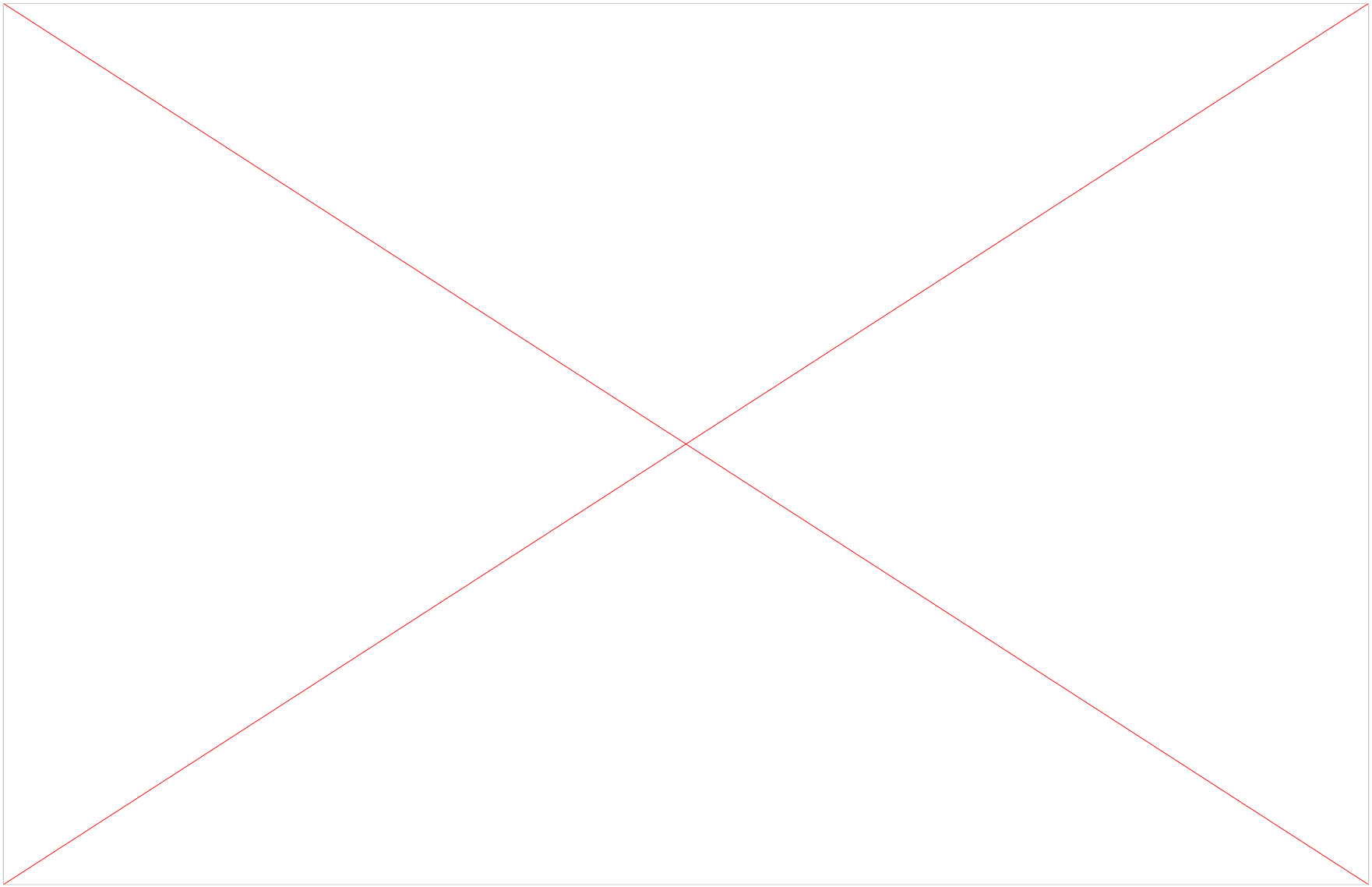


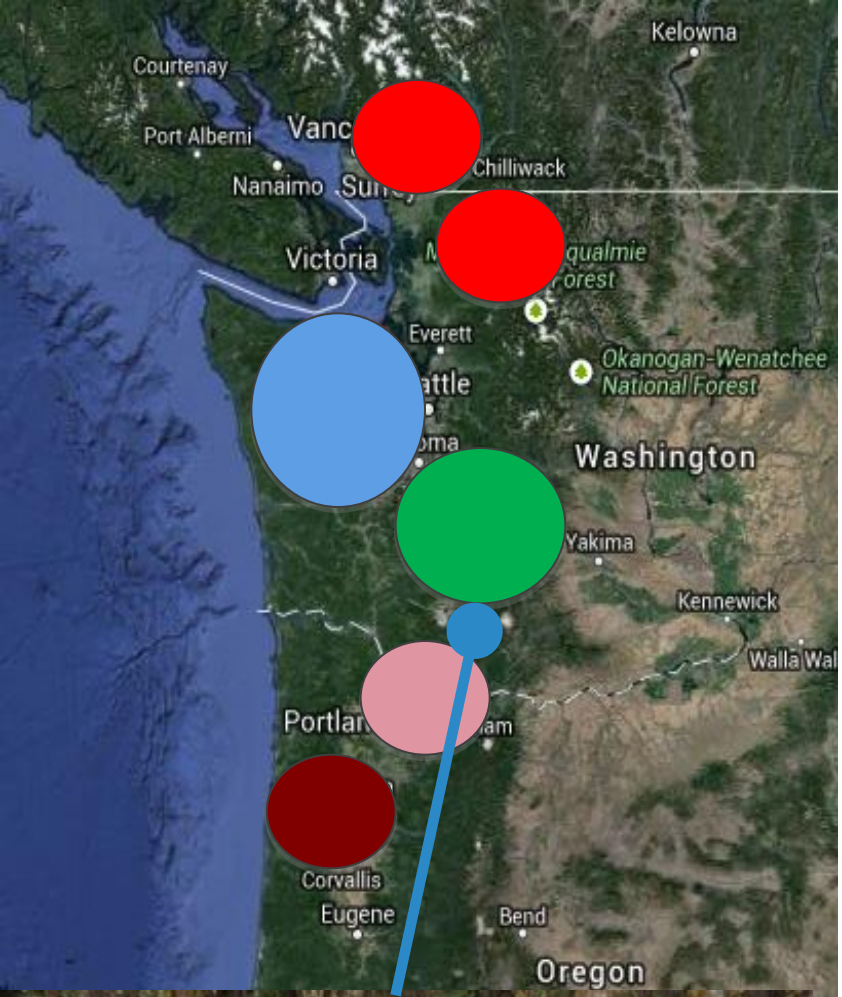
SOURCE: DOUBLEHELIX TRACKING TECHNOLOGIES

DNA analysis – species, region and individuals



SOURCE: LOWE & CROSS, 2011





Source: jardine et al., 2015

DNA fingerprinting developed

- 430 individuals from 40 populations
- 135 variable SNPs screened
- Significant genetic structure
- Individualisation probability 1 x 10^{23}

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"… the government notes that it has produced over 3,500 pages of discovery, which includes expert reports on plant DNA analysis and an extensive timber valuation analyses. The government expects to call approximately 20 witnesses at trial."

DNA evidence a big part of the case and potentially influential enough for J&L Tonewoods to plead guilty

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Mill owner admits to buying maples illegally cut in national forest

Originally published November 17, 2015 at 9:09 am | *Updated November 17, 2015 at 9:17 am*

The U.S. Attorney's office says Harold Clause Kupers and his Winlock company, J&L Tonewoods, admitted to buying the highly prized wood without requiring sellers to show they had a special permit.

U.S. Attorneys » Western District of Washington » News

Department of Justice

U.S. Attorney's Office

Western District of Washington

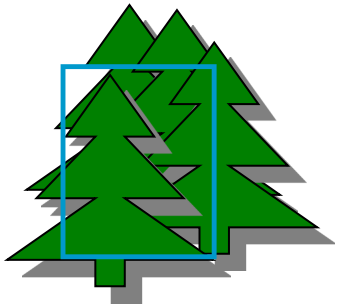
SHARE

FOR IMMEDIATE RELEASE Tuesday, April 19, 2016

Mill Owner Sentenced to Prison for Purchases and Sales of Stolen Figured Maple from National Forest

Made more than $800,000 Buying and Selling "Music Wood"

A Winlock, Washington wood buyer was sentenced today in U.S. District Court in Tacoma to six months in prison, six months of home detention and three years of supervised release and $159,692 in restitution for violating the Lacey Act by trafficking in big leaf maple illegally cut on national forest land,



