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LAND-187 - Towards an Assessment of Grassland Use Intensity by Remote Sensing: SAR-based Detection of Mowings

Dr Ir Curnel, Yannick R.W. (1); Prof. Defourny, Pierre (2); Dr Ir Planchon, Viviane (1)

(1): CRA-W, Belgium; (2): UCL, Belgium

Contact: y.curnel@cra.wallonie.be

Abstract

Current land use and land-use change have a direct impact on the global carbon cycle and climate through the emissions or removal greenhouses gases resulting from anthropogenic activities. Land use, and its influence on land cover, is also of critical importance for biodiversity and acts as a major driver of the distribution and functioning of ecosystems, and thus in the delivery of ecosystem services.

With more than a third the European agricultural area, grasslands are an important land use in Europe with essential functions for feed and regulating ecosystem services (e.g. reduction of erosion and of water contamination by fertilizers and pesticides) supply. Grasslands also support biodiversity and cultural services through its contribution to region's cultural heritage and to recreational values.

Land-use change and intensification are causing further fragmentation and homogenization of forests and agro-ecosystems. In areas where an intensification of agricultural practices is observed, there is an increasing pressure on grassland ecosystems through their conversion into arable land. This increasing pressure results in an intensification of grassland management. Grassland management practices (mowing or grazing) and the intensification level of these practices (number of mowings per year, livestock density, level of N fertilization) have an impact on the biodiversity and the different services associated to this agro-ecosystem such as for example carbon sequestration, nitrate and pesticides leaching risk or pollination support.

Land use science has so far mainly focused on broad land cover conversions while the spatial patterns in the intensity of cropland, grazing, and forestry systems remain highly unclear for most world region. Appropriate integration of remote sensing technologies into ecosystem services concepts and practices, through an assessment of land use intensity, could therefore lead to potential practical benefits for the protection of biodiversity and the promotion of sustainable management of Earth's natural assets.

Grassland use intensity can be assessed in mowed grasslands based on several features such as the biomass, the floristic composition or the mowing calendar.

The present study, representing a step of a wider approach aiming to assess land use intensity for the specific case study of grasslands, is focused on the detection of mowings by remote sensing in Belgium. As mowings are punctual events characterized by temporal differences due to climate and farm management, the use of multi-temporal image series ideally with a high temporal frequency is

therefore required. To face the limited use of optical images in Belgium arising from a frequent cloud cover, mowing calendar have been estimated based on SAR (ERS-2) data.

As a first step, a procedure to discriminate mowed from grazed parcels has been set up based on the difference in backscattering coefficients distributions and the effect of water content on backscattering coefficients. The procedure allows a good discrimination with an overall classification accuracy around 80%. In a second step, a methodology has been set up to detect mowings. The methodology uses a temporal approach and is on the relationship between the differences of backscattering between 2 successive SAR images against the differences of water content. Results for mowings detection are a bit lower as half of the mowings (14 mowings over 29) were correctly identified. Considering the ERS-2 sensor repeat cycle, the methodology can be however considered as promising in particular in the perspective of very dense SAR time series.

In this context, a study is currently underway based on observations collected during 2015 growing season and SENTINEL-1 data to validate the approach.