Timber Forensics
Scientific Analysis for Trade Control & Enforcement

Dr. Rob Ogden
Programme Director
TRACE Wildlife Forensics Network
Introductions

- Development and application of forensic science to wildlife law enforcement
Talk Overview

- Types of wildlife forensic application
- How can forensic application increase compliance?
- Principle methods
- Example applications
- International timber forensic initiatives
Background

Challenge  Identification or verification of products in trade

Identification:  What species is it? Where’s is it from?
Verification:  Does it match the paperwork?
Wildlife Forensic Applications

Casework
- Prosecutions
- Forensic evidence
- Admissible in court
- Gold standard
Wildlife Forensic Applications

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Traceability
- Trade regulation
- Detecting fraud
- Deterrent systems
Wildlife Forensic Applications

- **Casework**
  - Prosecutions
  - Forensic evidence
  - Admissible in court
  - Gold standard

- **Traceability**
  - Trade regulation
  - Detecting fraud
  - Deterrent systems

- **Intelligence**
  - Building pictures
  - Trade route analysis
  - Informing strategy
Forensic Science vs Research

What is forensics?

- The application of science to a legal question enforced by a criminal justice system
- ‘Forensic’ describes the end use of the result data
- ‘Forensic’ describes the control processes surrounding a test

Very important for wildlife scientists, enforcers and the judiciary to understand the distinction between research and forensics.
Wildlife Forensic Applications

Three broad applications:
• A common analytical toolkit (DNA, Morphology, Chemistry)
• Variation in purpose
• Variation in quality requirements

Implications:
• Casework applications are restricted and tightly controlled
• Traceability applications enable self-regulation / certification
• Intelligence applications address a wider range of questions
Improving Compliance

Model

Certification Scheme

Random Testing

Directed Investigation

Casework

Prosecution

Result Data

Monitor / Detect

Reward

Deterrent

Enforcement

Improved Compliance
Timber Traceability

Supply Chain Verification – stump to shop

DNA characterized at beginning

- Available for species verification
- Within species, currently available for certain genetically characterized consessions
Timber ID Methods

Identification Solutions – Taxonomic ID

<table>
<thead>
<tr>
<th>Low set-up cost</th>
<th>High set-up cost</th>
<th>Very high set-up cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low running cost</td>
<td>Medium running cost</td>
<td>Low running cost</td>
</tr>
<tr>
<td>1-3 hours</td>
<td>1-2 days</td>
<td>&lt; 1 hour</td>
</tr>
<tr>
<td>Very specialist</td>
<td>Lab trained staff</td>
<td>Lab trained staff</td>
</tr>
<tr>
<td>Genus level</td>
<td>Species level</td>
<td>Genus-species level</td>
</tr>
<tr>
<td>Expertise</td>
<td>DNA extraction</td>
<td>Reference data</td>
</tr>
</tbody>
</table>
Timber ID Methods

Identification Solutions – Geographic Origin

Options:

DNA assignment          relies on biological population
                        genetic differences among regions

DART-MS                  relies on molecular products (proteins)
                        varying among regions

Stable isotopes          relies on relating elemental isotope
                        ratios in a product to the
                        environmental background (isoscape)

All methods require extensive reference data and validation
Product verification is MUCH easier than unknown origin ID
DART ToF Mass Spectrometry

Revolutionary sampling advance:
From days to seconds

Slides and data from E. Espinoza, USFWS
DART ToF Mass Spectrometry

Heat Map

Multivariate Analysis

Hierarchical Cluster Analysis

Slides and data from E. Espinoza, USFWS
DART ToF Mass Spectrometry

- Species differentiation
- Geographic origin
- Wild vs cultivated (Aquilaria)
Example Scenarios

Czech Republic – Jan Ďoubal

1. Geographic origin – Europe or Russia?
   - Requires extensive reference sampling of claimed and suspected origins
   - Research on a case-by-case basis
   - DNA, chemical profiling, or stable isotopes

2. Species ID - Timber product composition
   - Microscopic ID challenging but possible to some level
   - DNA methods limited due to breakdown of DNA and presence of mixtures
   - DART-MS probably best option – requires ref standards

3. ‘Recycled’ status of timber products
   - Need to convert into scientific / diagnostic question
UNODC Timber Analysis Guide

Information for Investigators, Scientists & Legal Professionals

Background Document

Expert Group Meetings

Development of Guide

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**CHAIN-OF-CUSTODY RECORD**

<table>
<thead>
<tr>
<th>AGENCY</th>
<th>DATE AND TIME OF SEIZURE</th>
<th>REGION</th>
<th>EVIDENCE/PROPERTY SEIZED BY</th>
</tr>
</thead>
</table>

**SOURCE OF EVIDENCE/PROPERTY**

- TAKEN FROM
- RECEIVED FROM
- FOUND AT

**CASE TITLE AND REMARKS**

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(A) & (B)

SWGWILD Standards and Guidelines
(Version 2.0-Accepted by SWGWILD December 19, 2012)

1.0 Scope

This document provides minimum standards and additional guidelines for wildlife forensic analysts in the subdisciplines of DNA and morphology. This document covers good laboratory practices, evidence handling, and training which are central to all forensic laboratories. They also include critical considerations of phylogeny, taxonomy, and reference collections that are specific to wildlife forensic science.
Laboratory Options

• Casework – options very limited, very few labs accredited

• Traceability/Monitoring
  – Commercial labs, e.g. double helix
  – National labs, e.g. Thünen Institute – Germany

• General lack of laboratory services in the area
  – Lack of equipment
  – Lack of expertise
  – Lack of service provision – research focus
  – Supply / Demand issues – strong economies of scale
International Wildlife Forensic Science Meeting
University of Edinburgh, Scotland, June 2017

One-Week Scientific Meeting, 5-9th June
4th SWFS meeting on Wildlife Forensic Science

• Invited speakers
• Training workshops
• Expert discussions
• Presentations & Posters

Join us for a fantastic week in Edinburgh to share the latest developments in wildlife forensics

One-Day International Symposium, 7th June
Integrating Policy, Enforcement and Forensic Science for tackling illegal trade

• Plenary speakers
• Panel discussions
• Knowledge exchange
• Full-day programme & evening reception

Dedicated sessions:
• Wildlife trade
• Fisheries
• Timber
• National wildlife crime

For further information visit: www.wildlifeforensicscience.org/2017-meeting
Registration opens September 2016, student and early bird discounts available

Email: swfs2017@wildlifeforensicscience.org