Primary

Matched back

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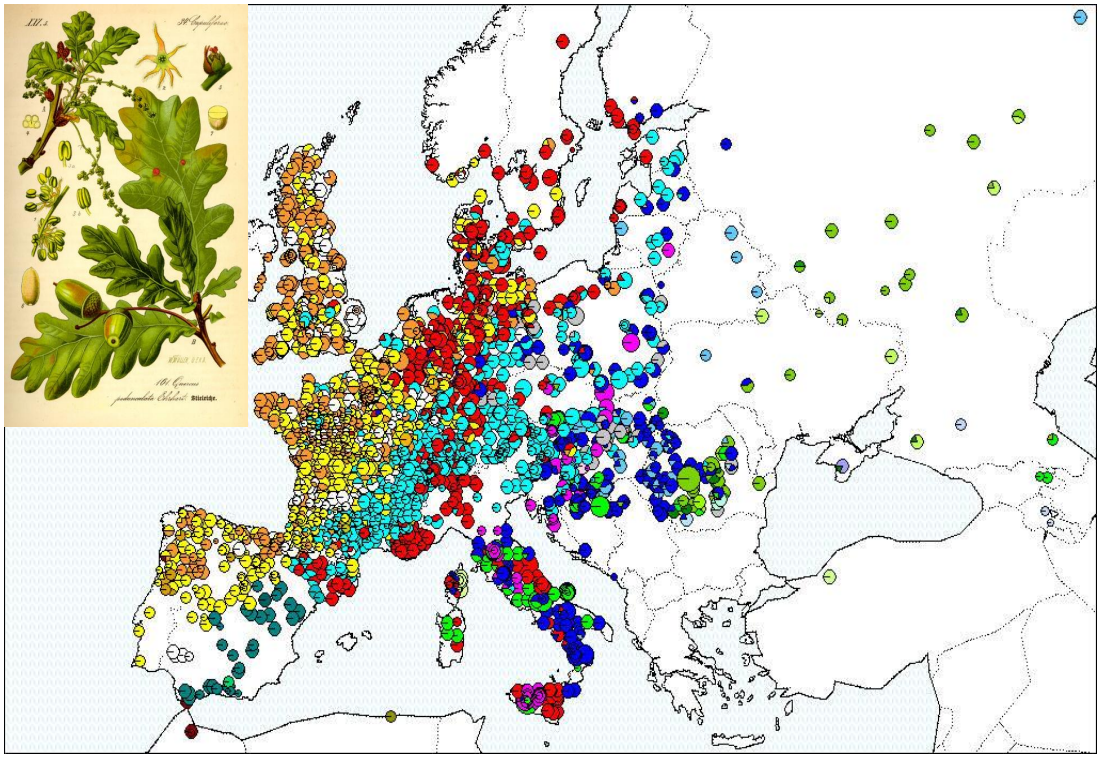
DNA Chain of custody
Perhutani Forest Management Unit Cepu

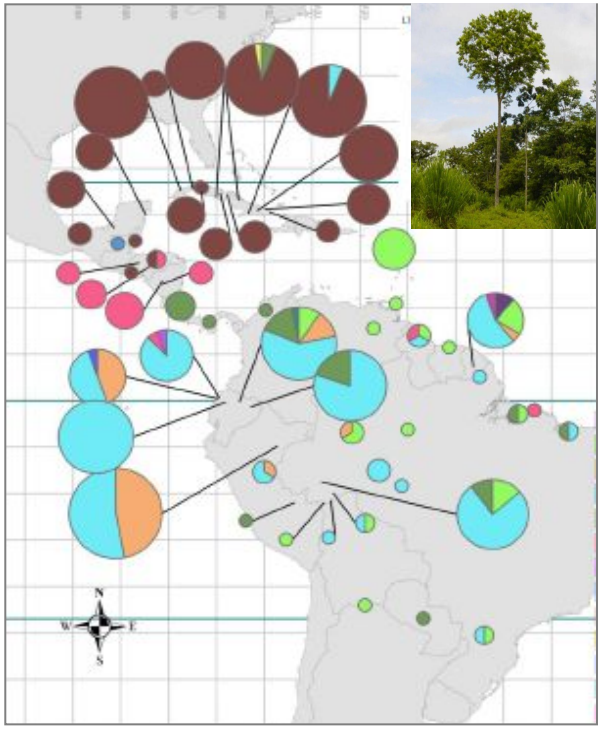
- Teak plantation - FSC certified in 2012
- Logs sampled in yard and matched back to stump through documentation
- 10% incorrect tree assignment
- 100% consistency for origin against broader teak database

Samples taken from stump

General view of the log yard

sample	origin	DNA CoC ID	DNA source
1	Cepu	match	Cepu
2	Cepu	match	Cepu
3	Cepu	match	Cepu
4	Cepu	match	Cepu
5	Cepu	match	Cepu
6	Cepu	match	Cepu
7	Cepu	no match	Cepu
8	Cepu	match	Cepu
9	Cepu	match	Cepu
10	Cepu	match	Cepu
11	Cepu	match	Cepu
12	Cepu	match	Cepu
13	Cepu	match	Cepu
14	Cepu	match	Cepu
15	Cepu	match	Cepu
16	Cepu	no match	Cepu
17	Cepu	match	Cepu
18	Cepu	match	Cepu
19	Cepu	match	Cepu
20	Cepu	match	Cepu





