Project number: 5690
Funding source: Teagasc

Date: November, 2011
Project dates: May 2007 - Dec 2010

The Irish hedge map - version 1.0

Key external stakeholders:
Policy makers, agri-environment researchers

Practical implications for stakeholders:
This is the first national map showing the location and extent of mature hedges.

- There is now a sound estimate of the amount of non-forest woody biomass in the country. This allows for accurate assessment of the carbon sink potential of Irish Agriculture.
- The map will aid in the identification of valuable high nature value "hotspots" in the agricultural landscape.

Main results:
- All mature hedgerows in the State, wider than 2m, have been mapped.
- Approximately 450,000 Ha or 6.4% of the country is covered by hedgerows, individual trees and small woodland patches and scrub- nearly the equivalent area of Co. Tipperary.

Opportunity / Benefit:
This map database will be freely available via the Teagasc web mapping portal, when the portal becomes live at the end of 2012.

Collaborating Institutions:
N/A

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Teagasc project team: Stuart Green (PI)
External collaborators: None

1. Project background:

Over the last decade there has been a concerted effort, undertaken by various state agencies, to map land-cover/land-use in Ireland. For forestry and trees, commercial plantations are well mapped and larger native woodlands have been surveyed. However the largest reservoir and most distinct element of the Irish arboreal landscape, its hedgerows, remain largely un mapped. Preliminary work in Teagasc estimated that up 6% of agricultural land could be under hedgerow.
Hedgerows are important as facets of the Irish Landscape, as important reservoirs of biodiversity and potentially valuable sinks within the national agricultural carbon budget.

2. Questions addressed by the project:

- Is it possible to train a computer to automatically identify and extract hedges from colour Arial photography?
- What area of Ireland, not already in the national forest database, is covered by hedges and small areas of natural woodland?

3. The experimental studies:

The work here is essentially *image processing* which involves taking a digital photograph and programming the computer to automatically detect hedges in the image. (We talk of “hedges” and not “hedgerows”, as traditionally hedgerows refers to the whole structure of the field boundary, not just the vegetation but the bank and ditch associated with it – in this project we just map the area extent of the vegetation as seen from above). When we look at a picture we identify objects through their colour but also the texture we can see, the location and the context. Computers can’t “see” the image, it sees a series of numbers– the job in image processing is to interpret and manipulate these numbers in such a way that the computer can apply thresholds and say that if a pixel has a particular range of numbers it is a hedge- otherwise it is not.
This project developed image processing techniques that exploited the colour but also the texture and shadows associated with hedges to classify the photographs. The project had to develop bulk processing techniques to process the 20,000 photographs that make up the national colour orthophotography database for 2005.

The process can be broken down into a number of steps.

1. Transform the colour image to its Intensity, Hue and Saturation components
2. Create a vegetation/shadow index from the Intensity and Hue information
3. Run a specially designed “wedge filter” over the Index to enhance the hedge structure in the image
4. Classify presence of hedge with a predefined threshold
5. Clean using standard GIS techniques and exclude upland and built areas

The Image processing takes the “raw” image on the left and eventually produces the yellow map of hedges and scrub you can see on the right

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4. Main results:

The results are the map, with 1m pixel size showing all mature hedgerows, individual trees and non-forest woodland/scrub with an 80% estimate accuracy. The map cannot be displayed at a visible scale in this document. The table below gives the estimate area under hedge/woodland in each county.

County	Area of HWS (Ha)	% of National HWS* Stock	% of County under HWS
Galway	30,000	6.7	4.9
Leitrim	11,000	2.4	6.9
Mayo	23,000	5.1	4.1
Roscommon	19,000	4.2	7.5
Sligo	11,000	2.4	6.0
Carlow	8,000	1.8	8.9
Dublin	5,000	1.1	5.4
Kildare	14,000	3.1	8.3
Kilkenny	19,000	4.2	9.2
Laois	12,000	2.7	7.0
Longford	8,000	1.8	7.3
Louth	8,000	1.8	9.8
Meath	24,000	5.3	10.2
Offaly	13,000	2.9	6.5
Westmeath	17,000	3.8	9.2
Wexford	20,000	4.4	8.5
Wicklow	10,000	2.2	4.9
Clare	22,000	4.9	7.0
Cork	57,000	12.7	7.6
Kerry	23,000	5.1	4.8
Limerick	25,000	5.6	9.3
Tipperary	35,000	7.8	8.1
Waterford	12,000	2.7	6.5
Cavan	20,000	4.4	10.4
Donegal	20,000	4.4	4.1
Monaghan	16,000	3.6	12.4

*HWS, Hedge, Woodland and Scrub

5. Opportunity/Benefit:

The main opportunity from this research lies with policy makers and researchers. Researchers now have a valuable layer of information when trying to map and predict high nature value farmlands. More importantly we can now estimate the carbon sink potential of “non-forest woody biomass” in agricultural grasslands. This important sink resource will potentially be worth millions of euro to the State in the context of reporting Land use change in post 2012 Phase III Kyoto agreements.

6. Dissemination:

The maps will be available per county via download on the Teagasc map viewer

7. Compiled by: Stuart Green

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