

EO-services - Huong Son & Vinh Tu

The Vietnamese trial supports the ForCES project in the test sites of Huong Son (Ha Tinh province) and Vinh Tu (Quang Tri province) by providing spatial input data on landscapes derived from EO data to support the valuation of ecosystems and services. The generation of forest maps for three different years (2005, 2010, 2012) and a land cover map of the recent date will provide valuable inputs for these purposes.

The service specification comprises the following EO derived products:

- 1) a **forest mapping product** for the years 2005, 2010 and 2011/12, providing information on:
 - forest area
 - forest type (primary forest with different forest densities, plantations; protected areas if available from in-situ data;)
 - changes in forest area, including clear cuts/deforestation as well as degradation
 - indicator for above ground biomass (ton per ha)
- 2) a **land cover and habitat mapping product** for 2011/12. This comprises:
 - a land cover map with classes compatible to the FAO Land Cover Classification Scheme LCCS. Classes shall include forest, major agricultural surface types (bare agricultural land, grassland), settlements, primary roads, bare soil, water bodies, rivers and wetlands.
 - a habitat fragmentation map based on forest area and type products with a focus on Morphological Spatial Pattern Analysis (MSPA).
 - a consolidated river network and delineation of water bodies.
 - a primary road network.

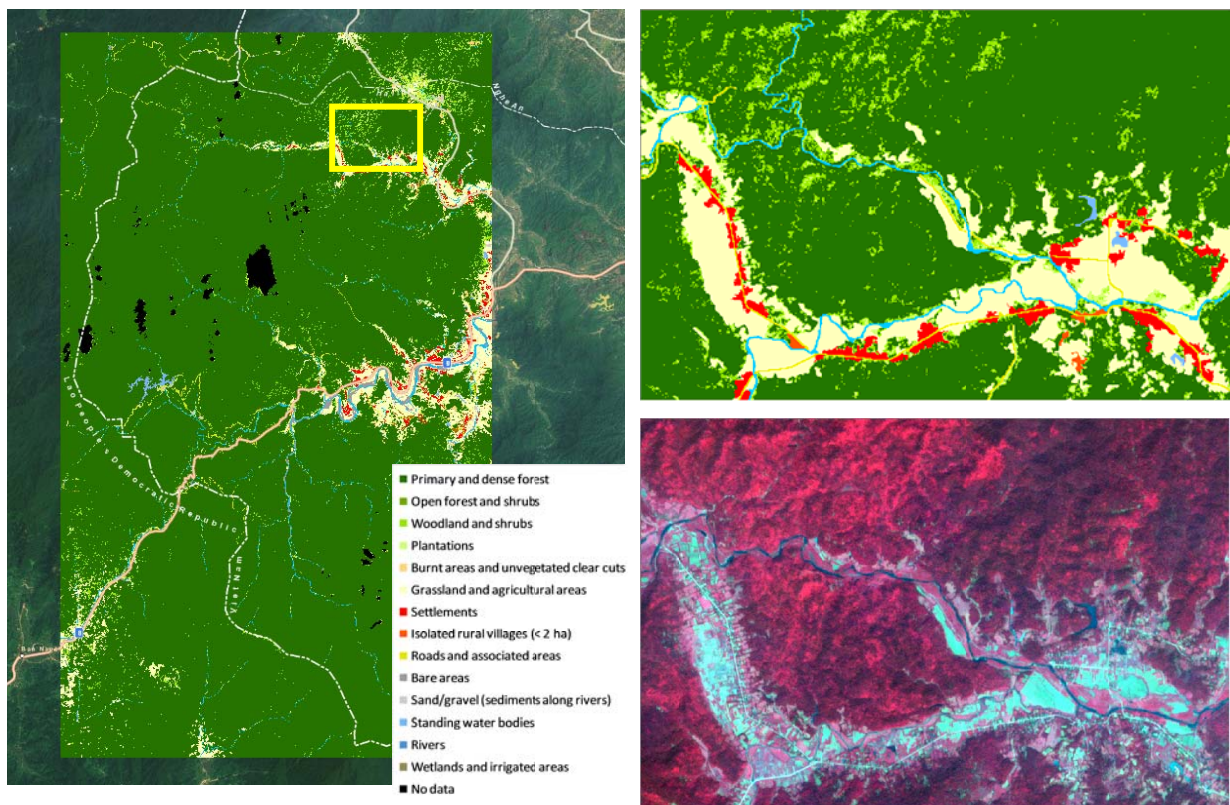


Land cover classification and SPOT5 image (ESA and Astrium) over the Vinh Tu area

