Rates and causes of tropical deforestation

Presented by Frédéric Achard

With contributions from H. Eva, Ph. Mayaux, HJ Stibig & others
Content of the presentation

1. Rates of deforestation in the Tropics

2. Main drivers of deforestation

3. Rationale for future monitoring
From Global Forest Resources Assessment 2005
FAO (Food and Agriculture Organisation)

Net global change in forest area:

- 8.9 million hectares per year for 1990–2000
- 7.3 million hectares per year for 2000–2005

Total net loss for countries with a negative change:

13.1 million hectares per year for 1990–2000
12.9 million hectares per year for 2000–2005
### Rates of Deforestation in the Tropics

<table>
<thead>
<tr>
<th>Region</th>
<th>Forest area (million hectares)</th>
<th>Annual net forest area loss (million ha / year)</th>
<th>Annual net forest area loss (Percentage)</th>
</tr>
</thead>
<tbody>
<tr>
<td>South America</td>
<td>762</td>
<td>-4.0</td>
<td>-0.5%</td>
</tr>
<tr>
<td>West &amp; Central Africa</td>
<td>278</td>
<td>-1.4</td>
<td>-0.5%</td>
</tr>
<tr>
<td>South &amp; South-East Asia</td>
<td>283</td>
<td>-3.1</td>
<td>-1.0%</td>
</tr>
</tbody>
</table>
The Amazon ‘rainforests’

- Largest tropical forest in the world
- Home to 20 million city-dwellers
- The Amazon river alone contains 20% of the Earth's fresh water
- World’s most biologically diverse region
- Under pressure from man
1960 sees the first road Brasilia to Belem;
1970s see the start of the development of the full official network;
1995 most of the main roads complete
Forest fires detected in 1993 – followed by 2007 – humid tropical forests becoming fire prone
Main drivers in Amazonia

1. Conversion of forest to cash crop plantations and pasture
   In the south of the Amazon (Mato Grosso): soya / cattle
   In the east (Pará): cattle / other cash crops

2. Impact of urbanisation and infra-structure (roads) improvements
   Urban population of Amazonia: from 3 million in 1970 to 13 million
   The road network has grown from nothing in 1970 to thousands of km’s
   $40 billion investment from 2000 to 2007 in highways and infrastructure

3. Concession logging and illegal logging
   Primarily in northern Pará – now moving south as stocks are depleted
   1 hectare of forest costs 10 times less than a hectare of pasture

4. Future factors: effect of biofuel
   The possible leakage effect of biofuel production in the south of Brazil
Forests of Congo Basin
Main drivers in Congo Basin

1. Deforestation is linked to increase in population, demand for land and improvement of access roads

2. Demand for timber in external markets is high (e.g. China) but:
   - Sustainable development objectives are increasingly considered in national forestry plans on Central African countries
   - Sustainable logging does not necessarily cause long-term degradation of the forest cover in the current conditions

3. Domestic fuel wood demand is still high in urban centres
   - Kinshasa needs 35,000 ha of forest/year leading to circa 100,000 ha per year of degradation (long distance impact)

4. Future potential factor: biofuel
   - Because of proximity to Europe, biofuel issues may have an impact
Hot spots of deforestation in South East Asia

Source: JRC & WRI, 2008
Forest Cover in year 2000

Source: JRC, 2004
Riau Province of Sumatra

Satellite Image mosaic from SPOT VGT Sensor
Years 1998-2000

Legend:
dark green = forests
magenta = burnt area
Riau Province of Sumatra

Satellite Image mosaic from MODIS Sensor Year 2004

Legend:
dark green = forests
magenta = burnt area
Riau Province of Sumatra

Satellite Image from MODIS Sensor
Year 2006

Legend:
*dark green* = forests
*magenta* = burnt area
Riau Province of Sumatra

Land Use Map from WWF
Year 2008

Legend:

green = forests
blue = Acacia plantations
yellow = Oil Palm

Source: WWF 2008
Main drivers in South East Asia

1. Conversion of forest to cash crop plantations
   Insular SE-Asia: Oil Palm; increasingly also in PNG
   Continental SE-Asia: Rubber, Coffee & Tee, partly Oil Palm,
   Mainly driven by foreign demand

2. Conversion of natural forest to industrial forest plantations
   Acacia magnum, Eucalyptus spp., e.g. Riau at cost of swamp forest

3. Concession logging and illegal logging
   Still a major factor in Indonesia
   Newly rising focus of logging industry in Papua New Guinea
   Unsustainable logging in Cont. SE-Asia (Myanmar, Laos, Cambodia),
   with illegal logging in remote areas towards country boundaries

