# Forest degradation detection using remote sensing: a case of Kapuas Hulu, West Kalimantan, Indonesia

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**Abstract:** One of the major uses of remote sensing is the process of monitoring any events that happens in the earth surface. Remote sensing has been used by many studies to estimate deforestation and forest degradation, essentially in the tropical forest, for the last decades. Estimating forest degradation is not an easy task due to the different interpretations and less precision of the remote sensing data itself. For the REDD+ activities, part of the major challenges is to quantify the carbon stock from the forest degradation. Classifying the sources of human pressure to the forest is one way to help in detecting the forest degradation through remote sensing. An example is the work of Peres *et al.* (2006) who grouped in three classes the sources of human pressure as highly detectable (recent slash-and-burn, major canopy fires, new infrastructure building), marginally detectable (selective logging, forest surface fires, small scale mining), and almost undetectable (hunting, harvesting non timber forest product, sub-canopy small roads or path).

The focus of this research was to detect the forest degradation in Kapuas Hulu district, West Kalimantan. We used Landsat Enhanced Thematic Mapper (ETM+) / Thematic Mapper (TM) images data in 1990, 2000, 2005, and 2010 for the analysis. This was a complex process requiring continuous representation of the land cover since biophysical variables vary continuously, not only in space but also in time.

The methods used were the image pre-processing in which we conducted the radiometric and atmospheric correction of the Landsat data based on physical models. Once the data were corrected from haze and other disturbances, we built a spectral library by examining pixel purity index (PPI). This process involved identifying the spectral curves that have the potential to be end members (green vegetation, non-photosynthetic vegetation (NPV), soil, cloud and shadow). After that we applied the spectral mixture analysis (SMA) which is an automated algorithm to estimating the proportion of each image pixel. The final part were to detect the forest degradation

by using the spectral mixture modeling technique and the normalized difference fraction index (NDFI). The latter had the advantage of combining all relevant information to estimate the forest degradation. We conducted ground truthing by collecting field observation data and to assess the accuracy of forest degradation maps. The expected result of this research would be maps and statistic matrix through which we would be able to identify and detect forest degradation.

Keywords: Landsat, forest degradation, pixel purity index, spectral mixture analysis, normalized difference fraction index