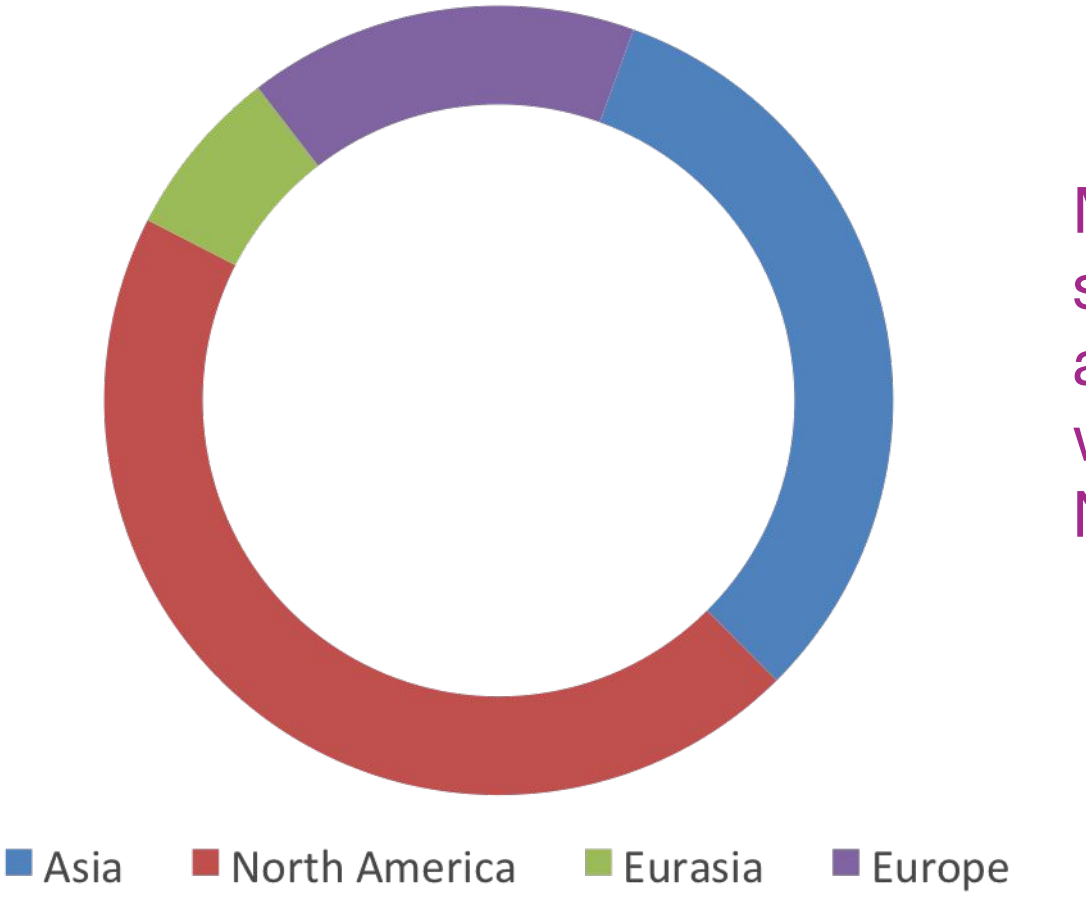
Source: PETIT ET AL., 2002 For Ecol Man; CAVERS ET AL., 2013, Mol Ecol

THÜNEN

Glued oak timber is declared as “Siberian oak “

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

Results of blind shopping in UK for ‘US white oak’



Actual origin, % of samples declared “U.S. white oak”

More than half of samples declared as “U.S. white oak” were not from North America

Regional/species verification test for oak

0000015301B	Claim	Isotopes	DNA	Verified
0000015301B	Europe	Asia	Asia	No
0000015302B	Europe	Europe	Europe/N Am	Yes
0000015303B	Europe	Europe	Europe/N Am	Yes*
0000011423B	Europe	Europe	Europe/N Am	Yes*
0000011424B	Europe	Europe	NA	Yes†
0000011425B	Europe	Europe	Europe/N Am	Yes
0000011426B	Europe	Europe	NA	Yes†

- Import verification check for Australian Government under Illegal Logging Prohibition Legislation
- Flooring product tested
- 1 out of 7 claims not verified

