REGIONAL OVERVIEW

Ecosystem Conservation and Restoration

Identifying drivers of land use change

In South America

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Capacity building workshop on ecosystem conservation and restoration to support achievement of the Aichi Biodiversity Targets - Linhares, Brazil, March 24-28, 2014
Outline

- Land-use change, deforestation and degradation
- Drivers of deforestation and forest degradation
- Analysis and assessment of drivers in South American countries
- Going deeper: Analysis of landscape transformation in tropical Latin America and implications for development and conservation
Sources of information used for this presentation


LAND USE CHANGE, DEFORESTATION AND DEGRADATION

Land use change

→ Change in the use or management of land by humans, which may lead to a change in land cover (IPCC Fourth Assessment Report)
   - A process by which human activities transform the landscape

- **Land clearing / degradation** is the most visible direct effect of land use change

- **Transitions in land use** activities that may be experienced within a given region over time (Foley et al. 2005)
Deforestation

FRA definition (FAO 2013): The conversion of forest to other land use or the long-term reduction of the tree canopy cover below the minimum 10 percent.

Explanatory notes:

- Deforestation is the long-term or permanent loss of forest cover and transformation into another land use.
- It includes areas of forest converted to agriculture, pasture, water reservoirs, rangeland and urban areas.
- The term specifically excludes areas where the trees have been removed as a result of harvesting or logging, and where the forest is expected to regenerate naturally or with the aid of silvicultural measures.
South America and Africa continue to have the largest net loss of forest.

**FRA (2010): Changes in forest area in South America**

- **Forest cover in 2010:** 864,351 M ha (49% of land area)

- **Trends in forest area, 1990–2010 (million ha):**
  - Africa
  - Asia
  - Europe
  - North and Central America
  - Oceania
  - South America

- **Global deforestation:** 0.13 % per year
- **Deforestación in South America:** 0.45 % per year
Degradation

**CBD definition**: Any combination of loss of soil fertility, absence of forest cover, lack of natural function, soil compaction, and salinization that either impedes or retards unassisted forest recovery through secondary succession (*UNEP/CBD/SBSTTA/11/INF/2*)

- **Land degradation**: a state and process, characterized by a loss or reduction in ecological or economic productivity (*Caspari et al. 2013*)

- **Forest degradation**: the reduction of the capacity of a forest to provide goods and services (*FRA 2013*)

The process of forest degradation can be abrupt or a slow gradual process
Forest degradation estimates


- Most of the existing data on degradation refer to the extent and rate of ecosystem conversion, rather than degradation

- **Globally:** 21.8% of land area converted to human-dominated uses or production landscapes
  - about 1/3 of total land area converted to agricultural land, including permanent pasture

- **Study of forest landscapes** (Laestadius et al. (2012)):
  - Degraded = 27 % (1,459 M ha)
  - Fragmented = 52 % (2,814 M ha)
  - Intact forest = 21 % (1,112 M ha)
DRIVERS OF DEFORESTATION AND FOREST DEGRADATION

- **Driver** → Any natural or human-induced factor that directly or indirectly causes a change in an ecosystem [Millennium Ecosystem Assessment]

- **Categories of drivers** (Nelson et al. 2006)

**Direct drivers**

- **Physical and biological drivers:**
  - Climate variability and change
  - Plant nutrient use (*nutrient application to agricultural systems*)
  - **Land conversion**
  - Biological invasions and diseases

**Indirect drivers**

- **Demographic drivers**
  - Population dynamics and primary determinants of population change: fertility, mortality, and migration

- **Economic drivers**
  - Consumption, production and globalization

- **Sociopolitical drivers**
  - Forces that influence decision making in the large conceptual space between economics and culture

- **Cultural and religious drivers**

- **Scientific and technological drivers**

**Drivers interact** across spatial, temporal, and organizational scales.

In some specific cases, **multiple direct drivers work in combination**.
### Direct drivers of DEFORESTATION

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture (commercial)</td>
<td>Forest clearing for cropland, pasture and tree plantations for both international and domestic markets, usually large to medium scale.</td>
</tr>
<tr>
<td>Agriculture (subsistence)</td>
<td>For subsistence agriculture, includes both permanent subsistence and shifting cultivation, usually by (local) smallholders.</td>
</tr>
<tr>
<td>Mining</td>
<td>All types of surface mining.</td>
</tr>
<tr>
<td>Infrastructure</td>
<td>Roads, railroads, pipelines, hydroelectric dams.</td>
</tr>
<tr>
<td>Urban expansion</td>
<td>Settlement expansion.</td>
</tr>
</tbody>
</table>

