TRAINING WORKSHOP REPORT

# LAND COVER MAP ACCURACY AND TRAINING WORKSHOP ON FAO SEPAL REMOTE SENSING TOOL

BOGOR -   INDONESIA

From Tuesday 2nd to Saturday 6th May 2017

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# REPORT ON LAND COVER MAP ACCURACY AND TRAINING WORKSHOP ON FAO SEPAL REMOTE SENSING TOOL

## 1   INTRODUCTION, BACKGROUND and RATIONALE

Indonesia seeks to improve its existing system for Measurement, Reporting and Verification (MRV) of Greenhouse Gas (GHG) emissions and removals from the forestry sector, as part of a comprehensive National Forest Monitoring System (NFMS), one of the four key elements of REDD+ under the Warsaw Framework of the UNFCCC.  For REDD+ reporting under the UNFCCC a National Forest Monitoring System is required that combines a National Forest Inventory (field plot data for biomass, carbon, emission factors etc.) and remote sensing data (used for forest extent and change in areas etc.).

The consistency and coherence of estimates between the successive iterations of the national GHG inventory is relatively low.  Indonesia's land cover/land use maps have been developed using different methodologies over time which leads to uncertainties when they are used to detect and report on changes. The series of land cover maps are one of the major input datasets to the calculating a wide range of important results from the NFMS, including the GHG emissions results used for reporting for REDD+ under the UNFCCC. Indonesia is still using a manual classification method which is slow and laborious requiring between 20 and 30 people to work for around one year to produce the updated land cover maps. The UNFCCC technical assessment of Indonesia's FREL, noted that direct comparison of satellite images would reduce the sources of errors and is seen as best practice in remote sensing analysis (UNFCCC 2016).

The FAO mission from December 2016 recommended that Indonesia investigate options for improving the methods for producing the forest and land cover maps using more advanced semi-or-automated map classification approaches and especially to create a consistent time-series dataset using the same methodology and data inputs over time.

FAO has developed a System for Earth Observation Data Access, Processing and Analysis for Land Monitoring, (called SEPAL[1]), which helps countries' access and process satellite data.  SEPAL is an easy-to-use platform for processing and interpreting satellite data using a cloud-based supercomputer and this helps overcoming barriers of poor internet connections and low computing power or storage space on local computers. SEPAL can connect to and use data and outputs from FAO's free and open-source software tools called OpenFORIS[2]. SEPAL is part of a partnership between FAO and Norway to help developing countries monitor forest resources that is funded to develop the new

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[1] For more information on SEPAL please see: http://www.fao.org/news/story/en/item/283188/icode/
[2] For more information on OpenFORIS and Collect-Earth see: http://www.openforis.org/home.html

software and cloud-computer processing to help countries store and analyse the large quantities of satellite data now available for improved forest monitoring.

FAO and the Indonesian Ministry of Environment and Forestry used FAO's Collect-Earth system in a 5 day [workshop](#) in September 2016 to collect a set of reference land cover and land use data from around 8,000 points across the country. These were used as some of the input data for this workshop using the SEPAL system.

## 1.1   Workshop objectives

This workshop demonstrated the uses of FAO's technical systems and expertise to provide practical technical support to Indonesia not only on forest change detection but also for advancement of REDD+ in Indonesia. All the planned objectives/outputs of the workshop were achieved:
- Develop the capacity of Indonesian technicians in accuracy assessment and forest change detection;
- Updating participants in the use of the Collect-Earth to collect reference data;
- Help further develop the capacity of Indonesian government staff mainly MoEF to carry out rapid and reliable forest monitoring using the latest technology.

## 1.2   Location and Period of Workshop
The workshop was held at Savero Hotel Bogor-West Java province, Indonesia from Tuesday 2nd to Saturday 6th May 2017.

## 1.3   Workshop organization
The workshop was funded by FAO and Norwegian, and was hosted by FAO in partnership with Ministry of Environment and Forestry the Republic of Indonesia.

## 1.4   Attendance
Of the 5 day workshop for 21 government [participants](#) (MoEF including DG-Planology, DG-CCC, FORDIA, Regional Office of Planology, Geospatial Information Agency, Peatlands Restoration Agency, and National Institute of Aeronautics and Space) to learn land cover map accuracy and FAO SEPAL remote sensing tool and clean the reference data from Sept. Workshop. A list of the participants is in included in Annex 1.

## 1.5   Workshop Training Team
The training team were Erik Lindquist and Yelena Finegold (FAO-HQ); Adam Gerrand and Abu R.J Mahmood (FAO-RAP); and Bambang Arifatmi and Harriansyah (FAO-ID).

