Open Foris and Google Earth Engine linking expert participation with natural resource mapping and remote sensing training in Tanzania

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Introduction

- The operational objective was to have forest plantations in Southern Highlands mapped and training in FOSS done
- **Mapathon event**: combining PGIS mapping, open-access remote sensing data catalogues, open source software, and cloud computing, and local expertise to map forest plantations in the Southern Highlands area of Tanzania.
- The **Geo-ICT project** continues to develop these training experiences and materials from the Mapathon further into **remote sensing training contents for Tanzanian universities.**

Case: Using a participatory mapping event to train on open source remote sensing methods

- Mapathon event in October 2016 at the University of Dar es Salaam
- A collaborative effort among FAO, University of Turku, Private Forestry Programme (PFP) and UDSM
- Collecting reference samples for mapping forest plantations in a Southern Highlands area in Tanzania.
- Forest officers, university staff and students were invited from different Tanzanian institutions
- Four days of training, four of data collection with open source tools

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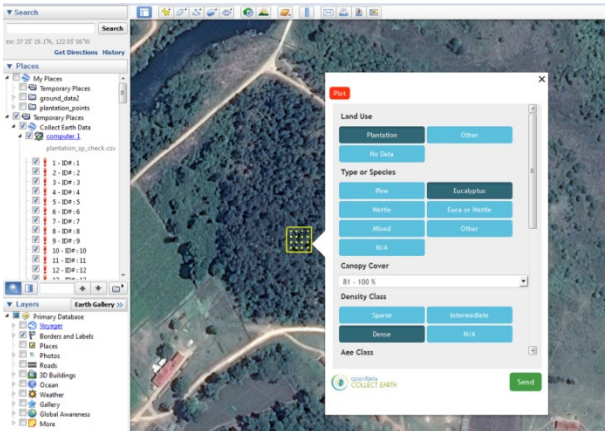
The Mapathon…

Week 1

- Hands-on training with the data collection tool **Open Foris Collect Earth**
- Familiarizing with the study area and visual interpretation of land cover in satellite imagery
- Group discussions and knowledge sharing, agreeing on land cover classification system together

Week 2

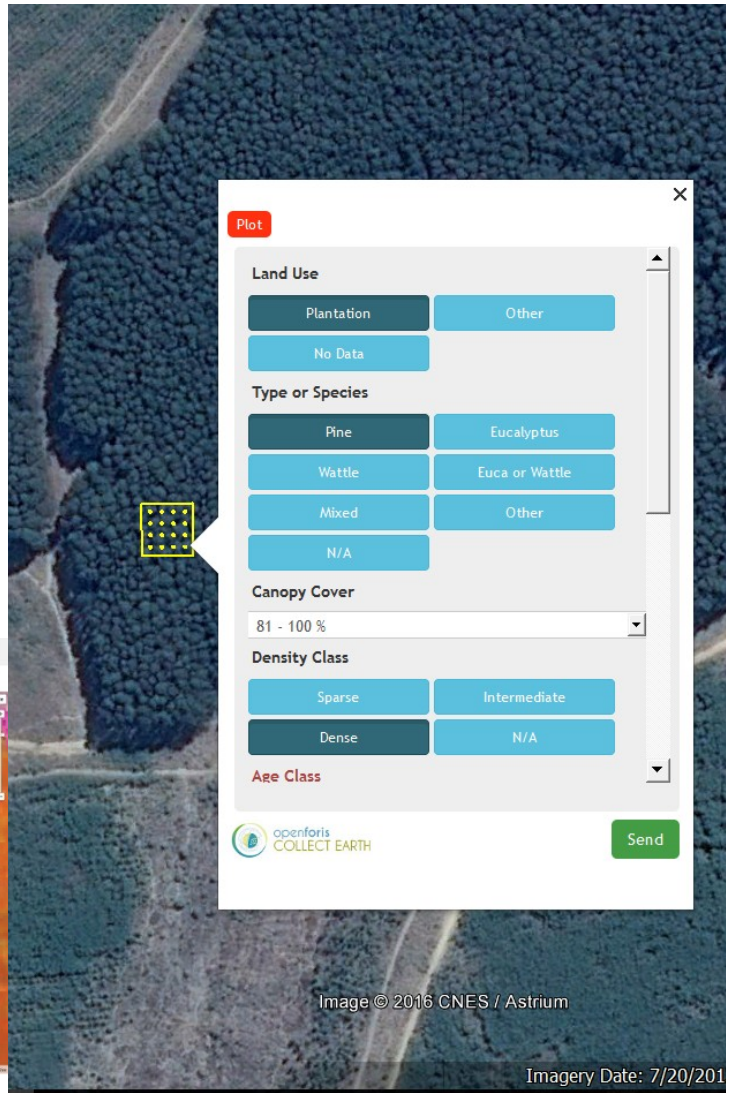
- Participants' interpretation accuracy testing
- Collecting a high volume of sample points through image interpretation
- Feedback from the participants about the learning experience

