Improving Land Cover Monitoring with TimeSync

Article by Phoebe Oduor, February 2017

During 2016, SERVIR-Eastern and Southern Africa (E&SA) at the Regional Centre for Mapping of Resources for Development (RCMRD) conducted a needs assessment for Uganda to identify climate related issues the country faces. One issue identified was the need for a rigorous approach, including timely and periodic land cover and land cover change maps, to identifying deforested and degraded forest areas. SERVIR-E&SA is collaborating with SERVIR Applied Sciences Team (AST) member Sean Healey from the United States Forest Service and partners from SilvaCarbon and Oregon State University on a project to address this need.

"Enabling Local Monitoring of Landscape Change across Eastern and Southern Africa" is a three year AST project that builds upon the TimeSync tool, Google Earth, and Google Earth Engine. It leverages Landsat's archive, Google Earth's High Resolution Imagery, and Google Earth Engine's processing capacity to integrate an ensemble of different land cover mapping algorithms. Reference data collected through TimeSync will be used to calibrate annual land cover and land cover change maps for between 2000 and the current year.

SERVIR-E&SA, together with Healey and his colleagues, held a capacity building and reference data collection activity in Entebbe, Uganda, from 23 to 25 January 2017. There were 22 participants from Rwanda, Zambia, Malawi, Ethiopia, Kenya, and Uganda. Representatives were present from the Ministry of Natural Resources, Energy and Environment - Department of Forestry, Malawi; Ministry of Lands, Natural Resources and Environmental Protection –Survey Department, Zambia; Rwanda Natural Resources Authority(RNRA); Ethiopia Mapping Agency, Ministry of Environment, Forest and Climate Change, Ethiopia; National Forestry Authority, Uganda; Makerere University, Uganda, Climate Change Department (CCD), Ministry of Water and

Environment, Uganda; Climate Change Department (CCD), Ministry of Water and Environment, Uganda, Kilimo Trust, Uganda; NEMA, Uganda, REDD+ Uganda; DRSRS, Kenya; Kenya Water Towers Agency (KWTA); Kenya Forest Service; and USAID-USFS - Kenya Water Tower Climate Change Resilience Program.

In the three days training, the participants learned about reference data collection using TimeSync. TimeSync is an application that allows researchers and managers to characterize and quantify disturbances and landscape changes by facilitating pixel-level interpretation of Landsat time series stacks of imagery. TimeSync was created in response to research and management needs for time series visualization tools, fuelled by rapid global change affecting ecosystems, major advances in remote sensing technologies and theory, and increased availability and use of remotely sensed imagery and data products (Cohen et al., 2010).

TimeSync can be used to

- Characterize the quality of land cover map products derived from Landsat time series.

- Derive independent statistical estimates of change with uncertainty, including type of change over time and rates of change.

- Validate change maps.

- Explore the value of Landsat time series for understanding and visualizing change on the earth's surface.

