Satellites and the implementation of REDD+: a case study from Indonesia

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What is REDD+?

Reducing Emissions from Deforestation & forest Degradation

REDD+ has emerged from the UNFCCC process

REDD+ will create economic incentives to halt forest loss
REDD+ not a new idea

Malaysian Prime Minister Mahathir bin Mohamad (1992)

Advocated that

« If it is in the interests of the rich that we do not cut down our trees, then they must compensate us for the loss of income »
RIO Earth Summit - 1992

Concept of “compensation for opportunity cost forgone” and “common but differentiated responsibilities” introduced

But not adopted
Timeline for REDD

• Formally discussed in COP11 (Montreal), 2005
• Bali Action Plan (COP13, 2007)
• Poznan, 2008 – REDD+ born
• COP15, Copenhagen Accord ‘taken note of’ (2009): included REDD+
• Further progress in subsequent COPs
• Framework to be agreed Paris 2015 for implementation from 2020
How will REDD+ payments be made?

• No agreement on how REDD+ will be financed
• REDD+ Readiness payments already made
• For full REDD+, payments likely to be by results
• Need good country-level Measurement, Reporting & Verification
Measurement, Reporting & Verification

- UNFCCC rules for REDD+ not yet fixed, so use:
  - IPCC Guidelines
  - FCPF Guidance
  - UN REDD Guidance
  - GOFC-GOLD Sourcebook
  - GFOI Methods & Guidance (2014)
Why not do MRV internationally?

- National sovereignty
- Local differences in forest structure, forest definitions, carbon storage
- Local differences in deforestation pressures
IPCC Basic methodology

Activity Data $\times$ Expansion Factors = Emissions estimate

1) Activity data – satellite data

2) Carbon content – expansion factors

Tropical broadleaved forest = 160 Mg C ha$^{-1}$
Tropical savanna woodland = 35 Mg C ha$^{-1}$

3) Degradation
Satellite data essential for MRV

• Need for frequent whole-country coverage
• Need for consistent measurements
  → only possible with satellites
Indonesia

- > 130m ha of forest; 70% of national territory
- Rate of deforestation c. 2 million ha per year
- Significant emissions from peatland loss
Forest and peatland fires affect local population health, schools, transport and the wider region (e.g. Singapore)
Indonesia’s peat forests

• Key global carbon source
• Deforestation, drainage, climate change

41% of Indonesia’s 2005 GHG emissions were from peatland loss
Indonesian Response

- Committed to 7% annual economic growth
- Committed to 41% emission reduction by 2020
- US$1 bn from Norway for performance-based REDD+.

Examples:
- 2-yr moratorium on new forest concession licences
- REDD+ Pilot Provinces: started with Central Kalimantan
- REDD+ Demonstration Activities

But...
- Profits from palm oil worth US$16 bn per year
- New Administration might have different objectives
Indonesian forest protection laws

President Instruction No. 10/2011 on Forest Moratorium (Development of REDD+ schemes including Indicative Moratorium maps)

President Instruction Inpres 6/2013 on extension of the forest moratorium [Executive] (extends moratorium to 2015)

Regulation Of The Minister Of Forestry Number : P.27/Menhut-II/2006 on Indonesia's Forestry Long Term Development Plan [Executive] (Aims to improve sustainability of forest management: improved management of extractive industry, improved conservation in protected areas)

Law No. 6 / 2007 on Spatial Planning [Legislative] (Recognises the ultimate limits of land conversion across archipelago. It says that spatial plans must include conservation areas and ensure that forest covers 30% of river and stream areas.)
Indonesian MRV System

National level

- Monitoring of deforestation
- National emissions
- Safeguards, co-benefits, drivers of forest loss
- Subnational emissions

Subnational level

Main flow

Cross checking/nesting flow

Preliminary MRV architecture as laid out by National MRV Strategy
What RS data does Indonesia plan to use?

