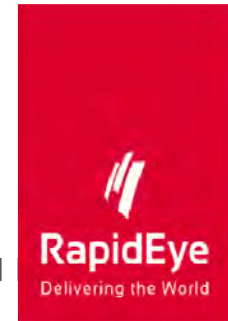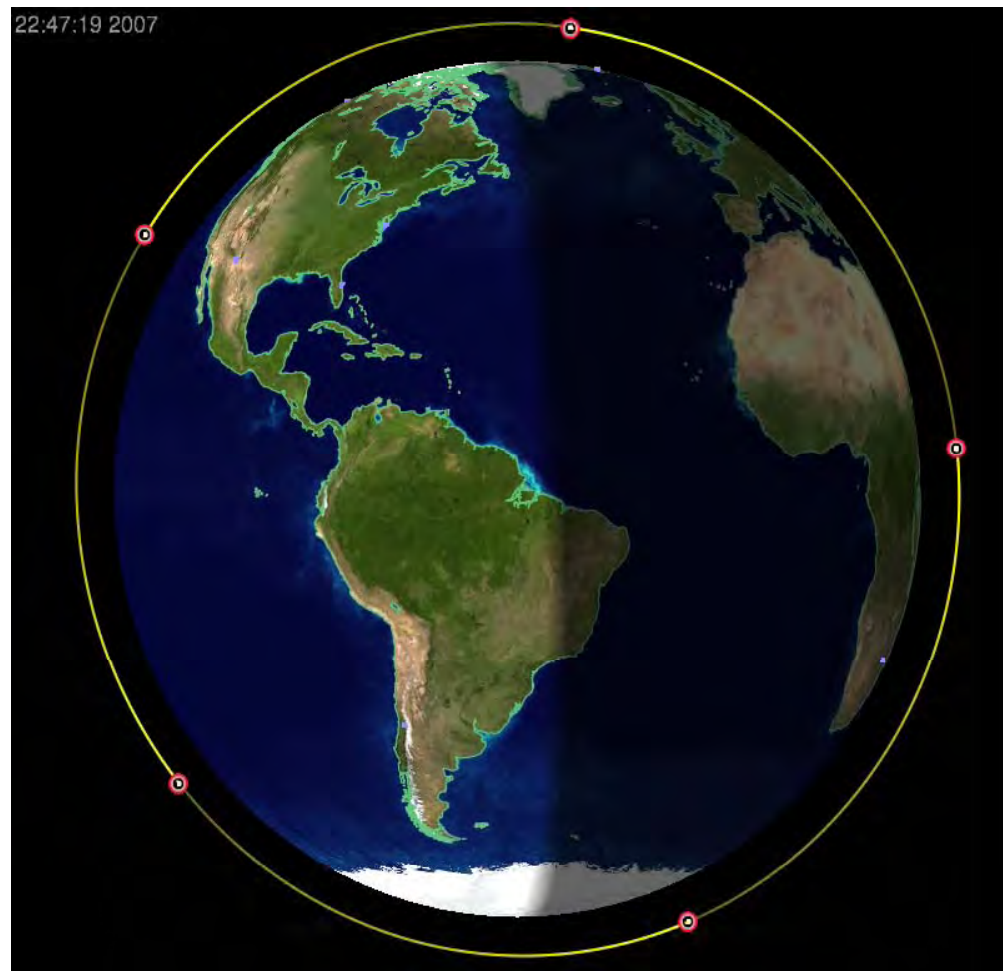# EXAMPLES OF THE USE OF RAPIDEYE IMAGERY TO CLIMATE CHANGE: REDD PROGRAM
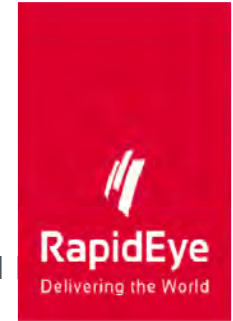
James Durana
Asia Pacific Region
Jakarta

RapidEye AG

- A global imagery and service provider

- 5 satellite constellation
- 5 m imagery
- 5 bands (including red edge)

- Empowering global land-use decisions

22:47:19 2007

RAPIDEYE Mission Drivers
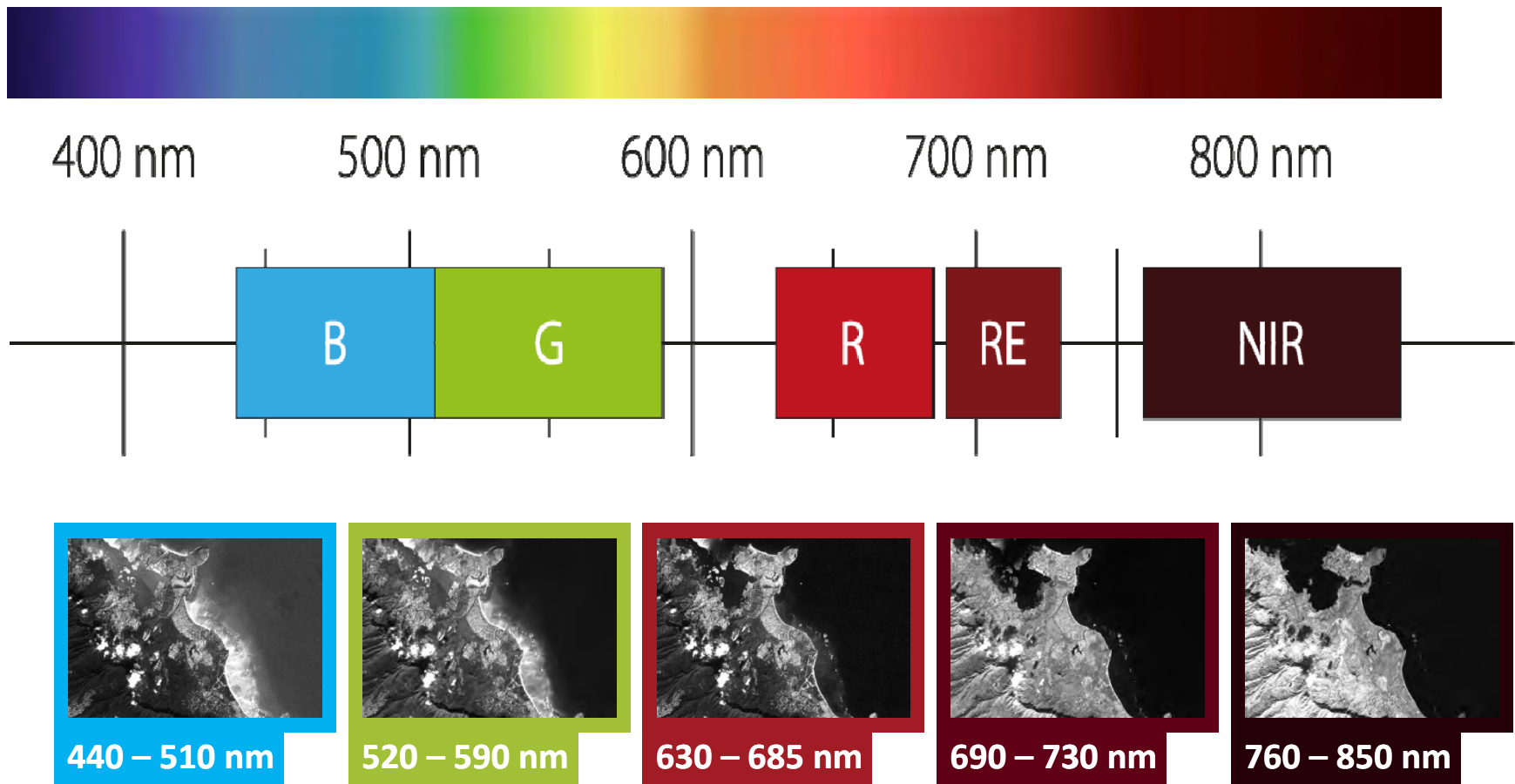
Full Operational Capacity

Acquisitions – Directed

Background Mission (BGM)
High Interest Areas, Natural
Disaster Assessment Monitoring
National Level Coverages
REDD Program,
Agriculture Monitoring &
Forecasting

Build Extensive Archive
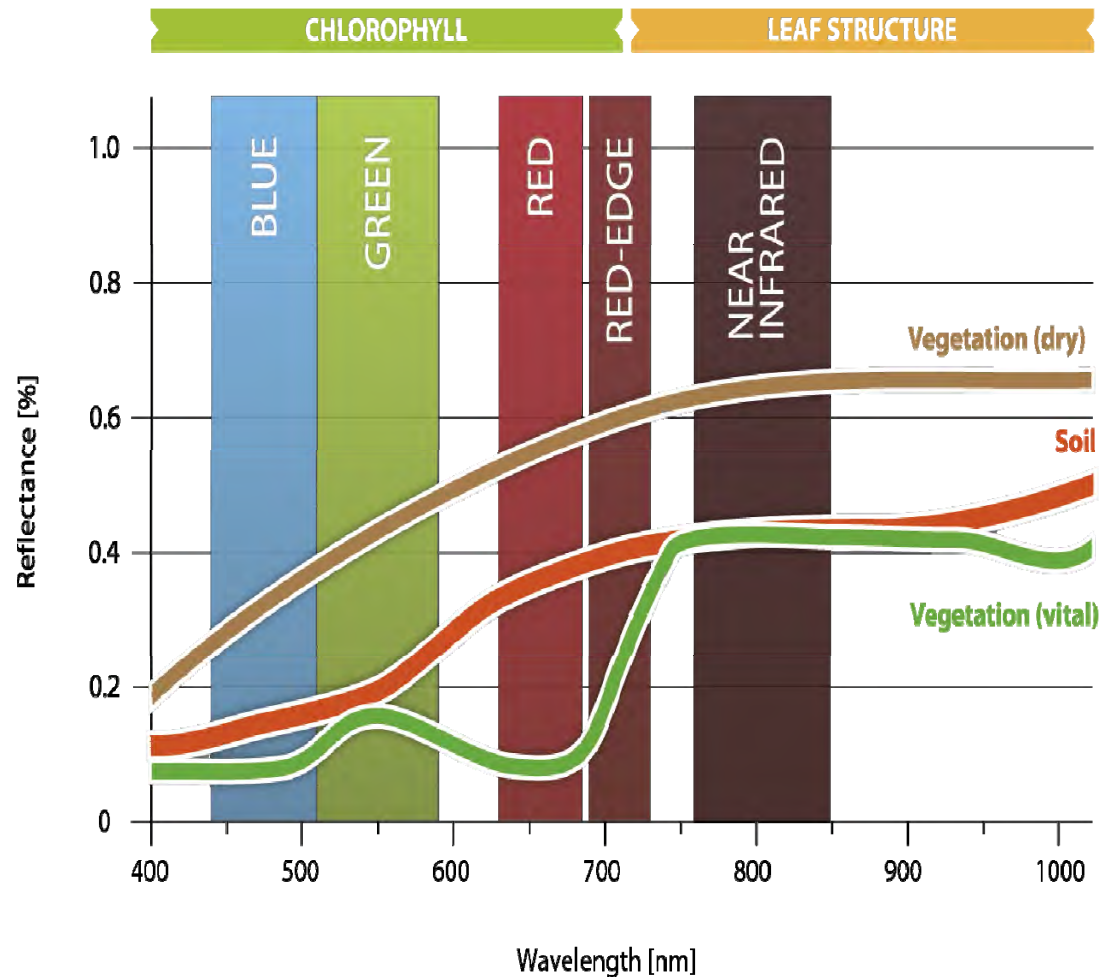Continuous Record of the Earth's   Surface,
2009 – 2019 and beyond