CONSORTIUM FOR THE BARCODE OF LIFE

international BARCODE OF LIFE

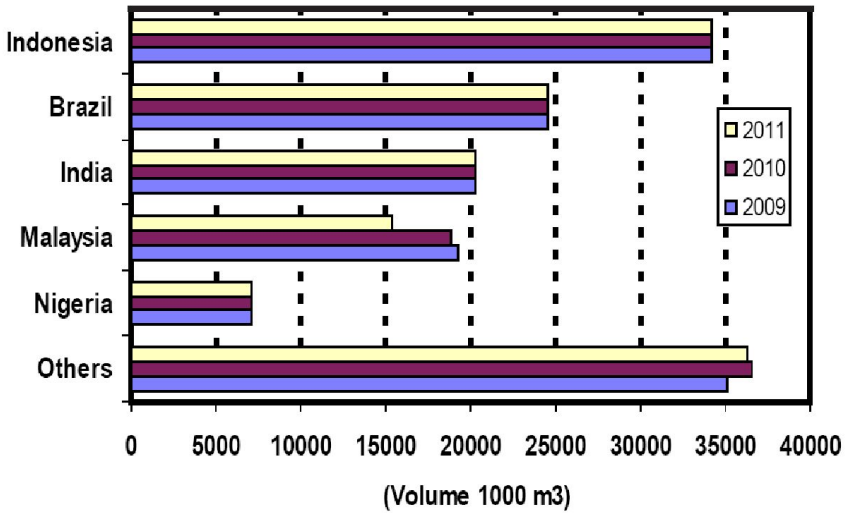
MarBOL

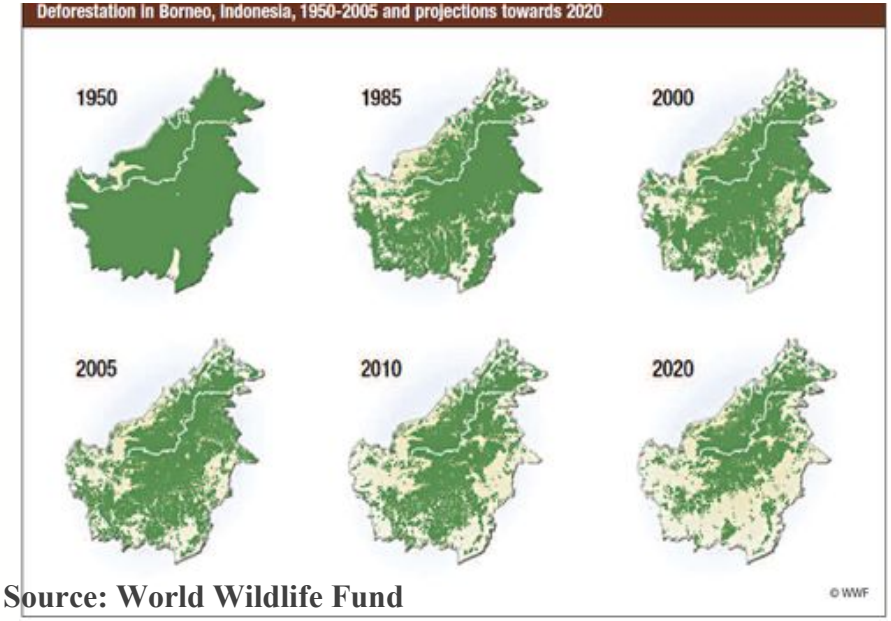
FISH-BOL

ECBOL

TreeBOL

GBOL
German Barcode of Life





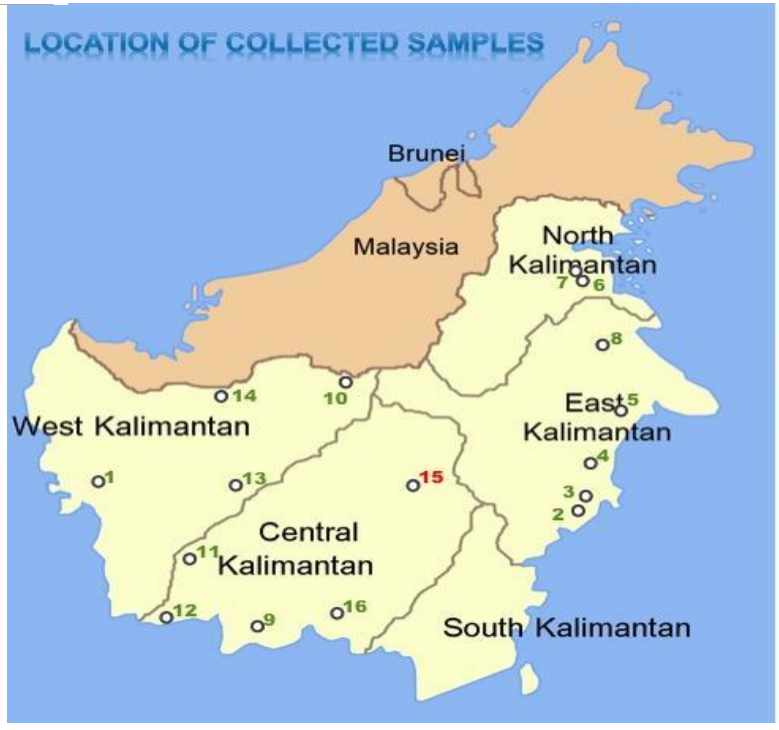
Source: World Wildlife Fund

Table 1. Trade and species name and value of important SE Asian meranti timber species