The EO data sources for this service are European EO missions providing high-resolution multi-spectral imagery. For the reference year 2012 very high resolution (5m) RapidEye imagery for Huong Son as well as SPOT-5

(2.5m) of 2011 for Vinh Linh are used. An additional SPOT high resolution coverage of 2011 available for Huong Son has been provided by ESA. For the AOI in Vinh Linh SPOT-5 provides a suitable coverage for 2010. SPOT-5 10m data are used for mapping of both sites in 2005. Due to the unavailability of a local DEM, high-precision ortho-correction and illumination correction was not possible, but all images were adapted to each other by relative co-registration techniques, both geometrically and radiometrically, what is especially important for performing reliable detection of land cover changes. Finally, all EO data for the three available dates (2005, 2010, 2012) per trial site are geometrically co-registered with a geometric accuracy of ideally less than one pixel, facilitating the change analysis of the land cover.

Forest type and density classification into primary (largely undisturbed or very dense) and secondary (degraded with less density) forests is done using calibration data on tree cover density extracted from very high resolution image reference data (partly KOMPSAT-2, partly Google Earth). Ideally such information would be taken from existing forest inventory data, but these could not be made available to the producers at the time of production. The sampling of different tree canopy densities is extrapolated to the areal classification of the high-resolution SPOT/RapidEye data. Density classes of the forest are classified based on the differentiated spectral reflectance and are dependent on tree species, the amount of ground vegetation present as well as the amount of shadows in the crown cover depending on size and structure of the tree crowns. After harvest with selective cuttings there is initial influence of bare soil on the spectral signature. The result of this procedure is a pixel-based continuous representation of tree cover density on a 0-100% scale, which is thematically aggregated to depict major forest types such as “primary or dense forest” with densities of at least 70%, “woodland or shrubs” with 30-70% density and “open forest or shrubs” with lower 30% density.



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Resulting classes for the forest mapping product are:

- Primary or dense forest (mainly high density range of >70%-100%)
- Open forest and shrubs (mainly medium density range of approx. 30-70%)
- Woodland and shrubs (mainly low density range of 0-<30%)
- Non-forest

In addition to the forest cover, the land cover map contains plantations as well as burnt areas and unvegetated clear cuts. One particular challenge is forest plantations as their rotation and harvest cycles change their appearance across seasons. Short-term changes are hence highly dependent on the acquisition dates of the images.

Resulting classes of the forest change product are:

- Forest loss
 - Deforestation (from x% to 0% density)
 - Degradation (from x% to lesser y% density)
- Forest growth
 - Densification (from x% to higher y% density)
 - Re-/Afforestation (from 0% to x% density)

The final legend of the land cover maps has been designed in accordance with the demands of FSC and SNV:

- Forest with sub-classes from forest mapping product
- Plantations
- Burnt areas and unvegetated clear cuts
- Grassland and agricultural areas
- Settlements
 - Settlements
 - Isolated rural villages (<2ha)
- Roads and associated areas
 - Primary roads
- Bare areas
 - Bare areas (bare soil/rocks)
 - Sand/gravel (sediments along rivers)
- Water bodies
 - Standing water bodies
 - Rivers
- Wetlands and irrigated areas (only where clearly visible such as Vinh Tu and Huong Son)
- No data areas (clouds / cloud shadows)

Forest change between 2005 to 2010 as well as 2010 to 2012 predominately appear close to settlement areas or along major roads, but hot-spots of change have moved. Deforestation has significantly accelerated from 997 ha (2005-2010: 200 ha/year) to 1.302 ha (2010-2012: 650 ha/year). Yearly rates of degradation have experienced a moderate increase (2005-2010: 218 ha/year; 2010-2012: 280 ha/year). On the other hand, afforestation has developed from 934ha in 2005-2010 to 1136ha in 2010-2012 and densification decreased from 1989 ha in 2005-2010 to 1388 ha in 2010-2012. Forest change in Vinh Tu is also characterized by a higher amount of forest growth than forest loss, potentially due to the clearing/regrowth on forest plantations, the same reason as in Huong Son. However, degradation has also remarkably advanced in 2010-2011 (256ha/year) compared to the previous period 2005-2010 (29 ha/year) and the same is true for deforestation (2005-2010: 17ha/year; 2010-2011: 112ha/year).