ILLEGAL LOGGING – THE EXTENT OF THE PROBLEM
ANDREW K SKIDMORE
GLOBAL LAND COVER

forest = 32%
agriculture = 37%
other = 31%

Production = 30%
Multiple use = 24%
Conservation = 12%
Protection = 8%
Permanent grassland = 37%
Permanent crops = 64%
Arable = 37%
Others = 31%
Unknown = 16%
Other = 7%

FAOSTAT 2013
GLOBAL FOREST AREA

- 4 billion ha (global)
- 485,000 ha (NL) = 0.01% (FRA 2010)
- 125 million ha (Aust) = 3.1%

- Growing stock estimate
  2010 = 527 billion m³
- 70 million m³ (NL) = 0.01%
- Australia unavailable

FAO 2005, 2015
COVER AT DIFFERENT SCALES

- **World**
  - Agriculture: 31%
  - Forest: 21%
  - Other: 48%
  - FAOSTAT 2013

- **Europe**
  - Agriculture: 37%
  - Forest: 35%
  - Other: 23%
  - EEA 2006

- **Netherlands**
  - Agriculture: 55%
  - Forest: 12%
  - Other: 33%
  - CBS 2008

- **Australia**
  - Agriculture: 62%
  - Forest: 21%
  - Other: 17%
  - EEA 2006
DEFINING LAND COVER TYPES

- Teak (*Tectona grandis*) interplanted with sweet potato (*Ipomea batatas*) - Solomon Islands

- Native cypress pine (*Callitris glauca*) - Australia

Forest: crown cover >10%, area >0.5 ha, ht>5m
LAND COVER TYPES

LAND COVER TYPE, VEGETATION TYPE, PLANT FUNCTIONAL GROUPS

- Land cover traditionally derived from air photo interpretation
  - Vegetation characterized as discrete patches
  - This does not capture mixes and gradients
- Land classes become
  - pre-classified areas
  - transferability issues
HOW ARE FOREST AREAS ESTIMATED?

TRADITIONAL FOREST INVENTORY

- UN FAO Forest Resource Assessment 2010
- Ground survey
- Forest inventory plots
- Satellite remote sensing
HOW ARE FOREST AREAS ESTIMATED?

LAND COVER FROM REMOTE SENSING

- Earth Observation by satellite
  - NASA AVHRR
  - NASA MODIS
  - French SPOT VGT
  - ESA MERIS
  - NASA Landsat
  - *ESA SENTINEL series*
  - High resolution *GeoEye, WorldView, Quickbird*...
HOW ARE FOREST COVER MAPS MADE?
HOW ARE FOREST COVER MAPS MADE?
HOW ARE FOREST AREAS ESTIMATED?

REMOTE SENSING

Results from time-series analysis of Landsat images characterizing forest extent and change.

Trees are defined as vegetation taller than 5m in height and are expressed as a percentage per output grid cell as '2000 Percent Tree Cover'. 'Forest Cover Loss' is defined as a stand-replacement disturbance, or a change from a forest to non-forest state, during the period 2000-2014. 'Forest Cover Gain' is defined as the inverse of loss, or a non-forest to forest change entirely within the period 2000-2012. 'Forest Loss Year' is a disaggregation of total 'Forest Loss' to annual time scales.

Reference 2000 and 2014 imagery are median observations from a set of quality assessment-passed growing season observations.

Download the data.

Reset to default view

- Data Products
  - 2000 Percent Tree Cover

Legend
- 75-100%
- 50-75%
- 25-50%
- 0-25%
- Water or no data

Other Data Layers
- Tropical Hinterland Forests

Background Imagery

Published by Hansen, Potapov, Moore, Hancher et al.

Map data ©2017 Google, INEGI, ORION-ME

500 km

Terms of Use

Powered by Google Earth Engine

Help
HOW ARE FOREST AREAS ESTIMATED?

