COUNTY LEITRIM
HEDGEROW APPRAISAL SURVEY REPORT
2023

CONTAE LIATROMA
TUARASCÁIL SUIRBHÉIREACHTA MEASÚNÚ FÁLACHA
2023

WOODLANDS OF IRELAND / COILLEARNACHA DÚCHASACHA

Lead author: Neil Foulkes,
Co-authors: Joe Gowran & Trevor Seery

31st October 2023

This project was funded by the Department of Housing, Local Government and Heritage under the LGH - Local Biodiversity Action Fund

Comhairle Chontae Liatroma
Leitrim County Council

Leitrim Heritage
Oidhreacht Liatroma

An Roinn Tithíochta, Rialtas Áitiúil agus Oidhreachta
Department of Housing, Local Government and Heritage

County Leitrim hedgerow landscape (LM01)

They laughed at one I loved -
The triangular hill that hung
Under the Big Forth. They said
That I was bounded by the whitethorn hedges
Of the little farm and did not know the world.
But I knew that love's doorway to life
Is the same doorway everywhere.

First verse of *Innocence* by Patrick Kavanagh

CONTENTS PAGE NO.

LIST OF TABLES AND FIGURES

ACKNOWLEDGEMENTS

Thanks are primarily due to:

National Parks and Wildlife Service for the funding of the project..

Leitrim County Council for their instigation and support of the project.

In particular the authors would like to thank Sarah Malone, Leitrim County Council Heritage Officer, for her co-ordinating role.

We are also very appreciative of the assistance of Martin Donnelly, Leitrim County Council for the provision of maps and IT support.

Stephen Shaw of Tailte provided the EPA Land Cover data to Leitrim County Council which was utilised during the project.

Special thanks to Isobel Oakes who assisted with the field recording in South Leitrim.

Our gratitude is also extended to all the landowners who gave permission for us to access their lands during this survey.

1.0 EXECUTIVE SUMMARY

County Leitrim's hedgerow network is a huge asset to the county, being valuable in terms of the predominantly livestock-based agricultural systems, wild flora and fauna, water quality, landscape, carbon sequestration and employment.

In the summer of 2006 field recording of hedgerows was carried out using what was then the standard methodology in 16 sample 1 km squares distributed evenly around the county, covering approximately 1% of its total area. The focus of the survey was to record information on the extent, species composition, structure, condition and management of hedgerows.

Subsequent to that survey the Hedgerow Appraisal System (HAS) was developed by Woodlands of Ireland, (Foulkes et al, 2014) which has become the standard recording methodology for hedgerow surveys in the Republic of Ireland.

During the summer of 2023 the same area as in 2006 (and where possible the same individual hedgerows) was re-surveyed using the HAS.

Results from the 2023 County Leitrim Hedgerow Appraisal Survey were compared, as far as possible, with those from the 2006 Survey to assess trends in the extent, status and condition of hedgerows.

Origins

Based on mapping data much of the hedgerow network in County Leitrim is of relatively recent origin. An assessment of first and second edition Ordnance Survey maps indicates that most hedges were probably established during the period between the two surveys (1837-1909), with just less than a third of boundaries assessed being shown on the first edition survey.

Extent

The hedgerow landscape in County Leitrim is varied. There is a mixture of farm land with clearly defined field boundaries and other areas with irregular, scrub like boundaries which tax the definition of 'hedgerow' to the limit. In upland areas hedgerows tend to lose vigour as they rise up the contours. Above 150m hedgerows become very patchy and weak and no hedges were recorded at more than 190m above sea level.

Based on the results from the 2006 Survey it was estimated that the total length of hedgerow in County Leitrim was 11609km, and the average figure for hedgerow density was 7.31 kilometres per square kilometre (km/km^2).

Based on the sample the 2023 Appraisal indicates that there has been approximately an 8.06% loss of hedgerows between the two surveys.

Afforestation of farmland, particularly with exotic coniferous species with inadequate setbacks is the major cause of the effective Hedgerow loss between 2006 and 2023. Although Hedgerows are not actively removed they are effectively no longer hedgerows when subsumed with forestry plantations without a clear setback that allows them to persist as linear features. The structure and ecological value of what remains is very seriously diminished.

Species Diversity

26 species were recorded in the shrub layer of the sampled hedges. 17 of these are species native to Ireland. However, just five species dominate the counties hedgerows Hawthorn (known locally as Whitethorn) (present in 95% of hedges), Ash, Holly, Blackthorn, and Willow.

The 2023 survey recorded significant increases in the frequency of occurrence of Beech (up 10%), Hazel (up 8%) and Oak (up 5%) compared with the 2006 survey.

Hedgerow Trees

Ash remains the dominant tree species in Leitrim's Hedgerows found in 68% of the sample. 16 other species were recorded in the tree layer of the sampled hedges including a Common Mulberry. Holly increased in its frequency of occurrence as a tree from 10% in 2006 to 32% in 2023.

Ash Dieback

The survey indicated that the Ash trees in over 50% of hedgerows were exhibiting greater than 25% loss of canopy as a result of Ash Dieback disease. 25% of sampled hedges recorded Ash trees with only 0-25% canopy cover. These trees are either dead or are dying. Whilst the results are of serious concern the fact that 49% of hedges were recorded in the 75-100% canopy cover Class would give some hope that a proportion of this key species will survive. It is important that as many relatively healthy Ash trees as possible are retained and not subject to pre-emptive or precautionary felling. Efforts need to be made to replace lost trees with alternative species in the interest of wildlife, the landscape and carbon capture. Mechanisms (both financial and practical) to support landowners in dealing with the implications of this disease must be implemented.

Connectivity

County Leitrim's hedgerows show a good degree of connectivity with other natural and semi-natural habitats. 28% of sampled hedges adjoin semi-natural grassland and 15% are adjacent to a watercourse.
62% of sampled hedgerows had at least one link with another Hedgerow or Treeline.

Functionality

Some degree of field rationalisation has occurred since the second edition of the Ordnance Survey in 1907-09, but it is not possible to accurately quantify hedgerow loss since that period as there is no reliable compatible benchmark against which to base the current results.
31% of hedges were classed as redundant boundaries in terms of the field division on farms. This is up from 22% in the 2006 survey.

Structure & Management

There has been some polarisation of hedgerow structure between 2006 and 2023 with more very low, narrow hedges and more very tall wide hedges being recorded.

Management levels, although low, with just 29% of hedges being routinely managed on short-term cycle, are broadly comparable with the figures from 2006. They are, in part, a reflection of extensive farming practices and the difficulty of accessing land with conventional hedge-cutting equipment.

The number of very gappy hedgerows (> 25% gaps) has increased from 6% in 2006 to 18% in 2023. This is reflective of the low management levels and the fact that most hedgerows are not naturally self-sustaining. This structural decline is of concern.

Hedgerow Appraisal System

The Hedgerow Appraisal System is designed to identify hedgerows of historical, ecological and/or landscape significance and to provide a means of condition assessment for hedgerows based on the data recorded using the standard recording methodology.

Hedgerow Significance

The Hedgerow Appraisal System assesses the recorded data and apportions a Significance classification to Hedgerows in five Categories. Historical, Species Diversity, Structure, Construction & Associated Features, Habitat Connectivity and Landscape. On the basis of the significance assessment hedgerows may be determined to be Heritage Hedgerows.

In total 38% of sampled Hedgerows were classified as Heritage Hedgerows.

16% of sampled Hedgerows were considered to be Historically Highly Significant; 19% were considered Highly Significant in terms of their Species Diversity; just 9% were Highly Significant in terms of their Structural qualities.

3% of hedgerows were classed as Highly Significant in terms of their Habitat Connectivity; these were all either within or linking to Lough Gill Special Area of Conservation.

Hedgerow Condition

Under the Hedgerow Appraisal System hedgerows are accorded a condition score based on structural qualities such as height, width and lack of gaps. The maximum possible score under the HAS is 24.

The sampled Hedgerows scored between 4 and 16 in terms of Condition Score with the average score being 11.

21% of all sampled hedges were determined to be in Favourable Condition based on the absence of a suite of negative indicators. The 2006 Survey found that 25% of sampled hedgerows were in Favourable Condition but the methodology of the two surveys is slightly different so the two figures are not a direct comparison.

The 2023 Hedgerow Appraisal Survey found that 30% of Heritage Hedgerows were deemed to be in Favourable Condition.

Recommendations have been made based on the Hedgerow Appraisal, considered in the light of current best conservation practice.

LM01

These hedgerows, hardly hedgerows, little lines
Of sportive wood run wild; these pastoral farms,
Green to the very door; and wreaths of smoke
Sent up, in silence, from among the trees!

Lines Composed a Few Miles above Tintern Abbey, On Revisiting the Banks of the Wye during a Tour. July 13, 1798 William Wordsworth

2.0 INTRODUCTION

Hedgerows are a multi-functional feature of much of the lowland Irish countryside, particularly so in County Leitrim; providing value for agriculture, wild nature (biodiversity), water quality and hydrological function, soil protection, carbon sequestration, the visual and cultural landscape and tourism.

For the purposes of this survey Hedgerows are defined as

"*Linear strips of woody plants with a shrubby growth form that cover more than 25% of the length of a field or property boundary. They often have associated banks, walls, ditches (drains), or trees*".

This sample study appraises individual hedgerow significance and condition based on the data recorded using a standard methodology which examines context, species composition, structure, condition and management of hedgerows in County Leitrim. It also includes an assessment of trends in the status of the resource in comparison with data recorded during the County Leitrim Hedgerow Survey in 2006 (Foulkes, 2006a).
An estimate of hedgerow extent is made based on extrapolation from the sample, with an estimate of hedgerow loss between 2006 and 2023.

This output of the Survey can be used to further the objectives of the County Leitrim Biodiversity Action Plan 2021-2026 (Leitrim County Council, 2021) which contains actions and themes directly or indirectly interlinked with hedgerow conservation.

3.0 BACKGROUND

3.1 OVERVIEW OF COUNTY LEITRIM

County Leitrim occupies an area of 1,589 km² (614 mile²) and is situated in the North Western part of Central Ireland. It is bounded to the North by Donegal Bay and County Donegal; to the North and East by Counties Fermanagh and Cavan; to the South by County Longford and to the South-West and West by Counties Roscommon and Sligo.