5 Bands: Spectral Resolution

400 nm   500 nm   600 nm   700 nm   800 nm

B   G   R   RE   NIR

440 – 510 nm   520 – 590 nm   630 – 685 nm   690 – 730 nm   760 – 850 nm
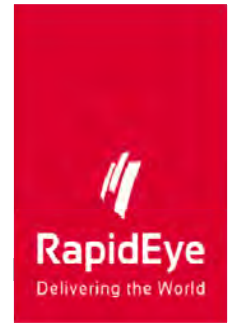
The Red Edge Band

The Red-Edge band is used to monitor vegetation health, improve species separation and measure Chlorophyll, Protein and Nitrogen content
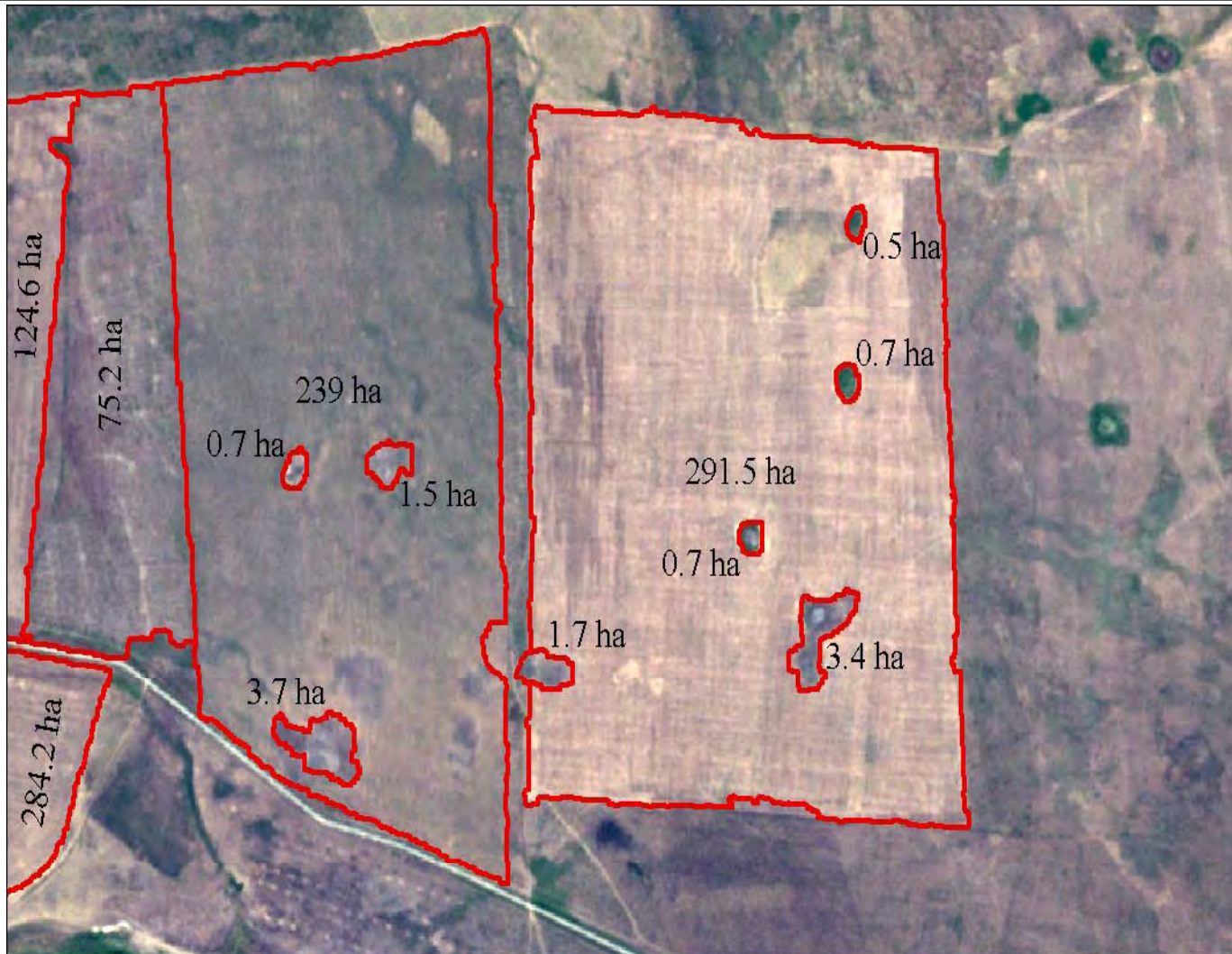
RapidEye 5 m Resolution Imagery:
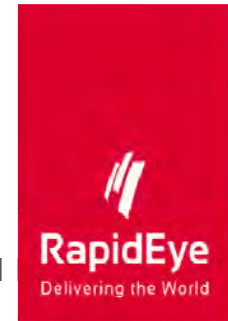## For details

- ### Notice Roofs
  - True blue band
- ### Notice Runway Centerline
  - Right amount of detail
- ### Notice Airplanes
  - Identify individual features
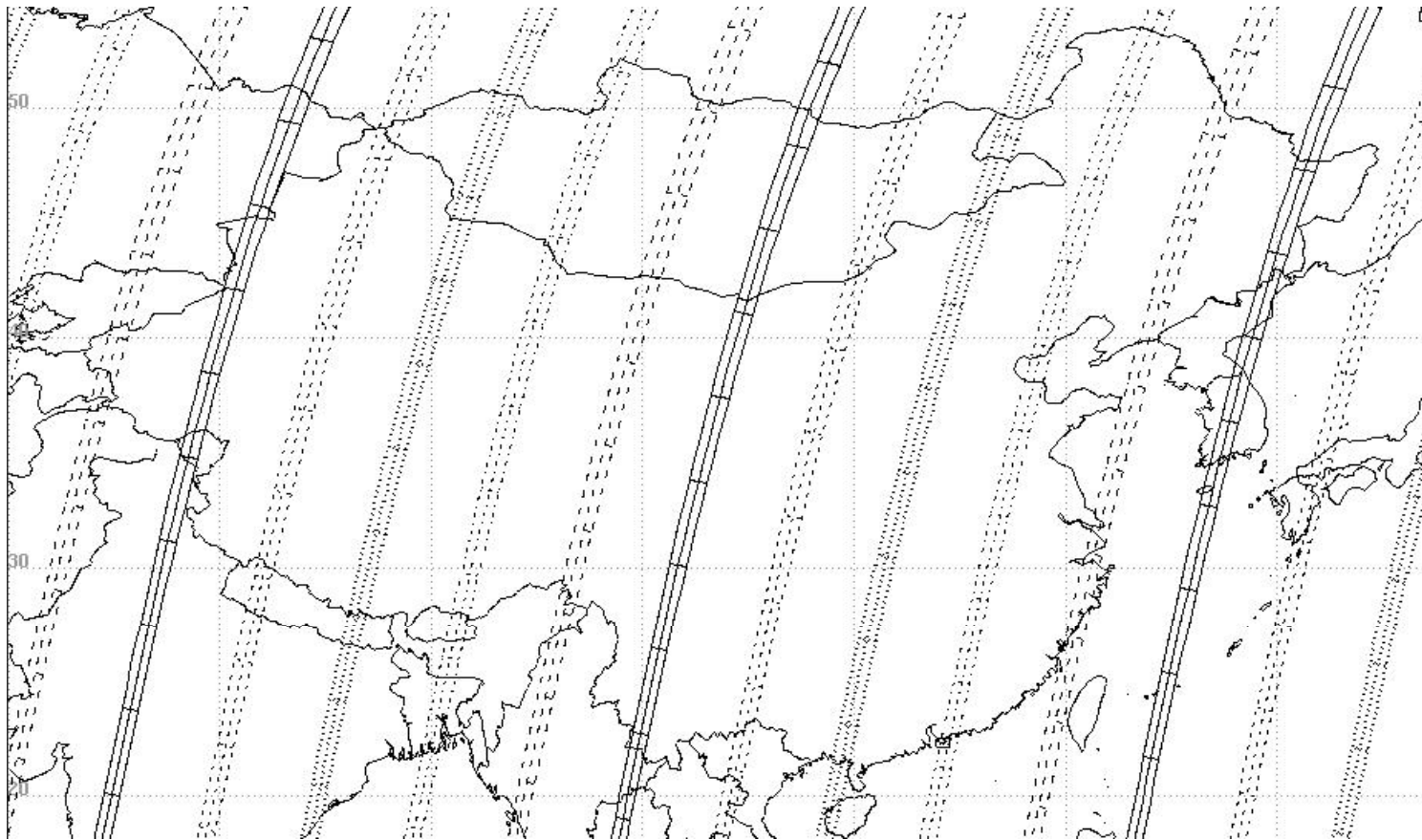- ### Positional Accuracy
  - 1:25,000 map scale possible

Beijing , China International Airport

Rural Cadaster:
Digitization of Field Boundaries

RapidEye: Daily coverage over China

The importance of temporal resolution
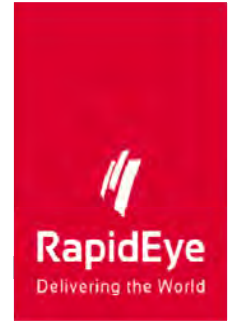
Quick vegetation regrowth after fire impact

22.05.2009

28.07.2009

two month later...