HIGHER TEMPORAL RESOLUTION

Legend for upcoming animation

<table>
<thead>
<tr>
<th>Decreasing Trend (Decreasing Greenness)</th>
<th>Increasing Trend (Increasing Greenness)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; -0.3</td>
<td>0.05 - 0.1</td>
</tr>
<tr>
<td>-0.3 - -0.2</td>
<td>0.1 - 0.2</td>
</tr>
<tr>
<td>-0.2 - -0.1</td>
<td>0.2 - 0.3</td>
</tr>
<tr>
<td>-0.1 - -0.05</td>
<td>0.3 - 0.4</td>
</tr>
<tr>
<td>No trend</td>
<td>-0.05 - 0.05</td>
</tr>
</tbody>
</table>

Washington State “Flight” Path for Upcoming Animation
HOW ARE FOREST AREAS ESTIMATED

HIGHER TEMPORAL RESOLUTION

1985

Boston University
Woodcock et al.
HOW RELIABLE ARE THESE AREA ESTIMATES?

REMOTE SENSING

Researchers use different methods and not comparable

Scepan (1999) AVHRR = 59%

(Friedl et al. (2010) BU = 74%

ESa (2010) GLOBCOVER = 47%

2190 points based on API of Google Earth

3 interpreters

Jung et al. 2006
HOW RELIABLE ARE THESE AREA ESTIMATES?

UN FAO FRA 2012

- Austria
  - Forest definitions different at national and FAO level

- Australia
  - Districts → Regions → State → Commonwealth
  - 2003 → 2008: 9% reduction in forest area

- Azerbaijan
  - Country report compiled by FAO staff in Rome (p.4)

**DEFINITIONS**

FAO = 0.5 ha, trees, > 5m ht, >10% canopy cover
A = 0.05 ha, trees > 5m ht, >30% canopy cover

**CHANGING TECHNIQUES**

“The ability by states and territories to estimate forest extent continues to improve with the increasing availability of high resolution remotely sensed data and improvements in forest typing methods.” FRA 2010 – Country Report Australia (p.6)

Report preparation and contact persons

No report has been received from Azerbaijan.

This report is the result of a desk study prepared by the FRA secretariat in Rome, which is based on the existing available information using the established format for FRA 2010 country reports.
GLOBAL FOREST CHANGE

- 13 million ha/yr forest lost 2000-2010
- 16 million ha/yr forest lost 1990-1999

FAO FRA 2010

Asia shifted from net loss to net gain in forest cover
- Oceania net loss 1 mill ha/y
  - Australia identifies improved inventory (p6)
  - FRA blames drought (p19)

10% of original primary forest remains (Nellemann 2012)
REGIONAL FOREST CHANGE - EUROPE

- FAO 2010 FRA European forest area expanded by:
  - 1990-1999 = 0.9 million ha/yr
  - 2000-2010 = 0.7 million ha/yr

- EEA 2006 European forest area expanded by:
  - 2000-2006 = 0.1 million ha/yr
  - CORINE database
FOREST AROUND ENSCHEDE

http://upload.wikimedia.org/wikipedia/commons/f/fe/Enschede-topografie.jpg
http://www.earthzine.org/2012/07/25/pan-european-forest-maps-derived-from-optical-satellite-imagery/
http://forest.jrc.ec.europa.eu/download/data/google-earth-overlays/

Dutch topographic map
1:25000

Aerodata International
10 cm air photo

JRC Forest Map
2006
23m
(FMAP2006)

IRS-P6 LISS-III

Netherlands
FOREST AROUND ENSCHEDE

Dutch topographic map
1:25000

Aerodata International
10 cm air photo + Hansen Forest 2000

JRC Forest Map
2006
23m (FMAP2006)

IRS-P6 LISS-III

http://upload.wikimedia.org/wikipedia/commons/f/fe/Enschede-topografie.jpg
http://www.earthzine.org/2012/07/25/pan-european-forest-maps-derived-from-optical-satellite/
http://forest.jrc.ec.europa.eu/download/data/google-earth-overlays/
http://earthenginepartners.appspot.com/science-2013-global-forest

UNIVERSITY OF TWENTE.
FOREST AROUND ENSCHEDE

http://upload.wikimedia.org/wikipedia/commons/f/fe/Enschede-topografie.jpg
http://www.earthzine.org/2012/07/25/pan-european-forest-maps-derived-from-optical-satellite-imagery/
http://forest.jrc.ec.europa.eu/download/data/google-earth-overlays/

GLOBCOVER Forest class 300 m pixel with Spatial Pattern Analysis (MSPA)
JRC (GCOVER2009) MODIS
TIMBER PRODUCTION

- Global production (2011)
  - 1578 million m³ roundwood
  - Sawnwood
  - Veneer and plywood
  - Pulp and paper

- Export/trade
  - 115 million m³ roundwood
  - Average $140/m³
  - Tropical hardwood $185-340/m³

- Roundwood production $247 billion
- Roundwood exports $10 billion

Source: FAOSTAT-Forestry database

ITTO, FAOSTAT 2012

UNIVERSITY OF TWENTE.
GLOBAL TRADE IN TIMBER

EU = 35% of global timber consumption

Source: FAO 2008a.

