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Surveying and modelling of semi-natural habitat cover on farmland

Key external stakeholders:

Policymakers
Participants in agri-environment schemes
Extensive farmers
Agri-environmental researchers and NGOs

Practical implications for stakeholders:

- Having failed to halt biodiversity loss by 2010, halting and reversing biodiversity loss by 2020 will undoubtedly be one of the specific public goods to be prioritised following CAP reform (e.g. as Ecological Focus Areas), and in the National Biodiversity Plan 2010-2015.
- Biodiversity conservation goals will not be achieved solely by protecting particular habitats or species (as under the Natura 2000 network of designated sites), and there is now a policy target to protect habitats and species in the wider countryside. To this end, High Nature Value (HNV) farming and forestry systems are prioritised in both EU and national policy goals for biodiversity. Member States are required to identify HNV farmland, and target agri-environmental payments toward them.
- Farmland can be a significant reservoir of biodiversity. In a survey of 32 farms in east Galway, there was an average of 2.6 semi-natural habitats per farm, with an average of 15% of the surveyed farms containing semi-natural habitats. The area of semi-natural habitat cover ranged from 0% to over 60%. All of the surveyed farms were dominated by grassland, but a total of 13 semi-natural habitats were recorded on the 32 farms.

Main results:

- We found a widespread occurrence (43% of surveyed fields in east Co. Galway) of a 'semi-improved grassland' category that is not currently recognised in the Irish grassland classification system. Failure to identify semi-improved grassland can underestimate the biodiversity levels on farmland.
- Semi-natural habitat cover on lowland farms was best predicted using the variables 'stocking density', 'soil diversity' and 'river and stream length'. Such modelling approaches could be further developed and used to provisionally target areas with high percentage of semi-natural habitat. Farm-scale assessments may still be required for verification and local targeting of measures of greatest environmental merit.

Opportunity / Benefit:

- These results point to significant opportunities for the targeting of agri-environmental funding toward the protection and/or restoration of existing farmland habitats and species of conservation value.

Collaborating Institutions:

National University of Ireland, Galway

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1. Project background:

Public money from the proposed reform of the Common Agricultural Policy (CAP) will be more closely linked to support the delivery of environmental public goods. Having failed to halt biodiversity loss by 2010, halting and reversing biodiversity loss by 2020 will undoubtedly be one of the specific public goods to be prioritised.

Biodiversity conservation goals will not be achieved solely by protecting particular habitats or species (as under the Natura 2000 network of designated sites), and there is now a policy target to protect habitats and species in the wider countryside. To this end, High Nature Value (HNV) farming and forestry systems are prioritised in both EU and national policy goals for biodiversity (including the National Biodiversity Plan 2010-2015). These systems can be found in designated sites, but are also widespread in other (undesignated) areas of countryside. All Member States were required to identify HNV farmland, and target agri-environmental payments toward them by 2008. The national-scale spatial distribution of undesignated HNV farmland and farming systems is a significant knowledge gap and considerable work remains to fully incorporate HNV farmland into agri-environment policy and practice

This project involved whole-farm habitat surveying and mapping in a geographic information system (GIS). Grassland and hedgerow plant surveys also formed an important component of the field work. The project developed a model for predicting semi-natural habitat cover on farms in a region of western Ireland, suggested an improvement to the current grassland classification in Ireland and accurately describing farmland habitat heterogeneity as well as highlighting the implications of this for HNV farmland identification.

2. Questions addressed by the project:

We developed methods for identifying semi-natural habitat cover on farmland, and surveyed grassland habitats on lowland farms located outside EU- or nationally-designated sites in the west of Ireland (e.g. Natura 2000). We investigated habitat diversity of grasslands, diversity of linear habitats on selected farms, as well as the relationship between field vegetation diversity, field characteristics, management practices and topographic factors. We also identified field-based indicators of grasslands of conservation value that can be used to aid identification of HNV farmland at the farm scale.

3. The experimental studies:

The study was located in County Galway, in the west of Ireland. The east of the county was chosen as, unlike the west of the county, most farmland in this region is outside of European and national nature conservation designation sites (Special Areas of Conservation, Special Protection Areas, and Natural Heritage Areas). District Electoral Divisions (DEDS) were selected as the sites for this study, as the Irish Central Statistics Office compiles farming data per DED. Using stratified random selection, six DEDs were selected from the east of County Galway. These DEDs were representative of lowland farms in East Co. Galway and much of the midlands. Ten per cent of the farms in each of the six DEDs were surveyed, giving a total of 32 farms and an area of over 1200 ha. On each selected farm, all habitats were identified and all fields and field boundaries were surveyed in more detail. All vascular plant species and bryophytes observed were identified and assigned an abundance based on the DAFOR (D = dominant, A = abundant, F = frequent, O = occasional, R = rare) scale. The grassland habitat type in each field was identified based on existing classifications. Data were collected from 603 fields during the summers of 2006 and 2007.