The County is divided by Lough Allen into two distinctive topographical areas. The Northern half is characterised by mesa mountains, with deep glacial valleys radiating from the centre of the land mass to form a distinctly scenic landscape. The Southern half is typical drumlin country; close-packed drumlin hills, with an abundance of small lakes. The River Shannon with its associated lake systems forms the County's South-West boundary with County Roscommon.

The majority of the soils are gleys (mineral and peaty), which tend to drain poorly, a factor which limits the length of grazing season. Peat based soils are the next most frequently occurring, with a small proportion of more freely draining limestone based soils, commonly known as 'rock land'.

3.2 THE HISTORY OF HEDGEROWS IN CO. LEITRIM

The system of land division, across the whole of Ireland and Gaelic Scotland, into units we now call townlands, goes back to the early Christian period , if not earlier (Nicholls 2003) These were named and had defined boundaries. Townlands are the smallest administrative unit in Ireland still, in a descending order of size, from parish, barony, county and province (Reeves 1861)
'Permanent hedges or ditches were, however, usual as boundaries between different townland units…and there is evidence that it was normal to treat the townland as a unit for agricultural production, putting the whole under tillage or grazing in any one year.'(Nicholls 2003)
The presence of hedgerows pre 1600 as a regular feature of the countryside, particularly on townland boundaries is also confirmed by the accounts presented in Duffy 2009, MacCotter 2008, Clutterbuck 2013 and O'Sullivan 2010 (Gowran 2017 unpublished).

In ancient times (pre-1600AD) the lands of what is now County Leitrim consisted of 5 baronies derived from Gaelic territories called tuathas which in turn were part of the old Gaelic Kingdom of Breffni, where the O'Rourkes were Kings c.964-1257AD and then Lords 1257-1605AD, with their strongholds largely being in the Drumahaire barony. Other chief families in Drumahaire barony included O'Finn, O'Carrol, Keaney and Ford. Rosclogher, the northern most barony had notable chief families of O'Murrey, MacMurry, MacClancy and O'Meehan.The southern baronies of Leitrim and Mohill were for the most part ruled by Muintir Eolais families of Reynolds, O'Mulvey, O'Moran, MacShanley and MacGarry from around 900AD to the 1590's. The

Reynolds were also dominant in the Carrigallen Barony in the late medieval period, where the Darcy family were chiefs.

Much of the land was thickly forested and five great forests endured into the 17th century. Under the Gaelic system of joint land ownership there was little need for permanent enclosure or fencing. Instead tillage plots were protected with fencing for one season before being moved. There is, however, some evidence to suggest that some fortified farmsteads (ring forts) were set (planted) with blackthorn and whitethorn. Permanent banks with or without hedges on them may also have existed on townland and territorial boundaries

It was the Anglo-Normans who introduced the concept of private land ownership. As they spread into substantial parts of Ireland during the thirteenth century, they introduced the Feudal System, whereby tenants had to rent fixed plots of land from the landlord. The division of land and enclosure of commons was encouraged, even in some cases enforced by landlords. These changes were much resented by small stockowners. Although they succeeded in taking the south of the county briefly from 1245 to 1247, the Anglo-Normans failed to conquer the northern portion, which remained under the control of the O'Rourke's and their allies until the late sixteenth century.

'*Places mentioned in documents from the 12th to the 16th century are identifiable as later historic townlands. The Anglo-Normans, although adding significantly to this cultural landscape in those parts of the country they controlled, also tended to adopt and adapt the pre-existing Gaelic landscape for their purpose. A corner-stone of this continuity was the Christian church in Ireland'* (Clutterbuck 2015)

By later medieval times (mid 14th to end of 15th centuries) townlands had become the fundamental unit of land tenure. They were bounded by banks or ditches, which often had hedges too. The land within was largely unenclosed, though this was dependent on the landowner and their preferences. Townland boundary hedges thus tend to have larger banks and ditches than other hedges, and are often among the oldest hedges in the landscape. For these reasons they may also contain a more diverse flora than other, non townland boundary hedges.

In 1583 the County (or Shire) of Leitrim came into being when the Lord Deputy, Sir John Perrott, marked out its boundaries. In a survey it was revealed that of its 43,200 acres only 12,240 were inhabited, the large proportion (23,760 acres) being regarded as waste. The civil survey of 1654-56 further described the County as "*generally very course and mountaneous*", (Breifne (1970)).

Large portions of the county were acquired by various means from their traditional owners between 1620 and 1641 (Plantation of Leitrim) with the objective of planting the county with English, Welsh and Scots settlers (Mac Cuarta 2001). However, the plantations were not as successful in Leitrim as in other parts of Ireland. Settlers and native tenants did clear forests and establish farms on which they laid out systems of enclosed fields which were in contrast to the dispersed pattern of farmsteads and small or irregular fields of the earlier indigenous population. This would have been the embryo stage in the formation of the current patchwork landscape of small fields and hedgerows. The development of Ironworks at Sliabh an Iarainn and the associated production of charcoal for fuel also contributed to deforestation in the district at this time.

Map and documentary evidence for the continuity of the ancient boundaries comes from the Down Survey of Ireland 1656 -1658, and related documents such as the Books of Survey and Distribution, which detail lands confiscated as a result of the 1641 rebellion, the 1641 Depositions which contains statements of those seeking compensation for losses (including damage to hedges (O' Dowd 1991, Clutterbuck 2015) incurred during the rebellion, and the 1659 Census of population. These became available to view on line in 2013 (https://downsurvey.tchpc.tcd.ie). The various sources are linked and 'geo-referenced' to early Ordinance Survey and Google maps using a Geographical Information System (GIS). (Gowran 2017 unpublished)

Additional enclosures occur as a result of the 1667 Cattle Act and the 1721 Irish Parliament enclosure act (Foulkes, various). Other major events that affected farming practises and the density of the rural population, which in turn led to more field divisions, were the catastrophic major Famines of the 1730s, 1840s and to a lesser extent the 1870's (Crowley et al 2011)
'*Enclosure, one of the iconic reflections of the age of improvement in the eighteenth century was driven by agrarian capitalism to produce a transformed and regulated land*.' Duffy 2009
Mass movements for land reform and political independence followed in the wake of so much death, disease, severe hardship and emigration, that was endured by the millions of poor rural dwellers in the 18th and 19th century. (Crowley et al 2011) From (Gowran 2017)
It is from these events that the Irish Land Commission 1881-1999 eventually emerged.

In 1802 James McParlan produced his Statistical Survey of County Leitrim. In it he described in detail the method of construction of ditches and hedges,

"*The fences are in general a drain from four to six feet wide, and raised or backed at one side with clammy plastic aluminous earth, to a height of 3 or 4 feet. This sort of ditch, as it soon hardens almost into brick, becomes strong, and answers all their purposes of fencing, except where there are sheep; in which case they top the ditches with a layer of sods, and under each sod place a small tuft of some brush or other underwood, such as haw-thorn, black-thorn, or bramble.*"

"In building up the ditches, they lay in front of it, within about 3' of the top, a single row of young hawthorn plants, which, as the ditch commonly fills with water, and that from above they are out of the reach of the cattle, generally thrive very well, and in the southern parts of the county, where they are chiefly to be seen, are extremely useful to the husbandmen."

Wealthier landowners could afford to go to greater lengths in constructing their boundaries,

"*But the few rich farmers and gentleman build strong double-faced ditches, with double rows, at each side, of hawthorn and crab-tree, and interspersed with ash, elm, beech, and other forest trees, and sometimes a row of some of the latter on the top of the ditch."*

There is little reference in McParlan's survey as to the general condition of existing hedgerows. This contrasts with similar statistical surveys carried out around the same period in other counties which often give a barony by barony account of the nature and condition of fences (including hedges and stone walls). The comparative scarcity of this level of information in the Leitrim survey would suggest that the bulk of the hedgerow resource was in its infancy at this time.

The process of land enclosure from this point would have been relatively slow and an examination of the first series Ordnance Survey maps (1837) for the County show large areas still unenclosed. Enclosure was not welcomed by many.

"Inclosure came and trampled on the grave
Of labour's rights and left the poor a slave …

And birds and trees and flowers without a name
All sighed when lawless law's enclosure came."

John Clare

The population increases of the 18th and 19th centuries necessitated the intensive reclamation of much previously un-cultivated land, due in no small part to the success of the potato and the desire of landlords to extract maximum rents from their lands. Initially settlement would have spread along new roads. However, as pressure on land increased, communal mountain pasture lands above the 150m contour were exploited and small farms developed on mountain slopes. These farms would be above the normal growing range for most common hedgerow trees and shrubs so additional methods of enclosing lands were utilised.

The county was very badly affected by the Great Famine - An Gorta Mór. The population fell from 155,000 in 1841 to 112,000 in 1851. The relatively poor agricultural productivity of the county has been a contributory factor in high levels of emigration from the county since these times (the population at the last census in 2022 stood at 35,199).

In the aftermath of the famine, stronger farmers increased their holdings at the expense of weaker neighbours. After 1880 centralised intervention led to long term reorganisation of the rural landscape. It is to this period that the majority of the current field systems, rural settlement patterns and hedgerows in County Leitrim date. The Congested Districts Board (CBD) initiated infrastructure development, agricultural improvement and promoted changes in the countryside including encouraging the dispersion of farms and reorganising land-holdings. Clustered farm settlements and rundale holdings were replaced by owner occupied strip holdings. The second edition Ordnance Survey maps (1907-09) show enclosure patterns much more consistent with those of the current day indicating that the majority of the hedgerow network in the county would have been established between the famine and the end of the nineteenth century. The CBD was absorbed into the Irish Land Commission 1881-1999. Landed estates were significantly reduced in

size and ongoing redistribution of land after the creation of the Irish Free State in 1922 often continued to involve the creation of new field boundaries with planted thorn hedges.

Older hedges may follow natural landscape features, such as streams; whereas more recent hedges were marked out by surveyors and follow straight lines. Certain Acts of Parliament prescribed specifications for hedgerow construction including dimensions for banks and drains, and methods of planting (Feehan 1983). Many landowners included such details as clauses in tenants' leases. Whitethorn was the preferred choice of hedgerow shrub, but crab was also recommended (Hayes 2003).

Other hedgerows in the county may owe their origin to other transport routes. The building of Railways, in particular, (1847-1860s), would have involved the planting of many miles of hedgerow.

