

Monitoring tree cover dynamics in complex landscapes under global change

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Tropical forests are currently an important topic on the Conference of Parties (COP) of the UNFCCC (UN Framework Convention on Climate Change), because deforestation in developing countries is responsible for about 18 % of global greenhouse gas emissions. The REDD+ framework (Reduced Emissions from Deforestation and forest Degradation plus), one of the seven building blocks of the Bali roadmap, would reward countries to sustain and protect forests. Reporting guidelines within this framework are now being set up, and are based on the forest extent, biomass estimates and surface affected by degradation.

A current weakness of REDD+ is that it only considers forest in accordance with a certain forest definition. This leads to a partial carbon balance at the landscape scale and risks to cause extra pressure (leakage) on other land use types not considered as forest. These land use types are generally managed by smallholders. The landscape scale and thus the interactions between different land cover types and land uses are neglected. The REDD+ mechanism can potentially lead to higher pressure on other land cover/land uses, with associated greenhouse gas emissions. Therefore, it is essential to consider REDD+ within the complex interactions at landscape level. Only then, can it contribute to sustainable land use.

Secondly, the effect of natural climatic variability on forest ecosystems and their surrounding landscape are not taken into account, basically because they are not very well understood. It can be questioned whether countries can be held responsible if the accumulated biomass is lower because of changes in climatic conditions (e.g. severe droughts), which could cause serious compliance risks within a finance-for-result-based REDD+ mechanism. The understanding of the effects of climatic variability on vegetation is the 2nd subject of this research.

This PhD subject will focus on these lacking elements that are important issues for decision making on sustainable land use within a changing environment at the landscape level. Time series of remote sensing images enable us to analyze the past evolution of landscapes and relate these dynamics with other variables like climate and human interactions.

The research will use long time series of satellite data available at VITO-TAP: e.g. SPOT-VEGETATION (1km resolution, 1998-present), NOAA-AVHRR (4km resolution, 1982-2000). These will be complemented with analysis on high resolution historical imagery for detailed analysis and with ground truthing campaigns, both from a biophysical point of view and a socio-economic point of view.

The research will focus on Rwanda as a case study. Rwanda is characterized by large gradients in topography, climate and has experienced large changes in land cover / land use over the past decades. This makes it an ideal region for this research topic.