Objective

To detect in near real-time vegetation loss and gain resulting from human activities in South-East Asia and thus provide updated information about land use change with a frequency and spatial resolution relevant for decision makers.

The challenge

The accelerated loss of forest vegetation and its related cover results in a dramatic change in land use that can cause serious damage to biodiversity and ecosystem services of great importance such as water supply, regulation of greenhouse gases and even the prevention of natural disasters. Despite this, in many parts of the world there is not sufficient information available to take care of the forests.

Therefore, decision makers need to prioritize interventions and design activities to control these changes; but this requires accurate and current information about the loss in forests cover and land use change. Terra-i, designed for this task is a robust platform that reports in near real time the state of vegetation. With this tool you can take action in the conservation, forest cover and land use change monitoring, and thus meet the goals of the Convention on Biological Diversity’s (CDB); identify areas of interest for the implementation of REDD + projects, monitor protected areas status, among many other applications.

The opportunity

Terra-i is a near real time monitoring system for natural vegetation loss detection and land use change. It was first implemented in Latin America and is currently implemented in Asia and Africa. Since June 2012, Terra-i data has been available free of charge for download on www.terra-i.org. Currently, there is a map of vegetation loss available every 16 days between January 2004 and the present date. Since this dataset has been made available, it has been updated every two months. Beside the generation of the data, Terra-i team has used these results in several studies such as identification of areas with high risks of deforestation in the near future, road impact assessment, protected areas effectiveness assessment, trends and rates analysis and many more. All these results and literature are available on Terra-i website.

The methodology is based on the premise that natural vegetation follows a predictable pattern of changes in greenness from one date to the next brought about by site-specific characteristics and climatic conditions in the preceding days. We use a Bayesian-probability based neural network to learn how the greenness of a given pixel (derived from the MODIS product MOD13Q1) responds to a unit of rainfall (derived from the TRMM and GPM daily...
rainfall products), then apply the model to identify anomalies in the time series which can be attributed to human activities (i.e. non-natural fluctuations in greenness).

**The strategy**

Terra-i is currently applied at pantropical scale based on atomized calibration. Although the results of such calibration are globally good, the outputs of the tool can be greatly improved by including the local expertise and knowledge. For instance, Terra-i was successfully implemented by the Peruvian Ministry of Environment (MINAM). Since Terra-i Peru was officially launched in April 2014, it has been applied as the official early warning system for land cover and land-use change in Peru. The collaborative framework agreement signed between the International Center of Tropical Agriculture (CIAT) and the Peruvian Ministry of Environment (MINAM), implemented the new early warning system successfully, producing as a result monthly update. This collaboration has a direct impact on the different working groups such as the General Direction of Land Management (DGOT) and National Protected Areas Service (SERNANP), which use the data for analysis of loss of coverage locally and decision making. After a year of capacity building, MINAM engineer were able to use Terra-i to produce themselves the alerts with the continuous support of CIAT team.

**The way forward**

In order to provide concrete evidence for future applications of Terra-i in Southeast Asia, three case study areas have been selected: Indonesia, Vietnam and Laos. These countries have experienced very different land use change trajectories during the past few decades and could provide an interesting range of spatial analyses through Terra-i tool: land use change from 2004 to present could be monitored, enabling the main drivers of these large-scale changes to be better understood and the location of these changes in near real time and at a small spatial scale to be provided.

1. In Indonesia, deforestation rates keep increasing since the 20’s and have reached a critical point in 2015 with mainly the expansion of agriculture, smallholder shifting cultivation, illegal logging and forest fires. Besides, other land use changes are occurring in the country like for instance the conversion from cocoa to rubber, oil palm and eucalyptus plantations. With Terra-i, it is possible to target these changes and to build a daily alert system accessible by a large range of stakeholders. Terra-i can detect hotspots of land use changes and it also allows to downscale for more accuracy thanks to a multi-sensor combination methodology.

2. Vietnam have witnessed dramatic changes in its forest cover through very intense deforestation episodes. Terra-i can provide major information of the remaining forest resources for both primary and secondary forest and analyze the impact of increasing reforestations programs on other land use types and crops where CIAT has focused and built its expertise on.

3. Laos is an interesting case of study for Terra-i application because few studies of land use change at the country scale have been explored deeply. For example, there is first a huge pressure on Laos borders with an increasing rubber and cassava production from the neighboring countries that Terra-i can monitor. Besides, Terra-i can provide many opportunities to explore the actual remaining forest cover and to analyze its dynamic in relation for instance GDP growth, infrastructure development or agricultural expansion.

The implementation of an improved version of Terra-i for South-East Asia can be split into four steps:

1. Identification of the local actors, experts and available data agreeing to participate in a working group for the fine tuning of the methodology.
2. Implementation of calibration and methodology fine-tuning based on local expertise and the data gathered.
3. Capacity building of the local actors on the use of the data, the advantages and limitations of the tool and finally the use of the tool to generate the alerts.
4. Implementation of a web map platform to share the results.

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The International Center for Tropical Agriculture (CIAT) – a member of the CGIAR Consortium – develops technologies, tools, and new knowledge that better enable farmers, especially smallholders, to make agriculture eco-efficient – that is, competitive and profitable as well as sustainable and resilient. With headquarters near Cali, Colombia, CIAT conducts research for development in tropical regions of Latin America, Africa, and Asia. [www.ciat.cgiar.org](http://www.ciat.cgiar.org)