Intensification of farming and the development of larger machinery resulted in hedgerow removal on many farms in Ireland particularly during the 1960s and '70s. The absence of any survey data means that it is not possible to quantify the extent of the loss, but a comparison of the current status with field boundary patterns from the second series Ordnance Survey maps from the early part of the twentieth century would suggest that hedgerow loss is a fraction of what occurred in Britain (and other parts of Ireland) during a similar period. The drumlin topography and poor soil drainage in County Leitrim do not lend themselves to the large scale mechanisation more common in areas with better quality agricultural soils.

The development of afforestation programmes, particularly on marginal land has resulted in hedges being absorbed into (usually coniferous) forestry plantations. The heavy shade cast by the growing forestry crop has the effect of suppressing and weakening the hedgerow trees and shrubs, effectively resulting in a significant degree of progressive hedgerow loss.

Economic prosperity in Ireland at the end of the twentieth century and beginning of the twenty first century resulted in an intensive period of house building. Development in the countryside and on the fringes of town and villages impacted on the hedgerow resource, particularly individual houses in the countryside which lead to fragmentation of some hedgerow networks if mitigation measures were not taken. Since the economic crash in 2008 development and particularly rural development have slowed considerably.

In the early 1990s increased emphasis on environmental conservation in connection with agriculture (largely driven by the EU) resulted in the advent of Agri-Environment Schemes administered by what is now the Department of Agriculture Food and the Marine (DAFM).

Ireland has had a number of Agri-Environment Schemes including the Rural Environment Protection Scheme (REPS), Green Low-Carbon Agri-Environment Scheme (GLAS), Agri-Environment Options Scheme (AEOS), the interim Results-Based Environment-Agri Pilot (REAPS) and now, under the new Common Agricultural Policy Strategic Plan, the Agri-Climate Rural Environment Scheme (ACRES)

Hedgerow Conservation has been included as a component of each of the Schemes. The effectiveness of these programmes will be considered in the Discussion section of this Report.

3.2 THE VALUE OF HEDGEROWS FOR COUNTY LEITRIM

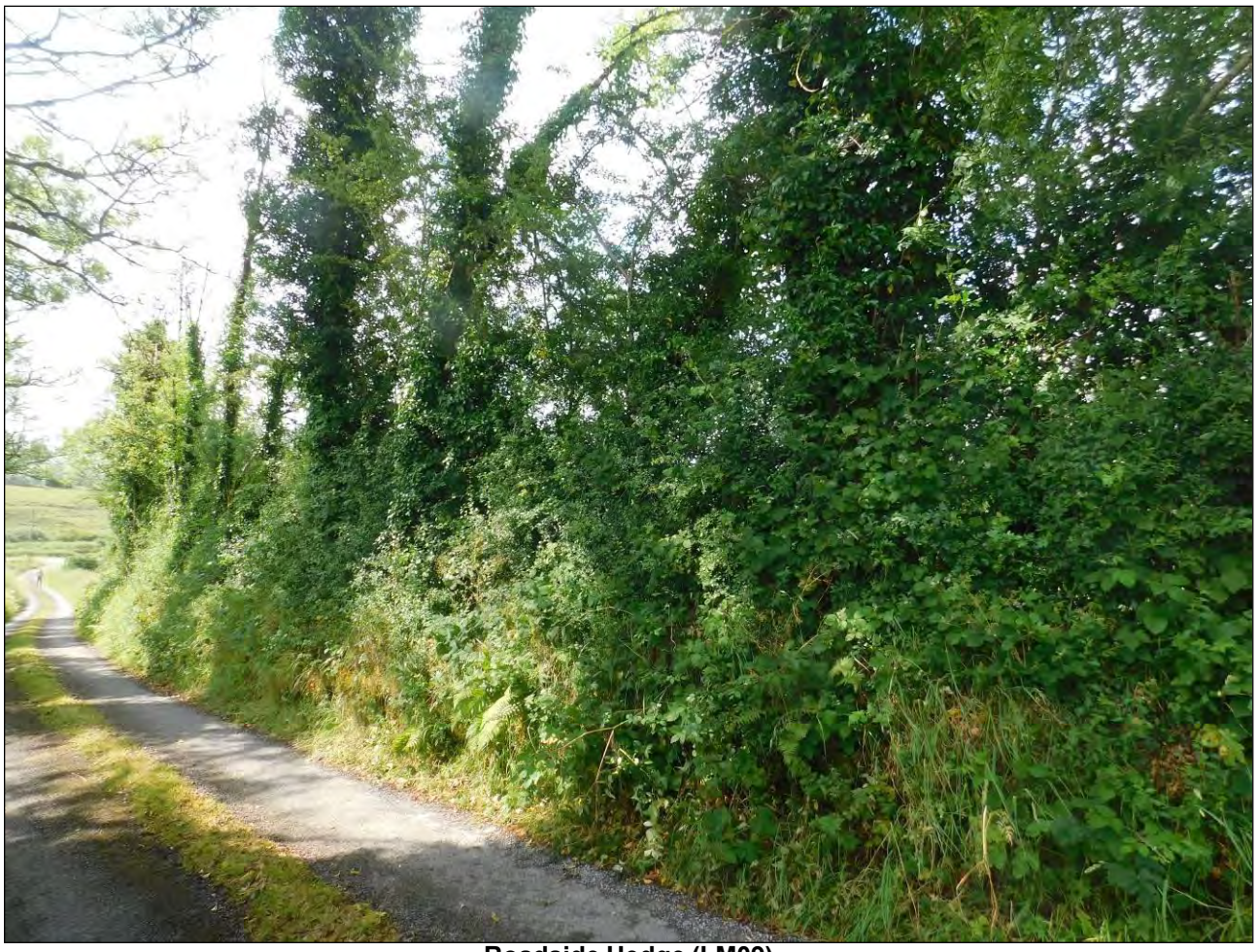
Based on the results of the Badger and Habitats Survey of Ireland (Smal, 1995) the hedgerow/tree row network in Ireland was estimated to be approximately 382,000 km. The estimated figure for County Leitrim was 10,766km (2.8% of the national total).

The 2006 County Leitrim Hedgerow Survey estimated there to be 11,609 km of hedgerow in the County.

More recent estimates by the EPA with Teagasc have produced figures up to 698,000km (Green et al 2019) for the Republic of Ireland and 114,000km for Northern Ireland (McCann et al 2012). The discrepancy is largely accounted for by broader definitions of 'hedge' used in the later estimates.

Landscape

Perhaps more than any other landscape element, the patchwork of fields and hedgerows, along with stonewalls, endow the lowland Leitrim countryside with a distinctive and natural appearance. The flowering and fruiting of hedgerow shrubs give a colour and fragrance to the summer countryside that is unique. In particular, regional and local variations in hedgerows give character to a townland or county and lead to a sense of place. They frame the passage through much of the countryside by lining the roads and in certain areas give the impression of a wooded landscape.



Roadside Hedge (LM09)

While the glint
Of hollies dark in the swollen hedges lasts—
One mile—and those bells ring, little I know
Or heed if time be still the same, until
The lane ends and once more all is the same.

From The Lane, by Edward Thomas

The County Leitrim Landscape Character Assessment (RPS, 2020) divides County Leitrim in to 17 distinct Landscape Character Types.

In the North of the County the "*valleys and glens in between mountain and ridgelines feature drumlin farmland in use predominantly as pasture with hedgerows and sometimes post and wire fences as enclosure*", whilst "*The southern part of the county features a mosaic of pastoral drumlin hills interspersed with numerous loughs and areas of coniferous and deciduous forest. Field pattern is generally strongly defined by mature hedgerows*". (RPS, 2020)

Hedgerows are recognized as a significant component in nine of the Character Types, and a defining feature of some, notably;

LCT 2. Coastal Drumlin Farmland - Pastoral farmland is present as a small to medium scale field pattern defined by hedgerows or post and wire fences.

LCT 3. Wooded Lakeside Farmland - The farmland comprises mostly pasture with a small to medium scale field pattern usually defined by mature hedgerows.

LCT 7. Upland Farmland and Foothills - Landform is diverse, ranging from gentle sloping foothills to steeper hillsides. Pastures are grazed within a patchwork of hedged fields which stretch up the hillsides often within distinctive linear formations. This hedgerow field pattern tends to become weaker with increasing elevation.

LCT 8. Valley Farmland - Land cover comprises pastoral farmed with a strong field pattern defined by mature hedgerows.

LCT 9. Drumlin Farmland - The consistent orientation of the hills gives the landscape a uniform grain and has its origins from the direction of ice flows during glaciation. The pattern or grain can be difficult to appreciate, being masked largely by the abundant mature hedgerows which race up and down the hillsides forming a patchwork pattern usually of small-scale.

LCT 11. Drumlin Lough and Stream Margins - The farmed land cover comprises pasture defined mainly by mature hedgerows but occasionally post and wire fences in lower lying wetter ground.

LCT 12. River Floodplain - Field boundaries are typically defined by post and wire fences, often colonised by scrub species and ranker growth, giving the appearance of established hedgerows. There is virtually no settlement within this LCT. Roads are also generally absent. A small number of isolated houses do exist, occupying small undulating areas of land to escape flooding. These isolated dwellings tend to be accessed by narrow winding lanes and often enclosed by tall species rich hedgerows.

LCT 13. Low Limestone Outcrops - Shallow soils support grazing within fields defined by a network of stone walls in contrast to the surrounding lowlands where hedgerows are dominant. Woodland is restricted to steep slopes although hedgerow trees and isolated trees within pasture and scrub provide some cover.

LCT 15. Undulating Hill Farmland - Soils tend to be poorly drained. The land cover comprises pasture with a field pattern strongly defined by dense mature hedgerows.

The Conservation Recommendations for all Landscape Character Types state that;

Traditional hedgerow boundaries with native species are preferable to post and wire fence boundaries in order to conserve landscape pattern;

Landscape Character Areas

The Leitrim landscape is further distinguished by division in to 14 Landscape Character Areas (LCA)

Field and Hedgerows dominate the lowland landscape (LM03)

Agriculture

Although the hedgerow network is largely a result of 18th and 19th century farming methods, hedges still have many benefits for the modern farmer. Apart from their basic function as cheap (Meyen, 1997) and environmentally friendly stock-proof boundaries, they provide vital shade, shelter and protection of stock and crops across the county. In areas of high rainfall and poor soil porosity hedgerow root systems improve the drainage of land in proximity to the hedge. By trapping airborne viruses they can prevent the spread of disease between farms and they can prevent animals from neighbouring farms coming in direct nose to nose contact. Good hedgerows reduce wind speeds and thus protect against soil erosion.