Timber trade name	Species	Trade value (ITTO trade data US$ Million)
Red meranti	*Shorea amplexicaulis, Shorea splendida, Shorea stenoptera*	71
Dark/light red meranti	*Shorea acuminate, Shorea beccariana Shorea hemsleyana, Shorea platycarpa Shorea palembanica, Shorea macrantha*	-
Light red meranti	*Shorea parvifolia ssp. parvifolia Shorea parvifolia ssp. velutinata Shorea ovalis ssp. sarawakensis Shorea ovalis ssp. sericea Shorea almon, Shorea dasyphylla Shorea lepidota, Shorea leprosula Shorea quadrinervis, Shorea rubra Shorea scrabrida, Shorea smithiana Shorea teysmanniana*	34
Dark red meranti	*Shorea platyclados, Shorea pauciflora Shorea ovate, Shorea flaviflora Shorea curtisii, Shorea coriacea Shorea argentifolia, Shorea singkawang Shorea slootenii*	1
Yellow meranti	*Shorea faguetiana, Shorea acuminatissima Shorea balanocarpoides, Shorea gibbosa Shorea longisperma, Shorea maxima Shorea multiflora, Shorea richetia Shorea xanthophylla*	-
White meranti	*Shorea gratissima, Shorea agami Shorea assamica, Shorea bracteolate Shorea henryana, Shorea ochracea Shorea resinosa, Shorea roxburghii*	-
Other meranti	*Shorea pubistyla, Shorea rugosa Shorea uliginosa*	2

Project focus

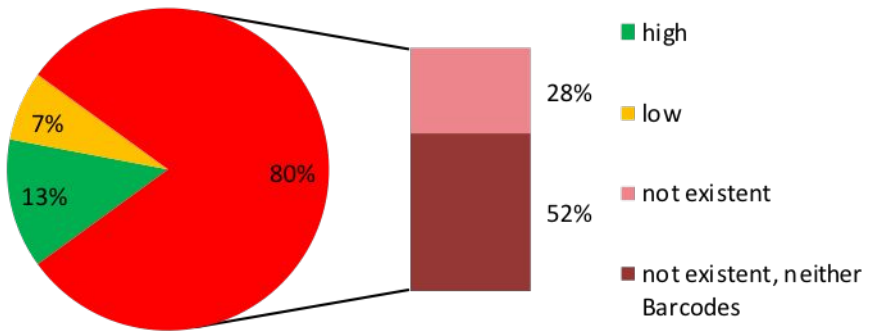
- Species ID > 100 meranti species
- Regional ID of Bangkirai
- Training, capacity building and dissemination
- Implementation with industry



Common Name	Scientific Name	Barcoding	Genographic	Fingerprinting
Northern temperate forest				
Oak	*Quercus* spp.	✓	✓	✓
Larch	*Larix* spp.	✓	✓	
Poplar	*Populus* spp.	✓		
Maple	*Acer macrophyllum*		✓	✓
Neotropical forest				
Mahogany	*Swietenia* spp.	✓	✓	✓
Andiroba	*Carapa guianensis*		✓	✓
Cedro	*Cedrela fissilis*	✓	✓	✓
Cerdo-cheiroso	*Cedrela odorata*	✓	✓	
Angelim Vermelho	*Dinizia excelsa*		✓	✓
Jatobá	*Hymenaea courbaril*		✓	✓
Pará-pará	*Jacaranda copaia*		✓	✓
Maçaranduba	*Manilkara huberi*		✓	✓
Marupá	*Simarouba amara*		✓	✓
Ipê-amarelo	*Tabebuia serratifolia*		✓	✓
Cumala	*Virola surinamensis*		✓	✓
Cumaru/ Shihuahuaco	*Dipteryx odorata*		✓	✓
African tropical forest				
Doussie	*Afzelia* spp.	✓		
Okan	*Cylicodiscus gabunensis*	✓		
Sepele/Sipo	*Entandrophragma* spp.	✓	✓	✓
Tali	*Erythrophleum ivorense*	✓		
African mahogany	*Khaya* spp.	✓	✓	
Azobé	*Lophira alata*	✓		
Iroko	*Milicia excels, M. regia*	✓	✓	✓
Wenge	*Millettia laurentii*	✓		
Ayous	*Triplochiton scleroxylon*	✓	✓	✓
African Teak	*Pericopsis elata*	✓		✓
Padauk	*Pterocarpus soyauxii*	✓		
Prunus	*Prunus africana*		✓	✓
Sipo	*Entandrophragma utile*		✓	✓
Okoumé	*Aucoumea klainea*		✓	✓
Okan	*Cylicodiscus gabonensis*		✓	✓
Padouk	*Pterocarpus soyauxii*		✓	✓
Azobé	*Lophira alata*		✓	✓
Bilinga	*Nauclea diderrichii*		✓	✓
Khaya/Acajou	*Khaya invorensis*	✓	✓	✓
SE Asian tropical/Australasian forest				
Ramin	*Gonystylus bancanus*	✓		
Merbau	*Intsia bijuga,*	✓	✓	✓
Sandalwood	*Santalum* spp.	✓	✓	✓
Teak	*Tectona grandis*		✓	✓
Meranti/Balau Bangkirai	*Shorea* spp. *Dipterocarpus* spp.	✓	✓	✓