### Direct drivers of FOREST DEGRADATION

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Timber/logging</td>
<td>Selective logging, for both commercial and subsistence use, includes both legal and illegal logging.</td>
</tr>
<tr>
<td>Uncontrolled fires</td>
<td>Includes all types of wildfire.</td>
</tr>
<tr>
<td>Livestock grazing in forests</td>
<td>On both large and small scales.</td>
</tr>
<tr>
<td>Fuelwood/charcoal</td>
<td>Fuelwood collection, charcoal production, for both domestic and local markets.</td>
</tr>
</tbody>
</table>

(Hosonuma et al., 2012)
Continental-level estimations of relative importance of deforestation and forest degradation drivers (Hosonuma et al. 2012)

In Latin America

Commercial agriculture (including livestock) → the most important driver of deforestation (~2/3 of total deforested area)

Commercial timber extraction and selective logging → main drivers of forest degradation (more than 70%)
Pressures from many international (indirect) drivers to clear forests are expected to increase in future due to: (Kissinger et al. 2012)

→ global urbanization
→ increasing developing country prosperity
→ changing food consumption patterns (meat-based diets)
→ growth in developing country regional markets for key commodities
→ long-term population trends
→ climate change adaptation factors

No one size-fits-all --- As drivers of D&D operate at sub-national, national, regional, and global scales, so too must strategies and interventions aiming to affect them, engaging actors at various scales
### Availability of data is an issue!!

- Data to assess the drivers is not easily available
- Difficulties to establish clear links between underlying factors and deforestation/degradation patterns

### Options for monitoring approaches and data sources of the main forest change activities and drivers on the national level *(Kissinger et al. 2012)* – **EXAMPLES:**

<table>
<thead>
<tr>
<th>Activity/Driver of deforestation and forest degradation</th>
<th>Indicator for mapping</th>
<th>Common sources for activity data (on national level)</th>
<th>Common data sources for emission factors/estimations (on national level)</th>
<th>Examples of other data on proxies and for accessing underlying causes</th>
</tr>
</thead>
</table>
| Commercial agricultural clearing for cattle ranching, row crops etc. | Large clearings; post-clearings land-use | Historical satellite data for deforestation area and land-use following deforestation | Traditional national forest inventories/ground measurements | ▪ Commodity prices  
▪ Agriculture census  
▪ Agriculture GDP, export etc. |
| Subsistence agriculture, small-holder farming and shifting cultivation | Small clearings, often rotational fallow cycles | Historical satellite data for determining area and rotation pattern | Traditional national forest inventories/ground measurements and targeted surveys  
Efforts to assess long-term net emissions | ▪ Population growth in rural and urban areas  
▪ Agriculture imports,exports  
▪ Land-use practices (i.e. rotation cycles etc.) |
## Analysis and assessment of drivers in South American countries

*(Hosonuma 2012, Kissinger et al. 2012)*

### Summary of the main country reported information on direct and indirect drivers

<table>
<thead>
<tr>
<th>COUNTRY</th>
<th>DIRECT DRIVERS</th>
<th>INDIRECT DRIVERS</th>
</tr>
</thead>
</table>
| **ARGENTINA**  
*(FCPF June 2010)* | - Industrial/ commercial soybean  
- Biofuel *(new threat)*  
- Livestock production *(expected to increase)* | - Climate change  
- Increased international demand and prices for certain commodities  
- Insufficient law enforcement  
- Change of scale and increased availability of capital associated with the emergence of crops consortia  
- Macro-economic factors |
| **BOLIVIA**  
*(UN-REDD March 2010)* | - Agricultural expansion  
- Illegal forest activity  
- Infrastructure *(electrification, oil exploration & extraction, roads)*  
- Fires  
- Degradation mostly from domestic logging *(incl. firewood)* and legal and illegal forest sector activity | - Inobservance of land use legislation  
- Agricultural incentives *(policy, subsidies)*  
- Weak forestry sector  
- Governance and enforcement  
- International demand for agricultural/ wood products/ bio-fuels  
- Demographic growth  
- Corruption |
<table>
<thead>
<tr>
<th>COUNTRY</th>
<th>DIRECT DRIVERS</th>
<th>INDIRECT DRIVERS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CHILE</strong></td>
<td>• Fuel wood extraction</td>
<td>• Weak institutions</td>
</tr>
<tr>
<td><em>(FCPF R-PIN Jan 2012)</em></td>
<td>• Illegal logging</td>
<td>• Socio-cultural and economic barriers – land tenure and rural poverty</td>
</tr>
<tr>
<td></td>
<td>• Livestock production</td>
<td></td>
</tr>
<tr>
<td><strong>COLOMBIA</strong></td>
<td>• Agricultural expansion (legitimate and illicit)</td>
<td>• Population growth</td>
</tr>
<tr>
<td><em>(R-PP (FCPF September 2011)</em></td>
<td>• Livestock</td>
<td>• Migration</td>
</tr>
<tr>
<td></td>
<td>• Settlement</td>
<td>• Market trends</td>
</tr>
<tr>
<td></td>
<td>• Infrastructure</td>
<td>• Land speculation</td>
</tr>
<tr>
<td></td>
<td>• Mining</td>
<td>• Low perceived value of forests</td>
</tr>
<tr>
<td></td>
<td>• Illegal logging</td>
<td>• Political / institutional-weak policies and governance</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Poor land management</td>
</tr>
<tr>
<td><strong>PERU</strong></td>
<td>• Agricultural expansion (including oil palm, soybean and illegal crops)</td>
<td>• Infrastructure expansion</td>
</tr>
<tr>
<td><em>(R-PP (March 2011)</em></td>
<td>• Cattle raising</td>
<td>• Population increase</td>
</tr>
<tr>
<td></td>
<td>• Slash and burn clearing and logging</td>
<td>• Poverty</td>
</tr>
<tr>
<td></td>
<td>• Transportation</td>
<td>• Social exclusion</td>
</tr>
<tr>
<td></td>
<td>• Energy</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Mining infrastructure</td>
<td>• Lack of management control in forest concessions and in wood value chain</td>
</tr>
<tr>
<td></td>
<td>• In future: Investment plans and the pressure of illicit activities</td>
<td></td>
</tr>
</tbody>
</table>
Analysis of deforestation in the Region
(Grau and Aide (2008))