1 km

Deforestation
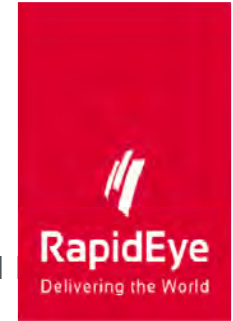
Short-term changes
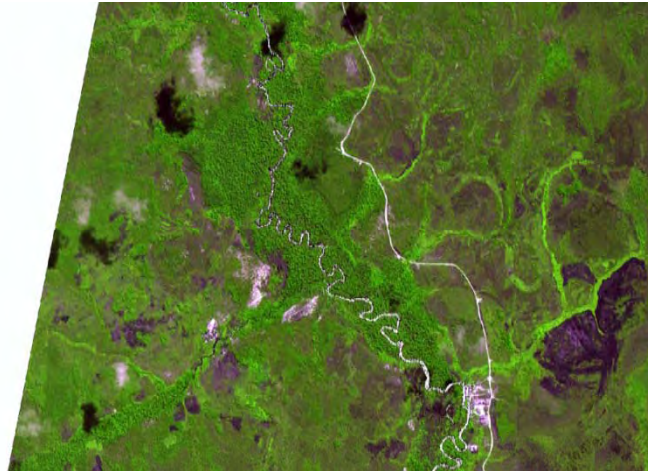
22.05.2009
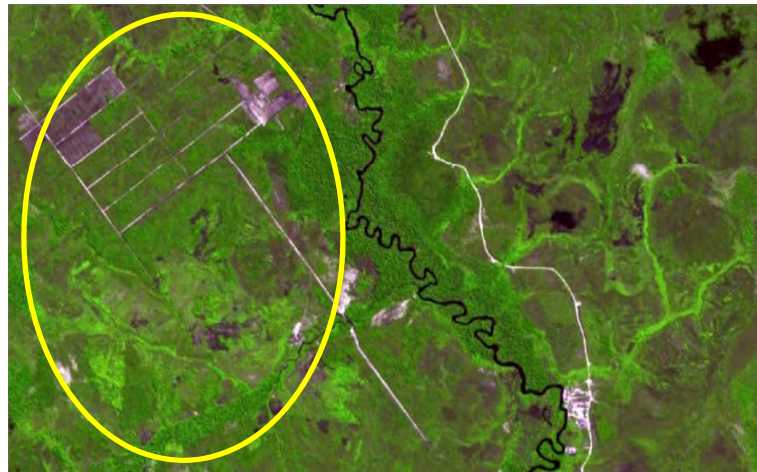
28.07.2009

Take Home Message
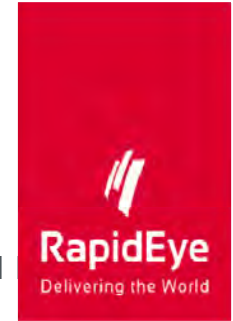
5,000,000 km^2

Daily collection capacity – the new industry benchmark

2019

Life extended until at least

Data Continuity

Focus for 2013

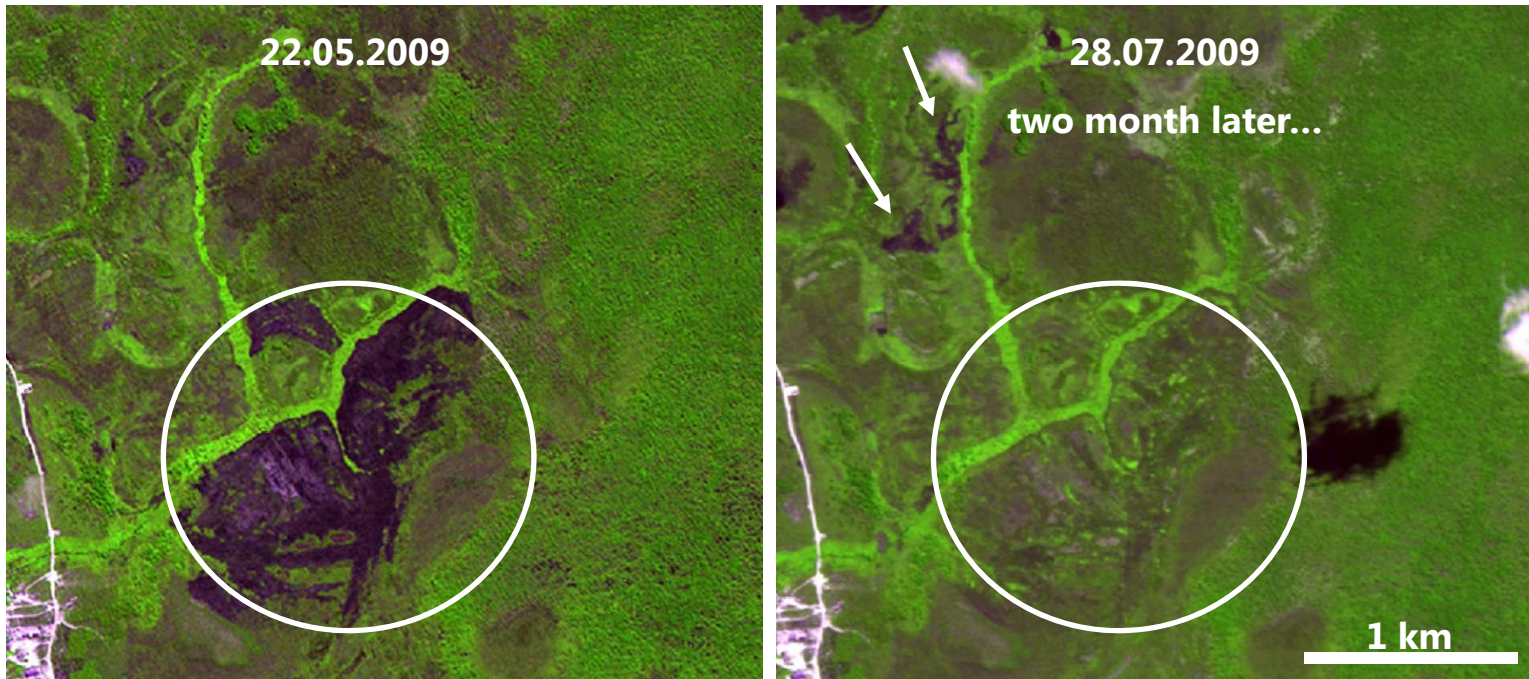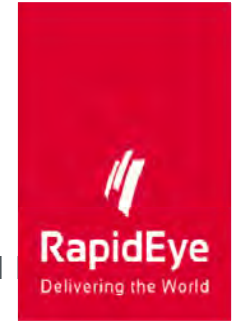# What is REDD+

REDD stands for internationally funded efforts undertaken at the national level to **R**educe **E**missions from **D**eforestation and forest **D**egradation

The + stands for: Additionally fostering conservation, sustainable management of forests, and enhancement of forest carbon stocks in particpating countries

Greenhouse gas emissions by sector

Global GHG Emissions (2005)

- Electricity & Heat 26.6%
- Manufacturing & Construction 11.2%
- Transportation 11.6%
- Other Fuel Combustion 8.2%
- Fugitive Emissions 3.8%
- Industrial Processes 4.0%
- Waste 3.1%
- International Bunkers 2.1%
- Land-use Change and Forestry 16.3%
- Agriculture 13.1%

GET UPDATED SOURCESource: www.conservation.org

Greenhouse gas emissions (2005)
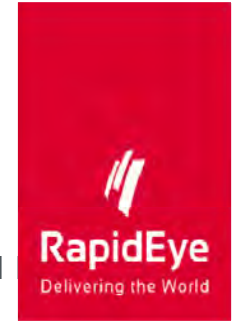
7200 Mt CO2e
3200
1200
330
56
2.6
0

