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- Update on REDD+, in the context of the recent Paris Agreement (UNFCCC COP-21, fall 2015)
- Support for GFOI
- Contributions of the GOFC-GOLD LC-IT to the GEO Biological Observing Network
- Progress on “good practices” for use of Earth Observations
- Progress on open-source tools for remote sensing
- Other activities:
 - Biomass Working Group

<http://www.gofcgold.wur.nl/index.php>

Name	Affiliation	E-Mail
Land Cover Implementation Team Co-Chairs		
Martin Herold	Wageningen UR	
Curtis Woodcock	Boston University	
GOFC-GOLD Land Cover Office		
Brice Mora	Wageningen UR	
Members		
Frédéric Achard	Joint Research Centre of the European Commission	
Sergey Bartalev	Space Research Institute (IKI), Russian Academy of Sciences	
Ruth DeFries	Columbia University	
Matthew Hansen	University of Maryland	
Alex Held	Australia's Commonwealth Scientific and Industrial Research Organisation	
Hervé Jeanjean	Centre National d'Etudes Spatiales	
Josef Kellndorfer	The Woods Hole Research Center	
Thomas Loveland	USGS EROS Data Centre	
Philippe Mayaux	Joint Research Centre of the European Commission	
Hakan Olsson	Swedish University of Agricultural Science	
Devendra Pandey	Forest Survey of India	
Christiane Schmullius	Friedrich-Schiller University Jena	
Frank Martin Seifert	European Space Agency	
Carlos M. Souza	Amazon Institut of People and the Environment - IMAZON	
John Townshend	University of Maryland	
Mike Wulder	Canadian Forest Service	

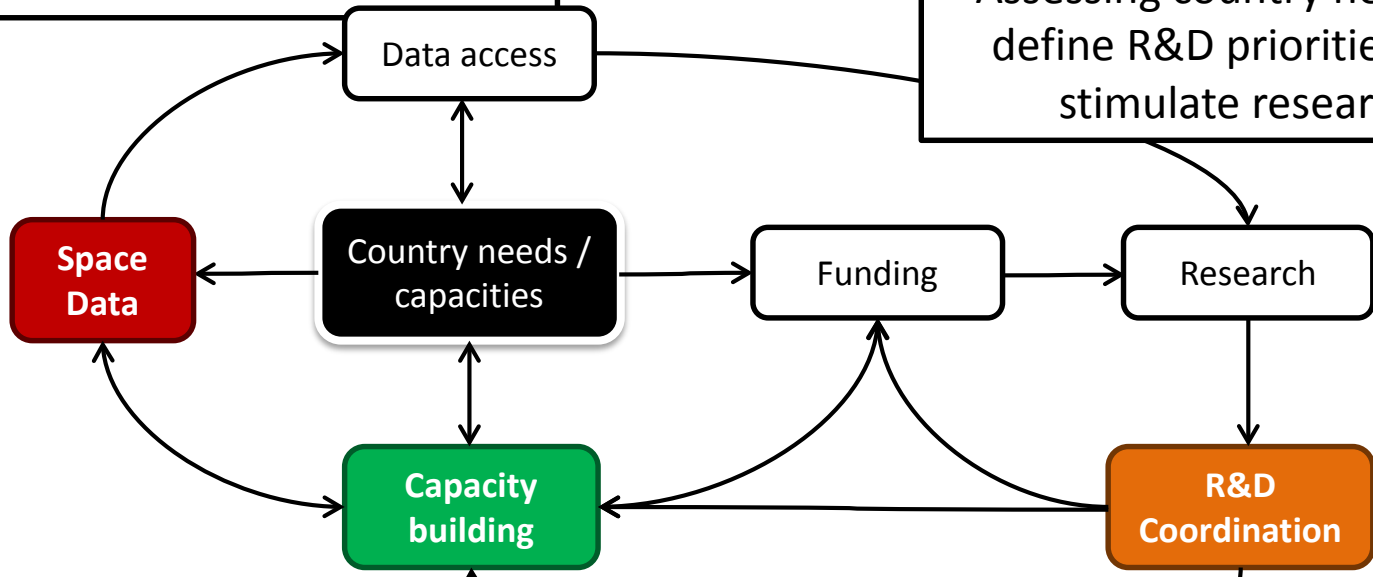
GEO Global Forest Observation Initiative (GFOI)