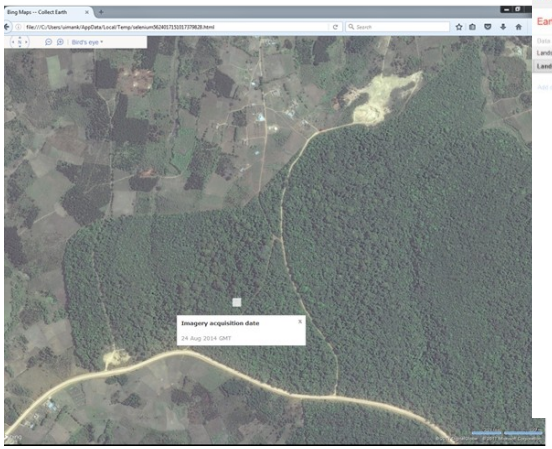


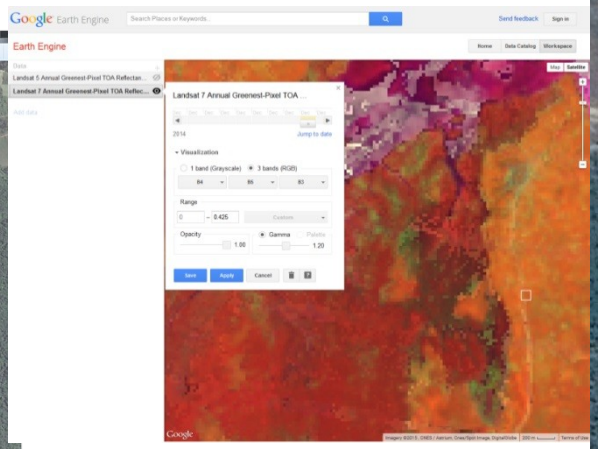
Open source tools – Open Foris Collect Earth

- FAO-developed Open Foris Collect Earth tool enables data collection from high resolution satellite imagery collaboratively
  - Combines the resources of Google Earth, Bing Maps and Google Earth Engine
  - The user fills a structured survey form with relevant land cover information for the sample locations based on his/her visual interpretation
  - Offers a easy-to-use solution for crowdsourcing/ participatory mapping

