

Monitoring Land Cover Changes in Jambi Province, Sumatra using Sentinel-1 and Google Earth Engine

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GEORG-AUGUST-UNIVERSITÄT
GÖTTINGEN



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Deforestation
Remote Sensing in Tropics

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Chair of Forest Inventory
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INDONESIA HAS THE WORLD'S 3rd LARGEST TROPICAL FOREST (2010)

FWI/GFW (2002). The State of the Forest Indonesia. Bogor, Indonesia. Washington D.C. :
World Resources Institute, Forest Watch Indonesia, Global Forest Watch.



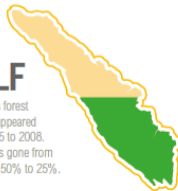
and yet
Indonesia ranks 2nd in the world for tropical deforestation

498.000 Ha/year

2000-2010 (FAO State of the Forest, 2011)

HALF

of Sumatra's forest
cover has disappeared
from 1985 to 2008.
Forest cover has gone from
50% to 25%.





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- Near real-time detection
- Land cover change detection → Burned area
- Area calculation
- Evaluation of suitability of Sentinel-1



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- Hosted by the European Space Agency (ESA)
- C-SAR
- Two-satellite constellation
- Spatial resolution: up to 5 x 5 m
- Temporal resolution: 6 days
(up to 3 days over Europe and Canada)



European Space Agency





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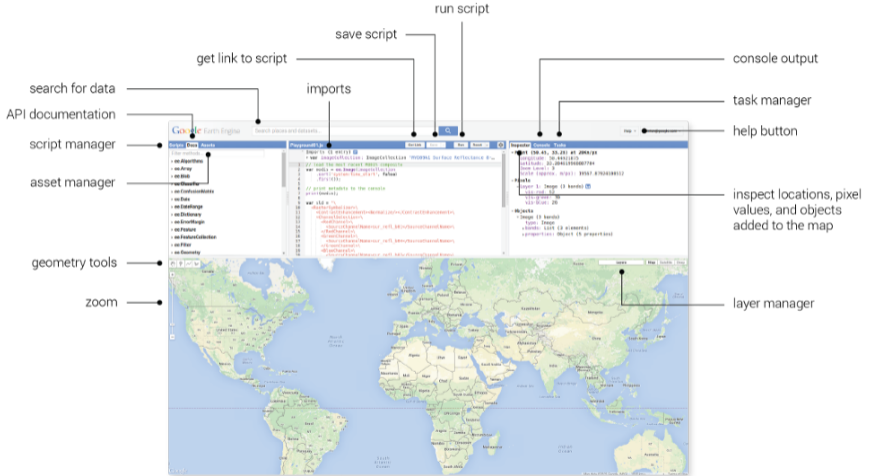
- Data download not necessary
- Huge computational power
- Platform for the scientific analysis of high-resolution imagery
- Team of > 100 programmers
- Java Script or Python API





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- Clear cut or burned area of a minimum size is required

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- Clear cut or burned area of a minimum size is required
- Sentinel-1 Ground Range Detection (GRD) of 2015

```
// Load the Sentinel-1 ImageCollection.  
var sentinel1 = ee.ImageCollection('COPERNICUS/S1_GRD')  
    .filterDate('2015-'+monthi+'-01', '2015-'+monthi+'-28')  
    .filterBounds(geometry);
```

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- Clear cut or burned area of a minimum size is required
- Sentinel-1 Ground Range Detection (GRD) of 2015
- Filtering for Interferometric Wide Swath Mode (IW), dual polarization (VH)

```
var vh = sentinel1
    // Filter to get images with VV and VH dual polarization.
    .filter(ee.Filter.listContains('transmitterReceiverPolarisation', 'VH'))
    // Filter to get images collected in interferometric wide swath mode.
    .filter(ee.Filter.eq('instrumentMode', 'IW'));
```