- Help countries prepare for reporting on emissions and removals of greenhouse gases in the land sector (following IPCC Good Practice Guidance)
- Led by Australia, Japan, Norway and now the US
- Four components:
 - Space Data Coordination (close coordination with CEOS)
 - Methods and Guidance Document
 - Capacity Building
 - R+D

<http://www.gfoi.org/>

Advocacy role for novel data and approaches: potential and limitations

Assessing country needs to define R&D priorities and stimulate research

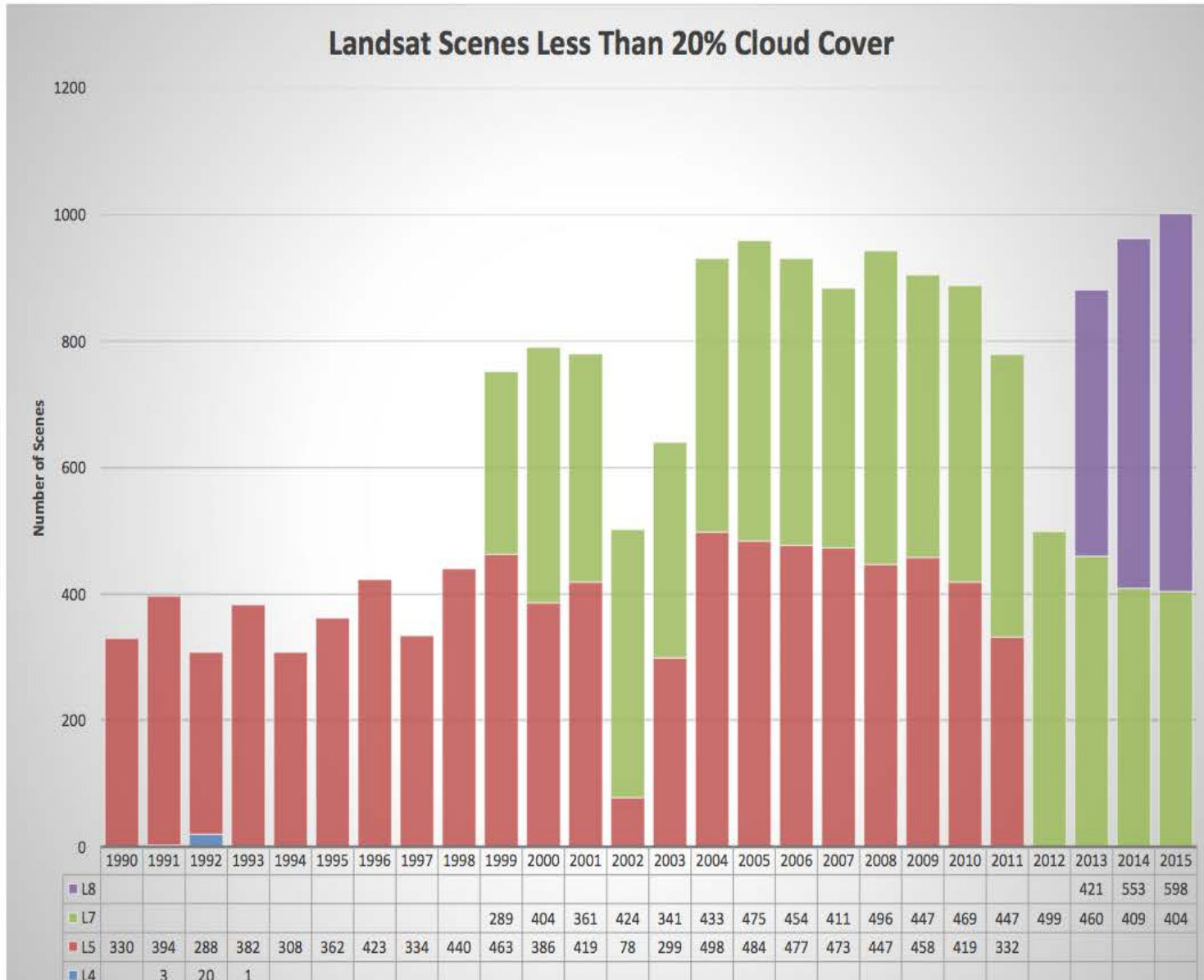


Development of training materials and joint capacity building activities

Methods & Guidance

Research synthesis (workshops on key issues (countries, donors) and regular updates of guidance documents (GFOI MGD & GOFC-GOLD Sourcebook)

Helping Countries understand sources of satellite data



Integrating remote-sensing and ground-based observations for estimation of emissions and removals of greenhouse gases in forests