## 1.6 Workshop program

The major topics addressed in the five day of the program included (details in Annex 2):

a.  Assessing data availability, existing sample data and maps;
b.  Introducing overall concepts of accuracy assessment and change detection;
c.  Introducing some available tools- Google Earth Engine, QGIS, SEPAL, R, Collect Earth;
d.  A short refresher on using Collect Earth and checking / cleaning the reference data from Sept workshop;
e.  Testing change detection in Google Earth Engine using points from Collect Earth exercise as training data;
f.  Designing an accuracy assessment and processing the results in SEPAL.
g.  Using SEPAL to prepare draft burnt-area maps (if time and spatial data permit – 2015 burnt area map would be a very useful dataset to use if it is available)

## 1.7 Software used in the workshop and good internet speed is important

The training workshop used data and cloud computing systems from a variety of sources (Google Earth, Google Earth Engine, BING maps, SEPAL). The workshop organizers had arranged for reliable high-speed internet up to '100 mpbs' using fiber optic from Moratel-ISP company Indonesia. Participants were instructed to download and install several software programs and have them pre-loaded and installed on computers before coming to the workshop, as shown in the Table below.

| No | Pre-Load Software |
|----|-------------------|
| 1  | Google Chrome: https://www.google.com/chrome/ |
| 2  | **QGIS** – open source GIS software – either a) 32bit version or b) 64bit http://www.qgis.org/en/site/forusers/download.html |
| 3  | The statistical software package called "R": a. R main program  b. RStudio |
| 4  | Google Earth Pro (GEP): https://www.google.com/earth/download/gep/agree.html |
| 5  | Collect Earth: http://www.openforis.org/tools/collect-earth.html |
| 6  | Gmail account: https://accounts.google.com/signup |
| 7  | Sign up for a Google Earth Engine developer account: https://signup.earthengine.google.com |

## 1.8 Official opening of the workshop

The training workshop was opened at 9a.m. with a welcome statement by the Forestry Officer-FAO RAP, Mr. Adam Gerrand, and an opening speech held by Mr. Adriat Halim, Acting as the Director of Inventory and Forest Resources Monitoring, MoEF.

In his opening speech, Mr. Adriat emphasized that the workshop can improve the national monitoring and reporting of forest resources and forest changes, particularly in improving the accuracy of land cover data and the calculation and mapping of deforestation and forest degradation areas. It is also important to continue to improve

the relatively good capacity of the technical staff to take advantage of these new computing facilities to make the work faster and more efficient.

Mr. Adam Gerrand that "*an important part of REDD+ under the UNFCCC is the need to have monitoring systems that are as accurate as reasonably possible, recognizing national circumstances which are limited in many countries*". He gave an initial introduction to Collect-Earth and SEPAL as one of the options countries can use that have relatively easy to use but powerful systems that can be used to enhance the technical ability of Indonesian staff in the monitoring of forest resources.

Mr. Sigit Nugroho, Head of Sub Directorate for Forest Resources Monitoring presented the existing of Indonesia National Forest Monitoring System presenting its milestone, objectives, roadmap, process flow and method, accuracy assessment, FREL, burn scar monitoring system, and future improvement. In addition to that, he mentioned that overall accuracy assessment on land cover 2015 of 23 classes of land cover using stratified random sampling is 67% and for forest and non-forest the accuracy is 93%. He hoped that this workshop not only can improve Indonesia to generate a better land cover map but also can help Indonesia beyond that, a shift from traditional visual interpretation to semi-automated land cover system.

## 2   HANDS-ON TRAINING IN USING THE SOFTWARE

### 2.1   Group exercises on Collect Earth data cleansing

All participants divided into 5 working group to discuss, analysis, and improve some reference points that needed checking from September 2016 Collect-Earth Workshop. This was done where there was inconsistent results in the land cover classes and the percentage vegetation on 106 of the points out of as a results of the blurry satellite image either from Google Earth Engine and Bing Map, then the combining of the color of satellite imagery and NDVI technique was applied.

| Group 1 | Group 2 | Group 3 | Group 4 | Group 5 |
|---------|---------|---------|---------|---------|
| Anna Tosiani | Franki Zamzani | M. Yazid | Sudirman S | Wahyu C.A. |
| Ign. C. Ginting | Alfi Purnamasari | Bobby Rachmat | Dody Fathoni | Mila Soraya |
| Inggit Lolitasari | Sayidah Sulma | Fitriyanto | Hananto | Thomas Rinuwat |
| Ajat Sudrajat | Melisa E.P. | Iid Itsna Adkhi | Aditya Eka P | Endrawati |
| | | Emba T. Allo | | |

This work has now enabled an improved dataset of CE points across Indonesia that can be used for various analyses and purposes. It was used in the later sessions for doing accuracy assessments (see section 4). A compiled national set will be placed on the Google Drive available to participants and MoEF staff for later uses.

The points to be checked were selected by filtering data inconsistencies (see Table 1). The filters used were locations that were labeled as forest land use but with 0% tree cover

recorded. Plots labeled as forest land use but with 90-100% shrub cover or 80-100% water body cover were flagged for rechecking, as well as plots labeled as not forest land use (cropland, grassland, wetland, other land or settlement) but with 90-100% tree cover.