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- Clear cut or burned area of a minimum size is required
- Sentinel-1 Ground Range Detection (GRD) of 2015
- Filtering for Interferometric Width (IW), dual polarization (VH)
- Processing monthly mean SAR imagery
- Calculating the differences between two months

```
var tempvh = vh.select('VH').mean().select([0], ['VH_'+month]);
```

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- Processing monthly mean SAR imagery
- Calculating the differences between two months
- **Visual interpretation**
- **Dual temporal composite**
- **Validation: MODIS**

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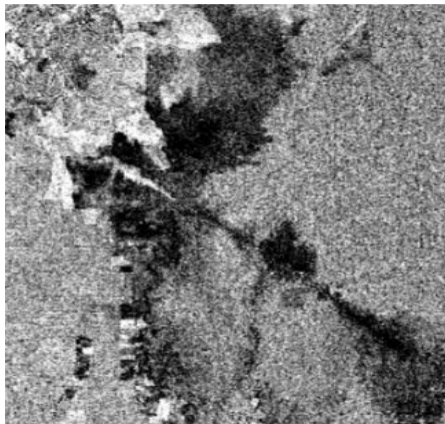
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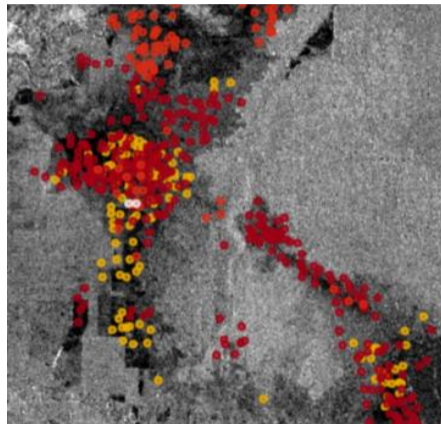
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July - November 2015



● August

● October

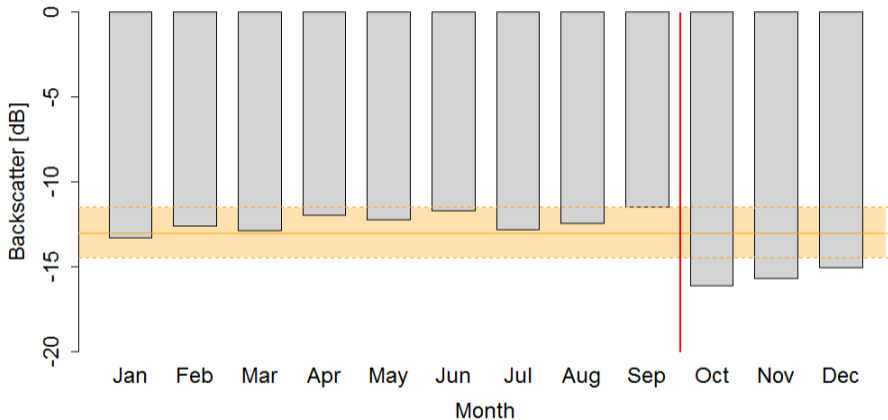
● September

● November

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- Earth Engine provides preprocessed data (Level 1 GRD)
- Powerful tool for change detection with a high spatial and temporal resolution

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- Earth Engine provides preprocessed data (Level 1 GRD)
 - Powerful tool for change detection with a high spatial and temporal resolution
 - Changes in backscatter are caused by many different aspects:
 - Acquisition mode
 - Local topographic aspects like slope or surface roughness
 - Water content
- ⇒ complicate the distinction between actual change in land cover caused by fire or anthropogenic disturbances

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- ⇒ complicate the distinction between actual change in land cover caused by fire or anthropogenic disturbances
- **Validation data**

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- This study showed successfully the suitability of Sentinel-1 data for monitoring burned areas and its expansion on a high temporal resolution
- Radar imagery is a beneficial tool for observing land cover change



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- This study showed successfully the suitability of Sentinel-1 data for monitoring burned areas and its expansion on a high temporal resolution
- Radar imagery is a beneficial tool for observing land cover change
- **Automatic classification**
- **Area calculation**

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Thank you for your attention!