www.openforis.org



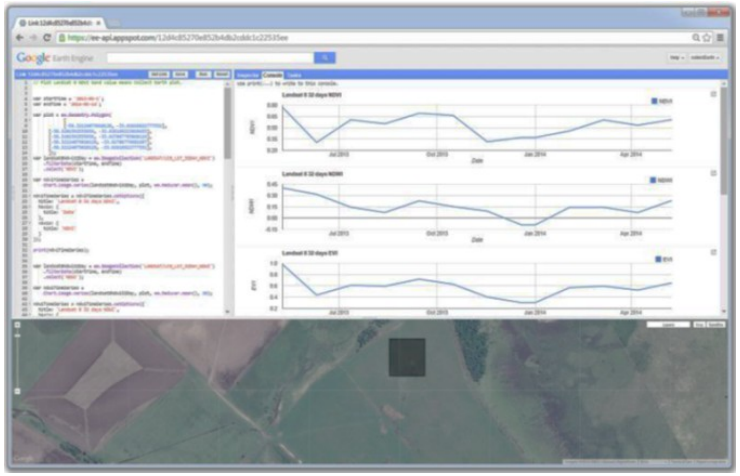


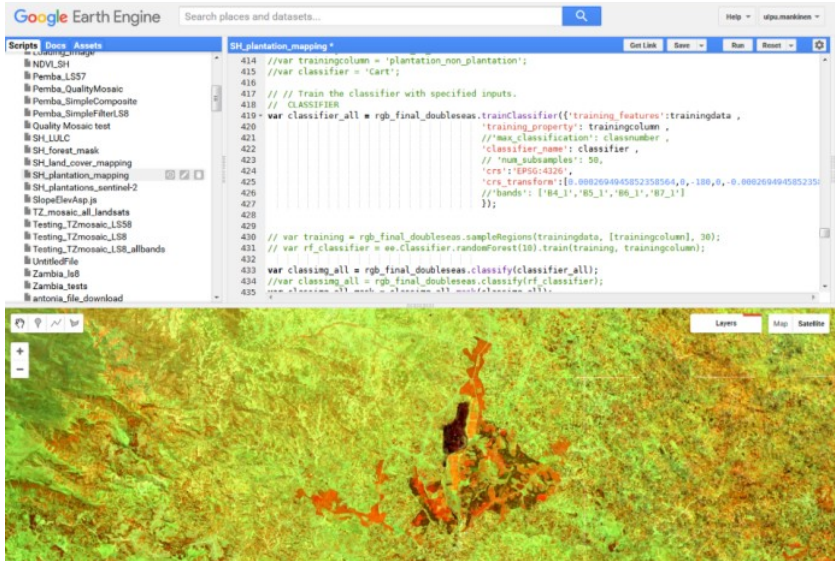


Open source tools – Google Earth Engine

earthengine.google.com

- Google Earth Engine cloud platform offers direct access to Google's satellite image archives
  - Landsat, Sentinel-2, digital elevation models, etc.
  - Although having coarser spatial resolution, the temporal and spectral resolution of the data offered by GEE increases the interpretation possibilities substantially.
  - Offers also a free solution for high-performance parallel computation service for data processing and analysis

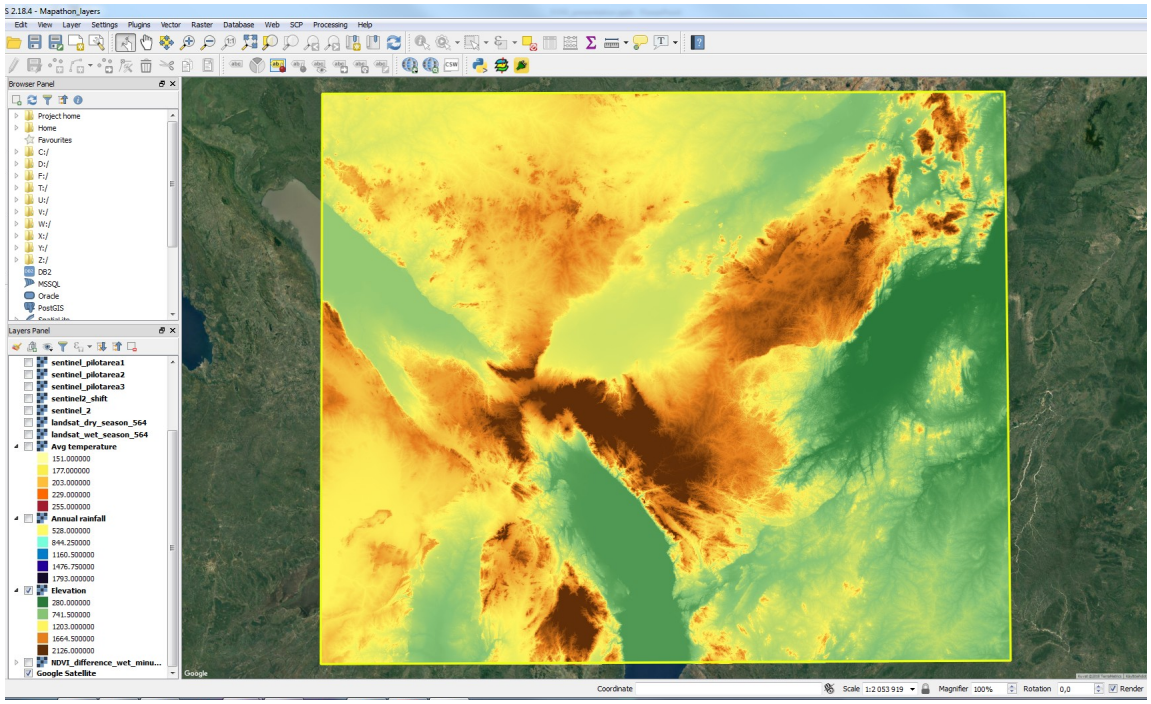




Open source tools – QGIS

www.qgis.org

- Working around unreliable internet: usage of previously downloaded auxiliary data (from Google Earth Engine and other sources) offline in QGIS
  - Landsat 8 OLI 2-season mosaics, SRTM digital elevation model, and Worldclim average temperature and mean annual rainfall
- Multispectral imagery facilitated interpretation though simple image manipulation in QGIS offered as part of training



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Follow-up: remote sensing training development through the Geo-ICT project

www.geoict.org

Geospatial and ICT Capacities in Tanzanian Higher Education Institutions project (2017-2020)

A collaboration of University of Turku, Finland, and four Tanzanian universities;

- University of Dar es Salaam (UDSM)
- Ardhi University (ARU)
- State University of Zanzibar (SUZA)
- Sokoine University of Agriculture (SUA)

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- One project aim is to develop the geospatial and ICT-related curricula and courses in partner universities.
- Five-day event in March 2018 to train teachers of geo/IT to develop and implement participatory mapping surveys and classifying land cover in QGIS or Google Earth Engine
- Participants discussed the possibilities to integrate the practised tools and Mapathon-like events in the Tanzanian universities' geospatial and remote sensing courses.