• Landsat – though cloud and resolution problems

• SPOT - license purchased
  • High resolution data can enable more accurate assessment of land use
  • Better match to terrestrial data
Berkak REDD+ Demonstration Activity

b) Biomass in 2007.

Extent of radar scene in yellow
Berbak REDD+ Demonstration Activity

- Berbak peat forest landscape
  - Protected forests
  - Neighbouring village farms

- Business-as-usual:
  - Fires
  - Deforestation
  - Peatland subsidence
  - Degraded, flooded unusable land

- Local villagers recognise the problems, e.g. flooded fields, and want to find solutions
Challenge of achieving ‘green growth’

- Potential activities under discussion:
  - Re-wetting peat by blocking drainage canals
  - Replanting degraded forests in buffer zone
  - Shifting to certified timber
  - Improving fisheries and farming
  - Human-tiger conflict mitigation
Berkak REDD+ MRV

Two systems tested
1. G-ECO-MON – SPOT based
   - semi-automated classification
2. ALOS PALSAR – radar
   - change in backscatter
PALSAR Radar analysis

Credit: Murray Collins (PhD student, LSE/ZSL), supervised by Marcus Rowcliffe, Chris Carbone, Susana Mourato

Basal area weighted height (Lorey’s height, m) from ICESAT GAS
PALSAR Radar analysis

Credit: Murray Collins (PhD student, LSE/ZSL), supervised by Marcus Rowcliffe, Chris Carbone, Susana Mourato

Change in HV backscatter, 2007-2010 (dB)

Density

Change in HV backscatter, 2007-2010 (dB)
SPOT analysis of forest loss, 2007-2010

L-band deforestation, 2007-2010
Illegal logging within Berbak detected by radar
Illegal logging within Berbak detected by radar
Data availability

- Huge range of active optical satellites
  - Landsat series; SPOT series; RapidEye; DMCii; CBERS; Sentinel-2; etc etc

- Long-wavelength radar much more limited
  - ALOS PALSAR – 2007-2011
  - ALOS-2 PALSAR-2 – 2014-
  - SAOCOM – 2014-
  - BIOMASS (P-band) – 2020-

- Short wavelength radar
  - Sentinel 1 – 2014 – 2030s
Role for active fire in monitoring systems

Hotspot count in Jambi
Distribution of MODIS Aqua and Terra satellite observations of fire hotspots from 2001 - Oct 2011

Peat extent:
(c) Wetlands International Peat Atlas
Produced by Deltares, 2013
Lessons for Indonesia MRV

- Potential role for radar as well as optical data
  - Probably as a supplement not primary due to data availability and ease of interpretation
- Role for fire detection – early warning system
- **Most carbon stored belowground in peat**
  - Cannot easily monitor from space
- **Lots of carbon flux from forest degradation and regrowth**
  - Cannot easily monitor from space
## Monitoring Safeguards

<table>
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<tr>
<th>UNFCCC – Cancun Agreements</th>
<th>Indonesian safeguard Principle</th>
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<tbody>
<tr>
<td>7 Cancun Safeguards</td>
<td>10 principles, 27 criteria, 97 indicators</td>
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<td>e.g. REDD+ should be consistent with forest conservation</td>
<td>Improving the conservation of natural forests, biodiversity and ecosystem services</td>
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- Countries are not obliged under UNFCCC decisions to monitor Safeguards.
- Indonesian Safeguard Principles (PRISAI) include principle of conserving natural forest.
- How to monitor ‘natural forests’ using RS?
Role for RS in safeguard monitoring

• RS *may* be able to map area of intact forest and provide indicators of disturbance

• Social variables, biodiversity etc will be ground-based, integrated with GIS systems?
Summary

• National MRV systems are being developed by all countries interested in REDD+

• Activity data will largely come from optical data – role for free datasets (Global Forest Watch)

• Deforestation and forest area can be mapped fairly well, but
  – Degradation
  – Cloud cover

• Role for radar, fire hotspots, ground data (community collected as well as professional?)
Any questions?