Methods and Guidance from the Global Forest Observations Initiative

Version 1.0
January 2014



To Answer Mutlu's Question

- Olofsson, P., Foody, G.M., Stehman, S.V., and C.E. Woodcock, 2013. Making better use of accuracy data in land change studies: estimating accuracy and area and quantifying uncertainty using stratified estimation, *Remote Sensing of Environment*, 129:122-131.
- Olofsson, P., Foody, G. M., Herold, M., Stehman, S. V., Woodcock, C. E. and Wulder, M. A. (2014). Good Practices for Assessing Accuracy and Estimating Area of Land Change. *Remote Sensing of Environment*. 148:42-57.

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4 **Integrating remote-sensing and ground-based**
5 **observations for estimation of emissions and**
6 **removals of greenhouse gases in forests:**

7 **Methods and Guidance from the Global Forest**
8 **Observations Initiative**

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Edition 2.0

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June 2016

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REDD+ training materials



Erika Romijn, Brice Mora, Martin Herold

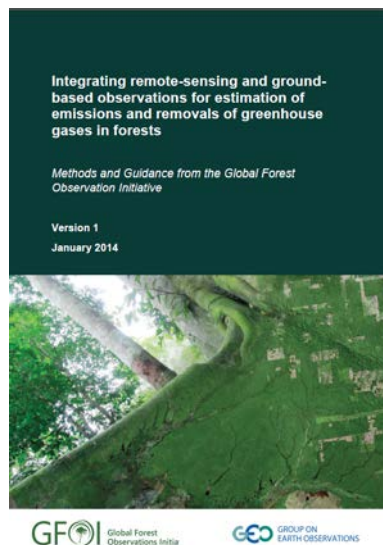
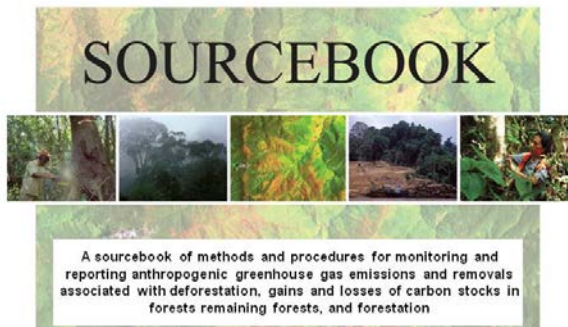
Coordinated by:

GOFC-GOLD LC PO & Wageningen University

In partnership with the World Bank FCPF

11 November 2015

Objectives of training materials



- Respond to the need for technical assistance and guidance for countries to develop capacities and implement REDD+ monitoring and reporting
- Provide a set of modular training materials that can be used in combination with complementary guidance documents (i.e. IPCC GPG, GOFC-GOLD Sourcebook, GFOI MGD, WB FCPF documents, FAO/UN-REDD documents)
- Based on GOFC-GOLD Sourcebook, building upon the GOFC-GOLD expert network, supported by independent review process
- For developing countries and capacity development efforts

Coordination team, Developers & Reviewers

Coordination team:

- World Bank FCPF
Alexander Lotsch
Marco Van der Linden
- GOFC-GOLD LC PO & Wageningen University
Martin Herold - Overall project leader
Brice Mora - Coordination and cooperation with international experts and institutions
Erika Romijn - Coordination of the technical and organizational implementation

Development team:

Suvi Monni (*Benviroc*), Frédéric Achard, Giacomo Grassi, Andreas Langner, Jukka Miettinen, Yosio Shimabukuro (*European Commission, Joint Research Centre*), Carlos Souza (*Imazon*), Luigi Boschetti (*University of Idaho*), Arturo Balderas Torres, Margaret Skutsch (*Universidad Nacional Autónoma de Mexico*), Veronique De Sy, Martin Herold, Brice Mora, Erika Romijn (*WU*), Sandra Brown, Felipe Casarim, Lara Murray (*Winrock International*)

Independent reviewers:

Naikoa Aguilar-Amuchastegui, Valerio Avitabile, Veronique De Sy, Sandro Federici, Carly Green, Inge Jonckheere, Ben de Jong, Gabrielle Kissinger, Pham Manh Cuong, Ron McRoberts, Anthea Mitchel, Jim Penman, Rosa Maria Roman Cuesta, Arief Wijaya, Sylvia Wilson