Source: wikipedia.org

What is REDD+

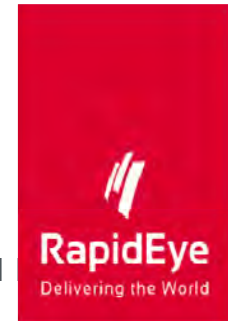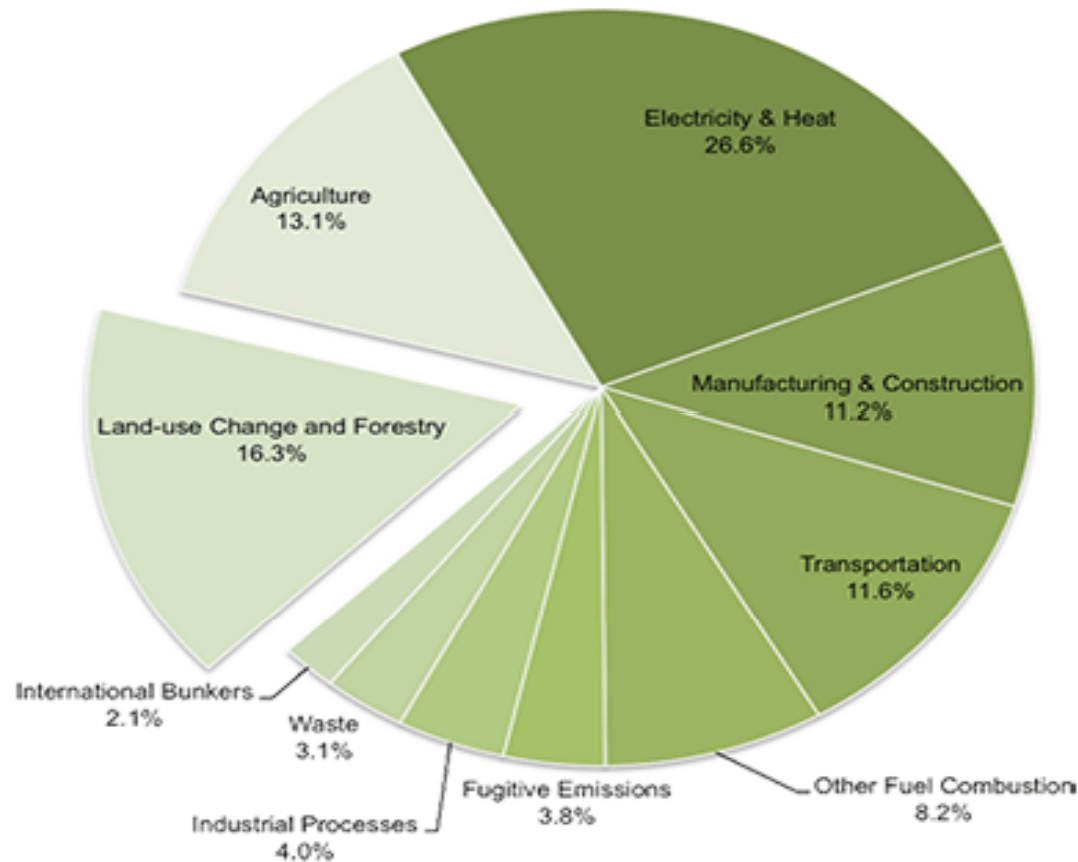**REDD** stands for internationally funded efforts undertaken at the national level to **R**educe **E**missions from **D**eforestation and forest **D**egradation

The + stands for: Additionally fostering conservation, sustainable management of forests, and enhancement of forest carbon stocks in particpating countries

REDD "Requirements"
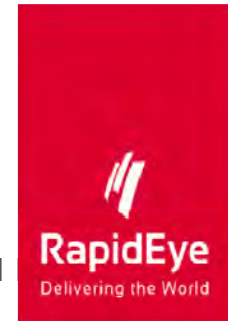
Regular, reliable monitoring wall-to-wall

Data continuity

Detailedness (MMU 0.5 ha) perfect for forest degradation

Availability through BGMs

Positional accuracy, but more important co-registration for change detection

MONITORING LOW INTENSITY LOGGING

RapidEye time series showing a peat swamp forest in Central-Kalimantan and the progress of selective logging
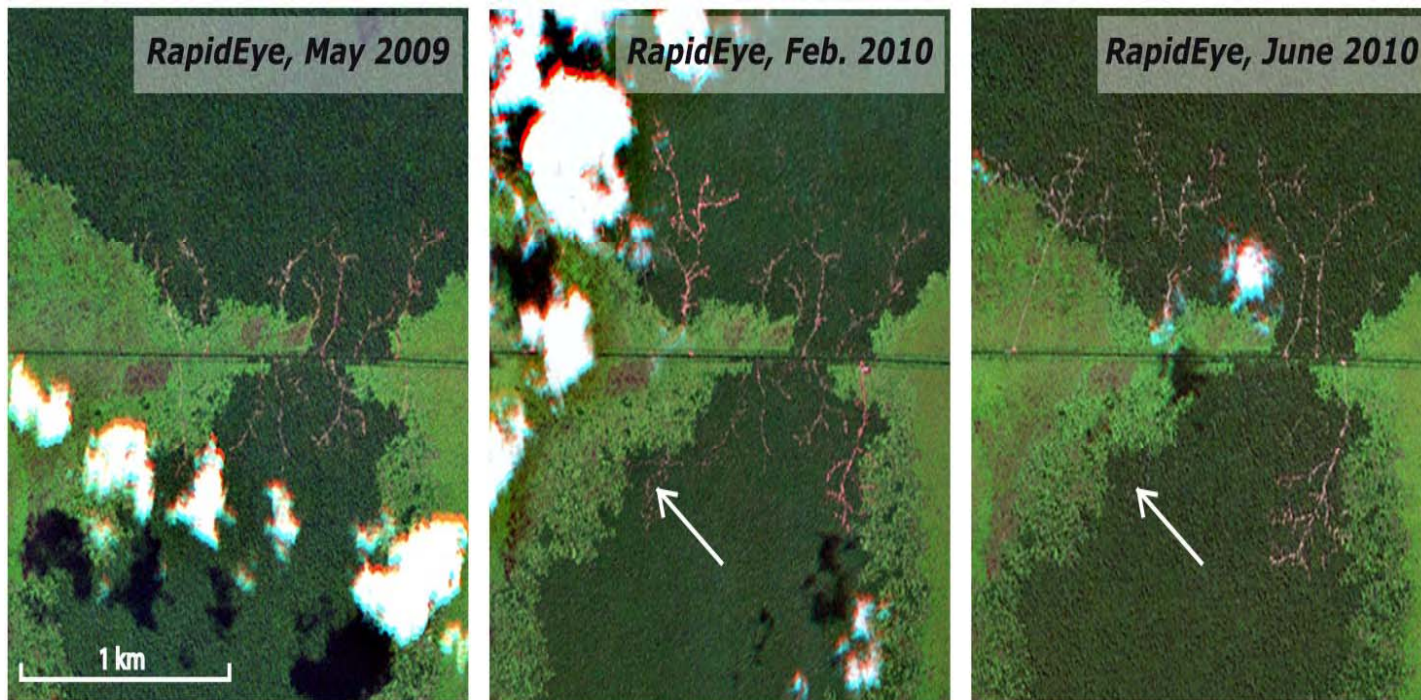
Forest degradation by logging

Viewing direction

Forest degradation by logging
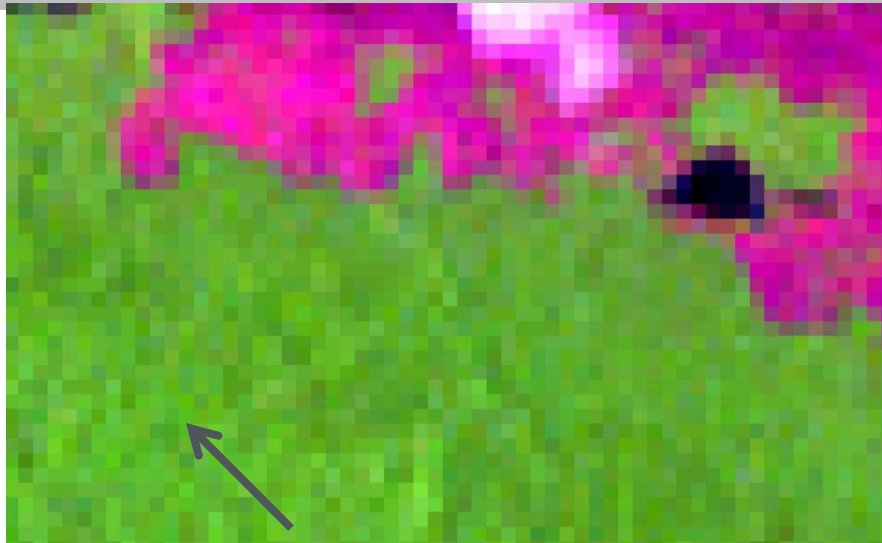
Landsat, 30 meters

RapidEye, 6.5 meters

Forest degraded by illegal
logging

RapidEye | www.rapideye.com
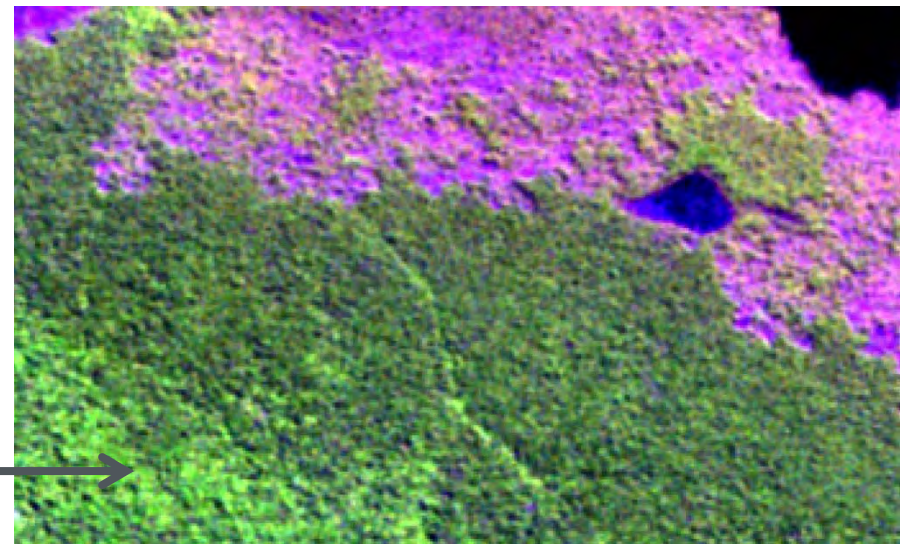
Forest Disturbance Assessment
Comparison with Landsat