- **Traditional shifting agriculture and cattle ranching** → historically the main drivers of deforestation, **BUT**

- **Export-oriented industrial agriculture** → has become the main driver of deforestation
  - **Amazon basin** → Lost the largest area to deforestation: conversion to agriculture and pastures, and increasingly to large-scale agriculture

- **Soybean production** → in extensive areas of seasonally dry forest with flat terrain: Brazil, Bolivia, Paraguay, Argentina

- **CRITICAL UNDERLYING DRIVERS** of D&D identified by countries → **weak forest sector governance and institutions**, including **conflicting policies beyond the forest sector**, and **illegal activity** (related to weak enforcement) *(Kissinger et al. 2012)*
Map of Latin America main biomes
(based on Eva et al. 2004), showing the main deforestation fronts (based on FAO 2003 and Gasparri et al. 2008) and selected case studies of ecosystems regeneration

Grau and Aide (2008)
CASE STUDY: ANALYSIS OF LANDSCAPE TRANSFORMATION IN TROPICAL LATIN AMERICA

(Pacheco et al. 2011)

- Focus on **productive landscapes** and the groups of producers and extractors associated with them

- **Changing policies and market environments** have influenced the development of tropical forest landscapes in Latin America by shaping opportunities and constraints for social actors
### Landscape transformation in tropical Latin America (Pacheco et al. 2011)

<table>
<thead>
<tr>
<th>Types of social actors</th>
<th>Land-use management</th>
<th>Main type of land-use</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>INDIGENOUS PEOPLE</strong></td>
<td>Forest-based activities and shifting agriculture</td>
<td>Forest resources extraction and shifting agriculture</td>
</tr>
<tr>
<td><strong>TRADITIONAL SUBSISTENCE SMALLHOLDERS</strong></td>
<td>Shifting agriculture and some forest extraction</td>
<td>Food production in restored forest fallows</td>
</tr>
<tr>
<td><strong>SMALL-SCALE FARMERS</strong></td>
<td>Small-scale sedentary agriculture</td>
<td>Mainly agricultural production under diversified systems</td>
</tr>
<tr>
<td><strong>LARGE-SCALE FARMERS AND RANCHERS</strong></td>
<td>Large-scale agriculture</td>
<td>Agricultural production under extensive or intensive systems</td>
</tr>
<tr>
<td><strong>LOGGERS AND TIMBER COMPANIES</strong></td>
<td>Logging could be linked to land- speculation goals</td>
<td>Selective logging and marketing of valuable timber species</td>
</tr>
</tbody>
</table>

Notes:
- Forest resources extraction and shifting agriculture
- Food production in restored forest fallows
- Mainly agricultural production under diversified systems
- Agricultural production under extensive or intensive systems
- Selective logging and marketing of valuable timber species
Type of landscape