Overview of Modules REDD+ training materials

REDD+ Background and Design

- 1.1 UNFCCC context and requirements and introduction to IPCC guidelines
M. Herold, E. Romijn, B. Mora
- 1.2 Framework for building national forest monitoring systems for REDD+
E. Romijn, M. Herold, B. Mora
- 1.3 Assessing and analyzing drivers of deforestation and forest degradation
E. Romijn, M. Herold

REDD+ Measuring and Monitoring

- 2.1 Monitoring activity data for forests using remote sensing
F. Achard, J. Miettinen, B. Mora
- 2.2 Monitoring activity data for forests remaining forests (incl. forest degr.)
C. Souza, S. Brown, J. Miettinen, F. Achard, M. Herold
- 2.3 Estimating emission factors for forest cover change (def. and degr.)
S. Brown, L. Murray, F. Casarim
- 2.4 Incorporating community based approaches in national REDD+ monitoring
M. Skutsch, A. Balderas Torres
- 2.5 Estimation of carbon emissions from deforestation and forest degradation
S. Brown, L. Murray
- 2.6 Estimation of GHG emissions from biomass burning
L. Boschetti
- 2.7 Estimation of uncertainties
G. Grassi, S. Monni, F. Achard, A. Langner, M. Herold
- 2.8 Overview and status of evolving technologies
B. Mora, E. Romijn

REDD+ Assessment and Reporting

- 3.1 National data organization and management
E. Romijn, V. De Sy
- 3.2 Data and guidance on developing REDD+ reference levels
M. Herold, E. Romijn, S. Brown
- 3.3 Guidance on reporting REDD+ performance using IPCC Guidelines and Guidance
G. Grassi, E. Romijn, M. Herold

Presentation at USGS Headquarters

January 13, 2016, Reston VA

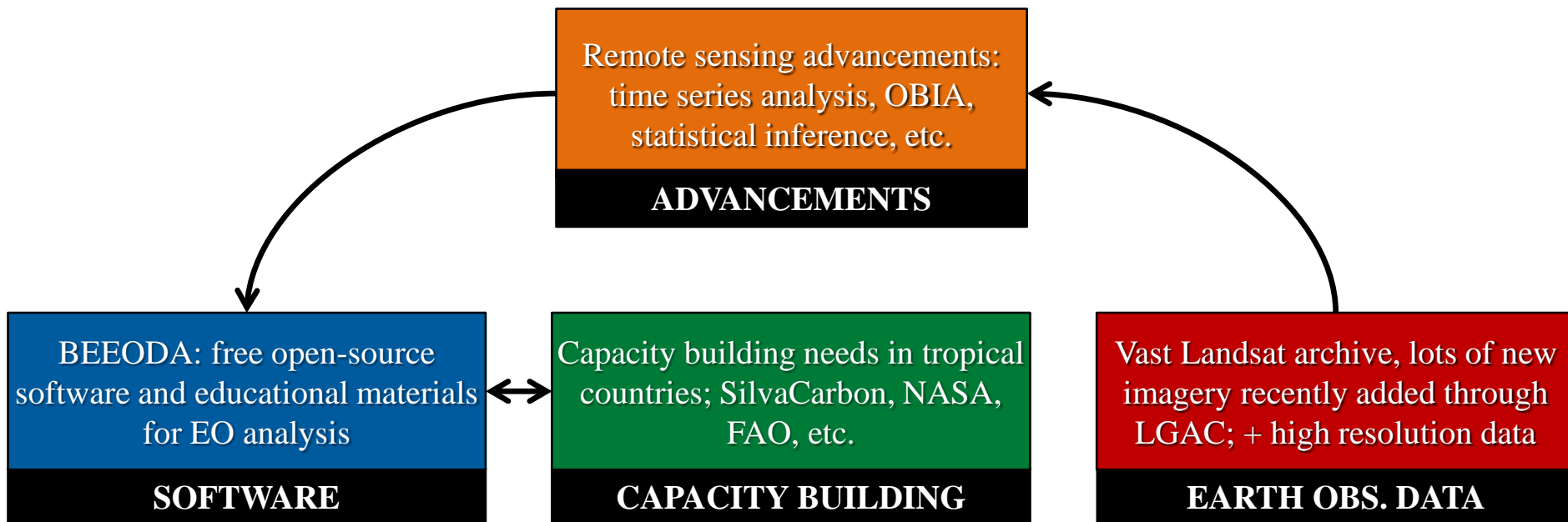
BEEODA: a suite of open-source software and educational materials for processing Earth Observation data

Pontus Olofsson



Why are we doing this?