Reference databases

Status of genetic resources for top 100 timber species



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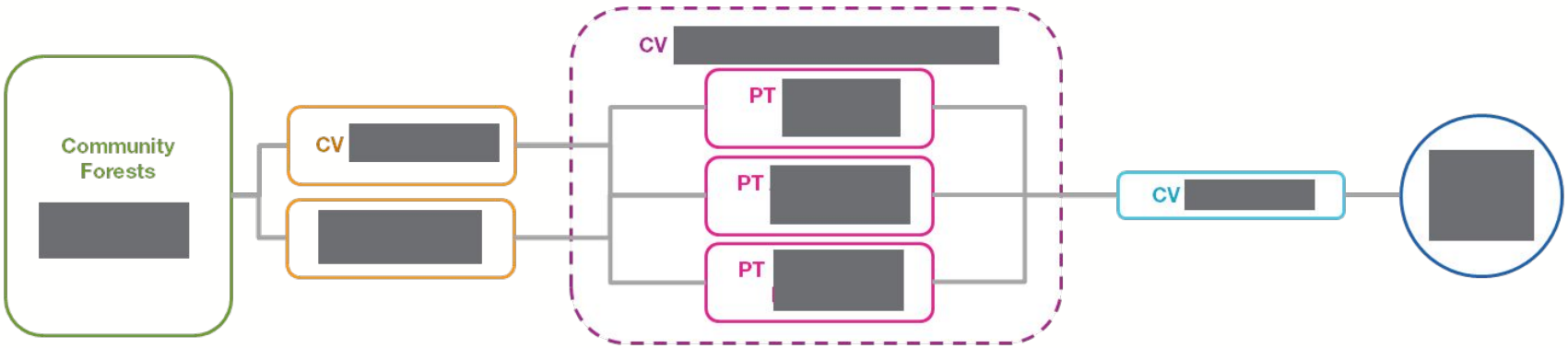
Third party product verification for wood importers

Product risk assessment

- **5-point risk assessment**
  - **Country**
    of harvest
  - **Species**
    vulnerability or confusion
  - **Market**
    country of trade / manufacture
  - **External**
    outside parties
  - **Supply chain**
    transparency; traceability; legality

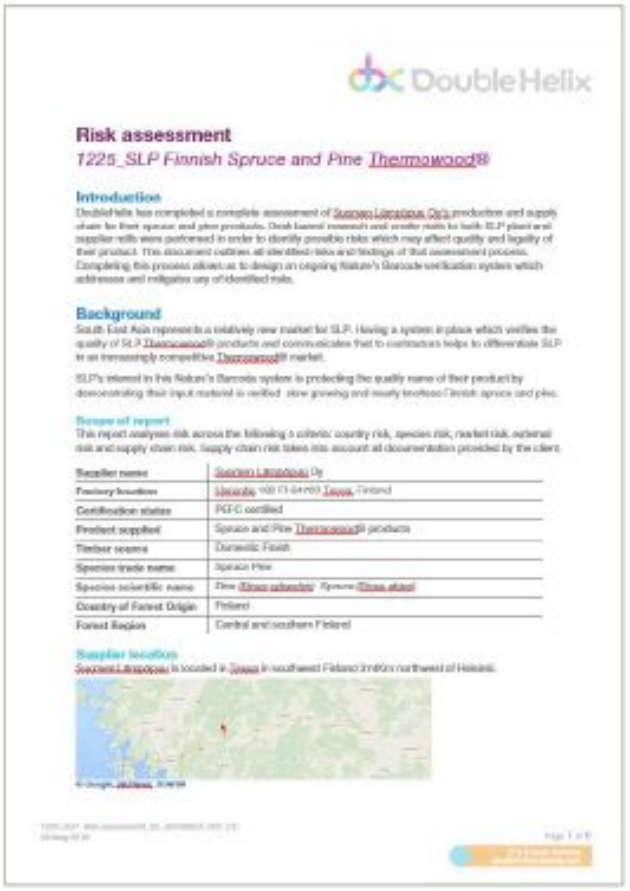
Deliverables



Forest sources: Indonesia	Primary sawmills: Indonesia	Manufacturers: Indonesia	Trader: Indonesia	Exporter: Indonesia	Buyer: Australia
Traceability documentation					
• Farmer identification • Transport documentation (SKAU)	• Supply contract (SKAU) • Log receipt records • Production records • Output / stock control • Sales invoice	• Nota / sales contract • Sawn timber transport (SKSHH) • Production records • Output control	• Purchase order • Contract with manufacturers • Packing list • Sales invoice	• Purchase Order / invoice • Bill of lading / packing list • Certificate of Origin • Phytosanitary certificate • V-Legal certificate	• Invoice / contract • BL / Packing List • Phytosanitary cert • V-legal cert.
Licenses / Legal registration / Certificates					
• Certificate of land ownership	• Deed of Incorporation • Business license (SIUP) • Company reg. (TDP) • Industry permit (IUI) • Tax ID (NPWP) • Env. Docs (UKL/UPL) • Raw material purchasing planning and realization (RPBBI) • SVLK certificate	• Deed of Incorporation • Business license (SIUP) • Company reg. (TDP) • Industry permit (IUI) • Tax ID (NPWP) • Env. Docs (UKL/UPL) • SVLK certificate	• Deed of Incorporation • Business license (SIUP) • Company reg. (TDP) • Tax ID (NPWP)	• Deed of Incorporation • Business license (SIUP) • Company reg. (TDP) • Tax ID (NPWP) • Exporter license (ETPIK) • SVLK certificate	