4. Other factors of local importance:
   Land speculation; shifting cultivation; roads, dams & mining;
   fires remain a threat in Indonesia
Content of the presentation

1. Rates of deforestation in the Tropics

2. Main drivers of deforestation

3. Rationale for future monitoring
## Carbon Emissions from deforestation

### Fluxes and Rates in GtC yr⁻¹

| Source: IPCC 4th Assessment report |

<table>
<thead>
<tr>
<th></th>
<th>1980s TAR</th>
<th>1980s TAR revised⁴</th>
<th>1990s TAR</th>
<th>1990s AR4</th>
<th>2000–2005c AR4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atmospheric Increaseᵇ</td>
<td>3.3 ± 0.1</td>
<td>3.3 ± 0.1</td>
<td>3.2 ± 0.1</td>
<td>3.2 ± 0.1</td>
<td>4.1 ± 0.1</td>
</tr>
<tr>
<td>Emissions (fossil + cement)ᶜ</td>
<td>5.4 ± 0.3</td>
<td>5.4 ± 0.3</td>
<td>6.4 ± 0.4</td>
<td>6.4 ± 0.4</td>
<td>7.2 ± 0.3</td>
</tr>
<tr>
<td>Net ocean-to-atmosphere fluxᵈ</td>
<td>−1.9 ± 0.6</td>
<td>−1.8 ± 0.8</td>
<td>−1.7 ± 0.5</td>
<td>−2.2 ± 0.4</td>
<td>−2.2 ± 0.5</td>
</tr>
<tr>
<td>Net land-to-atmosphere fluxᵉ</td>
<td>−0.2 ± 0.7</td>
<td>−0.3 ± 0.9</td>
<td>−1.4 ± 0.7</td>
<td>−1.0 ± 0.6</td>
<td>−0.9 ± 0.6</td>
</tr>
</tbody>
</table>

### Partitioned as follows

- **Land use change flux**: 1.7 (0.6 to 2.5) (1.4 (0.4 to 2.3) n.a.) 1.6 (0.5 to 2.7) n.a.
- **Residual terrestrial sink**: −1.9 (−3.8 to −0.3) (−1.7 (−3.4 to −0.2) n.a.) −2.6 (−4.3 to −0.9) n.a.
A key element in the Global GHG budget

Estimated CO₂ emissions in 1990’s associated with land use change (mainly deforestation in Tropics) were 1.6 GtC yr⁻¹ (0.5 to 2.7 GtC yr⁻¹), to be compared to 6.4 GtC yr⁻¹ from anthropogenic emissions, i.e.

Emissions from deforestation = 15% - 25% of anthropogenic emissions

Political dimension in the UNFCCC framework

- Discussions initiated at COP-11 in December 2005 on a potential new mechanism (post-Kyoto) called “REDD” (Reducing Emission from Deforestation and Degradation in Developing Countries)
National level monitoring: Brazilian example

Source: INPE (Brazilian Space Agency), 2003
Annual deforestation rates for the Brazilian Amazon

Source: INPE (Brazilian Space Agency)
Tropical Remote Sensing Surveys of 1990s

JRC Survey (1990-1997)

Systematic sample grid to estimate forest cover changes between 1990, 2000 & 2005

Samples are 20km x 20km size
Conclusions / key messages

A regular assessment of the state and conditions of tropical forests is needed:

• “Show and tell” approach is influential in raising awareness of size of the deforestation problem
  – using visual products
  – based on credible analytical methods

• Continuity of observation is critical and relies on:
  – Technology (Satellite remote sensing)
  – Development of expertise (Forestry, RS)
  – Dissemination of data & results
Both deforestation and degradation need to be measured

**Deforestation**: from forest cover (land) to non-forest cover (land)

- definition of forest cover (% tree cover)
- or definition of forest land (land use definition)
- importance of mapping unit size

**Degradation**: alteration of forest ecosystem

- remaining cover (< 70%, >30%),
- biomass (C) ratio,
- biodiversity index
2005 Global Forest Resource Assessment  FAO

area change (%)

biomass carbon change (%)

Indonesia

Brasil
• Net Deforestation rate: 0.19% per year
• Net Degradation rate: 0.10% per year
  – Rate is less than half of Amazon and a quarter of SE Asia

• National patterns
  – Democratic Republic of Congo has highest rate
  – Congo, Gabon and Central African republic have very low rates

• Local patterns
  – Fringes of the Basin are more affected
  – ‘Landscapes’ are well protected (rates are half than out of landscapes)