- Our own research needs!
- Built in support of our own research and education, and capacity building organizations/initiatives (SilvaCarbon, GFOI, GOFC/GOLD)
- Lesson learned from teaching workshops: **software to take home and that are in line with new advancements needed**



Overview

- BEEODA: *Boston Education in Earth Observation Analysis*
- Collection of: existing open-source tools +
our own implementations +
educational materials
- Philosophy: *“try to use as much existing tools as possible and only implement the missing pieces”*
- Educational material divided into modules in line with demand and advancements in remote sensing analyses such as time series analysis and accuracy/area estimation



Technical aspects

- Runs as a virtual machine in Windows, OS X, Solaris and Linux platforms
- *Oracle VM VirtualBox* (freeware) is the only software required
- Can also be run from a USB stick with no additional software needed
- In addition to homemade tools, VM includes *QGIS*, *GDAL*, *Orfeo*, *R*, *Python*, *Git* in a Linux Ubuntu operating system

```

opengeo-vm@opengeo-vm: ~/demo/work/3_changed
File Edit View Search Terminal Help
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LT50120312011181EDC00_B3.TIF
LT50120312011181EDC00_B4.TIF
LT50120312011181EDC00_B5.TIF
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LT50120312011181EDC00_B7.TIF
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LT50120312011181EDC00_cfmask.tif
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LT50120312011181EDC00_sr_band2.tif
LT50120312011181EDC00_sr_band3.tif

```

```

sample_map.py (-~/demo/work/4_estimation/3_sampling)
File Edit View Search Tools Documents Help
Open Save Undo
sample_map.py x
7 from osgeo import gdal
48 import numpy as np
49 try:
50     from osgeo import gdal
51     from osgeo import ogr
52     from osgeo import osr
53 except:
54     import gdal
55     import ogr
56     import osr
57
58 __version__ = '0.1.0'
59
60 _allocation_methods = ['proportional', 'equ
61
62 VERBOSE = False
63
64 gdal.UseExceptions()
65 gdal.AllRegister()
66
67 ogr.UseExceptions()
68 ogr.RegisterAll()
69
70 logging.basicConfig(format='%(asctime)s %(le
71                     level=logging.INFO,
72                     datefmt='%H:%M:%S')
73
74 logger = logging.getLogger(__name__)
75
76 def str2num(string):
77     """ parse string into int, or float """
78     try:
79

```

QGIS 2.8.1-Wien

Project Edit View Layer Settings Plugins Vector Raster Database Web Processing Help

Layers

- 2001161_segmentation
- 2001161_lcmab
 - Forest
 - Water
 - Non-forest
 - Grass
- 2001161_seg_mean
- rois
- LE70120312001161_stack

Processing Toolbox

Search...

Recently used algorithms

- TrainImagesClassifier (rf)
- Image Classification
- Mean Shift filtering (can be used as Exac...
- Segmentation (meanshift)
- GDAL/GRASS [45 geotools]
- GRASS commands [160 geotools]
- Models [0 geotools]
- Orfeo Toolbox (Image analysis) [83 geotool...
- Calibration
- Feature Extraction
- Geometry
- Image Filtering
- Image Manipulation
- Learning
 - Classification Map Regularization
 - Compute Images second order statist...
 - ComputeConfusionMatrix (raster)
 - ComputeConfusionMatrix (vector)
 - FusionOfClassifications (dempstersh...
 - FusionOfClassifications (majorityvoti...
 - Image Classification
 - SOM Classification
 - TrainImagesClassifier (ann)
 - TrainImagesClassifier (bayes)
 - TrainImagesClassifier (boost)
 - TrainImagesClassifier (dt)
 - TrainImagesClassifier (gbt)
 - TrainImagesClassifier (knn)
 - TrainImagesClassifier (libsvm)
 - TrainImagesClassifier (rf)
 - TrainImagesClassifier (svm)
 - Unsupervised KMeans image classific...
- Miscellaneous