Hedgerow root system improves land drainage (LM02)

Take away what surrounds a field and what is left is not worth keeping

Old proverb from Brittany

Flora and Fauna

Hedgerows are an essential wildlife habitat in the modern countryside, especially in the light of the low percentage of native woodland cover in County Leitrim (and Ireland as a whole). Hedgerows may be the only significant wildlife habitat on many farms. They are home to a range of wild flowers and flowering and fruiting trees and shrubs, all of which form the base of the food chain. They support invertebrates and other pollinators like butterflies, moths, ladybirds, beetles, bumblebees and hoverflies. In turn, two thirds of our bird species nest in hedgerows, finding essential food and shelter within. Birds of prey like kestrels, merlins, owls, and sparrowhawks use hedgerows for hunting along. Bats depend on hedgerows for shelter, roosting, and most importantly for their insect food. Hedges can support substantial breeding Badger setts, one of Ireland's most recognisable animals, which are protected under the Wildlife Act as well as internationally, as a listed species in the Bern Convention (to which Ireland is a signatory). Hedges support many other species such as Mice, Hedgehogs and Foxes.

LM15

The hedges are all drowned in green grass seas,

From June, by Francis Ledwidge

Hedges as habitat corridors

The network of hedges across the country provides links between surviving fragments of other wildlife habitats, thereby allowing the movement and dispersal of species through agricultural landscapes. This network is thus vital to the conservation of much of our native flora and fauna. The quality of any particular hedge, in terms of its height, width, density, and general structure and condition (especially the amount and size of gaps), determines the extent to which it will act as a corridor for species movement and dispersal. Red Squirrel, also protected under the Wildlife Acts, will navigate their way between habitats using hedgerows.
Even a relatively poor hedge may be important in an otherwise very intensive agricultural landscape.
A recent survey from the European Commission's Joint Research Centre found that planting hedgerows is one of the best ways to combat ecosystem fragmentation in intensively farmed landscapes (Dondina et al., 2018).

Water Quality

Hedgerow networks have a role in protecting water quality. The root systems of hedgerow shrubs and trees regulate the movement of water through the landscape, absorbing and recycling nutrients, thus reducing the risk of pollution, whilst also reducing the potential for flooding. Hedges also stop sediment from moving down-slope, preventing excessive siltation in waterways. 'Siltation' is the clogging up of river beds with fine grained particles like soil. It contributes much to the deterioration of aquatic habitats, preventing salmon and trout from spawning. The hedgerow network is of such a scale that it must have an impact on the overall hydrology of the County but the actual impact of hedgerows on water quality has not been subject to any systematic study in Ireland.

Climate / Carbon Sequestration

Hedgerows are essentially ribbons of native woody vegetation spanning the countryside. This woody vegetation therefore plays a vital role in sequestering carbon towards meeting Ireland's obligations under the Climate Action and Low Carbon Development (Amendment) Act 2021. This Act provides the framework for Ireland to meet its International and EU climate commitments.

The BRIAR project (EPA, 2019) estimated that Ireland has 689,000km hedgerows or 186,000ha based on an average width of 3.7m.

It was estimated that the above ground biomass stock was ~58 tonnes of carbon per hectare. It is estimated that hedgerows, together with non-forest woodland and scrub (Other Wooded Land), can remove up to 1.4 Mt CO2 per year per hectare – even after accounting for emissions used from equipment or machinery in the process of maintenance works (EPA, 2019).

Less intensively managed, wider, taller hedges contain a significantly higher amount of carbon than more intensively managed smaller hedgerows.

The EPA Report found that allowing smaller hedgerows to grow out and expand to increase height and width by 1m increased sequestration by 1-2t carbon per hectare per year.

Research from a number of dairy farms in the UK found that, on average, 31% more carbon was stored in soil beneath hedgerows than in the adjacent grassland. Older hedgerows stored more soil carbon than younger hedgerows.

The soil organic carbon (SOC) sequestration rate beneath hedgerows was 1.48MgC ha^{-1} yr^{-1} for a 37 year old hedge in the top 50cm of soil (Biffi, 2022).

Folklore

Many of our native shrubs are important in Irish folklore. The Hawthorn / Whitethorn (Sceach Gheal) is the dominant hedgerow species in Ireland. In early Irish law it was classified as an *Aithig fedo* or Commoner of the Wood. The Hawthorn is known by a variety of different names, The May Tree, The Beltaine Tree, The May Blossom, Quick etc. The Sceach Ghealis also known as the Faerie Tree for it is said to guard the entrance to the faerie realm and it is still considered bad luck to harm one. For the purposes of this report it will be referred to by its widely accepted common name of Hawthorn.

Employment

A number of people derive at least part of their income directly or indirectly from the management of hedges. These would include hedge cutting contractors; nursery suppliers and other management contractors such as those involve in hedge laying, hedge coppicing and hedge planting.

We are not aware of any estimates that have been made of the economic impact of the management of the hedgerow resource in Ireland.

Seed collectors often collect indigenous genetic stock seed from hedge sources to propagate plants for Agri-Environment schemes such as ACRES or forestry schemes involving native tree cover.

The DAFM Forestry Programme 2023-2027 includes grant measures to support seed collecting, establishing seed orchards and nursery expansion and references current Agri-Environment schemes in this regard.

A Material Resource

In respect of native and naturalised species, a significant proportion of the country's broadleaf tree resource is contained within hedgerows. These provide the raw materials for a variety of crafts, including culinary crafts and are also a source of carbon-neutral fuel.

3.3 THREATS TO HEDGEROWS IN COUNTY LEITRIM

The Heritage Council has laid out the following threats to hedgerows in Ireland:

- Hedges need regular maintenance in order to provide effective boundary and shelter. Neglected hedges grow tall and gappy, so that they cease to function as effective barriers. A gappy hedge is bad, both for wildlife and for farming.
- Neglected hedges may become overgrown with bramble so that they encroach on fields or roadways and become inaccessible for maintenance.
- Inappropriate management can damage hedges. This includes frequent (annual) cutting, and cutting during the bird nesting period.
- Building developments in which all hedgerows are removed are a major threat to the hedgerow network.
- Road-widening programmes may threaten hedges. Although the removal of hedges may be necessary for public safety, in many cases it is possible to preserve the original boundary by moving it back from the road to a safer position.
- Disturbances of roadsides to lay and maintain services such as telecommunications, sewage and water can cause disruption to hedgerow root systems, or hedges may be completely removed. This can be avoided with proper planning.
- Poor roadside drainage can threaten hedges by rotting their root systems. It can also endanger road users. It is important to maintain drains, particularly to prevent blockage with plastic.
- Hedges may be removed because there is a wish to open up views from roads in scenic areas. This is usually unnecessary if proper hedge maintenance is practised.
- Field enlargement is a threat to hedges. Farmers need to remove hedges in some cases, but should be encouraged to retain and maintain hedges, particularly along roadsides, as vital links in wildlife corridors.

Additionally, loss of land to afforestation, particularly coniferous afforestation has a severely detrimental impact on hedgerow quantity, quality (and sustainability) and their role in the local ecology and as landscape features.

Ash Die-Back disease in hedgerow trees poses a threat to public health and safety, landscape integrity and dependent biodiversity.

4.0 SURVEY RATIONALE AND OBJECTIVES

Hedgerows are comprised of communities of living organisms (plants) which change naturally over time and in response to management activities and changing land-use objectives. Given the financial costs and the limited number of skilled operators available to appropriately manage hedgerows, it is unrealistic to expect that the entire hedgerow network in the country can be maintained in optimum condition. Therefore, conservation strategies need to prioritise individual hedgerows and hedgerow networks on the basis of their significance in terms of agricultural, ecological, environmental, heritage and landscape value.
Hedgerow conservation initiatives should focus on measurable results, not only in terms of quantity, but also in terms of the hedgerow qualities and attributes that impact on their value to agriculture, biodiversity, heritage and wider landscape functions. Hedgerow conservation policy in Ireland is embraced primarily indirectly through national legislation and incentive, especially agriculturally-related schemes. A number of County Councils also espouse hedgerow policy in County Development Plans. Nonetheless, hedgerow policy and legislation does not necessarily equate with protection and many hedgerows have been removed or severely degraded in recent years as a result of agricultural intensification, new road schemes, building developments and afforestation with exotic tree species.

In addition, management is generally poor due to a lack of skills-based knowledge and resources. It could be argued that much of the annual roadside hedge cutting that takes place is overly aggressive and often unnecessary. For convenience and cost-effectiveness, management often entails mechanical flailing which, if done without skill and due care, has a tendency to weaken the shrubs in the hedgerow.
Much of the legislation to protect hedgerows is not enforced for various reasons, including the fact that there are currently too few National Parks & Wildlife Service (NPWS) conservation rangers and the relevant legislation contains too many loopholes to permit for adequate enforcement.

However, at the time of writing this report, targeted efforts are being made to protect biodiversity, including increased prosecutions for wildlife crime, the hiring of more NPWS rangers and the establishment of a

dedicated Wildlife Crime Unit by the Department of Housing, Local Government and Heritage (though this appears to have stalled). A review of the Wildlife Acts is also in train.

In terms of Agri-Environment schemes, the new Common Agricultural Policy (CAP) places more emphasis on biodiversity and results-based programmes.

Taking the above in to consideration, any attempt to promote hedgerow conservation through management needs to be based on a systematic assessment of the current resource, a meaningful interpretation of the data collected and appropriate management.

4.1 THE NEED FOR A HEDGEROW APPRAISAL SURVEY IN COUNTY LEITRIM

As will be seen from section 4.3, hedgerow conservation in Ireland is embraced through legislation, policy and incentive. Individual and collective hedgerow conservation needs to be based on an accurate and meaningful assessment of the current resource in the context of accepted best practice. This is why an appraisal of the extent, species composition, structure, condition and management of the hedgerows of County Leitrim is important.

The 2006 County Leitrim Hedgerow Survey provided baseline data for the County's hedgerow resource. This new study includes the extra step of actually appraising individual hedges in terms of their Historical, Ecological and Landscape Significance as well as producing a Condition Score.

Ireland has been in a State declared Biodiversity Emergency since May 2019. Hedgerows, along with other, non-forest, wooded lands account for an estimated 6-7% of the land areas of the State (Teagasc, 2011). The potential for these features to contribute to arresting and reversing biodiversity decline should not be underestimated.