Landsat 7 ETM+ 22/05/2009   RapidEye 22/05/2009
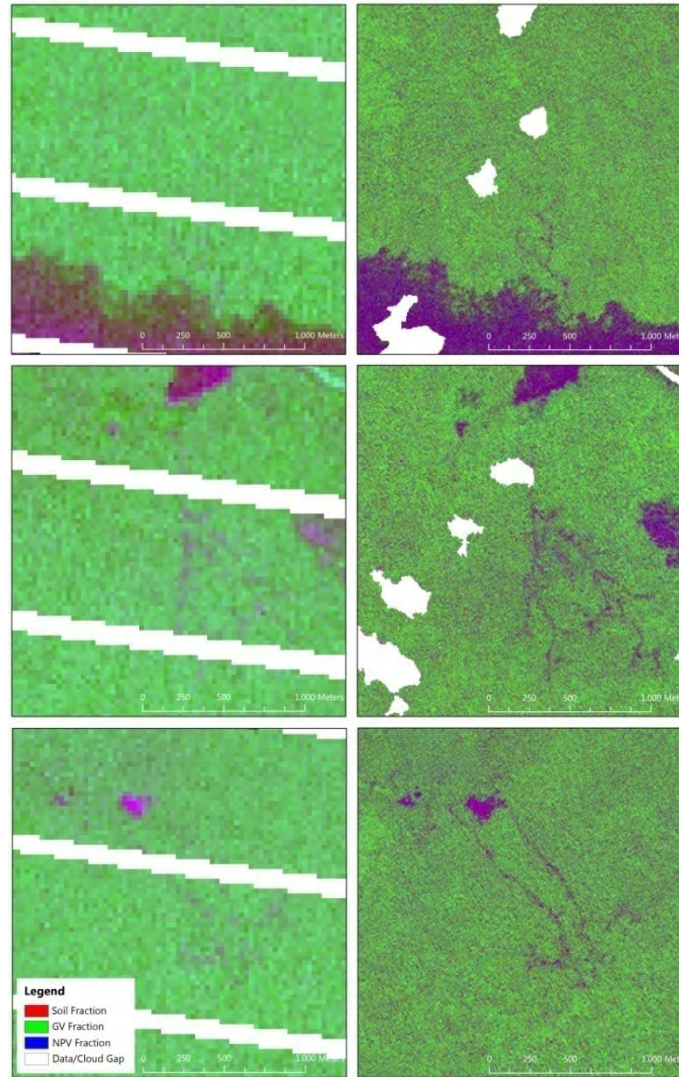
Legend
- ■ Soil Fraction
- ■ GV Fraction
- ■ NPV Fraction
- □ Data/Cloud Gap

Example forest monitoring 2009-2012 (Brazil)

Sete de Setembro Indigenous Land, Mato Grosso, Brazil
Forest Monitoring 2009 - present

Legend

Forest
Other land cover

Data Source:
RapidEye, acquired on
09/07/2009 and 13/08/2009

(c) RapidEye (2011), provided
under EC/ESA GSC-DA

Projection:
WGS 1984, UTM Zone 20S

Processing:
Project: REDD-FLAME
Production: Remote Sensing Solutions GmbH

0   0,5   1   2 Kilometers

Example forest monitoring 2009-2012 (Brazil)

Sete de Setembro Indigenous Land, Mato Grosso, Brazil
Forest Monitoring 2009 - present

Legend

- Deforestation/Degradation 2009-2010
- Forest
- Other land cover

Data Source:
RapidEye, acquired on
14/05/2010 and 17/05/2010

(c) RapidEye (2011), provided
under EC/ESA GSC-DA

Projection:
WGS 1984, UTM Zone 20S

Processing:
Project: REDD-FLAME
Production: Remote Sensing Solutions GmbH

0   0,5   1   2 Kilometers

Example forest monitoring
2009-2012 (Brazil)

Sete de Setembro Indigenous Land, Mato Grosso, Brazil
Forest Monitoring 2009 - present

Legend
- ■ Deforestation/Degradation 2009-2010
- ■ Deforestation/Degradation 2010-2011
- ■ Forest
- ■ Other land cover

Data Source:
RapidEye, acquired on
24/05/2011

(c) RapidEye (2011), provided
under EC/ESA GSC-DA

Projection:
WGS 1984, UTM Zone 20S

Processing:
Project: REDD-FLAME
Production: Remote Sensing Solutions GmbH

0   0,5   1   2 Kilometers
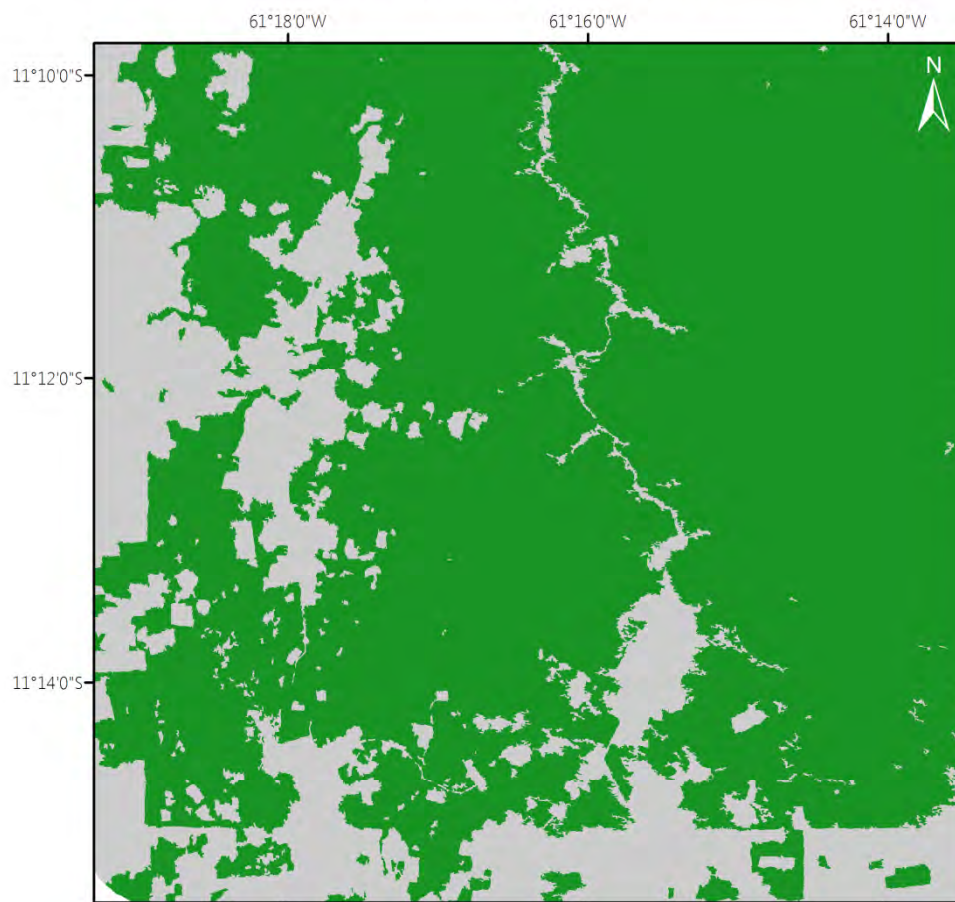
Example forest monitoring 2009-2012 (Brazil)

Sete de Setembro Indigenous Land, Mato Grosso, Brazil
Forest Monitoring 2009 - present

Legend

- Deforestation/Degradation 2009-2010
- Deforestation/Degradation 2010-2011
- Deforestation/Degradation 2011-2012
- Forest
- Other land cover

Data Source:
RapidEye, acquired on
01/06/2012

(c) RapidEye (2011), provided
under EC/ESA GSC-DA

Projection:
WGS 1984, UTM Zone 20S

Processing:
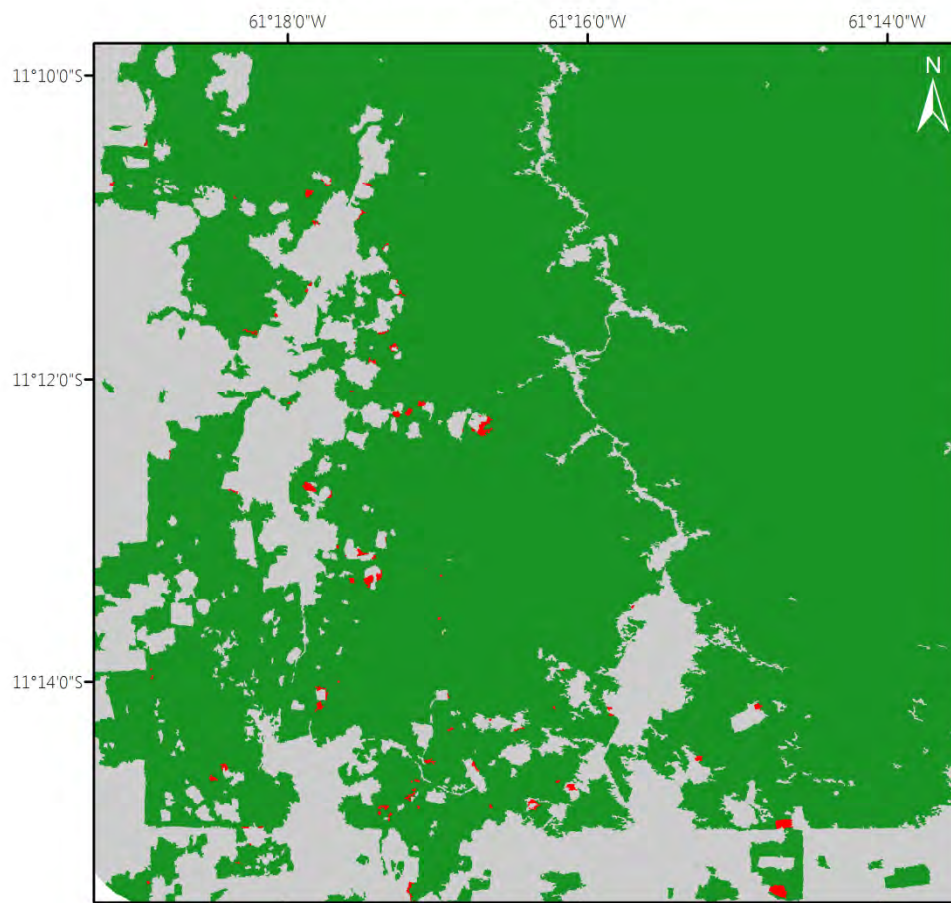Project: REDD-FLAME
Production: Remote Sensing Solutions GmbH