Advanced interface

277402,4647008 Scale 1:356.871 Rotation: 0.0 Render EPSG:32619

28 PM EDT

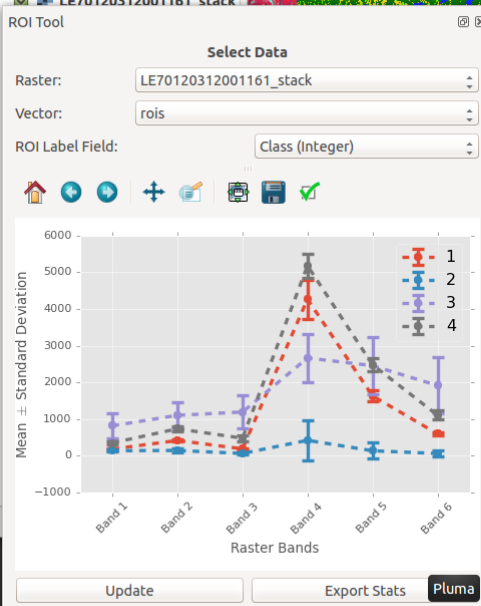
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Pictures LT50120312011181EDC00_sr_adjac... 60.3 MB TIFF raster data Wed 08 Jul 2015 10:49:53 AM EDT

Videos LT50120312011181EDC00_sr_atmo... 120.6 MB TIFF raster data Wed 08 Jul 2015 10:49:50 AM EDT

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Python Tab Width: 4 Ln 1, Col



Modules

- Modules consist of
 - step-by-step instructions
 - relevant literature
 - recorded demos and lectures

Sourcebook for Biodiversity Monitoring in Tropical Forests with Remote Sensing Data and Methods

- Need to present RS data and methods, including good practices, in support of policy targets (UNCBD Aichi targets, UNFCCC REDD+ mechanism (co-benefits)) to countries.
- Need to support development of the relevant EBVs (e.g., Ecosystem extent and fragmentation, habitat structure), as part of the BON-in-a-Box toolkits.

GOFC-GOLD

Global Observation for Forest and Land Cover Dynamics

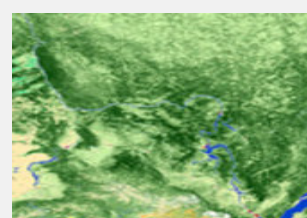
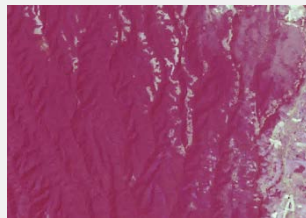
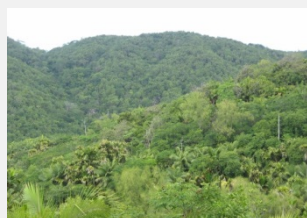


Land Cover
Project Office

GEO BON

SOURCEBOOK

UNCBD COP 13



**A SOURCEBOOK OF METHODS AND PROCEDURES FOR
MONITORING ESSENTIAL BIODIVERSITY VARIABLES IN
TROPICAL FORESTS WITH REMOTE SENSING**

GOFC-GOLD 
Global Observation of Forest and Land Cover Dynamics

GEOBON

Sourcebook for Biodiversity Monitoring in Tropical Forests with Remote Sensing Data and Methods

Purpose: guide biodiversity monitoring via RS to inform national and sub-national policy and decisions, convention commitments and targets

Target Users: project managers, technical level practitioners in national, sub-national government agencies, academic institutions, NGOs, assuming audience has a background on RS.

Focus: validated RS techniques, integration of *in situ* and RS observations, present and discuss sampling approaches, evolving technologies presented separately, list available datasets.

Approach: structured around relevant Essential Biodiversity Variables (EBVs), living document (updated every year), complementary to other initiatives (GEO Handbook, CBD Tech. reports, ZSL-GIZ report).

Sourcebook for Biodiversity Monitoring in Tropical Forests with Remote Sensing Data and Methods

Contributors: GOFC-GOLD Land Cover Office, GEO BON, European Space Agency, Wageningen University, Twente University, Jena University, EC Joint Research Centre, Woods Hole Research Center, IIASA, Earthwatch, DLR Germany, Resources For the Future, Universidad de Medellín, CONABIO, ISSIA CNR, IRSTEA, University Bangalore, Helmholtz Centre for Environmental Research – UFZ, Bari University, Universidad Nacional de Colombia, Instituto Humboldt, University of Saint Andrews, Oak Ridge National Laboratory.

Time schedule:

Winter 2016: internal & external reviews

Spring/summer 2016: round of update

Fall 2016 (UNCBD COP-13): Version 1 published online

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Opportunities for Participation

- Review GFOI MGD Version 2
- GFOI R&D and GOFC-GOLD Land Cover Science Meeting
The Netherlands
31 October – 4 November, 2016
Draft Announcement and Program available