*Table 1: Rules for identifying plots with potential data inconsistencies*

| Land use | Tree cover | Shrub cover | Water body cover |
|---|---|---|---|
| Forest | 0% | - | - |
| Forest | - | 90-100% | 80-100% |
| Cropland, grassland, wetland, otherland or settlement | 90-100% | - | - |

The 106 plots were reassessed using a simple IPCC Collect Earth project interface (see Figure 1). The NDVI and complete time series of medium resolution satellite imagery was assessed using the Google Earth Engine Playground geo-located plot information (see Figure 2).
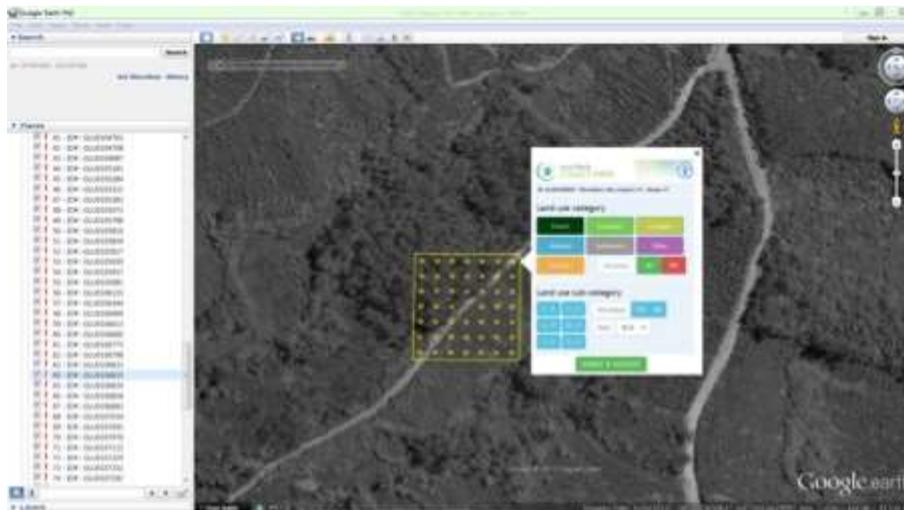


*Figure 1: Collect Earth project for re-assessing the land cover of plots with potential inconsistencies*
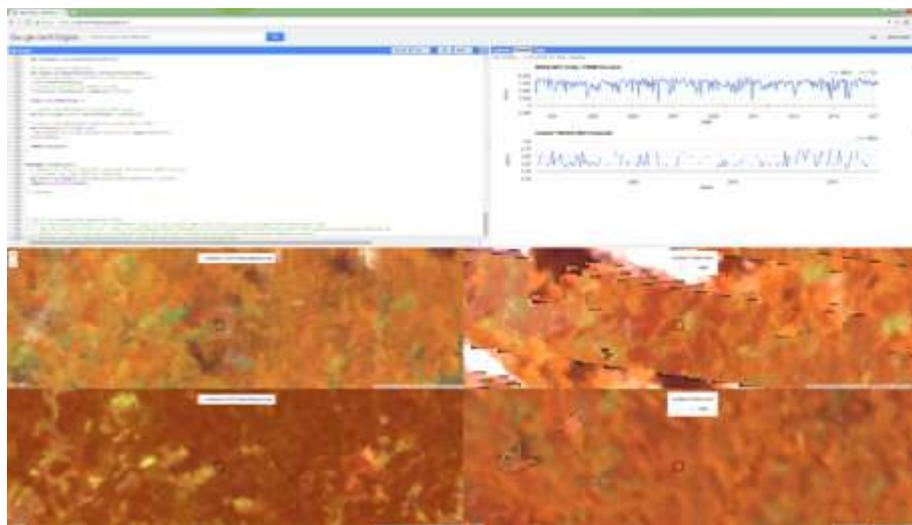


*Figure 2: Google Earth Engine Playground geo-located plot with NDVI time series using MODIS and Landsat satellite imagery from 2000-2017*

## 2.2    Doing change detection (e.g. deforestation) in SEPAL

One of the most useful and important functions of remote sensing imagery is to be able to use two or more images of the same location from different times to be able to generate a change detection image with pixels or polygons that have changed between the two dates. SEPAL has this functionality built in through a series of steps in the GEOPROCESSING tools. The participants were shown how to do this and did a practical exercise to learn how to do it themselves on their own computers. This is a fundamental processing step for REDD+ where the change detection from remote sensing data forms one of the major inputs (called "activity data") into the calculations of GHG emissions. Not all the changes picked up in the remote sensing processing are the kind that need to be included in REDD+ activity data, so there will need to be additional screening and checking to ensure that only the polygons that have significant biomass or carbon emission related changes are counted and some others are not (e.g. change from bare ground to water).