0   0,5   1   2 Kilometers
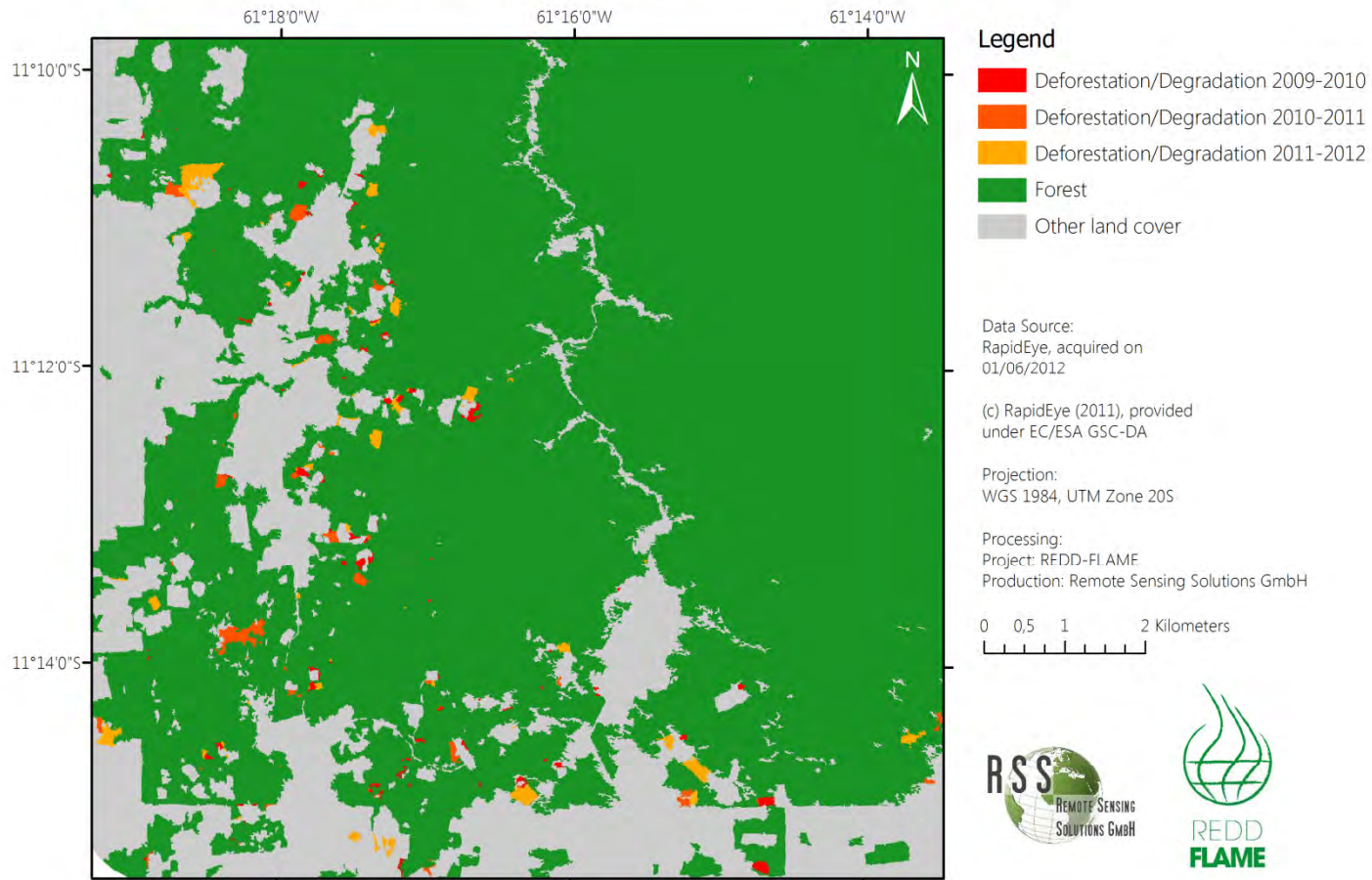
Example forest monitoring
2009-2012 (Indonesia)

RapidEye
Delivering the World

Deforestation & Forest Degradation Block B, Central Kalimantan, Indonesia, 2009-2012

Location Diagram

MALAYSIA

INDONESIA

Block B

Copyright: ©2012 Esri, DeLorme, NAVTEQ

Legend

Deforestation/Forest Degradation 2012
Deforestation/Forest Degradation 2010
Forest Benchmark 2009
Other Land Covers

Interpretation

This map shows the forest extent in Block B of the Ex Mega Rice Project, Central Kalimantan, Indonesia in May 2009 and the deforestation and forest degradation in 2010 and 2012 caused by fire and illegal logging. The forest area was analyzed using RapidEye imagery.

Cartographic Information

0   1.000
                Meters

N

Map scale: 1:40.000
Projection: UTM zone 50 South
Datum: WGS '84

Framework

Data sources: (c) RapidEye, provided under EC/ESA GSC-DA.
Spatial resolution: 5m
Image dates: 22/05/2009, 21/06/2010, 29/07/2012
Created: July 2012
Produced by: RSS GmbH
Contact: info@rssgmbh.de
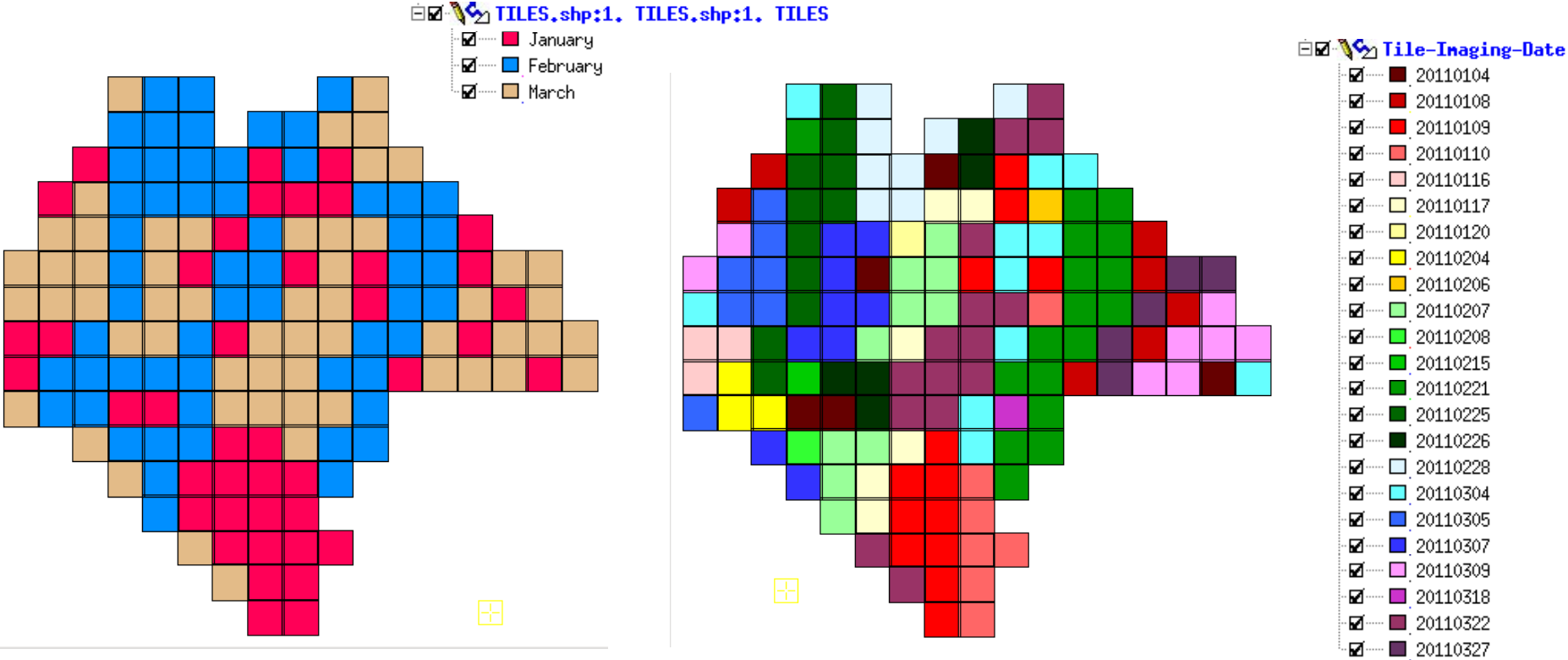
RSS
REMOTE SENSING
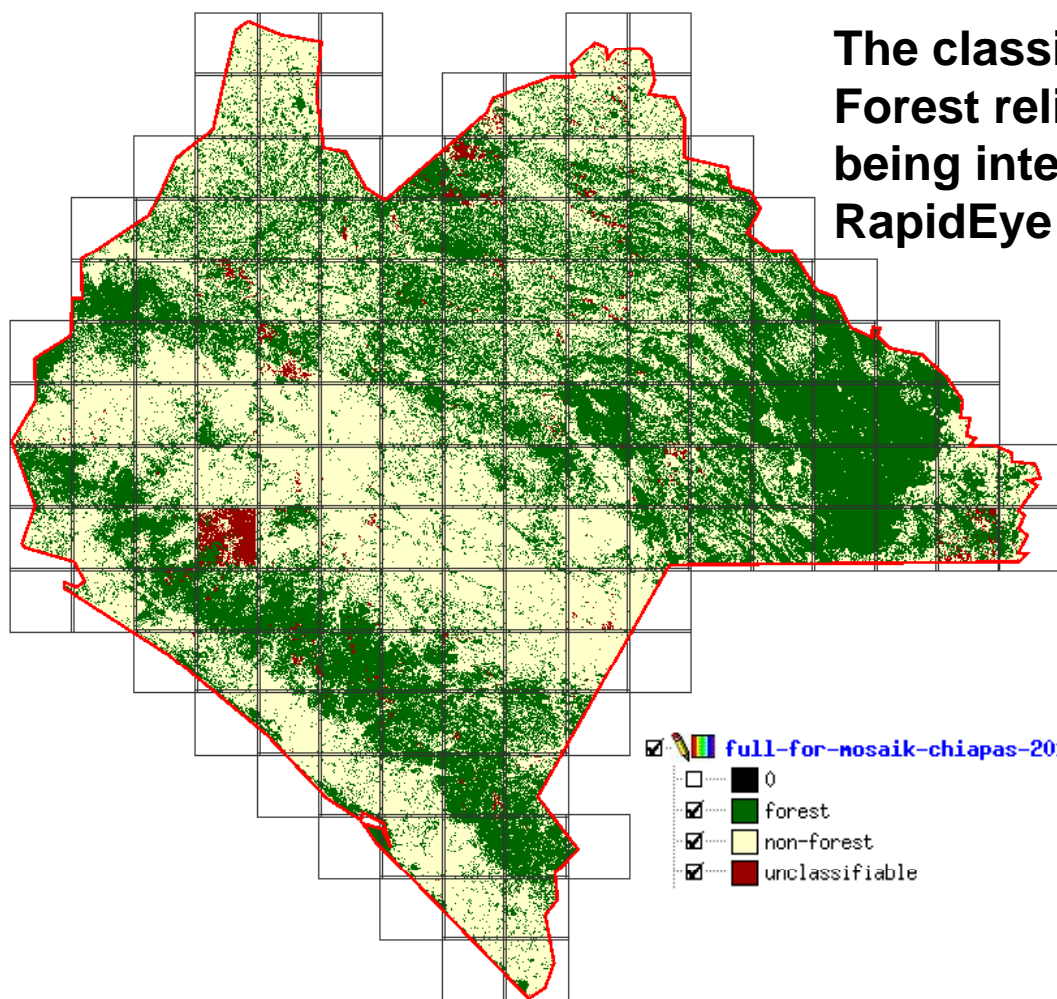SOLUTIONS GMBH

Forest Cover Mapping Chiapas 2011

The area of Chiapas is covered by 158 RapidEye tiles (98750 km²)

Forest Cover Mapping Chiapas 2011

The high repitition rate of the RapidEye system allows for collection of imagery over large areas with minimized cloud cover in short time windows. In 2011 Chiapas was imaged within 3 months (23 revisits) with a cloud cover less than 2%.