4. Main results:

A Generalized Additive Model (GAM) was used to model the relationships between landscape and farm management variables and farmland habitat diversity. Semi-natural habitat cover on lowland farms was best modelled using the variables ‘stocking density’, ‘soil diversity’ and ‘river and stream length’. This approach could be adapted and applied in other discrete regions of Ireland and combined to create a national map of semi-natural habitat cover on Irish farms.

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With specific reference to the lowland grasslands, using the Fossitt (2000) classification system the majority of the 603 fields classify into two grassland types, improved or semi-natural. However, multivariate analyses of these grasslands revealed a continuum between semi-natural and improved agricultural grassland categories, including an intermediate category of 'semi-improved grassland'. The fields in this intermediate grassland type are more species-rich (>10 species per field) and have lower Ellenberg N values (<6) than the more intensively farmed fields (Table 1). This gradation from improved to semi-natural grassland highlights the biodiversity variation that occurs on farms that are frequently considered to be of low nature value. Failure to identify semi-improved grassland could underestimate of biodiversity levels on these farms. The detailed description of the grasslands that occur on these lowland farms has the potential to provide a better assessment of the overall nature value of a farm, potentially aiding the identification of Type 2 High Nature Value farmland. There is a need to amend the Irish grassland classification system so that intermediate semi-natural grassland assemblages can be identified at the field level. Field surveys are necessary for this level of detail.

Table 1. Surveyed fields were categorised according to their average Ellenberg N value of the vegetation. Different superscript letters indicate significantly different groups (ANOVA, $p < 0.001$). The number of fields in each vegetation category is also represented as a percentage of the total number of fields. (From Sullivan et al. 2010.)

	Group 1 (n = 61) Unimproved Grassland	Group 2 (n = 262) Intermediate Grassland	Group 3 (n = 280) Improved Agricultural Grassland
Total number of species	139	143	107
Mean (±sd) species richness per field	23.5 ± 8.2[a]	16.9 ± 5.6[b]	12.0 ± 3.9[c]
Max./min. species richness per field	49/9	36/6	27/3
Percentage of total number of fields	10	43	46

The average (± s.e.) farm size was 39.8 ha (± 4.6). The average number of habitats on any farm was 10.6 (± 0.6) and the average number of semi-natural habitats was 2.6 (± 0.3). The average cover of semi-natural habitats per farm was 15.2% (± 3.0). The proportion of semi-natural habitat cover on any one farm varied from 0% to over 60% with just 9% having no non-linear semi-natural habitat cover. All farms were dominated by grassland, but a total of 24 habitats were recorded on the 32 farms. Of those, 13 were semi-natural habitats (see Sullivan et al. 2011).

This research also investigated field boundaries as indicators of biodiversity. There was no correlation between non-linear semi-natural habitat area and either field boundary density or hedgerow density. We did find statistically significant variations in hedgerow quality and species-richness between sites and noted that more intensive farms had better quality linear semi-natural habitats and a lower area of non-linear semi-natural habitats. This has implications for any future agri-environment schemes that aim to adopt spatial-targeting of measures for field boundaries in more intensively farmed regions of the country.

5. Opportunity/Benefit:

These results point to significant opportunities for the targeting of agri-environmental funding toward the protection and/or restoration of existing farmland habitats and species of conservation value.

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6. Dissemination:

The results of this project have been presented at a number of national and international conferences, and HNV farming systems have been included as part of a number of in-service training events for Teagasc advisory staff.

Main publications:

Sullivan, C.A., Bourke, D., Gormally, M.J., Sheehy Skeffington, M., Finn, J.A., Green, S. and Kelly, S. (2011) Use of generalised additive models to estimate area of semi-natural habitats on lowland farms in western Ireland. *Biological Conservation* 144: 1089-1099.

Sullivan, C.A., Sheehy Skeffington, M., Gormally, M.J., and Finn, J.A. (2010) The ecological status of grasslands on lowland farmlands in western Ireland and implications for grassland classification and nature value assessment. *Biological Conservation,* 143: 1529-1539.

Sullivan, C., Sheehy Skeffington, M., Gormally, M., Finn, J.A. and Kelly, S. (2007). Identifying High Nature Value Grassland in the West of Ireland. *High Value Grassland: providing biodiversity, a clean environment and premium products,* Conference Proceedings, University of Keele, Staffordshire, pages 325-328.

Sullivan, C.A. 2010. *Identification of High Nature Value (HNV) farmland on lowland farms in East County Galway, Western Ireland*. PhD thesis. National University of Ireland, Galway.

Popular publications:

Sullivan, C., Sheehy Skeffington, M., Gormally, M., and Finn, J.A. (2009) Conservation status of lowland grassland in western Ireland. In: *Ireland's Rural Environment: research highlights from Johnstown Castle.* Teagasc. p. 86-87. ISSN 1841705438.

Sullivan, C.A., Sheehy Skeffington, M., Gormally, M.J. and Finn, J.A. (2008) Characterisation of agricultural grasslands in the West of Ireland and implications for identifying High Nature Value farmland. British Ecological Society Annual Meeting, London, 3-5 September.

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