*Figure 3: An example of automated change detection between two time periods.  Time 1 image is upper left.  Time 2 image is upper right.  Areas of land cover change between the two periods are shown in white on the bottom image.  Change is detected in all land cover classes and is dependent only on a significant spectral difference between the time periods.  No 'cause' of the change is classified, and that needs expert operator assessment but the areas are identified much more quickly and consistently that with manual classification.*

## 2.3    Doing segmentation (e.g. creating polygons) in SEPAL

Participants were also shown how to do segmentation which creates polygons around groups of adjacent pixels that have similar spectral properties (Figure 4). This is a very useful technique that is much faster and more consistent than manual image classification. There are various parameters and settings that users can choose to control the size, shape and homogeneity of the segments (polygons). Users are encouraged to experiment with the settings to test and determine what settings produce results that are satisfactory.

This is something that FAO encourages MoEF to continue to work on to find the parameters that produce results that the MoEF finds reasonable to produce standard methods and output products. We did not have time for that in this first workshop but it is something that can be explored either by individuals testing it with peer support (including online) or occasional email contacts from FAO staff, or we could run another workshop to cover this.

The segmentation algorithm is quite fast, and has a huge advantage in processing speed over manual classification as well as being more consistent across the image and in different dates which will help to improve the consistency through time and the overall accuracy of the results.

A set of notes outlining the steps to do a change detection analysis and segmentation in SEPAL is attached in Annex 3 Change detection and segmentation Indonesia.pdf
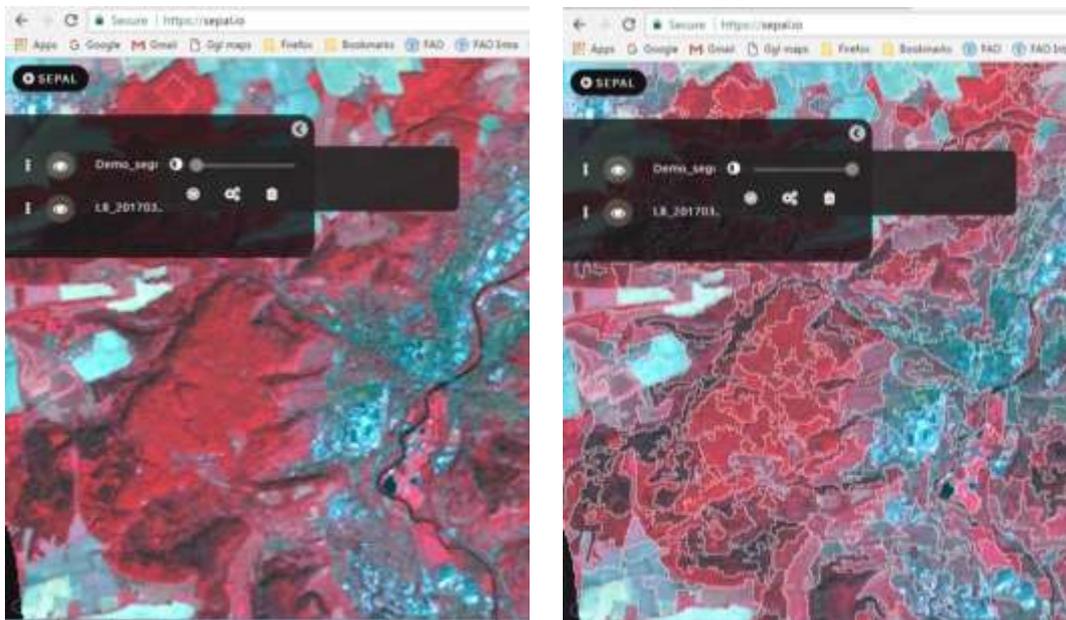


*Figure 4: Example of a normal remote sensing image (left) that has been segmented into polygons using SEPAL (right).*

## 2.4    Designing an accuracy assessment in SEPAL

A demonstration of the stratified area estimator- Design tool for generating a stratified random sample based on an input map. The tool generates a probability sample that can be assessed and used for an accuracy assessment of a thematic map and to estimate areas of the map.

