HNV FARMLAND & FORESTRY
FARMFORBIO

Design of a national-scale monitoring programme for HNV Farmland and Forest areas in Ireland

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This document is a summary of a longer technical report available at: https://hnvfarmforbio.ie/

Executive summary

High Nature Value farmland and forest (HNVFF) areas are associated with high biodiversity and provision of environment services. Currently, few dedicated programmes to monitor the quantity and quality of HNVFF are implemented in Europe and none in the Republic of Ireland. We present a practical approach to monitor quality, quantity, and change of HNVFF areas in the Republic of Ireland in a way that is regular, systematic, repeatable, and national in scale.

The methods were developed as part of the HNV FarmForBio project, and tested using a set of monad sampling cells distributed across a range of representative landscapes.

For a set of 15 sampling cells (1 km × 1 km), high resolution habitat cover maps were developed using OSi PRIME 2, and recent and historical orthoimagery collated. This enabled a simulation of a temporal monitoring cycle to compare trends in HNV farmland and forest quality, quantity, connectivity and habitat change.

To upscale the monitoring to national scale, a sampling strategy using a recent landscape classification is proposed. This would require 1784 and 140 sampling cells (1 km × 1 km), for a statistically valid method to detect change in habitat quantity and quality in HNVFF respectively, with a 3-year monitoring frequency. The cost of implementing the proposed monitoring system is estimated to be €660,500 for each cycle.

Such a monitoring programme is not intended to assess the specific effects of individual schemes or policy interventions. Our approach can deliver: a regular, systematic, repeatable, national-scale monitoring programme that can detect change over time in quantity and quality of HNVFF. The observed effects will reflect the aggregate effects of land use change.

Introduction

High Nature Value farmland and forest (HNVFF) areas are associated with high biodiversity and the provisioning of a range of ecosystem services. Conservation of natural resources, reversing the loss of biodiversity and halting the degradation of ecosystem services are key environmental objectives of the European Union. (e.g. CAP, EU forest strategy, National Biodiversity Action Plan, Food Vision 2030, EPA State of the Environment Report).

As part of the DAFM-funded HNV FarmForBio project, we aimed to:

- Develop and field test methodologies to assess the ecosystem quality and quantity of HNV farmland and forest areas
- Develop a costed national monitoring programme for HNV farmland and forestry

Considerations for the design of a monitoring programme for HNVFF include:

- Stratification of the national landscape into representative landscape types
- Spatial area and number of sampling cells (numerous small units vs fewer larger units)
- Frequency of sampling
- Choice between permanent or non-permanent sampling cells
- Methods with which to map HNVFF, quantify habitat quantity and quality, measure connectivity and quantify change over time
- Cost
- Reporting of the outputs

Following a review of best practice, we designed and implemented a monitoring protocol in 15 sampling cells of size 1 km × 1 km (monad). The cells were distributed across Leitrim, Galway and Wicklow to compare landscapes that represent a range of biophysical contexts. The OSi PRIME2 dataset was used to produce habitat maps of the sample cells. This national dataset provides a highly detailed spatial database. The spatial data were enhanced with additional digitisation and classification of habitats where necessary, performed by orthophoto interpretation of OSi Digital Globe imagery (OSi, 2022(b)). Habitats were interpreted and classified using Fossitt (2000) level two/ three.

Habitat quantity

A HNVFF area index was calculated from $AHNV_{cat}$ / LUA, the area of different HNV land classes as a proportion of Land Use Area (LUA) of terrestrial habitats, where:

$AHNV_{cat}$ = HNV Farmland (GS, HH, PB, WS1) + *Grazed* HNV Farmland (GS, HH, PB2) + HNV Forest (WN, WD1)

LUA = sum of area of all mapped terrestrial habitats (excluding technogenic and water)

All cell maps were subsequently revised using aerial imagery from 2000 to provide data for trend analysis and change detection in the spatial assessments. This was carried out using an overlay of OSi Ortho_2000 aerial imagery (OSi, 2022(b)) and mapped and classified habitats were modified or adjusted as observed (Fig.1).