Forest Cover Mapping Chiapas 2011

RapidEye
Delivering the World

Legend:
- full-for-mosaik-chiapas-2011
- 0
- forest
- non-forest
- unclassifiable

The classification into Forest and NON-Forest relies on a machine learning algorithm being integrated into the proprietary RapidEye work flow.

Result:

Mapped forest cover of Chiapas amounts to 33,131.56 km²
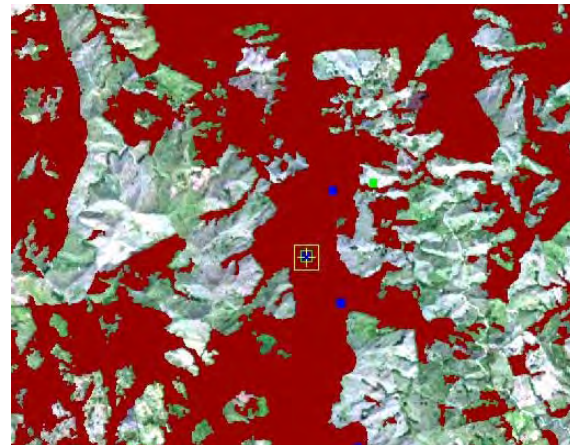This equals
45.15% forest cover
(based on 73,375.20 km² land area >>>CONABIO Shape File)
Or
43.81% forest cover
(based on 75,674.00 km² land area >>>Wikipedia)

Forest Cover Mapping Chiapas 2011

In the shapefile „b220111nalcms_chiapas.shp", which is containing the reference points for Chiapas landcover/landuse, Point ID 72863 is declared as CROPLAND (Level 2, 15). The RapidEye classification results at this point in the class FOREST. GoogleEarth confirms, that there is tree cover.

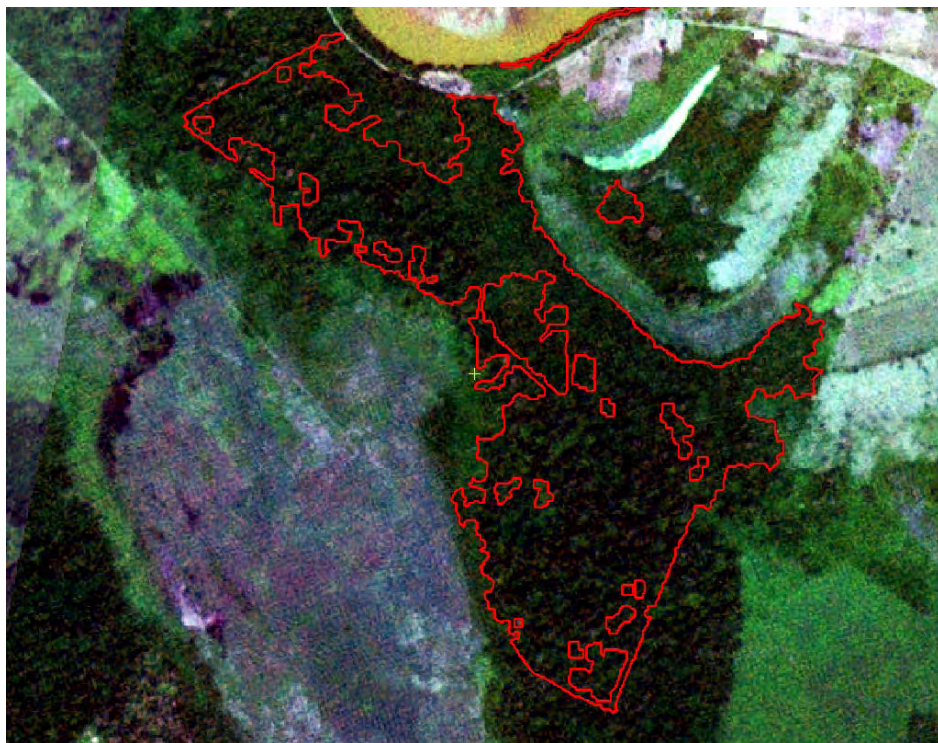# FOREST LOSS MAPPING Chiapas 2010 - 2011
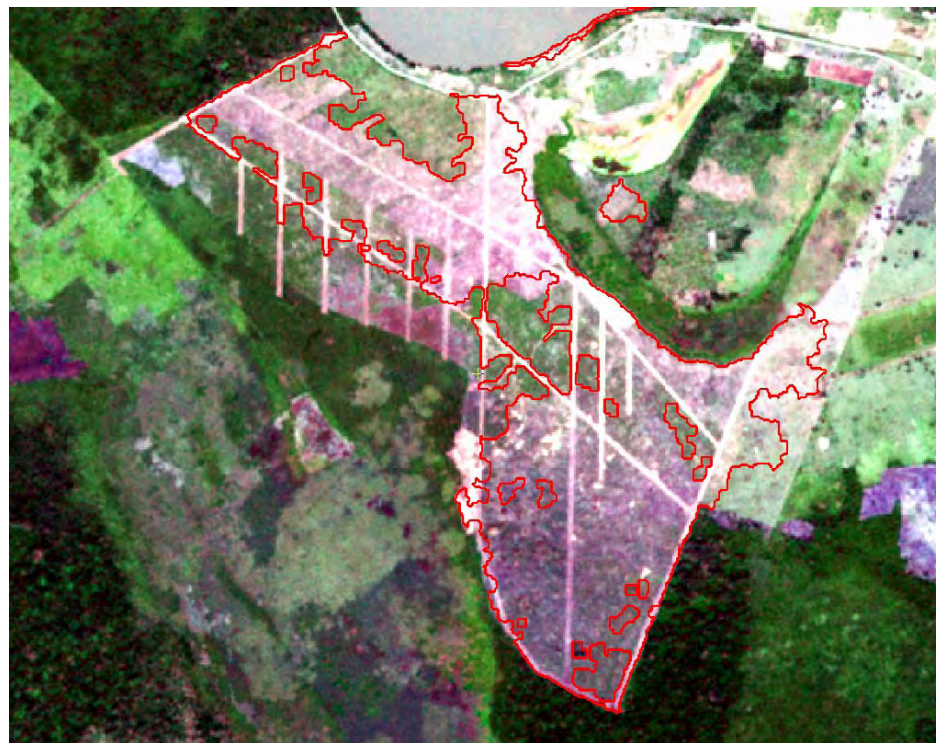
Forest Loss Chiapas 2010 - 2011

2010

2011

Correctly detected forest change (forest loss)

Forest Loss Chiapas 2010 - 2011

2010

2011

Correctly detected forest change (forest loss)

Forest Loss Chiapas 2010 - 2011
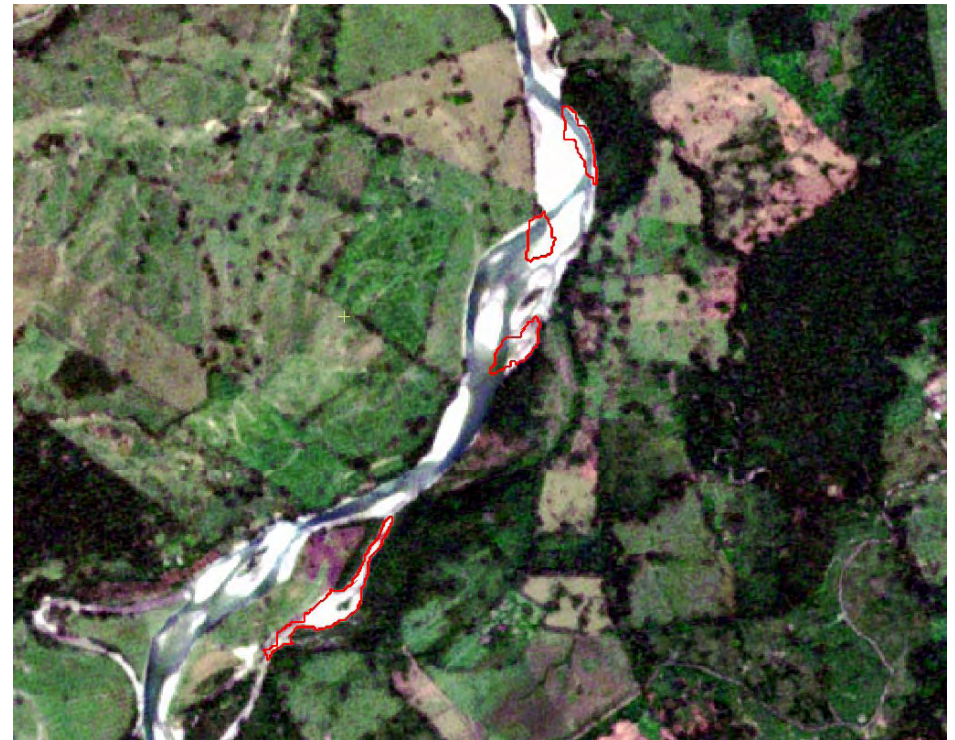
2010   2011