SEPAL has a simple interface to provide guidance for stratified area estimation and map accuracy assessment (Figure 5). There are 5 basic steps outlined in the box 'How to use the tool' in Figure 5 and guidance is provided at each step within the tool.
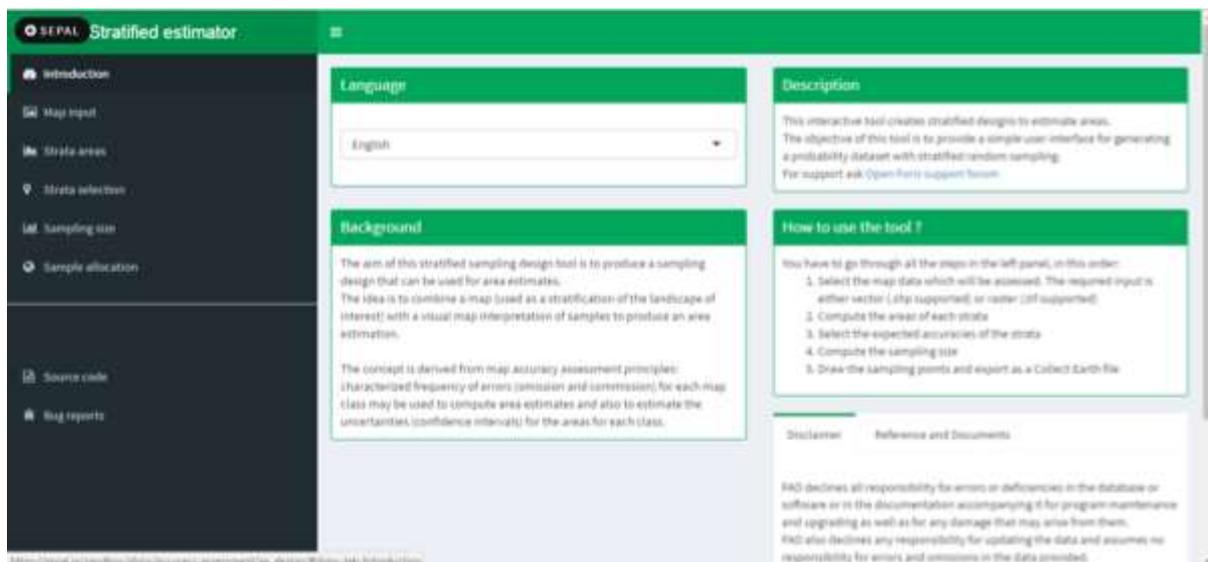
*Figure 5: The SEPAL Stratified Estimator- Design input screen used for assessing map accuracy.*

## 2.5 Processing results in SEPAL using points from Collect Earth exercise as reference data

The data collected during the previous Collect Earth workshops was analysed using the stratified estimator- analysis tool (Figure 5). The sample data from the Collect Earth workshops was designed as a systematic random sample. The 2015 land cover map information was used for post-stratification of the samples, with the aim to increase the precision of the estimates (decrease the confidence intervals). A stratified random sampling approach was recommended for area estimation of rare classes and change in order to increase precision with less samples. An example of the output screen from SEPAL with tables and a chart is shown below in Figure 6.
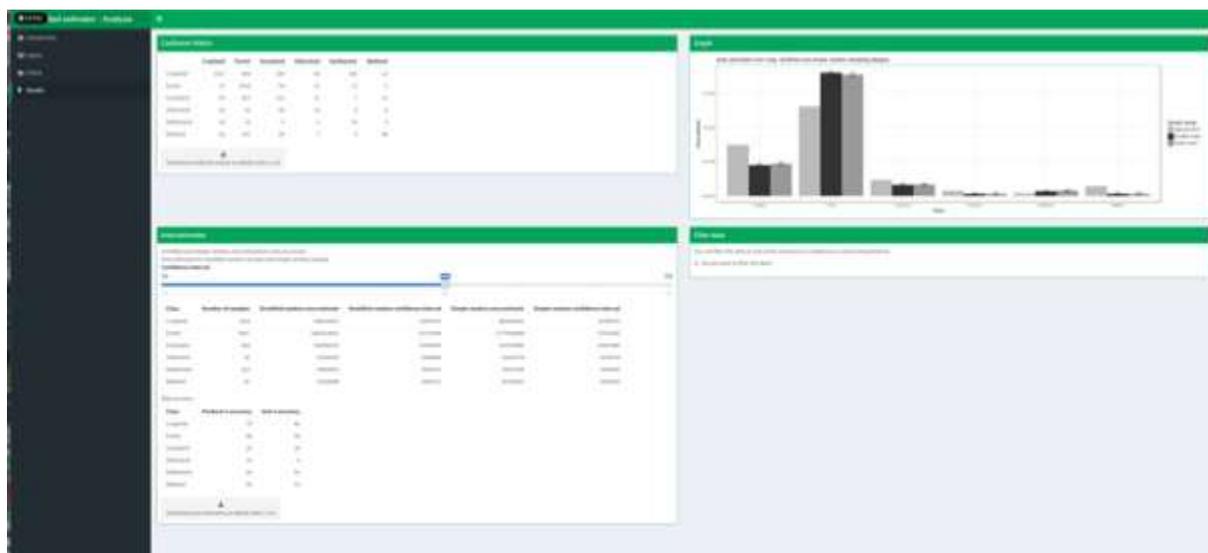


*Figure 6: Area estimation for the 6 IPCC classes from the sample data collected from the previous Collect Earth workshops. The area is estimated using only the sample data, using simple random area estimation and post-stratified using the 2015 land cover map as stratified random sample. Using both the map and sample data reduces the uncertainty of the estimate (smaller confidence intervals).*