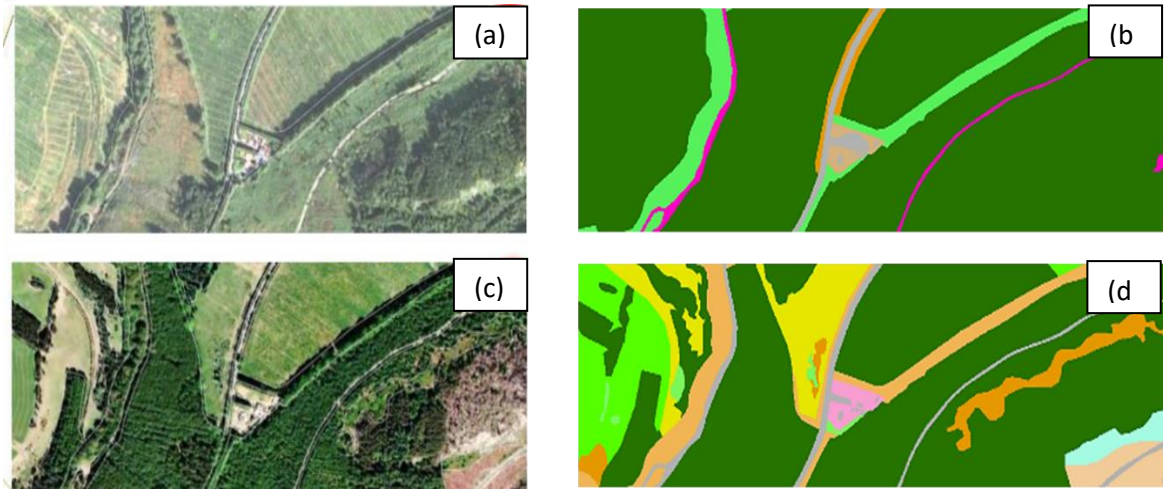

Fig. 1. Mapped (a, c) and classified (b, d) sampling cell imagery under the 2000 (a, b) and 2013 (c, d) reference years were rasterised and analysed using Change Detection in ArcGIS Pro.

Habitat quality

Habitat quality was assessed in randomly selected habitats (Fig. 2). Each habitat was visited and surveyed using Rapid Evaluation Cards. A quality score was subsequently calculated, accounting for habitat condition, damages, threats and prospects etc.

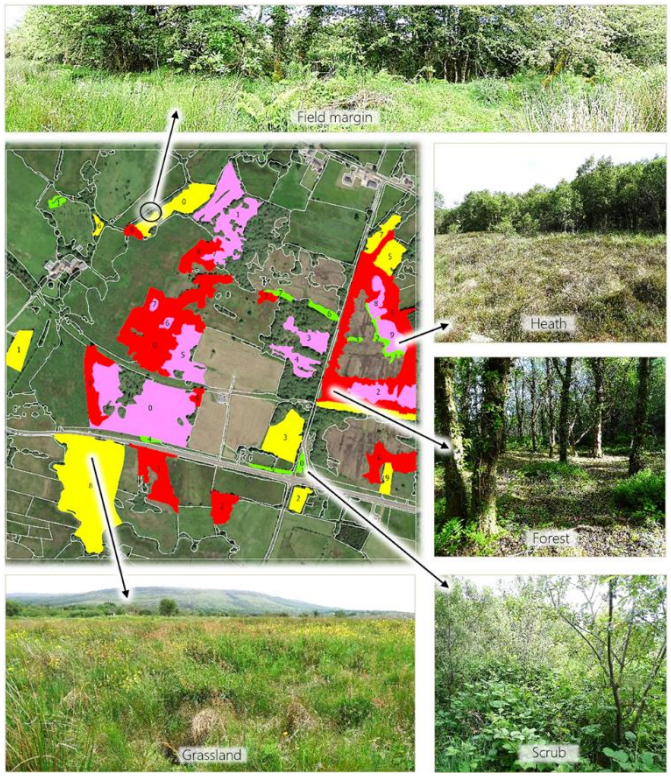

Fig. 2. Aerial field map (1:5000) (centre image comprising a monad cell) with randomly selected mapped HNV farmland parcel and forest areas (green = scrub; purple = peatland, red = forests, yellow = grasslands). Fixed point photography images taken during habitat quality assessments are indicated.

Using these method, it was possible to detect a contrasting trend of decreasing HNV farmland and increasing HNV forest quantity over this monitoring period. Categorical habitat change detection identified a range of HNV habitat loss and gain, driven predominantly by land use intensification, but also as a result of ecological succession and technogenic pressures. See the longer technical report (https://hnvfarmforbio.ie/) for further detail on measured changes in habitat quantity, quality, and connectivity.

Distribution of sampling cells, sampling cell size, number and frequency of sampling

The effort and design required to scale this approach to a national level was then estimated.

A landscape classification, based on multivariate classification of physiographic landscape units1 and land cover2 datasets, was developed (Carlier *et al*. 2021). This resulted in nine broad landscape classes (Fig. 3) that helped to stratify the design and distribution of sampling effort.

The number of sampling cells required for a statistically valid study to detect change, and the stratification of those cells across different landscape classes was calculated. A total of 1784 and 140 monad sampling cells would be required to adequately detect change in habitat quantity and quality, respectively. The sampling cells should be distributed across the 9 different landscape classes as indicated in Table 1.