It is a very appropriate time for a survey of this nature given the growing emphasis on ensuring environmental welfare, especially as part of agricultural programmes, in addition to increasing development pressure from housing, transport infrastructure and industrial development.

The Hedgerow Appraisal Survey provides useful information in a variety of ways;

- It gives a snapshot of the quantity and character of the hedgerows in the County.
- Repeat surveys provide a useful tool in monitoring environmental change.
- It is possible to identify current and potential future threats facing the resource by assessing the results in light of current conservation best practice.
- It identifies hedgerows of Historical, Ecological or Landscape Significance with a view to enhancing their future conservation.
- The survey identifies plant life local to the county.
- Comparisons can be drawn between hedgerows under different management regimes.
- Detailed information collated as part of the *County Leitrim Hedgerow Appraisal Survey* can complement data collated from other habitat related studies.
- The *County Leitrim Hedgerow Appraisal Survey* can be placed in its national context when viewed alongside other surveys based on the same methodology.
- The study provides valuable data which will be essential in planning and implementing future Biodiversity Action Plans for County Leitrim.

The survey results and conclusions will also provide a useful tool for decision makers, advisory bodies and educational institutions including;

- Local Authority planners
- National Roads Authority
- Road Engineers
- Landscape Planners
- Environmental Consultants, particularly in drawing up Environmental Impact Statements
- Department of Agriculture and Food, including the Forestry Division
- Teagasc
- Farmers, land owners and estate managers
- Foresters
- Schools, Colleges, and Universities
- State Bodies – National Parks and Wildlife Service, CIE, Waterways Ireland

4.2 THE AIMS AND OBJECTIVES OF THE COUNTY LEITRIM HEDGEROW APPRAISAL

Project Aim

The Leitrim Hedgerow Appraisal Survey aims to record information on the extent, species composition, structure, condition and management of hedgerows around the county.

Project Objectives

- A Survey of selected hedgerows across the County with assessment of their condition and biodiversity value.
- Provide recommendations for hedgerow conservation priorities in the County.
- Assess current legislation and policies in relation to hedgerow protection and make recommendations for hedgerow conservation in the County.
- Collate survey information in a comprehensive report and GIS dataset.
- Raise awareness in the County of the importance of hedgerows and their appropriate management.

4.3 LEGISLATION AND POLICY PROTECTION

The importance of hedgerows is recognized in national and international environmental legislation and policies:

Various Legislative Acts, Directives, and Guidelines (International, European, and National) reflect the importance of the hedgerow resource and its management. These are listed below with a summary given for those having the most direct relevance.

International

Hedges are included within the UN Food and Agriculture Organisation (FAO) definition of 'Other Land with Trees Outside the Forest' in Agriculture when the tree canopy cover is greater than or equal to 5%, equal to or greater than 3m wide and less than 20m wide, with a length of equal to or greater than 25m. It is often associated with Other Wooded Lands and Agroforestry in the UNFAO document Towards the Assessment of Trees Outside Forests 2013.

This is the categorisation used by the National Forest Inventory (NFI) of DAFM when reporting to the EU and the UN bodies regarding Land Use, Land Use Change and Forestry (LULUCF)

The Paris Agreement (or Paris Accord COP 21)

This is a legally binding international treaty on climate change. Under the Paris Agreement, all countries of the world agreed to reduce global warming to well below 1.5-2 degrees Celsius, compared to pre-industrial levels. The signatories committed themselves to national climate and CO2 reduction targets that they themselves came up with. As hedgerows and Other Wooded Lands (non forest trees) can sequester 1.4 Mt CO2 per year CO2/ha/year (EPA, 2019), hedgerows have the potential to play a key role in helping to reduce carbon emissions.

European Union

- COUNCIL DIRECTIVE 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora – the Habitats Directive

  Article 10 of the Directive states that, "*Member States shall endeavour in their land-use planning and development policies, to encourage the management of features of the landscape which are of major importance for wild flora and fauna*.

  Such features are those which, by virtue of their linear and continuous structure (such as rivers with their banks or the traditional systems for marking field boundaries) or their function as stepping stones (such as ponds or small woods), are essential for the migration, dispersal and genetic exchange of wild species."

- DIRECTIVE 2009/147/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on the conservation of wild birds – the Birds Directive

Article 3 of the Directive states that "*Member States shall take the requisite measures to preserve, maintain, or re-establish a sufficient diversity or area of habitats for all the species of birds referred to in Article 1"* - i.e. all species of naturally occurring birds in the wild state.

Article 5 of the Directive requires Member States to take the requisite measures to establish a general system of protection for all species of birds referred to in Article 1, prohibiting in particular:

"(a) deliberate killing or capture by any method;
(b) deliberate destruction of, or damage to, their nests and eggs or removal of their nests;
(c) taking their eggs in the wild and keeping these eggs even if empty;
(d) deliberate disturbance of these birds particularly during the period of breeding and rearing, in so far as disturbance would be significant having regard to the objectives of this Directive;"

This is relevant to the management of habitats, such as hedgerows, which provide nesting habitat for many species of wild birds.

- COUNCIL REGULATION (EEC) No 2078/92 of 30 June 1992 on agricultural production methods compatible with the requirements of the protection of the environment and the maintenance of the countryside.

  Since 1994, it has been compulsory for each EU state to have Agri-Environmental schemes (A-E) in place. These have included various schemes in Ireland, such as REPS (1, 2, 3 & 4), the Agri-Environment Options Scheme (AEOS 1, 2 and 3) and the Green Low Carbon Agri-Environment (GLAS). A 'bridge' A-E scheme between the old and new Common Agricultural Policy (CAP), called REAP (Results Based Environment Agri-Pilot Programme), included measures on hedgerow maintenance and enhancement (DAFM, 2021).

  The current A-E Scheme, the Agri-Climate Rural Environment Scheme (ACRES) is intended to help address biodiversity decline. It is has three Tiers;

  Tier 1 Priority Environmental Asset

  Tier 2 Environmental Asset / Action

  Tier 3 General Actions

  There are two ACRES schemes– General and Co-operation, each ACRES plan runs for 5 years

  ACRES General: is available nationally (outside of the high priority geographical area defined for the ACRES Co-operation approach) and offers a range of actions for individual farmers, both targeted and general.

  Tier 3 of ACRES General includes the follow hedgerow actions;

  - Coppicing of hedgerows (payment rate €2.47/m/yr)
  - Laying of hedgerows (payment rate €5.47/m/yr)
  - Planting a new hedgerow (payment rate €5.29/m/yr)

  There is no requirement to cut hedgerows in ACRES parcels. However, if they are being managed by cutting during the course of the contract they must not be cut below 1.8 metres from ground level (or top of bank where applicable). If existing hedges are less than 1.8 metres tall they must not be cut or trimmed. There are certain exemptions, notably for roadside hedgerows.

  ACRES Co-operation: available to farmers in defined high priority geographical areas, and involves results-based payments as well as bespoke farm and landscape actions.

  Under the standard ACRES hedgerows are quality assessed as part of the scoring for Grassland and Rough Grassland areas of the farm

	Poor Quality	Moderate Quality	Good Quality
Hedgerows	Low (<1.5m). Very gappy or patchy (gaps make up >50 % of 30m), not stockproof. One or fewer native woody species per 30m length of hedgerow.	Up to 2m wide and at least 1.5m tall. Occasional gaps present but only along the base and not greater than 30m long. 'A' shape absent, Hawthorn/ Whitethorn often top heavy. 2-3 native woody species per 30m length.	Continuous hedgerows 2+m wide and at least 1.8m tall. Few gaps along the base. Varied structure with 'A' shape throughout. Suitable for nesting birds. At least 3 or more native woody species per 30m length.

Farmers claiming payments under the Basic Payment Scheme are required to adhere to the Cross Compliance Rules. Cross Compliance is implemented under two main areas; Statutory Management Requirements (SMRs) and Good Agricultural and Environmental Condition (GAEC) standards. In terms of hedgerows and their dependent wildlife;

SMR 2 Conservation of Wild Birds

This requirement is aimed at protecting all wild birds, their eggs and nests.
As hedgerows are landscape features they cannot be removed at any time of the year.

Trimming/cutting of trees and/or hedges during the bird nesting season is not permitted unless the landowner is directed to do so by the Local Authority in the interests of health and safety.

GAEC 7 requires “Retention of Landscape Features and Designated Habitats and Controlling Invasive Species”.

Since 2009 Hedgerows and Treelines have been classed as Landscape Features and can only be removed in exceptional circumstances. Prior to removal two times the length of the proposed hedge must be planted on the same holding. This is up, in 2023, from the previous like for like (1 metre for 1 metre) replacement. The hedgerow species used must be traditional to the area, and the replacement cannot be for amenity purposes, e.g. around farmyard or driveway.

Farmers must not cut or trim hedgerows and/or trees between 1st March and 31st August each year (during the bird breeding season).

Breaches of Cross Compliance Rules can result in sanctions of up to 100% of the Basic Payment.

However, hedgerows that are allowed to encroach into a field can lead to a GAEC sanction. From 2023 farmers are permitted to have up to 50% of the eligible area of each land parcel on their holding retained for biodiversity. This means that spreading hedgerows can be included in this category and thus avoid a penalty.

- COUNCIL REGULATION (EC) No 1257/1999 of 17 May 1999 on support for rural development from the European Agricultural Guidance and Guarantee Fund (EAGGF) and amending and repealing certain Regulations

  Article 14 (2) permits for compensatory allowances to be granted per hectare of areas used for agriculture to farmers who apply usual good farming practices compatible with the need to safeguard the environment and maintain the countryside, in particular by sustainable farming.

- COUNCIL DIRECTIVE 91/676/EEC of 12 December 1991 concerning the protection of waters against pollution caused by nitrates from agricultural sources

  In order to reduce or prevent pollution of watercourses one of the objectives of the Directive is to limit the losses of nitrates linked to agricultural activities. To this end the Nitrates Directive promotes the "Buffer" effect of non-fertilised grass strips and hedges along watercourses and ditches.

  Nitrates Derogation – this is available to certain farmers stocking at high density.

Since 2020, Derogation farms now have a Biodiversity Option on Hedgerow Management. They can choose one of two options, which are:

1. Leave at least one Whitethorn or Blackthorn tree within each 300 metres of hedgerow
2. Maintain hedgerows on a minimum 3-year cycle (as cutting annually stops flowering and fruiting).