## 2.6   Using Google Earth Engine to prepare draft burnt-area maps

Participants were introduced to Google's Earth Engine javascript processing playground and a customized, user script written to help Indonesia detect burn areas in high-definition using Landsat time-series data.  Participants were provided a script that gathered all of the available Landsat data for a user-defined area of interest for 2 different time periods; pre-burn and post-burn.  Users calculated the Normalized Burn Ratio (NBR) for each time period and then created a difference image (a product that compared the NBR pre-burn with the NBR post-burn) to detect areas on the land with the specific spectral qualities relating to a fire-induced change in vegetation cover. An example of the output display is given in Figure 7.

Participants were able to modify the script, provide custom inputs and re-analyse areas of Indonesia for burn area extent interactively.  The scripts remain in a shared script repository where Indonesian and FAO specialists can exchange ideas and help each other improve with the methods.  The MoEF 2015 burnt area map is a very useful dataset to use as a guide for doing this work. Further development of these functions is encouraged to improve the results and FAO will work with MoEF to discuss how best to continue the development and application for Indonesia.
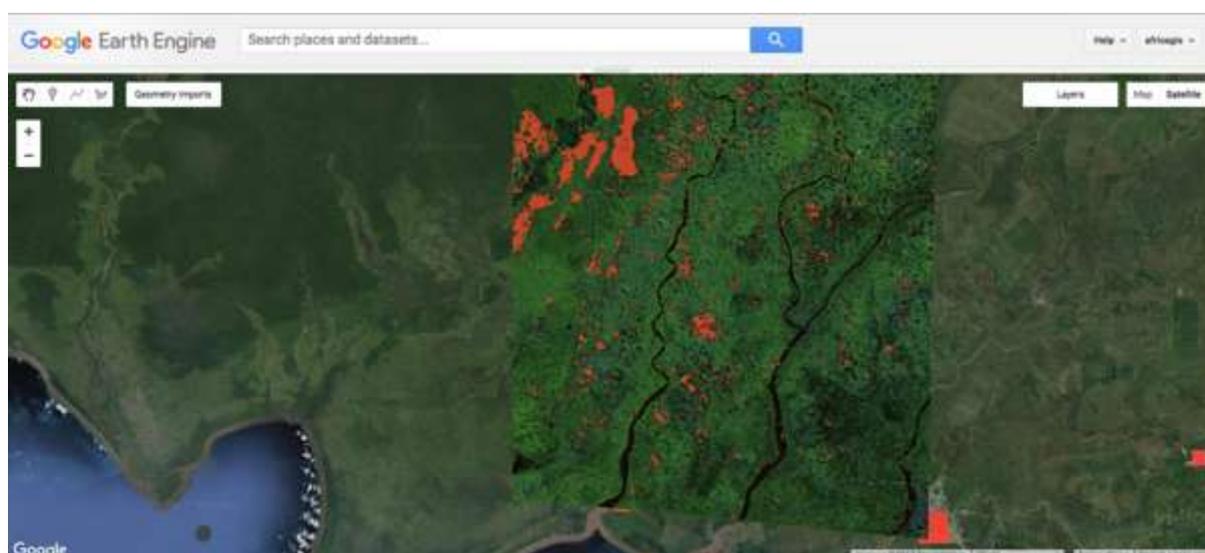


*Figure 7: Burned area mapping using for a portion of Kalimantan using a difference Normalized Burn Ratio approach and Google Earth Engine.*

## 3   CLOSING

Mr. Adam Gerrand representing FAO and Mr. Sigit Nugroho, acting as Director of Inventory and Forest Resources Monitoring, MoEF thanked all the participants and the facilitators. Mr. Sigit Nugrohoro officially closed the workshop around 12:00 p.m. on Saturday 6th May.

## 4   EVALUATION

Overall the training workshop was rated as highly successful by the overwhelming majority of the participants.  Some highlight quotes from participants in the evaluation survey include the following:

- Mosaicking, segmenting, analysing, and processing the satellite images at magnificent speed, its very EFFECTIVE, AND I LOVE IT!!

- It is a very useful system. I hope this system also improves in the near future and can link with all resources that are available in cloud system.
- This training is really awesome, hope I can join again for the next part.

The workshop was attended by 7 female (33%) and 14 males (67%) coming mostly from five national government institutions working on land change detection related issues (Annex 1).

The evaluation report shows that the workshop was very effective to increase participant's knowledge not only for the advancement of REDD+ in Indonesia but also to improve their own knowledge in area of NFMS. In addition, almost all participants (19 out of 21 or 90%) agreed that the combination of training methodologies used during this event with guided instruction and hand-on use on their own computer was very effective.