ILLEGAL LOGGING IN THE NEWS

The Guardian

Interpol arrests 200 and seizes $8m worth of timber in illegal logging raid

Police release details of one of the biggest raids on suspected illegal timber operations ever undertaken in Latin America.

The Guardian

Illegal Logging Bill to Be Passed Next Month in Indonesia

The law passed by the House of Representatives on April 19 is aimed at stopping the illegal logging of wood.

Jakarta Post

Is your furniture harming tigers in Russian forests?

The law is aimed at stopping the illegal logging of wood.
GLOBAL TRADE IN TIMBER

EU = 35% of global timber consumption

Source: FAO 2008a.

GLOBAL EXTENT OF ILLEGAL LOGGING

Illegal logging estimates
- Illegal logging activity's share of total logging
- Main producer
- Main importer

Illegal timber bilateral flows
Share in illegal exports
- More than 50%
- Up to 50%

(Nellemann 2012 INTERPOL)
GLOBAL EXTENT OF ILLEGAL LOGGING

- WWF (2008) illegal logging:
  - 20-40% of global trade
  - 350 to 650 million m$^3$/year
- Nellemann (2012) Interpol
  - 15-30% global trade
  - $30-100bn
- Amazon basin, Congo basin and south-east Asia
  - 50 to 90% logging illegal
- Indonesia illegal logging (Luttrell 2012)
  - 75% illegal = $8.7 billion, in lost tax = 1% GDP, and 10% of tax revenue
EU ILLEGAL TIMBER IMPORTS

- 16-19% of the timber imports (WWF 2008)
- 27-31 million m³ (10% global trade)
- 40% of manufactured products illegal
  BUT excluded by FLEGT*

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*EU Voluntary Licensing Regulation FLEGT – Forest Law Enforcement, Governance and Trade

(WWF 2008)

EFFECTS OF ILLEGAL LOGGING

- Illegal logging is covert
- Organized crime
- Land cover conversion
- Suppresses timber prices (15%)
- Loss of tax revenues ($15 billion)
- Magnitude encourages corruption
- Carbon emission – 6% of all CO₂ annually emitted is from illegal logging (Nellemann 2012)

EFFECTS OF ILLEGAL LOGGING

- Leakage - China logging ban encourages illegal (e.g. Indonesian) logging
- Undermines REDD+ for payments to communities – illegal payments are larger than REDD+ payments
- Increased flooding
- Decreased biodiversity

Total investment by World Bank 2008-2013 is $650 million through the Forest Carbon Partnership Facility (FCPF). (0.2% of illegal trade)

The **EU Timber Regulation (EUTR)** requires importers or sellers of timber and wood products to keep records of the sources of their supplies.

- **VPA (Voluntary Partnership Agreements)**

- **INTERPOL LEAF (Law Enforcement Assistance for Forests)** – UNEP, NORAD


*EU 2005 Forest Law Enforcement, Governance and Trade regulation*
HOW TO SOLVE THE PROBLEM OF ILLEGAL LOGGING

- Buy wood and paper products that are certified in accordance with the principles and criteria of the Forest Stewardship Council (FSC) and which bear the FSC label.
- Develop methods to track legal timber and identify illegal wood products – emerging role for Earth Observation from space.
GLOBAL FOREST OBSERVING SYSTEM

PROGRESS IN SATELLITES AND IMAGE PROCESSING TECHNIQUES

Landsat – systematic and global acquisition for next 25 years

Sentinel-2 – systematic global acquisition including the red edge to 2028

EnMAP- Environmental mapping and analysis program

GEDI – Global Ecosystems Dynamics Investigation LiDar
Thank you for your attention