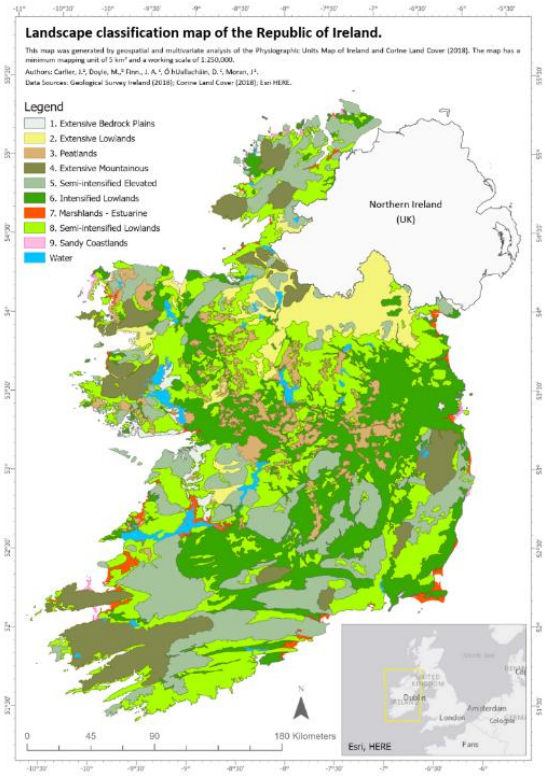

Fig. 3 Spatial distribution of nine landscape classes.

Table 1. Distribution of sampling cells across the nine landscape classes from Carlier *et al.* (2021), including relative percentage land cover of the classes. Sampling cell numbers (N) were estimated using power analyses for HNV habitat quality and area index assessments.

Landscape strata	1	2	3	4	5	6	7	8	9	Total
% Coverage	1.42	7.15	5.79	10.79	21.16	24.22	1.34	27.99	0.13	100
N: Quality assessment	8(+6*)	8	8(+1*)	13	25	29	8(+6*)	33	8 (+8*)	140
N: Area index	25	127	103	192	376	431	24	498	8 (+6*)	1784

*Sampling cells added to ensure a minimum of eight sampling cells per stratum.

Indicative cost

The indicative cost for a monitoring cycle with a frequency of three years was estimated at €660,500.

This represents the costs associated with the employment of three full time staff to coordinate one monitoring cycle over 24 months (Programme manager, €101,500/yr; data technician/analyst ~€90,000/yr, and; an ecologist ~€90,000/yr; values include 30% PRSI and 15% overhead rate). Their duties would include establishing and overseeing surveys on year 1, and conducting spatial analysis and reporting in year 2. This includes field-level assessment for scoring of habitat quality (~€98,000,

including 15% overhead rate). Costs are estimated from existing records of resources required during fieldwork and scaled up to cover 1784 and 140 sampling cells over a 3-year monitoring frequency.

Institutional hosting of the programme

The implementation and coordination of the proposed HNV farmland and forest monitoring programme could potentially benefit from integration within some existing national monitoring programmes, but it is difficult to install such an approach within the institutional scope and existing design of monitoring for other purposes. However, the development of a new monitoring programme is required to establish national-scale biodiversity monitoring of HNV farmland and forests.

The implementation and coordination of HNV habitat monitoring should be hosted by a suitable organisation with experience of monitoring and the provision of independent scientific advice at its core. Benefits from this approach would include reduced operational costs and use of existing infrastructure and relevant expertise. Full-time equivalent staff identified for the implementation of HNV farmland and forest monitoring could be seconded from current existing monitoring roles, or newly appointed members could have this approach included in their duties. This would reduce costs, and enable permanent staffing and retention of specialists with an accumulated knowledge on the long-term monitoring trends, sampling units, and increased familiarity with landowners and other programme stakeholders.

Purpose and aims

Such a monitoring programme is not intended to directly assess the effects of individual schemes or policy interventions. The approach can deliver: a regular, systematic, repeatable, national-scale monitoring programme that can detect change over time in quantity and quality of HNVFF. The observed effects will reflect the aggregate effects of land use change.

This monitoring strongly complements that achieved by Article 17 reporting on Natura 2000 habitat and species, and represents an important effort to monitor trends in biodiversity outside of Natura 2000. There is currently no regular, systematic, repeatable, and national-scale monitoring of biodiversity in the wider countryside; this monitoring approach would help rectify this omission.

References

Carlier *et al*. 2021. A landscape classification map of Ireland and its potential use in national land use monitoring. Journal of Environmental Management 289, 112498
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