A number of topics were of particular interest to participants including the key topics for REDD+ of: Estimation of deforestation or degradation areas from satellite data; and Estimation of burned area from satellite data; in both these 30% of participants said they had moderate improvement and 70% had high improvement in their knowledge. 90% of participants said *"I will use what I learned during the event"* and 95% said *"I will recommend colleagues or partners in the country to attend a similar event"*.

Overall satisfaction was 84% very satisfied, and 16% satisfied with nobody unsatisfied. We will do a short follow up survey in a couple of months' time to see how many participants have been using the systems (we can monitor SEPAL usage remotely) and get some additional feedback.

# 5   CONCLUSIONS

This five day workshop for 21 Indonesian participants gave them an initial introduction to the use of the FAO software called Collect-Earth and SEPAL and trained them in some of the main functions of the systems. The combination of on-screen demonstrations with participants being able to follow along on their own computers made the training particularly effective and the topics of change detection (e.g. deforestation, or fire mapping) were of particular relevance for many of the participants work.

The evaluation report demonstrates that the workshop was highly successful overall with the vast majority of the participants rating the workshop very satisfied (84%). Almost all participants (90%) said the combination of methodologies used during the workshop, including lots of hand-on computer use, was effective and all of them (100%) said that they wanted to do more training on FAO remote sensing tools like Collect Earth and SEPAL.

This workshop has improved the capacity of some of the Indonesian staff and demonstrated the usefulness and relevance of the FAO software. There is still much to be done to strengthen the skills of these participants and reach a wider audience and FAO will work with the Indonesian agencies to discuss additional course and an NFMS improvement plan.

# 6   DRAFT RECOMMENDATIONS AND WAY FORWARD

1) The FAO Collect-Earth and SEPAL systems have the potential to make significant contributions to helping Indonesia improve its National Forest Monitoring Systems. This initial training has only provided a demonstration and some opportunity for 21 participants from 5 government agencies to learn and practice using the systems in a few days training. Further discussions are needed with the various agencies to work out what their interests and needs are and to consider the best way forward. FAO is pleased to see that Indonesia would like to develop an improvement plan for the NFMS and FAO is ready and willing to contribute to that process.

2) Participants are encouraged to continue to use SEPAL and join the online OpenFORIS discussion group (http://www.openforis.org/support/ ) to share information between participants and others using SEPAL and CE to learn how they can support their work in detecting forest change, monitoring burnt scar area, and support National Forest Monitoring Systems. It is recommended to read the FAQ first: http://www.openforis.org/support/faq/ ; and also: http://www.openforis.org/support/questions/15/how-do-i-ask-a-question-in-this-forum

3) FAO will inform participants when Collect Earth online is released.

4) FAO will follow up with the BRG Deputy Director's interest in using both SEPAL and Collect Earth for monitoring changes and detecting burnt scar area on peatlands.

5) PowerPoint presentations will be available in the Google drive workshop folder.

6) FAO and MoEF will follow up with potential donors related funding to have additional and more advanced training workshops in the future.

# 7   ANNEXES

## 7.1   Annex 1.  LIST OF PARTICIPANTS

| No | Name | Institution |
|----|------|-------------|
| 1 | Alfi Purnamasari | Geospatial Information Agency (BIG) |
| 2 | Sayidah Sulma | National Institute of Aeronautics and Space (LAPAN) |
| 3 | Inggit Lolitasari | National Institute of Aeronautics and Space (LAPAN) |
| 4 | Thomas Rinuwat | Peatland Restoration Agency (BRG) |
| 5 | Wahyu Catur Adinugroho | Forest Research Development and Innovation Agency (FORDIA), MoEF |
| 6 | Franki Zamzani | Directorate of GHGs and MRV, MoEF |
| 7 | Mila Soraya | Sub Directorate of Forestry Spatial Data Network, MoEF |
| 8 | Ajat Sudrajat | Sub Directorate of Forest Mapping, MoEF |
| 9 | Bobby Rachmat Fitriyanto | Directorate of Planning, Utilization Establishment of Forest Area |
| 10 | Dody Rahmansyah | Sub Directorate for Forest Inventory, MoEF |
| 11 | Emba Tampang Allo | Regional Office of Planology XIV Palu, MoEF |
| 12 | Ign. Christianto Ginting | Regional Office of Planology XIX Pekanbaru, MoEF |
| 13 | Fathoni Hananto | Regional Office of Planology XXI Palangkaraya, MoEF |
| 14 | Andi France Daryanto | Sub Directorate for Forest Resources Monitoring, MoEF |
| 15 | Sudirman Sudrajat | Sub Directorate for Forest Resources Monitoring, MoEF |
| 16 | Anna Tosiani | Sub Directorate for Forest Resources Monitoring, MoEF |
| 17 | Iid Itsna Adkhi | Sub Directorate for Forest Resources Monitoring, MoEF |
| 18 | Aditya Eka Permadi | Sub Directorate for Forest Resources Monitoring, MoEF |
| 19 | Muhammad Yazid | Sub Directorate for Forest Resources Monitoring, MoEF |
| 20 | Endrawati | Sub Directorate for Forest Resources Monitoring, MoEF |
| 21 | Melisa Elisabeth Pasalbessy | Sub Directorate for Forest Resources Monitoring, MoEF |