National

- The Wildlife Act, (1976), as amended by the Wildlife (Amendment) Act, 2000

  The purpose of Section 40 of the original Act, as amended by Section 46 of the Amendment, is to protect breeding birds during the nesting season by establishing a prohibition on the cutting of hedges during the period from 1st March to 31st August (inclusive) each year. There are a number of exemptions to the prohibition including in the interest of public health and safety and the ordinary course of agriculture and forestry.

- European Communities (Environmental Impact Assessment) (Agriculture) Regulations 2011

  These Regulations cover the Restructuring of rural land holdings which includes hedgerow removal.

  This includes several stipulations,

  Mandatory Environmental Impact Assessment is required where greater than 4km of hedgerow is to removed or field size is increased to 50 ha or greater.

  A screening assessment must be carried out by DAFM where hedgerows are planned for removal to create a field of over 5 hectares, or if the field boundary hedgerows to be removed are over 500m in length (total), or where the activity is likely to have a significant effect on the environment or is likely to have a significant effect on a European or Nationally designated site.

  The Regulations and the Departmental procedures for implementing the Regulations are under review and have been subject to a public consultation.

- The Roads Act, (1993)

  Owners or occupiers of land are obliged to take all reasonable steps to ensure that any roadside hedge is;

  "not a hazard or potential hazard to persons using a public road and that it does not obstruct or interfere with the safe use of a public road or the maintenance of a public road".

- Planning and Development Act, (2000), as amended

  There is scope within this legislation for Local Authorities to give some measure of protection to hedgerows in specific circumstances. They can designate Special Amenity Area Orders (SAAO's) within which certain activities can be controlled. Once SAAO's are confirmed, Conservation Orders can be put in place.

  Local Authorities can also make Tree Preservation Orders (TPO's), but there are no TPO's designated in respect of hedgerows (Hickie, 2004).

- 3rd National Biodiversity Action Plan, for the period 2017-2021

  This was produced in response to the Convention on Biological Diversity (CBD, Rio de Janeiro, 1992). The current plan has a number of actions that are relevant to hedgerow conservation. These include:

  Action 2.1.3. Complete national terrestrial habitat, land cover, land use, and ecosystem service maps

  Action 2.1.5. Support research on economic and societal valuations and non-economic valuations of ecosystem services and benefits and how biodiversity underpins these values

Action 2.1.6. Undertake surveys and assessments of status, trends and distribution of all habitats and species of EU interest and additional habitats and species of national and regional importance

Action 2.1.10. Continue forest research programme on forest biodiversity, the delivery of wider ecosystem services (e.g. protection of water), carbon accounting and the interaction of climate change and forest systems

Action 2.1.12. Hedgerow surveys will be continued by Local Authorities

- Climate Action and Low Carbon Development (Amendment) Act 2021

  This Act was introduced to provide for the approval of plans by the Government in relation to climate change, for the purpose of pursuing the transition to a climate resilient, biodiversity rich and climate neutral economy, by no later than the end of the year 2050. It includes provisions for carbon budgets and a sectoral emissions ceiling to apply to different sectors of the economy and to provide for local authority climate action plans. As hedgerows are vitally important biodiversity corridors and contribute to carbon sequestration, they could be included under actions for this legislation.

- Heritage Ireland 2030

  Heritage Ireland 2030 is Ireland's new national heritage plan. It is built around a vision of our heritage – in all its forms – being at very centre of local and national discourse, valued by all and cared for and protected for future generations.

  The new Plan includes an Action to;

  Review the protection (including enforcement of relevant legislation) of our natural heritage, including hedgerows, native woodlands and wetlands.

- Waste Management (Prohibition of Waste Disposal by Burning) (Amendment) Regulations 2022 (S.I. No. 51/2022)

  Under the Waste Management (Prohibition of Waste Disposal by Burning) Regulations 2009, the burning of household, garden, commercial or industrial waste is not permitted. An exemption under the legislation, which has allowed farmers to dispose of waste generated by agricultural practices by burning as a last resort following strict application of the waste hierarchy, has been extended on several occasions. However, a final exemption ends on the 30th November 2023.

- Electricity Supply Act, (1927)

  Article 98 of the above Acts permits any "*authorised operator*" to "*lop or cut any tree, shrub or hedge which obstructs or interferes*" with electric wires.

- Communications Regulations Act, (2002)

  Article 58 of the above Acts permit any "*authorised operator*" to "*lop or cut any tree, shrub or hedge which obstructs or interferes*" with the physical infrastructure of the network.

- The Forestry Act, (2014)

  Section 19 exempts certain trees from the need for a felling licence; these include;

  Trees less than 5 years of age that came about through natural regeneration and removed from a field as part of the normal maintenance of agricultural land (but not where the tree is standing in a hedgerow)

  Outside of a forest;

  Trees of the hawthorn or blackthorn species, or

  Trees in a hedgerow and felled for the purposes of its trimming, provided that the tree does not exceed 20 centimetres in diameter when measured 1.3 metres from the ground.

- The Forestry Regulations (2017) SI 191 of 2017

  The Regulations require that any application for Afforestation or Forest Road Works must include a map which clearly shows Hedgerows.

- Sustainable Rural Housing Guidelines (2005)

  The Guidelines indicate that the removal of existing roadside boundaries, except to the extent that this is needed for a new entrance, should be avoided where at all possible except where required for traffic safety purposes.

Local

Leitrim County Development Plan 2023 – 2029

Section 10.6.6 of the Plan addresses the subject of Trees and Hedgerows and clearly stresses the values of hedgerows and the intent to protect them from removal where possible and also to augment them.

The removal of existing roadside boundaries, except to the extent that this is needed for a new entrance and traffic safety purposes, shall be resisted where at all possible. Where disruption is unavoidable the replacement with 'like for like' boundary hedges and trees will be required.

The Council encourages the augmentation of existing hedgerows and stands of trees and the planting of new trees and hedgerows, using native broad leaf species, where possible of local provenance, at the boundaries of new housing developments and around new housing, to create shelter and help absorb/assimilate the new development into the receiving landscape.

These statements are translated in to specific Policies within the Plan;

TREE POL 1 To require the submission of landscape plans, where appropriate, to accompany planning applications for rural development proposals prepared by competent professionals and to promote the use of native trees for boundary treatment and shelter belts.

TREE POL 2 To retain and protect significant stands of existing trees/hedgerows/woodlands, and seek increased planting of native trees, where appropriate, in new developments.

TREE POL 3 To protect and preserve existing hedgerows in new developments and where their removal is necessary to seek their replacement with new hedgerows of native species indigenous to the area.

The issue of Ash Dieback is also covered by an Objective of the Plan.

TREE OBJ 2 To support the measures being undertaken by the Department of Agriculture, Food and the Marine, Teagasc, Council for Forest Research and Development (COFORD) dealing with the effects of Ash Dieback disease and in the development of an ash breeding programme identifying and planting species of ash that are tolerant to disease.

Section 11.10 of the Plan, entitled Trees, Woodlands & Hedgerows, indicates the commitment of the Council to practical protections for hedgerows.

The Council will seek to ensure that hedgerows and verges are maintained and trimmed in the interests of ensuring road safety. The Council will avoid the cutting of hedgerows during the bird nesting season, as defined in the Wildlife (Amendment) Act 2000, from March 1 to August 31.

The Council will also seek to enhance the county hedgerows by increasing coverage using locally native species, taking opportunities provided by the consideration of new development proposals.

The Council will protect and preserve existing hedgerows where possible and seek their replacement with new hedgerows, consisting of appropriate native species, where their removal is necessary during roadworks or other works. The Council have, in association with the Heritage Council, previously carried out a Hedgerow Survey. The Council will be informed by the results of the survey in terms of their role in the protection and preservation of hedgerows.

A further Policy measure is indicated;

TWH POL 4 To protect and preserve existing hedgerows and minimise their removal. Where their removal is necessary, to seek their replacement with new hedgerow material native to the area (See Table 11.5 in this regard).

There are also a number of Development Management Guidelines and Standards which support hedgerow protection and conservation indicated in Chapter 13 of the Plan, this includes Entrances and Sightlines, Soft Landscaping, in Public Open Spaces for Residential Development, Boundary Treatments in Development, including for Self-Catering Developments and in the Laying of Underground Cables.

County Leitrim Biodiversity Action Plan 2021 – 2026

The aim of the County Leitrim Biodiversity Action Plan is to raise awareness of biodiversity amongst individuals and communities in County Leitrim by providing support, guidance and encouragement to engage with biodiversity through education and practical conservation participation.

Hedgerow conservation fits in to the themes of the Plan and two Actions of the Plan specifically refer to hedgerows.

Themes

1. Improving Our Knowledge of the Biodiversity Resource
2. Protection of wildlife corridors and biodiversity hotspots
3. Promote and encourage biodiversity awareness, education and training
4. Tackling Invasive Species
5. Biodiversity and Climate Change

Action 2D

Support local community groups to map and assess condition of local hedgerows and treelines and protect and/or restore hedgerows to good condition or plant new hedgerows/trees in community biodiversity plans.

Action 3A

Provide practical training workshops for local communities, outdoor recreational users, local employment scheme workers, local authority operatives and farmers. Training could include:

- *Hedgerow management training*

Leitrim County Council Hedge-Cutting Grant Scheme

Since 2017 Leitrim County Council has operated a grant scheme which currently provides a grant of €75 per km for the maintenance of roadside hedges / overhanging trees along the Public Road Network.
The scheme is open to individuals, communities and groups of applicants/residents. The minimum length of road network per application is 1km. As can be seen from the details below the number of applications and approvals under the scheme is growing each year.

Year Season	No of applications	No of approvals	Length of Hedges Cut (km)
2017/2018	8	7	34.3
2018/2019	9	5	23
2019/2020	39	29	118.75
2020/2021	48	36	169.37
2021/2022	55	51	213.55
2022/2023	59	57	243.1

5.0 METHODOLOGY AND FIELD SURVEY

The Methodology for the Survey work followed relevant aspects of the *Hedgerow Appraisal System: Best Practice Guidance on Hedgerow Surveying, Data Collection and Appraisal* by Neil Foulkes, Janice Fuller, Declan Little, Shawn McCourt & Paul Murphy (Woodlands of Ireland, 2014).

5.1 DEFINING HEDGES

For the purposes of this study hedgerows are:

"Linear strips of woody plants with a shrubby growth form that cover more than 25% of the length of a field or property boundary. They often have associated banks, walls, ditches or trees."

