Drivers of Deforestation and Forest Degradation

Articulating Forest Area Change in Guyana
Outline of Presentation

An Overview of Forest Area Change Mapping

Drivers of Deforestation and Forest Degradation

Contextualizing the Drivers of Forest Change and a Discussion of Expected Future Trends

Outline of quantitative and spatial information/databases

Tools and Methodologies for Quantifying Deforestation Impacts and Mapping Spatial Patterns of Drivers
Overview

In 2009 the G.o.G embarked on a national program with the Kingdom of Norway to protect and maintain its forests thereby reducing global carbon emissions while attracting resources to foster growth and development along a low carbon emissions path.

In the Memorandum of Understanding (MoU) between these two governments, Norway committed to providing financial support of up to US$250 million by 2015 for RESULTS achieved by Guyana from REDD.

The level of support that Guyana receives depends in part on the country’s delivery of results as measured against REDD-plus Performance Indicators assessed through the national MRV System, specifically Guyana’s FACA.
Overview

Under the Guyana/Norway REDD+ Agreement the definition for a forest follows the definition as outlined in the Marrakech Accords, therefore; Guyana has elected to classify land as forest if it meets the following criteria:

- Tree cover of minimum 30%
- At a minimum height of 5m
- Over a minimum area of 1ha.

Mapping of Year 3 forest change in Guyana employed 5m RapidEye imagery for 100% forested lands, compared to only 54% for Year 2 (areas not covered by Rapideye), Landsat TM and ETM+ were used, and 30m primarily used in Year 1. This allowed for more refined reporting of change areas.
Drivers of Deforestation and Degradation

Under Guyana’s Forest Area Change Assessment activities of the national MRV System the following drivers have been identified and are monitored on an annual basis:

The five anthropogenic change drivers that lead to deforestation include:

• Forestry (clearance activities such as roads and log landings)
• Mining (ground excavation associated with small, medium and large scale mining)
• Infrastructure such as roads (included are forestry and mining roads)
• Agricultural conversion
• Fire (all considered anthropogenic and depending on intensity and frequency can lead to deforestation)
Drivers of Deforestation and Degradation

The main sources of forest degradation are identified as:

- Selective and illegal harvesting of timber (not reported spatially in the current MRVS)
- Shifting cultivation (method developed in prototype in 2012)
- Fire
- Associated with mining sites and road infrastructure
<table>
<thead>
<tr>
<th>Driver</th>
<th>Historical Period</th>
<th>Year 1 2009-10</th>
<th>Year 2 2010-11 (15 months)</th>
<th>Year 3 2012</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1990 to 2000</td>
<td>2001 to 2005</td>
<td>2006 to 2009</td>
<td>2010-11</td>
</tr>
<tr>
<td>Forestry (includes forestry infrastructure)</td>
<td>6,094</td>
<td>8,420</td>
<td>4,784</td>
<td>294</td>
</tr>
<tr>
<td>Agriculture (permanent)</td>
<td>2,030</td>
<td>2,852</td>
<td>1,797</td>
<td>513</td>
</tr>
<tr>
<td>Mining (includes mining infrastructure)</td>
<td>10,843</td>
<td>21,438</td>
<td>12,624</td>
<td>9,384</td>
</tr>
<tr>
<td>Infrastructure</td>
<td>590</td>
<td>1,304</td>
<td>195</td>
<td>64</td>
</tr>
<tr>
<td>Fire (deforestation)</td>
<td>1,708</td>
<td>235</td>
<td>32</td>
<td>58</td>
</tr>
<tr>
<td>Degradation (year 2 converted to deforestation)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Amaila Falls development</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Area Change</td>
<td>21,267</td>
<td>34,249</td>
<td>19,400</td>
<td>10,287</td>
</tr>
<tr>
<td>Total Forest Area of Guyana</td>
<td>18,473,394</td>
<td>18,452,127</td>
<td>18,417,878</td>
<td>18,398,478</td>
</tr>
<tr>
<td>Total Forest Area of Guyana Remaining</td>
<td>18,452,127</td>
<td>18,417,878</td>
<td>18,398,478</td>
<td>18,388,190</td>
</tr>
<tr>
<td>Period Deforestation %</td>
<td>0.01%</td>
<td>0.04%</td>
<td>0.02%</td>
<td>0.056%</td>
</tr>
</tbody>
</table>
Drivers of Forest Change: The Context of Each Driver

The identification of a driver of forest change is based on the characteristic(s) of that driver.

**Rocks** – Identifiable by their distinctive linearity. Linear features are deemed to be roads if the spectral response shows the presence of bare soil which is associated with the construction of unpaved roads. Soil is depicted in grey, beige or red colours in the imagery.

**Mining** – activity produces forest clearings with very variable shapes and sizes and with sharp boundaries. The clearings often occur in clusters along streams or near water bodies and in remote areas with limited road infrastructure.
Drivers of Forest Change: The Context of Each Driver

**Permanent Agriculture:** includes arable and tillage land, and agro-forestry systems where vegetation “falls below the thresholds” used for the forest land category, consistent with the selection of national definitions. Cropland is identified as permanent fields, mainly sugar cane fields, but also other crops or mixed agricultural land, as long as the agricultural component appears to be dominant.

