CHANGE DETECTION ANALYSIS ON WALLOON BROWNFIELD SITES

Change detection analysis based on Sentinel-2 data in order to update the inventory and quantitatively assess the evolution of brownfield sites in time and space.

The challenge

After the successive industrial restructuring of the '70s and '80s, Wallonia has inherited numerous derelict and underused sites. In 2006, the European Commission required that each member state establish an inventory of these sites, known as brownfields. The Walloon inventory includes sites of economic and non-economic activities that have been abandoned, both polluted and unpolluted. It lists more than 2,000 sites previously dedicated to economic activity ranging from post offices to heavy steel industries. Due to its time-consuming nature and expansive cost, public authorities were looking for a new solution for the inventory. This solution would enable (1) frequent updating of the inventory and (2) prioritisation of the sites for urban redevelopment projects.

The space based solution

The developed decision-making tool uses Sentinel-2 data in combination with aerial orthophotos, LiDAR (light detection and ranging) and Pleiades data. The integration of these Earth Observation (EO) data with expert knowledge helps to detect and label the changes related to the rehabilitation of the inventoried sites. These include building demolition, renovation, new build and also conversion of land to recreational areas such as parks. Thanks to their high resolution multispectral data, Sentinel-2 satellites are of great interest to apply radiometric change detection methods on brownfield sites. They enable fine intra- and inter-annual change detection analysis.

The methodology uses a variety of spectral indices for detecting change in vegetation and other land covers. Indices are mathematical expressions combining different spectral bands of the electromagnetic spectrum. For instance, they quantify the strength and the vitality of the vegetation (e.g. the Normalized Difference Vegetation Index - NDVI) or the brightness of soils (e.g. the Brightness Index - BI) which is highly correlated with soil moisture and sealed surface materials (e.g. roads, parking areas or roofs). Spectral indices help to identify areas of changes, to qualify types of changes and, finally, to quantify their extension.

Benefits to Citizens

The identification of brownfields represents a valuable opportunity and an important potential for Wallonia. Indeed, some derelict sites have negative impacts the environment (visual impact, symbol of economic and social difficulties, environmental and health risks...). All residents settled in the surroundings of brownfields deserve a qualitative environment.

Previously abandoned sites could then be brought back to beneficial use by pushing local entrepreneurship spirit by highlighting the regional remarkable heritage. The rehabilitation of brownfield

Urban renovation in Seraing (West of Liège, Wallonia).
Former colliery site reconverted into commercial and service area.
Source : Walloon map – SPW

Thematic Area: TERRITORIAL MANAGEMENT AND URBAN PLANNING

Region of Application: WALLONIA

Sentinel mission used: SENTINEL-2

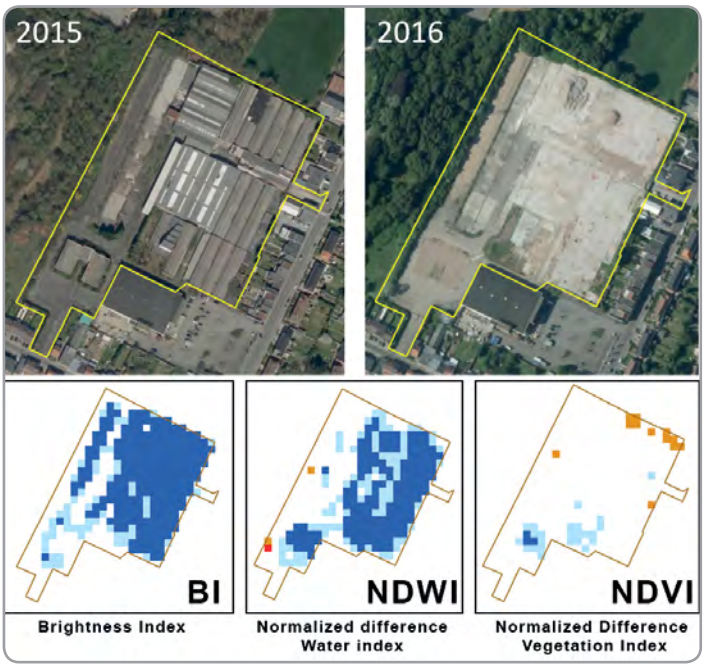
Copernicus Service used: –

Usage Maturity Level: 3

so enables urban sprawl within agricultural lands to be limited. Limiting regional soil sealing reduces the risks of flash floods. Moreover, brownfields of Wallonia are generally located in urban area and are thus well connected to public transport facilities. The regeneration of these areas will contribute to job creation and new developments of residential, industrial or recreational areas.

Outlook to the future

By exploiting the revisit time of Sentinel-2 data, this decision-making tool supports the public administration for a more efficient and rapid updating of the inventory of the brownfields. However, developing a fully automated change detection process remains challenging as photo-interpretation, i.e. expert knowledge, still plays an important role in the current tool. An initial outlook then consists in developing automatic steps to improve and accelerate the visual processes.



Old manufacturing industries being rehabilitated.
The total destruction of buildings is well identified by the spectral indices.
Sources : Wallon map - SPW Credit: Contains modified Copernicus Sentinel data [2015-2016]

> "This application, based on Sentinel data, will save time and reduce the costs of updating brownfield inventory."
>
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> ***DG04, Public Service of Wallonia, Belgium***

Secondly, we will develop more complex / composite indices, namely, those based on satellite time-series analysis, to enhance change detection accuracy. Testing Sentinel-1 data can overcome the issues of cloud cover on Wallonia.

In addition, the EO based method could study a further detection of non-inventoried brownfields in order to increase the completeness of the inventory.

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