The terms '*hedge*' and '*hedgerow*' are used inter-changeably throughout this report.

In accordance with the HAS Methodology, garden hedges and those bordering curtilage (BL3 as fully defined by Fossitt, 2000) have not been recorded unless they also border agricultural land.

5.2 SELECTING THE FIELD SURVEY SAMPLE

In line with the HAS methodology the south-western (or "bottom left hand") 1 km square of each of the Ordnance Survey ten kilometre National Grid squares of the country was selected for the Hedgerow Appraisal Survey. These are the same squares as those covered during the 2006 Survey.

This selection is also consistent with the sampling procedure used for *The Badger and Habitats Survey of Ireland* (Smal, 1995) and subsequently *The Countryside Bird Survey* (Birdwatch Ireland, ongoing study). This placement gives the potential for some joint assessment of these data sets in the future. The National Parks and Wildlife Service (NPWS) also use these squares as part of certain National surveys.

Samples areas are 1 km square. The sample area is approximately 1% of the total area of the County. The Ordnance Survey National Grid references and townland details for each survey square in County Leitrim are listed in Appendix 12.1.

In the original survey in 2006, within each sample square a maximum of 10 hedges were selected for detailed study using randomly generated points on a transparent overlay. The points on the overlay were selected at random using a random number generator and an appropriately scaled, numbered grid marked by subdividing the square, and then matching the randomly chosen numbers with points on this grid.

The overlay was then placed on top of the relevant aerial photograph of each square, and the hedge nearest to each point on the overlay was chosen for detailed investigation. If there was no hedge within a fixed radius (equating to approximately 175m) of the randomly selected point, the number of sampled hedges was reduced by one. This was to ensure that the sample would not be skewed by a higher sampling density in certain areas. Where the '*hedge*' chosen on the aerial photograph was discovered on the ground to be something other than a hedge (e.g. a tree line, a colonised drain, a vegetated bank, or a wall covered in vegetation), the next hedge nearest to the relevant point on the overlay sheet was recorded instead, provided that it fell within the specified radius of the random point.

Each hedge chosen for detailed investigation by the random selection process was clearly marked and labelled with a number on a copy of the relevant map. A length of hedge was generally taken as one side of a field or enclosure. End points were identified as the junction between adjacent sides of a field, or where three or more hedge lengths meet. In a few instances end points were marked where the construction, management, or character of a hedge changed suddenly and conspicuously along its length, or where a clear and obvious difference in the origin of the hedge was apparent, but where no junction was evident. This was normally a result of boundary removal, where the two portions of a linear hedge once bounded separate fields.

For the 2023 study the hedgerows identified from the 2006 were used as the base sample.

In certain circumstances due to changes on the ground some modifications were made in terms of the hedgerows surveyed in 2023 to those surveyed in 2006. This included a change of length or start and end points and also included cases where the feature surveyed in 2006 was no longer considered to be appropriate. Any changes between the two samples are identified in the relevant dataset.

5.3 GEOGRAPHIC INFORMATION SYSTEM

A Geographic Information System database was created for the project in QGIS.

Separate layers were created for the following;

- Each 1km sample square, showing the boundary
- Sample Hedgerows
- Heritage Hedgerows
- Random Points
- Random Point Buffers
- EPA Land Cover Hedgerows for each 1km square
- EPA Land Cover Treelines for each 1km square
- Landowner information (this will be retained by Leitrim County Council in accordance with GDPR policy)

Existing datasets were added in order to be able to contextualise the area and the hedgerows and also to facilitate ease of completing desk based elements of the survey recording.

Layers include;

- Contours at 5m intervals
- National Soil Data
- Sites and Monuments Record
- CORINE Land Cover
- Townlands
- Designated Areas (SAC's, SPA's, NHA's and pNHA's)
- DAFM Private Forestry database
- Coillte Forest Inventory
- Leitrim County Council Road Schedule
- Leitrim County Council Landscape Character Areas
- EPA Land Cover Mapping
- Teagasc Hedge Map
- EPA River Waterbodies Active Cycle 3
- NPWS Native Woodland Habitats
- NPWS Irish Semi-Natural Grassland Survey

Base Maps used were Open Street Maps and Bing Aerial.

QField is a Plugin available in QGIS which allows users to configure GIS projects for use in the field.

Relevant layers for field work were transferred in to a QField file which was exported to the Samsung Galaxy Pro Tablet in order to facilitate navigation and identification of features in the field.

QGIS and QField are both open source applications

5.4 PERIOD OF FIELDWORK

Fieldwork commenced on 7-6-23 and was concluded by 29-8-23

The late summer (July onwards) of 2023 was characterised by high rainfall which was not conducive to field work and field recording was over a longer period than was originally anticipated.

5.5 ACCESS AND PERMISSION

It was a condition of the study that permission was required from all landowners before accessing lands.

Field surveyors identified the landowners of each parcel of land where access was required to carry out the field study. This was generally by means of calling at relevant properties and following up on local sources of information. In a small number of cases the land owner was identified by means of a request through the Properties Registration Authority.

Identification of landowners took a disproportionate amount of time and in some cases involved multiple visits to surveys squares.

Permission for access was sought from all landowners. In one case the landowner was based abroad and could not be contacted so access was not possible.

A small number of landowners refused permission for access which was unfortunate but the landowner is within their rights to do so. However, in a number of cases landowners provided useful additional information. Their co-operation and assistance was much appreciated.

All fieldworkers had full public liability insurance cover for their work.

5.6 STRUCTURAL RECORDINGS OF HEDGES

For each hedge selected (a maximum of 10 hedges per sample square, as described above), two end points were identified. End points were generally identified as field corners or by junctions with other hedges or boundary features (i.e. one side of a field) or gaps greater than 20m. Each selected hedge was subjected to a detailed investigation along its whole length.

A validated field survey Excel spreadsheet was developed which was uploaded to a Samsung Galaxy Pro Tablet. This permitted for efficient field recording of the characteristics of each hedge and its associated features to be made.

Recordings were grouped under the following headings: Context, Construction, Structure/Condition, and Management. Each category field has a corresponding code that was entered into the appropriate spreadsheet cell. Data was automatically validated so that only permissible recordings could be made. This minimises the possibility of errors in the field recording.

Context

Each hedge is placed in the context of the location; land cover (CORINE); soil type (National Soils Database), proximity to roads, in terms of adjacent land classification and links with other habitats. Also recorded are any potential indicators of antiquity. The elevation and orientation of each hedge is also recorded.

Construction

The basic construction of the hedge relates to the linearity of the woody shrubs, the presence or absence of features such as drains, banks, walls or 'shelves' (where the hedge delineates differences in height between fields on each side). These characteristics can be indicative of the period of hedgerow origin and are largely of a fixed nature and unlikely to change over time.

Structure / Condition

The structure relates to the physical dimensions of the hedge (height, width, cross sectional profile, quantity and age profile of trees). Condition is gauged by an assessment of the percentage of gaps, density of basal growth (i.e. in the bottom metre of the hedge), bank erosion and overall vigour. These attributes can vary significantly over time and, where repeat surveys are undertaken, can be the main indicators of quality and condition. Furthermore, by assessing trends, the long-term sustainability of the hedgerow can be determined.

Management

This covers the type and method of hedgerow management, including flailing, laying, coppice management, short- and long-term absence of management, and evidence of past management of the hedge. It also includes an assessment as to whether the hedgerow has been managed during the closed period of the Wildlife Act (1st March to 31st August).

5.7 FLORISTIC RECORDINGS OF HEDGES

Recordings of the floristic species that made up the hedge/shrub layer were taken from two, randomly placed 30 metre strips. Identification and nomenclature followed Stace (2010). It should be noted, therefore, that Hawthorn is used as the common name for *Crataegus monogyna* rather than Whitethorn.

Hedgerows can be considered to be composed of three floristic layers;

a) Tree layer
Hedgerow trees are any trees within the hedge that have been deliberately or incidentally allowed to grow, as distinct from the shrub layer of the hedge.

b) Shrub layer
The shrub (hedge) layer includes shrubs such as thorns, woody climbers and tree species that have a shrubby growth form, normally due to management such as cutting or laying.

c) Ground or Herbaceous flora
This includes all herbaceous broadleaved plants, grasses, rushes and ferns found in the hedge bottom, some of which may be indicators of hedgerow age or origin (e.g. derived from scrub, old or ancient woodland). Comprehensive assessment of all ground flora is too time consuming for most hedgerow surveys. A list of the specific ground flora species to be recorded is identified in Appendix E of the HAS.

A number of worksheets were created in the validated Excel recording spreadsheet which permitted for recording of the Shrubs using the Domin Scale. The Domin Scale is used to record the percentage cover of each woody shrub species detected. Climbers and Ground flora were recorded using the DAFOR Scale.

Tree species present along the whole length of the hedge were noted and the dominant tree species, where applicable, was noted.

The presence of other species within the hedge but which did not fall within either sample strip was recorded separately.

5.8 RECORDING THE EXTENT OF HEDGEROWS IN SAMPLE SQUARES

Assessment of hedgerow extent was determined by comparing the latest satellite imagery for the sample areas with the presence / absence of hedgerows in the field. Any hedgerow loss was recorded.

In addition GIS Land Cover mapping was sourced Tailte Éireann via Leitrim County Council for the whole of the County.

Data from the original Teagasc Hedge Map (Teagasc, 2011) was also sourced in GIS format to permit for additional validation and assessment, particularly in relation to afforested land.

5.9 TARGET NOTES

Where appropriate, notes were made of irregularities, special features, or notable characteristics within the sample square or with regard to specific hedges. This was done by means of adding comments in the relevant cells of the Excel spreadsheet.

5.10 PHOTOGRAPHY

Photographs were taken using either the built in camera of the Samsung Galaxy Pro Tablet, a Canon EOS 4000D, Samsung Galaxy Pro phone or Samsung Galaxy A345G.

5.10 DATA RECORDING SECURITY

All of the data recorded during the field survey was backed up to a laptop after each days recording ready for subsequent analysis.

Digital photographs were downloaded, referenced, and stored in electronic folders relating to each sample square. These are currently stored on Google Drive and access will be made available via a link to Leitrim County Council.

6.0 DATA ANALYSIS

On completion of the fieldwork data record in the individual validated Excel spreadsheets was transferred in to a master database to facilitate analysis.