**Fires** – cause of fires (biomass burning), which, based on local knowledge, are largely human induced or anthropogenic events, largely occurs in managed forest lands, and in the case of deforestation by fire leads to a permanent change in land use: Forestry to Cropland or Bareland.
Drivers of Forest Change: The Context of Each Driver

Shifting Cultivation – areas are not considered (spatially) in the interim MRVS, but do represent a change (albeit temporary) in carbon stock. Presented in the landscape as a mosaic of land cover that are often small and scattered, appearing in different states spanning from bare land to grassland to regenerating forest. Small forest blocks can be found within this class as well.

Forestry activity within the State Forest Area is recognized most noticeably by the appearance of roading and the degradation caused by surrounding selective harvest areas. As part of a large concessionaires‘ annual plan they are required to submit maps (to GFC) that show intended harvesting roads.
Drivers of Forest Change: Their Expected Future Trends

Forestry related change has remained relatively stable between Years 1 to 3. Agricultural developments causing deforestation have increased in Year 3 and are in line with historical levels. Mining deforestation has increased in Year 3. The majority of the activity is still constrained to areas mined in Year 2. Fire events has increased relative to the post 2000 period. The area is still similar to the mean area of deforestation from 1990 to 2000.

The temporal analysis of deforestation from 1990 to 2012 is presented in Figure 1. This map shows that most of the change is clustered and that new areas tend to be developed in close proximity to existing activities. Year 1, 2 and 3 deforestation activities fell inside the footprint of historical change areas.
Historical & Year 3 Forest Change

Legend

Period
1990 - 2000
2000 - 2005
2005 - 2009
2010
2011

Legend
Year 3 Deforestation
Quantitative and Spatial Information/Databases

Guyana’s Interim Measures Reports (Y1, Y2 and Y3) are excellent sources of quantitative and spatial information regarding the drivers of forest change measured under the MRVS.

The Guyana Forestry Commission also manages a database (Network Attached Storage) which comprises mainly spatial.

Several other governmental agencies manage specific spatial databases based on their nature of work, such as the Guyana Geology and Mines Commission and the Guyana Lands and Surveys Commission among others.
## Quantitative and Spatial Information/Databases

<table>
<thead>
<tr>
<th>Agency</th>
<th>Role</th>
<th>Data Held</th>
</tr>
</thead>
<tbody>
<tr>
<td>Guyana Forestry Commission (GFC)</td>
<td>Management of forest resources</td>
<td>Resource management related datasets</td>
</tr>
<tr>
<td>Guyana Geology and Mines Commission (GGMC)</td>
<td>Management of mining and mineral resources</td>
<td>Mining lease information. Reconnaissance areas, large and medium scale mining areas including dredge locations.</td>
</tr>
<tr>
<td>Guyana Lands and Survey Commission (GL&amp;SC)</td>
<td>Management of land titling and surveying of land</td>
<td>Land tenure, settlement extents and country boundary</td>
</tr>
<tr>
<td>Central Housing &amp; Planning Authority</td>
<td>Management of Housing &amp; Communities</td>
<td>Existing and planned housing information that are located in forested areas.</td>
</tr>
</tbody>
</table>
Tools and Methodologies: Development of Mapping Methods

During year 3 several mapping methods have been developed. The focus of this work has been on improving monitoring methods and the determination of forest degradation for a range of drivers based on the analysis of satellite imagery and further verified by field inspections. In some cases these methods are still being evaluated and will be integrated into the MRV in Year 4.

- Monitoring Forest Degradation
- Assessment of methods for monitoring change in areas under forest management
- Methodology for monitoring reforestation over mining areas and roads
- Evaluation of the method to monitor degradation caused by anthropogenic fires.
- Evaluation of methods for mapping and integration of shifting agriculture into the annual reporting framework.
Historical & Year 3 Forest Change

Legend
Period
- 1990 - 2000
- 2000 - 2005
- 2005 - 2009
- 2010
- 2011

Legend
- Year 3 Deforestation

Georgetown
GUYANA
SURINAM
Boa Vista
Mining Spatial & Temporal Distribution Y1, Y2 & Y3
Forestry Spatial & Temporal Distribution Y1, Y2 & Y3
Infrastructure Roads Spatial & Temporal Distribution Years 2 & 3
Agriculture Development Spatial & Temporal Distribution Y1, Y2 & Y3

Legend
Agriculture Ha
- 0 - 10
- 10 - 20
- 20 - 50
- 50 - 100
- 100 - 1000

Legend
Year 3 Agriculture Hectares
- 0 - 5
- 5 - 10
- 10 - 20
- 20 - 40
- 40 - 50

Georgetown

area in hectares
- 0 - 10
- 11 - 20
- 21 - 50
- 51 - 100
- 101 - 5000

2009 - 2010
Biomass Burning - Fire Temporal and Spatial Distribution Y1, Y2 & Y3
Thank You