Results: The Mapathon experience

- Substantial improvement in interpretation for land cover characterisation and mapping
- Good mapping accuracy
- The orientation week was necessary to consolidate the participants' skills, sharing knowledge, and adaptation of the survey tools
- Interactive training with knowledge sharing and discussions was valuable for two-way learning process, standardizing of the data collection, and successful mapping
- The participants were highly motivated: they were interested to learn things beyond that were planned
- They readily focussed on scaling beyond the class

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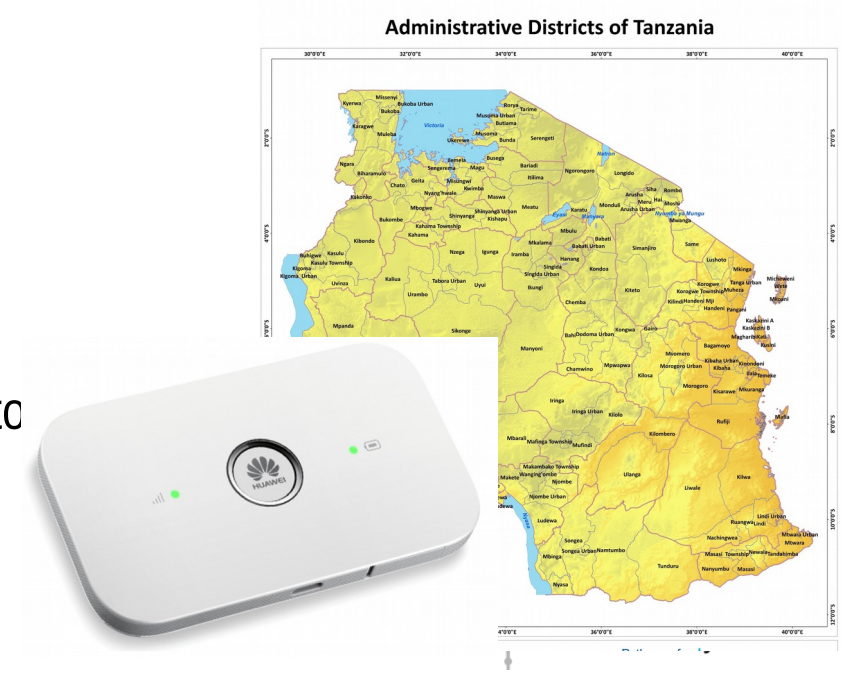
Results: usability of the tested FOSS methodology in teaching remote sensing

- Participants were eager to adopt some of the introduced FOSS options into their courses.
- New means to utilize the freely open data sets were called for, and the use of cloud environments such as Google Earth Engine interested many.
- The easy-to-use Collect Earth software could rather straightforwardly be embedded in the current training contents.
- QGIS is already gaining ground as an alternative to proprietary GIS software.
- The lack of technical or programming skills needed in some of the presented tools needs to be addressed
- To scale up training, modifications and workarounds are necessary



Conclusions

- PGIS, with open image repositories, with freely accessible cloud is promising for natural resource mapping especially in data scarce and rapidly developing countries in the Global South.
- The flow needs to include clear benefits for the voluntary participants of the mapping, such as knowledge sharing and networking possibilities and qualifications resulting from the learning experience.
- When the methodology is in the curricula of local HEIs it will become formalized, replicable, and adaptable according to the most recent data, technologies and tools.
- This is for continuity, commitment, and ownership of the process and lead to increased societal capacity to conduct natural resource mapping.

Thank you!

Contacts & links

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- Geo-ICT project www.geoict.org
- UTU Tanzania Team
  - www.utu.fi/tanzania
  - www.facebook.com/ututanzania
- QGIS www.qgis.org
- Open Foris Collect Earth www.openforis.org
- Google Earth Engine earthengine.google.com

Conclusions

- It is important to embrace open source software and grow means to utilize the growing repositories free Earth observation data.
- Support should be given to local institutions to emphasise professionals train and use free and open data, software and other tools.
- Extended training with follow-up procedures result into more permanent results
- Developing training methodologies on FOSS is crucial to ensure participants will develop their own skills and introduce the new tools in their home organizations.
- Data collection as part of intensive training is an effective way to teach and practice solving real world problems
- It is a great opportunity to embed some of the FOSS4G solutions into the undergraduate and postgraduate degree training at Tanzanian universities.
- We plan to continue by developing the training materials for remote sensing courses of the universities and further training of the key persons in each university.