## 7.2   Annex 2. AGENDA

**Monday 1 May 2017 (Day 0)**

| Hour | Description | Institution |
|------|-------------|-------------|
| 12.00– ……. | Registration for participant not from Bogor office | OC |

**Tuesday, 2 May 2017 (Day 1)**

| Hour | Description | Institution |
|------|-------------|-------------|
| 08:30 – 09:00 | Registration | OC |
| 09:00 – 09:15 | Opening Remarks | MOEF |
| 09:15 – 09:30 | Overview of Indonesian forest inventory and mapping | MOEF |
| 09:30 – 09:45 | Overview of FAO work to support Indonesia improving the NFMS and Objectives of the workshop | FAO |
| 09:45 – 10:00 | Self-introduction by participants | All |
| *10:00 – 10:30* | *Break/Coffee / Tea* | |
| 10:30 – 11:00 | How FAO systems like SEPAL, Collect-Earth and the other tools can support Indonesia improve its NFMS | FAO |
| 11:00 – 12:00 | Theory and details of the practical exercises/ Intro to software and systems to be used during the week | FAO |
| *12:00 – 13:00* | *Lunch* | |
| 13:00 – 15:00 | Sample data examination and cleansing using Collect-Earth | FAO |
| *15:00 – 15:15* | *Break/Coffee / Tea* | |
| 15:15 –17:00 | Sample data examination and cleansing (continued) | FAO |

**Wednesday, 3 May 2017 (Day 2)**

| Hour | Description | Institution |
|------|-------------|-------------|
| 08:30 – 10:30 | Analysis of cleaned sample data, estimating areas, errors, etc. Use of R statistical software | FAO |
| *10:30 – 10:45* | *Break/Coffee / Tea* | |
| 10:45 – 12:00 | Working with the samples and the map.  Combining map classes to match samples. Estimating efficiency of map as a stratifier for samples to reduce errors. | FAO |
| *12:00 – 13:00* | *Lunch* | |
| 13:00 – 15:00 | Continue from earlier session.  Discussion about how to augment sample for change detection or specific map accuracy information. | FAO |
| *15:00 – 15:15* | *Break/Coffee / Tea* | |
| 15:15 – 17.30 | Continue from earlier session.  Discussion about how to augment sample for change detection or specific map accuracy information. | FAO |

**Thursday 4 May 2017 (Day 3)**

| Hour | Description | Institution |
|---|---|---|
| 08:30 – 10:30 | Sample site distribution for augmented sample for map classes of interest or change.  Analysis of sample sites. | FAO |
| *10:30 – 10:45* | *Break/Coffee / Tea* | |
| 10:45 – 12:00 | Continuation from morning session. Using samples to construct a map? | FAO |
| *12:00 – 13:00* | *Lunch* | |
| 13:00 – 15:00 | Analysis of new sample sites and map / efficiency and errors | FAO |
| *15:00 – 15:15* | *Break/Coffee / Tea* | |
| 15:15 - 17.30 | Analysis of new sample sites and map / efficiency and errors | FAO |

**Friday 5 May 2017 (Day 4)**

| Hour | Description | Institution |
|---|---|---|
| 08:30 – 10:30 | Introducing Google Earth Engine and burned area estimation from satellite data. | FAO |
| *10:30 – 10:45* | *Break/Coffee / Tea* | |
| 10:45 – 12:00 | Continuation from the morning.  MODIS and Landsat trials.  Area calculation and comparison with national data.  Use of national data for 'training' detection? | FAO |
| *12:00 – 13:00* | *Lunch* | |
| 13:00 – 17:30 | Burned area mapping with national training data in Google Earth Engine | FAO |
| *15:00 – 15:15* | *Break/Coffee / Tea* | |
| 15:15 – 16.30 | Burned area mapping with national training data in Google Earth Engine | FAO |
| 16.30 –17.30 | Introducing SEPAL – making composites, image segmentation, change detection | FAO |

**Saturday 6 May 2017 (Day 5)**

| Hour | Description | Institution |
|---|---|---|
| 08:30 – 10:30 | Introducing SEPAL – making composites, image segmentation, change detection | FAO |
| *10:30 – 10:45* | *Break/Coffee / Tea* | |
| 10:45 – 11:45 | Continuation of SEPAL, wrap-up of activities and discussion | FAO |
| 11.45 –13.00 | Review of workshop and did objectives get met? | FAO |
| 13.00 –13.15 | Closing remarks | |
| *13:00 – 14:00* | *Lunch and end of workshop.* | |