Correctly detected forest changes (forest loss); some of the changes do not cover the entire change area, especially, when vegetation (forest) changes to vegetation (e.g. grassland)
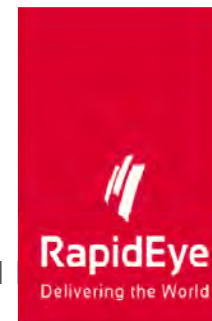
# Forest Loss Chiapas 2010 - 2011

2010

2011

Correctly detected forest change (forest
loss), probably caused by fluvial erosion

RapidEye's Key Advantage

RapidEye Advantages	Contribution to REDD
Archive	Over one billion square kilometers of EO data is added to RapidEye's archive every year
High resolution imagery (five meter pixel size)	Five meter pixel size is suitable for a Minimum Mapping Unit (MMU) of 0.5 ha.
Multiple country coverages already available	EyeFind makes it easy to find out quickly. Visit eyefind.rapideye.com
Collection capacity	RapidEye collects up to five million km² of earth every day. Wall-to-wall national coverages in short time frames
Multi-temporal	Multiple imaging opportunities due to daily revisit possibilities over the same point on earth (always < 20 degrees off-nadir)

RapidEye's Key Advantage
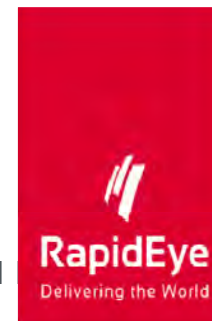
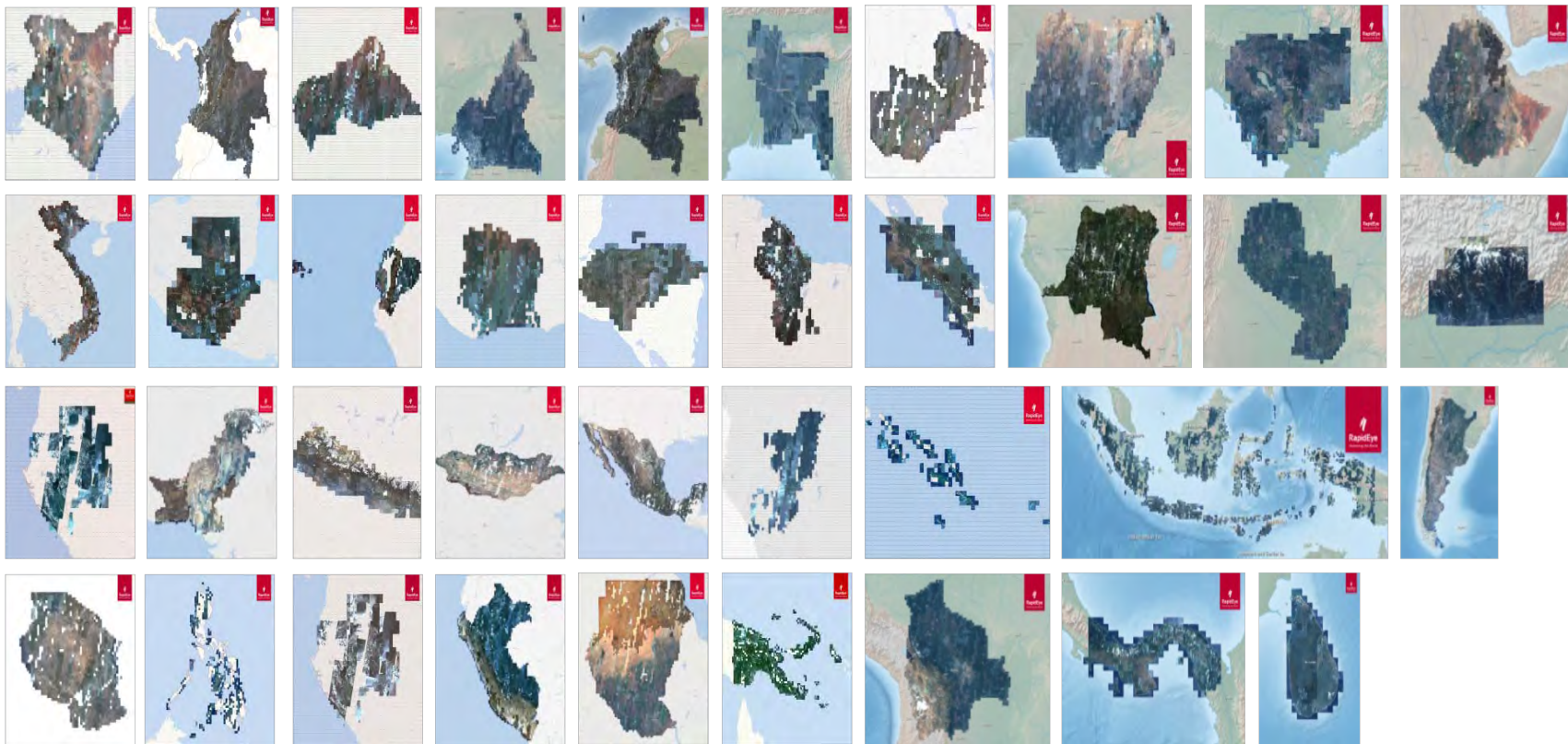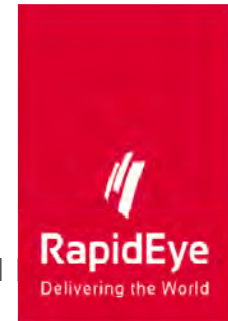| RapidEye Advantages	Contribution to REDD
Reliable collection of data in narrow time windows	Allowing for reference mapping and change detection based on various coverages over large areas
Multi-spectral sensor with five bands (including Red Edge)	RapidEye's sensors were built with the visible bands of Blue, Green and Red as well as Near-Infrared and the Red Edge band
Proven track record in global REDD efforts	Several current REDD projects rely on RapidEye for monitoring (Mexico, Guyana, Nepal, Costa Rica, Panama and more...)
Guaranteed data continuity	RapidEye is committed to providing a long-term data source

Large Imagery Archive
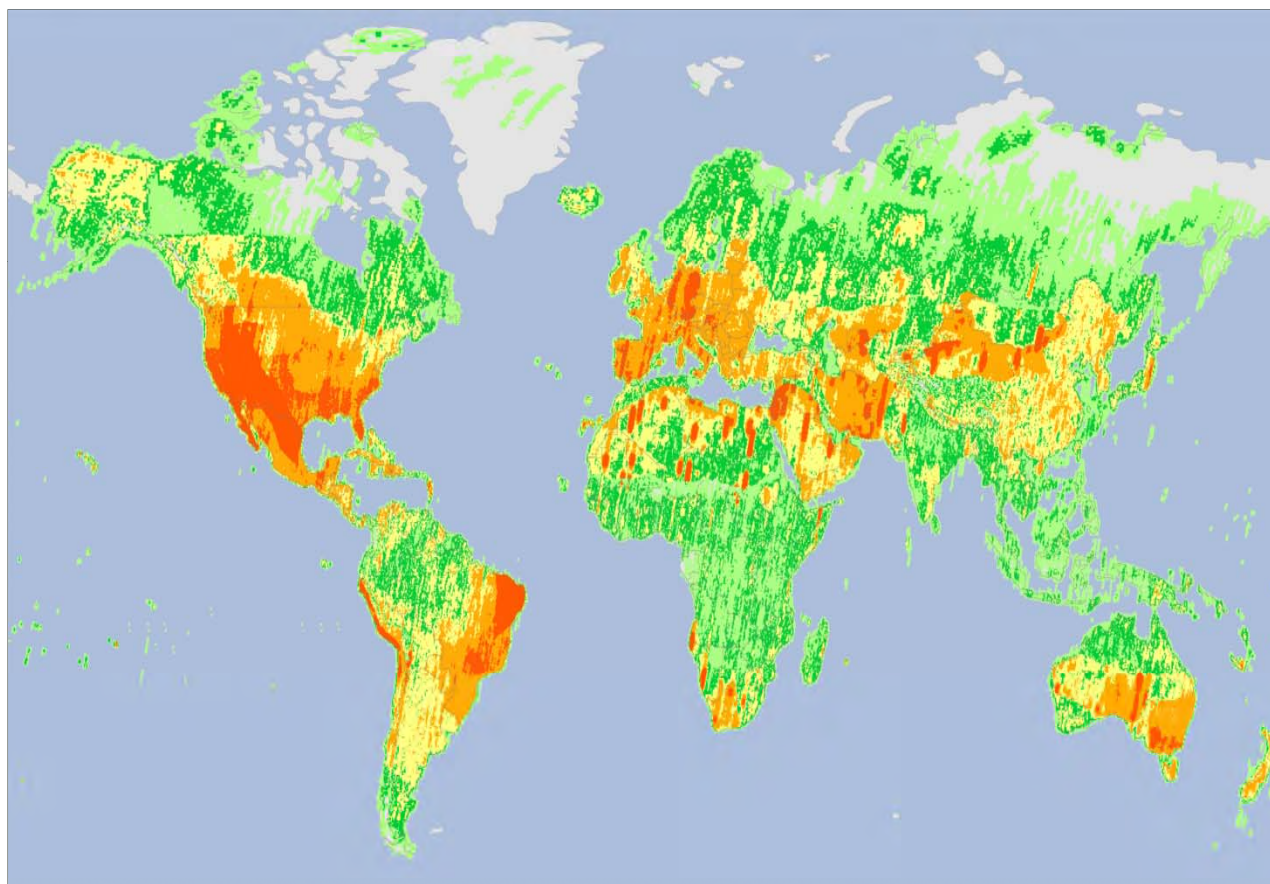
REDD Coverage maps available at www.rapideye.com/redd/index.html

REDD country coverage overviews

REDD Coverage maps available at www.rapideye.com/redd/index.html