Woody Biomass Assessment Using Very High Resolution Satellite Data

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Refugee camps and host communities

~ 2.8 billion people in developing countries dependent on biomass fuels

- Fuel wood
- Charcoal and
- Animal dung

(IEA, 2010)
Refugee camps and host communities

Fuel wood plays a vital role in **ensuring food security** of millions of people and its consumption must be better understood in order to address resource shortages and forest decline (MacDonald, Adamowicz and Luckert, 2001)

**Objective**

Detecting changes in woody biomass around refugee camps based on the need of UNHCR and local partners to create products for management and planning.
Use of very High Resolution images

• Coarse resolution has not enough detail
• Field inventory measurements in the area are hard to implement:
  • security issues and
  • limited funding

• Examples: Ethiopia, Chad, DRC, Nigeria, Tanzania, Uganda
Pre-Processing imagery

Image co-registration

Cloud masking

Seasonality
Training Data

- Shrubs
- Settlement
- Cropland
- Trees
Processing Chain

IMAD Change Detection

Image T1 → unsupervised classification/segmentation → T1 Classified

Image T2 → unsupervised classification/segmentation → T2 Classified

Training Data

Land Cover Change Map

Land Cover Change Statistics

Biomass Change Statistics

Field Data

Accuracy Assessment
Combining Field data with Map Data

From map classification

Land cover Categories (%) × Biomass coefficients = Biomass (Kg)

From field Measurements

UN-REDD Programme

Food and Agriculture Organization of the United Nations

UNDP

UNEP
Situation in Nigeria

**STRATEGIC OBJECTIVE 1**
Support lifesaving activities and alleviate suffering through integrated and coordinated humanitarian response focusing on the most vulnerable people.

**PEOPLE IN NEED IN BORNO, ADAMAWA AND YOBE**
8.5M

**STRATEGIC OBJECTIVE 2**
Enhance access to humanitarian assistance and protection services through principled humanitarian action.

**PEOPLE TARGETED**
6.9M

**STRATEGIC OBJECTIVE 3**
Foster resilience and durable solutions for affected people through restoration of livelihoods and basic social services.

**REQUIREMENTS (US$)**
1,054 M

Source: Human Resource Plan, Jan-Dec 2017
Situation in Nigeria

Source: Human Resource Plan, Jan-Dec 2017
Land Cover Map, Nigeria

True Color RGB

Classified Image

UN-REDD Programme

Food and Agriculture Organization of the United Nations
UNDP
UNEP
Change Detection Using SAFE processing Chain

SPOT 2013

SPOT 2016

UN-REDD PROGRAMME

Food and Agriculture Organization of the United Nations
UNDP
UNEP
Ethiopia

(FAO/UNHCR, 2016)
Chad
Available tools for data processing

FAO suite of modules
SAFE Processing Chain

- Standardized yet customizable processing chain,
- integrating multiple satellite data sensors and field data
- Open Source
- Efficient and quick processing of heavy data

https://github.com/lecrabe/safe_pc_tchad.git
<table>
<thead>
<tr>
<th>Description</th>
<th>Software/tool used</th>
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<tbody>
<tr>
<td>Working environment</td>
<td>Ubuntu 16.04.3 64bits</td>
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<tr>
<td>Processing languages</td>
<td>Bash 4.3.46</td>
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<tr>
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<td>Python 2.7.12</td>
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<td>Perl 5.22.1</td>
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<td>Spatial data processing</td>
<td>Open Foris Geospatial Toolkit 1.26.6</td>
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<td>Orfeo Toolbox 5.8.0</td>
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<td>Calculations</td>
<td>R 3.4.1</td>
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<td>Rstudio 1.0.153</td>
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<tr>
<td>Visualization, spatial editing, rendering</td>
<td>QGIS 2.18.3</td>
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</table>

http://www.openforis.org
Cloud computing structure

FAO Space Data and Product management System
(SEPAL)

Service providers
USGS/Landsat
ESA/Sentinel
JAXA/ALOS
Other

Access data
Search
Select
Acquire
Store

Process and Produce
Atmospheric correction
Cloud masking
Segmentation
Classification
Change detection

Direct delivery

Powered by Linux

Tools
Data & Products

End users

https://sepal.io
## Challenges related to VHR image

<table>
<thead>
<tr>
<th>Satellite</th>
<th>Resolution</th>
<th>Time Coverage</th>
<th>Price</th>
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<tbody>
<tr>
<td>Landsat</td>
<td>30 m</td>
<td>1975 - Present</td>
<td>Free</td>
</tr>
<tr>
<td>Sentinel 2</td>
<td>10m</td>
<td>2015-Present</td>
<td>Free</td>
</tr>
<tr>
<td>SPOT 4</td>
<td>10 m</td>
<td>1998-2013</td>
<td>€0.5/km²</td>
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<tr>
<td>RapidEye</td>
<td>5 m</td>
<td>2009-present</td>
<td>€1/km²</td>
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<tr>
<td>SPOT 5</td>
<td>2.5/5 m</td>
<td>2002-present</td>
<td>€3/km²</td>
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<tr>
<td>SPOT 6-7</td>
<td>1.5 m</td>
<td>2012-present</td>
<td>€5/km²</td>
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<tr>
<td>QuickBird</td>
<td>0.6 m</td>
<td>2001-present</td>
<td>€10/km²</td>
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<tr>
<td>WorldView</td>
<td>0.5 m</td>
<td>2009-present</td>
<td>€15/km²</td>
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Multi sensor possibilities

Bangladesh

In Bangladesh 4 different SPOT sensors were used for the IOM FAO collaborate work to access fuelwood in AOI

- 1994 with Spot 2 (XS)
- 1996 with Spot 3 (Pan)
- 2003 with Spot 5
- 2016 with Spot 6 and Spot 7

Uganda

combination of Radar and Optical satellite data used

- Sentinel-1
- Sentinel-2

IOM & FAO (2017)

FAO & UNHCR, 2017
References


Suggested Citation: IOM & FAO (2017). Assessment of fuel wood supply and demand in displacement settings and surrounding areas in Cox’s Bazaar District, Dhaka, Bangladesh


Thanks for your attention!