An atlas for vessel elements

Opportunity for GTTN in Latin America?

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www.globaltimbertrackingnetwork.org
What is a vessel element atlas?

Identification of solid wood

Microtome sections of 3 planes ➤ 80-100 identification features

A guide for the identification of paper & fibre boards

Macerated wood ➤ 12 identification features
A guide for the identification of vessel elements

Which tree genera* do they come from?

* Identification of pulp & paper products up to tree species is not possible
The importance of a vessel atlas for GTTN

Illustrations of the risk of illegality in the pulp & paper sector:

Wood chips from *Asia Pulp & Paper* (APP, Indonesia)

- theory: only plantation wood used
- practice: 46 (of 59 samples) Ramin = CITES II

Goal: ↓ illegal logging & trade by ↑ timber identification tools

www.greenpeace.org/ramintrail
Illustrations of the risk of illegality in the pulp & paper sector:

Notepad produced in Asia

- Memos of each colour made of completely different papers
- Two of the five contained tropical timbers
Illustrations of the risk of illegality in the pulp & paper sector:

**In general**

- Paper products mostly consist of different pulps and a variety of timbers
  - Risk of containing mixed tropical hardwoods
- Products from Asia often have missing or incorrect declarations
- Recycling material with hidden virgin fibres?

**THE GOAL**

Bring back transparency in the supply chains

To be investigated for Latin America
How to identify recycled fibres?

- Post-consumer recycling material can be identified
- Ratio recycling: virgin fibres can not be determined
Why an opportunity for GTTN-Latin America?

Environmental Paper Company Index 2017:

South America has taken a leadership role in participation this year with the disclosure of over 50% of the total volume of pulp and paper produced in the region (...)

33% of the pulp purchased globally comes from South America

(...) demand as well as production continue to increase

The capacity to develop a vessel atlas is already present ➤

Expertise of the GTTN members in Latin America

http://gftn.panda.org/?uNewsID=317590 epci.panda.org
5% of world consumption

Figure 1: Per capita paper consumption, by region

Kilos, per person
Source: FAO, 2016

ENP (2018); FAO (2016)
Planned or proposed new pulp milling capacity

- Mangroves are frequently used for the pulp production in SE Asia and China (Helmling et al 2016). Brazil has the 2nd largest mangrove area.

ENP (2018); FAO (2016)
Global impact

33% of world export

ENP (2018); FAO (2016); resourcetrade
There is a need for a vessel element atlas of South American trees.

Allow checking of legality of imported pulp & paper.

ENP (2018); FAO (2016)
How to develop a vessel element atlas?

- Reference wood samples
- Preparation of the wood material*
  - Maceration, defibration
  - Staining of cells
  - Preparation on microslides
- Light microscopy images
  - Selection of vessel elements
  - Multiple images per vessel
  - Same scale bar throughout atlas
  - Stitching of focused image parts

* For detailed info see Helmling et al 2016, 2018
Illustration of the variation in vessel elements

- Acacia spp.
- Rhizophora spp.
- Avicennia spp.
- Gonystylus spp.
- Palaquium spp.
- Dipterocarpus spp.
- Koompassia spp.
- Tetramerista spp.
- Calophyllum spp.
- Mangifera spp.
- Shorea subg. Rubroshorea

Scale: 200 μm
Vessel elements in the reference atlas should represent the full variation of the genus and illustrate all 12 main identification features.

**Swintonia spp.**

- **Vessels**
  - vessel-ray pits very large, window-like in 2-3 rows
  - width from average to slim
  - intervessel pits
  - 6-10-16 µm
  - inclined perforation plates
  - pits to axial parenchyma elongate
- **Parenchyma cells**
- **Fibers**

Examples of references

Especially important to identify mixed paper or pulp products
Examples of references

Ramin (Gonystylus spp.)

- Vessels: tails mostly short
- Simple perforation plates
- Intervessel pits over large areas and in tails
- Parenchyma cells
- Fibers
- Pits to axial parenchyma: cross-fields in vertical series
- Drum-shape rare
- Vessel – ray pits: cross-fields in horizontal series

Scale: 200 µm
Qualitative features are more important for the ID of vessel elements (due to the inhomogeneity of the material) but quantitative data are a helpful complement.

1. Vessel element length
2. Vessel element width
3. Vessel element ratio length to width
4. Type of perforation plate
5. Tails
6. Size of intervessel pits
7. Arrangement of intervessel pits
8. Shape of intervessel pit apertures
9. Vessel-ray pits (APS or VAS)
10. Shape of vessel-ray pits
11. Helical thickenings
12. Tyloses

For detailed info see Helmling et al 2016, 2018
Limits of the vessel element atlas

Vessel elements of similar appearance:

- **Durio spp.**
- **Lophopetalum spp.**
  - rectangular cross-fields of vessel-ray pits
- **Gonystylus spp.**
  - rounded cross-fields
  - cross-fields arranged as if with a ruler
Subgenera cannot be distinguished

1. Shorea subg. Anthoshorea
2. Shorea subg. Richetia
3. Shorea subg. Rubroshorea
4. Shorea subg. Shorea
The vessel element atlas for Asian timbers


Atlas of Vessel Elements
Identification of Asian Timbers

IAWA Journal 39 (3)

http://booksandjournals.brillonline.com/content/journals/10.1163/22941932-20180202
Available references

- North America & Europe
- Southeast Asia
- Temperate Asia

Fibre atlas of Ilvessalo-Pfäfli (1995) and Parham & Gray (1982)


No references for Latin America yet!
A vessel element atlas for Latin America?!

To discuss:

Practical
- Labs with the needed infrastructure
- Potential funding sources
- Need/potential for collaboration between institutes
- ...

Scientific
- Timber spp. of potential utilization in paper & pulp
  - Taxa commonly traded/of wide distribution & high economic potential
  - Widely used plantation spp.
  - Lesser known spp. and monocots
- Spp. from endangered habitats
- ...

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Your questions or feedback are always welcome.

I am who I am, because we are

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References


resourcetrade.earth
The objective of the Global Timber Tracking Network (GTTN) is to promote the operationalization of innovative tools for wood identification and origin determination, to assist the fight against illegal logging and related trade around the globe.

GTTN is an open alliance that cooperates along a joint vision and the network activities are financed through an open multi-donor approach. GTTN phase 2 coordination (2017-2019) is financed by the German Federal Ministry of Food and Agriculture (BMEL).
Extra information
global impact

33% of world export
global impact

► 5% of world consumption

FAO (2016); https://resourcetrade.earth
5% of world consumption

Share of global forestry products trade

Exporters: CARIBBEAN & CENTRAL AMERICA

Importers: CARIBBEAN & CENTRAL AMERICA

Trade flows

<table>
<thead>
<tr>
<th>TOP 5</th>
<th>Value (US $)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Guatemala to El Salvador</td>
<td>$4.9m</td>
</tr>
<tr>
<td>2 Costa Rica to El Salvador</td>
<td>$3m</td>
</tr>
<tr>
<td>3 Honduras to El Salvador</td>
<td>$2.2m</td>
</tr>
<tr>
<td>4 Nicaragua to El Salvador</td>
<td>$1.7m</td>
</tr>
<tr>
<td>5 Nicaragua to Costa Rica</td>
<td>$1.5m</td>
</tr>
</tbody>
</table>

FAO (2016); https://resourcetrade.earth
Using the vessel atlas

- Macerated material on 2 microslides is mostly enough for identification (if still hesitation after 2, make some more)
- Vessel elements should not be picked out, slides are scanned through
- 10x objective microscope is sufficient