During the training, the participants learned how to use TimeSync and how to customize the response design (Classification Schema and Change processes to be considered). The response design was determined to be applicable to all six countries covered by the project: Kenya, Uganda, Rwanda, Zambia, Ethiopia, and Malawi. It enables recording of the state of individual years in addition to determining the change process that may have occurred in between the different vertices (Change points).
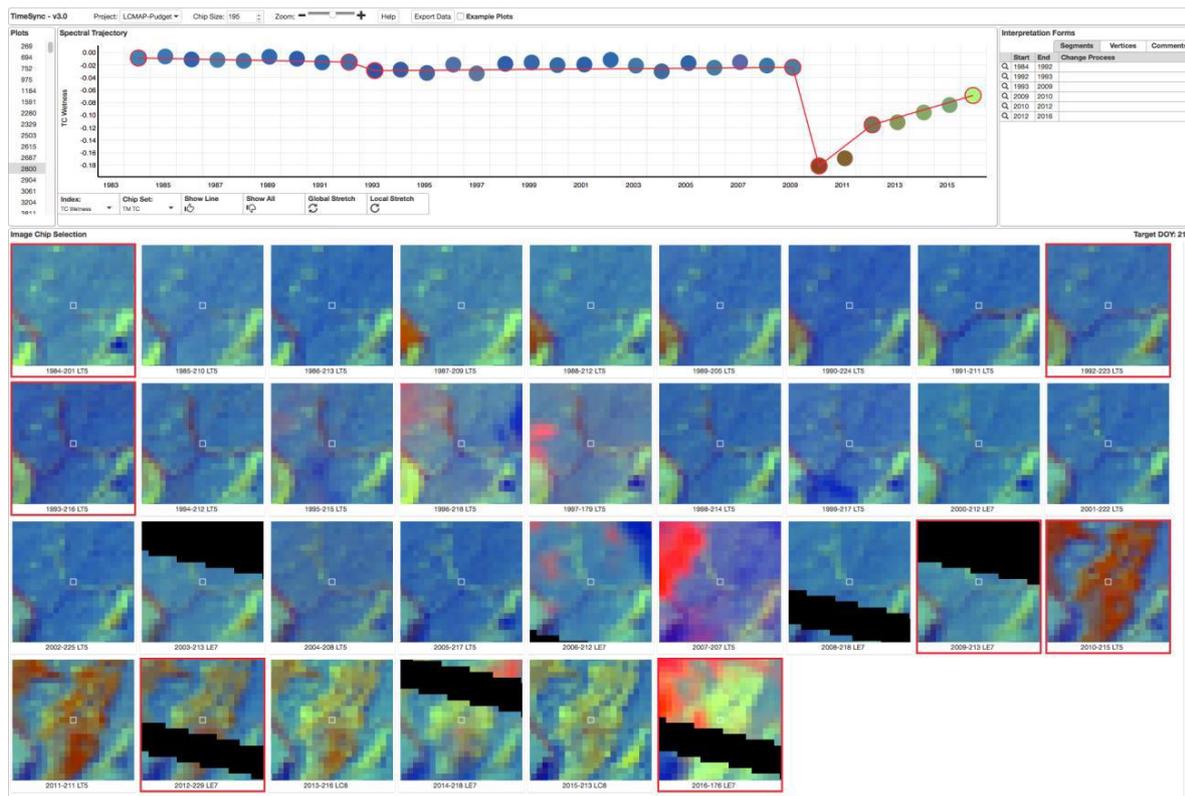
Figure 1. Time series of Landsat archive used to interpret forest disturbance history through the TimeSync interface. The trajectory indicates that the forest had been stable for some time, then experienced some deforestation, and has been greening in the last few years.

The reference data collected during the workshop was used to demonstrate how areas and error estimates for the different covers and change statistics can be derived. Albeit very few points (266) were available from the training for Uganda, the trend was corroborating what has been determined by other data sources and existing Land Cover maps. It is expected that more reference data will be collected over time to reduce the uncertainty of land cover change estimates.

Workshop participants found TimeSync's ability to monitor miniscule changes, including phenological differences occurring over very short durations, to be of great value. Some of the participants indicated that TimeSync will go a long way in enriching how they collect reference data and change analysis. Another participant saw the possibility to use the tool in current forest restoration programs given its ability to detect very small deforestation areas.

SERVIR-E&SA team members led the training and are now capable of running similar workshops in other countries. In addition, SERVIR-E&SA's programmer worked with TimeSync's developers and gained the ability to modify the software so that it can be customized for other reference data collection activities in the region.

A joint development initiative of National Aeronautics and Space Administration (NASA) and United States Agency for International Development (USAID), SERVIR works in partnership with leading regional organizations world-wide to help developing countries use

information provided by Earth observing satellites and geospatial technologies for managing climate risks and land use.

More information about the training and about TimeSync can be obtained from https://sites.google.com/site/rcmrdservir/home/