Deliverables

- Full evidence of risk assessment, legality and traceability
  - Supply chain map
  - Register of information (legality and traceability)
  - Risk assessment and gap analysis



DoubleHelix

Risk assessment

1225_SLP Finnish Spruce and Pine Thermowood®

Introduction

DoubleHelix has completed a complete assessment of Suonen Lämpöpuu Oy's production and supply chain for their spruce and pine products. Desk based research and onsite visits to both SLP plant and supplier mills were performed in order to identify possible risks which may affect quality and legality of their product. This document outlines all identified risks and findings of that assessment process. Considering this process allows us to design an ongoing feature's barcode verification system which addresses and mitigates any of identified risks.

Background

South East Asia represents a relatively new market for SLP. Having a system in place which verifies the quality of SLP Thermowood® products and communicates that to contractors helps to differentiate SLP in an increasingly competitive Thermowood® market.

SLP's interest in this feature's Barcode system is protecting the quality name of their product by demonstrating their input material is verified slow growing and mostly knotless Finnish spruce and pine.

Scope of report

This report analyses risk across the following 4 criteria: country risk, species risk, market risk, external risk and supply chain risk. Supply chain risk takes into account all documentation provided by the client.

Supplier name	Suonen Lämpöpuu Oy
Factory location	Harjavalta, [illegible] Tarvas, Finland
Certification status	PEFC certified
Product supplied	Spruce and Pine Thermowood® products
Timber source	Domestic Finish
Species trade name	Spruce, Pine
Species scientific name	Pine (Pinus sylvestris) Spruce (Picea abies)
Country of Forest Origin	Finland
Forest Region	Central and southern Finland

Supplier location

Suonen Lämpöpuu is located in Tarvas in southwest Finland 3 Hr's northwest of Helsinki.

Scientific testing

- Verifies authenticity of document claims
- Detects and deters substitution and fraud
- Clear, independent, scientific evidence in case of dispute
- Demonstration of best practice
- ISO inspection guidelines

Outputs

Traceability docket

Nature's Barcode

TRACEABILITY DOCKET

Docket number DX1225 - TD 001
Issue date 15 June 2016

Shipment Information

Container no. / Shipment no.	Shipment 178
B/L number (if applicable)	N/A
Total product volume (CBM)	21.3800
Verified product volume (CBM)	21.3800
Product type(s)	32x118 E4E R3, pine, 32x118 Vengroove, pine, 18x141 Finno RAL9010, spruce, 18x141 E4E R3 RAL9010, spruce, 26x66 E4E R3 RAL6010, spruce
Manufacturer bundle ref. nos.	H9801, H9806, F10798, F10811, F10812, F10817, F10822, F10880
Verified product bundle nos.	0000001, 0000002, 0000051, 0000052, 0000053, 0000054, 0000055, 0000056

Supply Chain Information

Species verified	Pine (*Pinus sylvestris*), Spruce (*Picea abies*)
Origin of harvest	Finland
Manufacturer	Suomen Lämpöpuu Oy, Finland
Buyer	Venturer Pte Ltd, Singapore

This docket has been produced for use of Suomen Lämpöpuu Oy and should not be copied or distributed to or by any other party without the prior written approval of DoubleHelix.

Verification Statement

The contents of the bundles listed above have been subject to independent verification using the Nature's Barcode™ system, to confirm the stated species and traceability back to stated origin of harvest.

Nature's Barcode™ provides assurance of product quality, consistency, and traceability. The product supply chain is monitored and controlled through a combination of document collection, on-site assessments and scientific testing applied using Statistical Process Control.

Full documentation is available on request by authorities to support this statement for every shipment with a Nature's Barcode™ docket.

Send enquiries to info@doublehelixtracking.com.

A service provided by
DOUBLE HELIX TRACKING TECHNOLOGIES PTE LTD

Scan here to learn

Bundle label

Verification and certification

Nature's Barcode™	Certification
• Compliance with national and international regulations	• Compliance with a standard (FSC, PEFC, SVLK, CertiSource)
• Verify by product supply chain	• Certification granted to individual entities along the supply chain
• Product traceability; supply chain transparency	• Required policies and processes developed and applied
• Mark of trust in product claim	• Process claim. All entities comply with the standard requirements

Thanks

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www.andylowe.org

linkedin.com/in/profandylowe/

SOURCE: CIAT INTERNATIONAL CENTER FOR TROPICAL AGRICULTURE