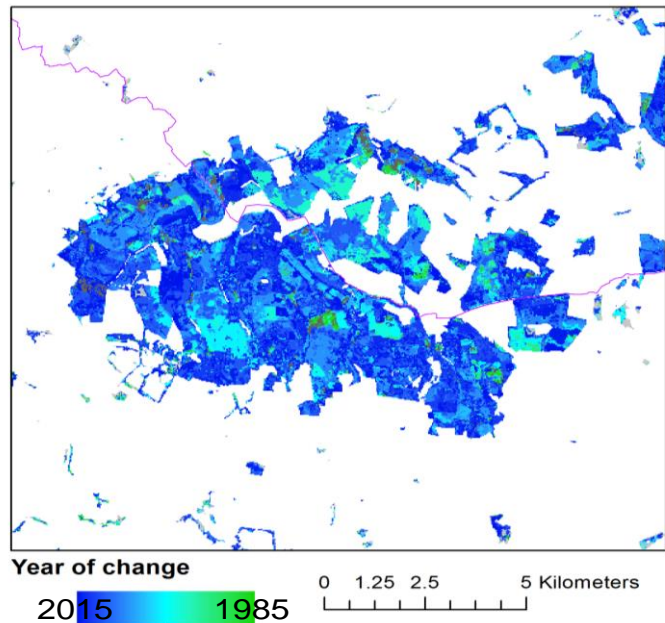


Project number: 6425
Funding source: Department of Agriculture,
Food & the Marine

Date: Nov, 2018
Project dates: Mar 2013 - Sep 2017

Automatic detection of forest disturbance by satellite



Key external stakeholders:

Forest Service, Planners

Practical implications for stakeholders:

We have created new software that automatically maps forest disturbance in Ireland using satellite imagery

- Main points

We can map forests on an annual basis from 1984 and automatically update forest maps going forward. This facility along with the supporting archive of imagery provides a baseline resource for researchers and planners.

Main results:

We have created a fully processed archive of satellite imagery (6000+ images) for the country from 1984 onward

We have created the first benchmark land use map for use in Green House Gas accounting using 1990 as the benchmark year.

We have created the Open Source software package- *IforDeo*, for the automatic generation of Irish landuse maps.

Opportunity / Benefit:

The software is open source (held on GitHub) and fully documented allowing anyone to use and alter it.

Collaborating Institutions:

Fers Ltd., UCC, UCD

Teagasc project team: Stuart Green (PI)
Dr Guy Serbin

External collaborators: Dr Kevin Black, Fers Ltd.
Dr Fiona Cawkwell, UCC

1. Project background:

The project, CforRep, led by UCD with additional partners in University College Cork, University of Limerick and FERS Ltd., aimed to improve Ireland's reporting of the forest carbon budgets and changes over time. Teagasc's role was to fill in major national data gaps by using satellites to provide a baseline for forest cover in 1990 and monitor forest cover and disturbance in the current forest going forward. Understanding the extent of disturbance of forestry, like felling or storm damage, is important as the events can possibly alter the carbon stored and thus impact carbon budgets and accounting more generally.

2. Questions addressed by the project:

Can we successfully make a landcover map in the present, using satellite imagery looking as far back as 1990?

How can we automate the mapping of forest change to facilitate assessment of change?

3. The experimental studies:

The project needed to track the lifecycle of every forest in Ireland from the 1980s using thousands of satellite images to be certain of establishing a 1990 baseline for reporting GHG budgets. This year is important as it is the baseline reference year for land use change under the Intergovernmental Panel on Climate Change (IPCC) reporting protocols. This objective required processes to be automated for atmospheric and geometric correction of the satellite images. The software developed is an open source Python library of modules and scripts – IForDEO (Ireland Forest Disturbance from Earth Observation). The modules operate automatically to process, classify, and assess satellite images as they become available.

Significant work was also put into creating a long-term archive of imagery from a number of satellite-receiving stations across Europe, to create the historical image archive for the island of Ireland.

Current forest conditions are classified as:

- continuing forestry,
- reforestation,
- deforestation.

4. Main results:

The software package The Irish Forest Disturbance from Earth Observation (IForDEO) module is built on open-source Python and uses two Teagasc-developed Python modules and scripts:

- The Irish Earth Observation (IEO) module
- IEOtools

IEO module maintains local LANDSAT remote sensing image data for Ireland automatically processing new images to be ready to use by researchers (it now contains more than 6,500 images)

IForDeo automatically tracks changes and disturbances as they relate to forestry. Maps can be produced for any year from 1984 to the present. The software also produces maps showing the date of changes within the national forest database.

An important application of this was the IForDEO 1990 land use map which allows us, for the first time, to estimate the land use of forestry in the National Forest Inventory as it was in 1990. This means we can improve our estimate of carbon sequestration achieved by the national forest planting programme.

5. Opportunity/Benefit:

The use of Open Source software is expanding at 3rd level and in the public sector and aligns with the growing agenda amongst research funders relating to Responsible Research and Innovation (RRI).. These published modules allow anyone with basic computer skills to create their own maps of forest change. This software can be easily adapted to map other changes such as urbanisation.

6. Dissemination:

All software outputs are available as an open-source Python code library.

On Github: <https://github.com/Teagasc/ieo>

Serbin, G., Balaji, P.M. ., Green, S. and Cawkwell, F. (2015). Remote sensing Irish forest disturbance with optical and SAR sensors. In: ASPRS IGTF 2015, Tampa, FL, USA, 04-May-2015,

Serbin, G. and Green, E. (2014). Remote Sensing Disturbance of small forest stands with landsat and Sentinel-2. In: Sentinel-2 for Science Workshop, Frascati, Italy, 25-May-2014, 1 34173

Serbin, G., Balaji, P.M., Green, S. and Cawkwell, F. (2016). Remote sensing forest cover change in Ireland. In: Presentation to ESA Living Planet Symposium 2016, Prague, Czech Republic, 13-May-2016, p1 35309

Popular publications:

Green, S., Serbin, S., Cawkwell, F. and Black, K. (2018) Automatic detection of forest disturbance by satellite. *T Research* Vol 13 (1) pp26-27.

<https://www.teagasc.ie/media/website/publications/2018/10-Automatic-detection-of-forest-disturbance-by-satellite.pdf>

7. Compiled by: Stuart Green