**AGRICULTURAL LANDS** DOMINATED BY AGRIBUSINESS

**PASTURE LANDS** DOMINATED BY EXTENSIVE CATTLE RANCHING

**FOREST–AGRICULTURE MOSAICS** UNDER DIVERSIFIED LAND USES

**FRONTIER AREAS** WITH DOMINANCE OF LOGGING

**AREAS BEYOND THE AGRICULTURAL FRONTIER** W/ LOCAL POPULATIONS

Social actors

Medium- and large-scale **farmers**

Medium- and large-scale **ranchers**

Peasants and migrant **colonists**

**Timber companies**, informal **loggers** and **migrant peasants**

**Indigenous people** and other traditional smallholders
Exogenous and endogenous factors that define landscape type and development

- The most important **EXTERNAL FACTORS** relate to
  - **Market conditions** - national and international (e.g., volume of demand and amount of investments)
  - **Policy frameworks** (e.g., taxes, fiscal incentives, public spending on infrastructure)

- The **ENDOGENOUS FACTORS** have to do with socio-economic interactions that take place in specific landscapes, i.e.:
  - Acquisition and legitimization of **land rights**
  - **Technology adoption**
  - Development of **value chains and power relationships**

- The **interactions** of these two sets of factors define outset, development path and **landscape outcome**
### Exogenous dynamics ‘from outside’

<table>
<thead>
<tr>
<th>Type of landscape</th>
<th>Trade and investment</th>
<th>Public policies</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>AGRICULTURAL LANDS</strong> dominated by agribusiness</td>
<td>Increasing global demand of agricultural commodities. Large investment in processing and storage facilities</td>
<td>Roads improvement, availability of cheap credit and export incentives</td>
</tr>
<tr>
<td><strong>PASTURE LANDS</strong> dominated by extensive cattle ranching</td>
<td>Increasing global consumption of beef. Growing number of slaughterhouses and meat-packing plants</td>
<td>Tax reduction and availability of financial incentives</td>
</tr>
<tr>
<td><strong>FOREST–AGRICULTURE MOSAICS</strong> under diversified land uses</td>
<td>Expansion of niche markets often for perennial crops</td>
<td>Reduced support for colonization settlements, though there is still some land distribution</td>
</tr>
<tr>
<td><strong>FRONTIER AREAS</strong> with dominance of logging</td>
<td>Expansion of demand for tropical timber, and growing links with export markets</td>
<td>Expansion of roads, allocation of concessionary rights in some cases</td>
</tr>
<tr>
<td><strong>AREAS BEYOND THE AGRICULTURAL FRONTIER</strong></td>
<td>Limited but growing markets for non-timber forest products</td>
<td>Increasing recognition of collective tenure rights, mainly for indigenous &amp; other local people</td>
</tr>
<tr>
<td>Type of landscape</td>
<td>Endogenous processes ‘from inside’</td>
<td></td>
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<td></td>
</tr>
<tr>
<td><strong>AGRICULTURAL LANDS</strong> dominated by agribusiness</td>
<td>Development of vigorous financial and market networks, involving links with international trade corporations</td>
<td></td>
</tr>
<tr>
<td><strong>PASTURE LANDS</strong> dominated by extensive cattle ranching</td>
<td>Adoption of improved pasture and cattle management techniques</td>
<td></td>
</tr>
<tr>
<td><strong>FOREST–AGRICULTURE MOSAICS</strong> under diversified land uses</td>
<td>Development of non-farm economies, growing pressure on land and emigration</td>
<td></td>
</tr>
<tr>
<td><strong>FRONTIER AREAS</strong> with dominance of logging</td>
<td>Extenuation of valuable timber species due to the adoption of selective logging operations</td>
<td></td>
</tr>
<tr>
<td><strong>AREAS BEYOND THE AGRICULTURAL FRONTIER</strong> with local populations</td>
<td>Growing social pressures for recognition of tenure claims and provision of social services</td>
<td></td>
</tr>
</tbody>
</table>
Cuiaba-Santarém Frontier Evolution

- Large scale crops with high value in the market
- Intensive cattle ranching and perennial crops
- Extensive Cattle Ranching and slash and burn agriculture

Source: IPAM 2005
Opportunities and threats (Grau and Adide 2008)

- **Forest transition** occurs when
  → an economy shifts toward non-agricultural production
  → agriculture concentrates in the most productive lands, and
  → marginal agriculture is abandoned, favoring the recovery of forests and other natural ecosystems

- **Highly inefficient land-use practices** in the region have significantly reduced or transformed natural ecosystems

- **Conflict between food production and conservation** of natural and semi-natural ecosystems

- **Opportunity to achieve LU efficiency** → a shift from traditional agriculture (grazing pastures) to modern agriculture (increase in per hectare food productivity)
  + **Policies** facilitating migration and discouraging non-competitive production systems
Gracias !!!