UPDATING CARBON STOCKS

Over the last few decades LiDAR technology has emerged as a robust tool for inventory forest purposes, however, its acquisition entails high costs which prevent its regular update. The aim of this study was to provide per-pixel current carbon estimates for a large region (Bizkaia) using already data sources. Species-specific regression models were applied generating a dynamic inventory of carbon stocks, which takes into account both the stands growth and the changes occurred after LiDAR data acquisition. The results showed it is possible to developed a methodology framework suitable for carbon stocks estimation at a reasonable cost readily updated.

Introduction

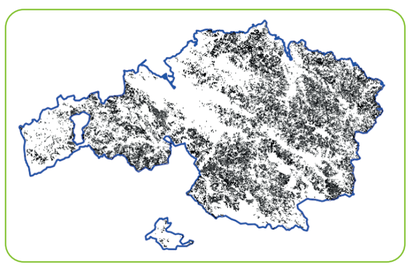
Despite the enormous benefits of LiDAR inventories, this tool may lose usefulness because of the changes in the environment in which they are used (McRoberts et al., 2018). In many cases it is not feasible to capture LiDAR data for forestry purposes with a high temporal resolution. In this sense, the Landsat programme provides a good solution to detect disturbances in a spatially continuous way.

Objective

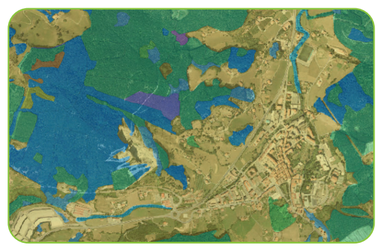
The aim of this study was to develop a methodology for the updated measurement of the amount of CO2 stored in the forest of Bizkaia (Pais Vasco, Spain).

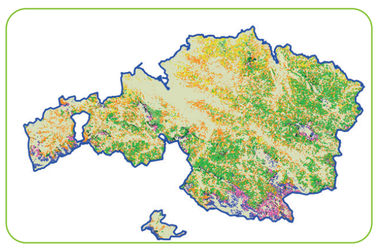
Methods

1. Parametric and non-parametric Random Forest (Breiman, 2001) models were adjusted using LiDAR metrics and field information to obtain wall-to-wall volume and annual volume increase estimates.



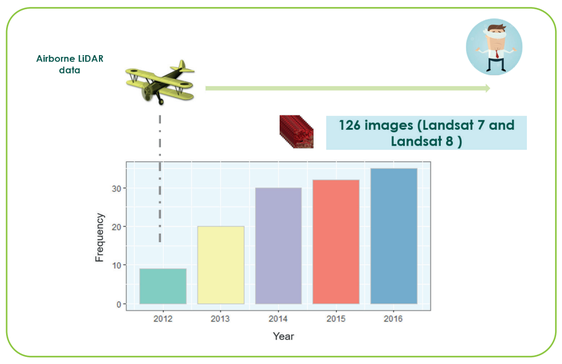
2. A species-specific factor was applied to estimate the carbon content (Montero et al., 2005). Species information composition was derived from the forest map of País Vasco and from Sentinel-2 (S2) in mixed stands.



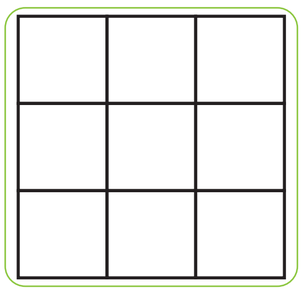


S2 classification

3. A change detection methodology was implemented using all available Landsat images over the period 2012-2017

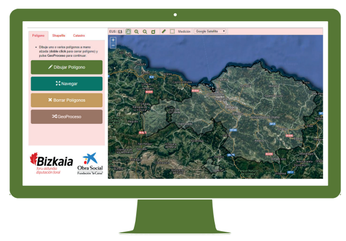


4. A wall-to-wall estimate of carbon



Results

The information generated was enhanced by means of an online platform that offers a real-time access and analysis service. The product to be downloaded consists of a summary report of the carbon estimates and the composition of forest species in the selected area, as well as a shapefile that can be uploaded to any GIS program.

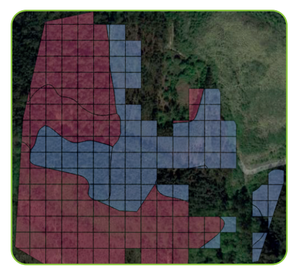


http://co2-bizkaia.agresta.org/

Detected disturbances were excluded from the final carbon estimates to avoid overestimates

Carbon estimates

Forest classification



Mixed stands

Discussion and conclusions

This study demonstrated the potential of fusing data from different sensors allowing for a dynamic CO2 inventory that takes into account both growth and disturbances. On one hand, LiDAR data provides information on the vegetation structure for realization of continuous mass inventories of high resolution and precision. On the other hand, passive sensors provide complementary information both for forest cover composition and for change classification.

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Forest solutions for the future

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