An Excel Macro was developed which validated the Domin recordings for each sample strip to ensure that recordings were within the correct scope.

A second Excel Macro was developed to apply the Hedgerow Appraisal System criteria to the recorded data to produce Significance status and Condition scoring for each hedge.

7.0 RESULTS OF THE COUNTY LEITRIM HEDGEROW SURVEY

The results from the sample survey are presented in this section with comments on the significance of the data discussed further in section 8.0. Recommendations for future conservation of the County's hedgerow resource in the light of these results are presented in section 9.0.

The analysis is based on detailed recording of 86 individual hedgerows – identified sample hedgerows were excluded where data could not be generated as access was not granted (4 cases), where the original hedgerow was no longer present (2 cases) and where the hedgerows sampled in 2006 were considered to no longer be hedgerows based on their location within parcels of land afforested since 2006 (10 cases). These hedgerows no longer meet the definition of hedgerows as linear features.

Where the current methodology and the 2006 methodology are sufficiently similar a comparative assessment has been undertaken.

The results from this study should be seen to be additional to and the results from 2006.

7.1 THE EXTENT OF HEDGEROWS IN COUNTY LEITRIM

Table 7.1.1 shows the extent of hedgerows in the individual sample squares of County Leitrim. The total area surveyed was 16km² which is approximately 1% of the total area of the county.

Table 7.1.1 Estimate of Hedgerow Extent in Sample Squares in County Leitrim

OS Grid Reference	Square Reference	Nearest Town/Village	Area km²	Hedgerow Length 2006 (km)	Hedgerow Length 2023 (km)	Difference 2006 to 2023 (m)
G 80 30	LM01	Dromahair	1	11.61	11.61	0
G 80 40	LM02	Gurteen	1	4.44	4.44	0
G 80 50	LM03	Largydonnell	1	6.29	5.35	-14.8%
G 90 20	LM04	Drumkeerin	1	0.00	0	0
G 90 30	LM05	Killargue	1	0.13	0	0
G 90 40	LM06	Manorhamilton	1	5.82	5.02	-13.7%
G 90 50	LM07	Rossinver	1	0.00	0	0
H 00 00	LM08	Drumsna	1	22.58	0	0
H 00 10	LM09	Drumshanbo	1	15.15	14.59	-3.7%
H 00 20	LM10	Ballinagleara	1	0.10	0.1	0
H 00 40	LM11	Glenfarne	1	4.08	4.08	0
H 10 00	LM12	Gorvagh	1	15.56	6.85	-56%
H 10 10	LM13	Ballinamore	1	6.75	6.75	0
H 20 00	LM14	Aughavas	1	17.07	11.49	-32.6%
H 20 10	LM15	Newtowngore	1	7.40	7.4	0
N 10 90	LM16	Tooman	1	4.97	4.41	-11.2%

It can be estimated that County Leitrim currently has a hedgerow length of 10673km assuming that the sampled hedges are representative of the county as a whole.

The length of hedgerows in the sample squares varies from 0 in upland and transitional scrubland areas up to 22.58km/km² in square LM08 (Drumsna).

Potential Error in Extent Values

Recording non hedgerows as hedgerows

Close inspection of every hedge within each 1km square for the purpose of recording extent was outside the scope of the survey within the working timeframe. Even on close inspection it was difficult, in certain cases, to determine whether a particular linear feature was or was not a hedgerow based on the survey definition. When it came to recording extent this distinction was often determined from a distance. It is possible that some features that were recorded for extent purposes as hedgerows may have been considered not to be hedgerows on closer physical examination. This potential error would be almost non-existent in most landscapes but in areas on the upland fringes of the periphery of bog-land the difference between a hedgerow and a colonized drain, linear scrub or similar feature is more blurred.

Non detection of new hedges

Young hedges that would not be included on early Ordnance Survey Maps and that would have been too small to register as distinct linear features on aerial photographs, satellite images or vector maps could only be recorded if detected during the field survey. The incidence of this was very low and it is not considered that new hedges would significantly contribute to the overall hedgerow extent.

Measurement Error

Features identified as hedgerows were matched with linear features on Leitrim County Council's Vector layer in QGIS. The Calculate Field feature was used to determine the length of each identified hedgerow. This permits for an accurate measurement of any feature

The length of hedgerows on very steep slopes may be slightly under-recorded due to map projection. This is considered to be insignificant in the overall totals.

EPA National Land Cover Map

The new EPA National Land Cover Map GIS data (March 2023) for County Leitrim was acquired from Tailte Éireann through a licence agreement held by Leitrim County Council. The land cover mapping includes categories for Hedgerows and Treelines. These are recorded as polygon features (area), rather than linear, or line, features (metres), which means that any data derived will have area as the base unit.

The total area of County Leitrim is 158,900 ha.

Analysis of the EPA data results in an area of;

6535 ha of Hedgerow (4.22%)

2058 ha of Treeline (1.27%)

This indicates a total area of 8593 ha of Hedgerow & Treeline, which is 5.11% of the total area of the County.

The extent of each of these features was clipped for each of the sample squares with the results in Table 7.1.2

Table 7.1.2 Area of Hedgerow and Treeline in each sample square based on EPA National Land Cover data

Square	Hedgerow (Ha)	Treeline (Ha)
LM01	7.84	2.02
LM02	11.92	0.27
LM03	4.35	0.32

LM04	0	0
LM05	0.45	0
LM06	5.01	0.13
LM07	0.12	0
LM08	10.31	1.46
LM09	7.71	2.76
LM10	0.65	0.17
LM11	2.29	2.9
LM12	3.16	1.34
LM13	2.78	2.84
LM14	4.55	2.48
LM15	2.83	2.5
LM16	3.05	0.98
Total	67.04	20.17

It was hoped at the outset that the EPA dataset would permit for an accurate assessment of the extent of hedgerows across the county and give an indication as to the accuracy / validity of the sampling methodology used for the HAS.

The sampled area of 16 km² (1600 ha) is 1.01% of the total area of the County. Using the EPA data the extent of Hedgerow and Treeline in this area was analysed as 87.21 ha which is 5.45% of the survey area. This compares with the figure of 5.11% derived for the County as a whole.

This 0.34% difference would indicate that the 1% sampling methodology is sufficiently representative in terms of estimating hedgerow extent by extrapolation.

However it was clear on assessing the data in the context of the sample squares that the EPA data has significantly over-recorded the area of Hedgerows and Treelines. As can be seen from Figure 7.1.2 some features identified as Hedgerows are well over 35m in width and are not linear features. Also, a number of features identified on the ground as Hedgerows have not been identified as Hedgerows or Treelines by the EPA mapping.

This matter will be addressed further in the Discussion and Recommendations sections of this report

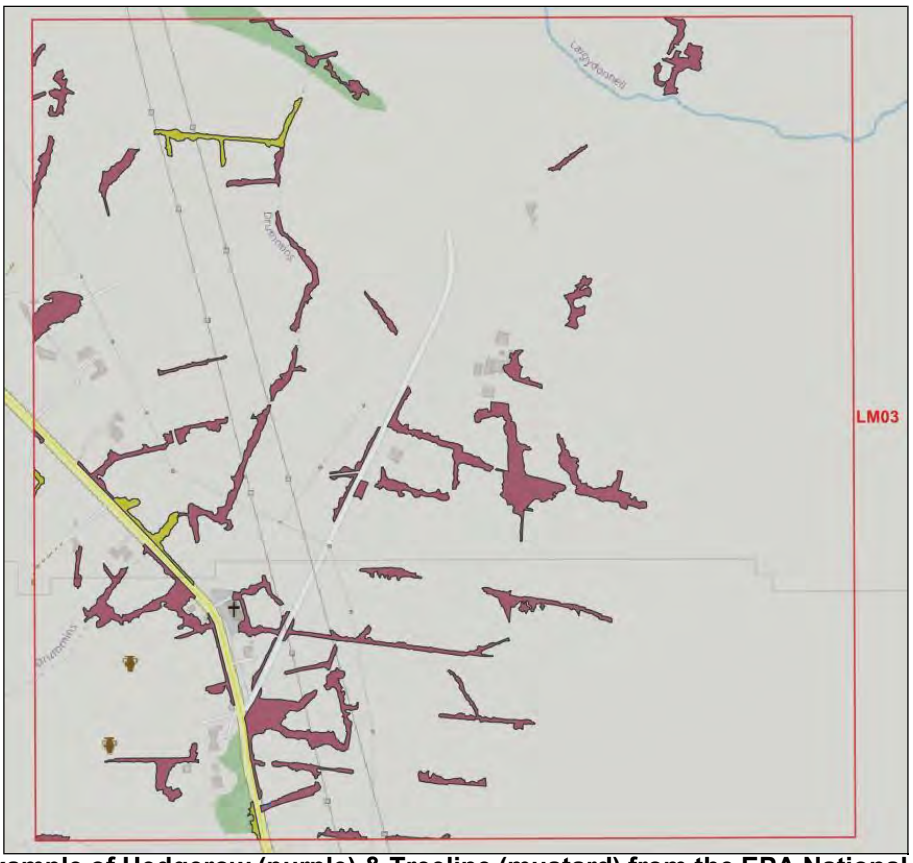


Figure 7.1.2 Example of Hedgerow (purple) & Treeline (mustard) from the EPA National Land Cover Map

7.2 SPECIES COMPOSITION OF HEDGEROWS IN COUNTY LEITRIM

The 'species composition' of hedgerows is individually examined in respect of the shrub layer, the tree layer, climbers / non-woody shrubs and ground flora. The average length of sampled hedgerows was 135m.

SHRUB LAYER

Shrub species occurring in the hedge layer

26 species were recorded in the shrub layer of the sampled hedges. 17 of these are species native to Ireland. In common with all previous studies Hawthorn (Whitethorn) is the most commonly occurring hedgerow shrub found in the sample strips of 95% of hedges. Four other species, Ash, Holly, Blackthorn and native Willow species each occur in over 50% of hedges.

The results do not preclude other species from being present in the sample area or within the County but it must be assumed that their frequency of occurrence is low.

Native species notable by their absence are Aspen *(Populus tremulus)* and Wild Cherry *(Prunus Avium)* which are known to be present in Leitrim.

Given that the precise location of the samples strips varied between this survey and the 2006 survey a small discrepancy in the frequency of occurrence could be expected.

The most notable differences in frequecy of occurrence between this survey and 2006 were with Beech (*Fagus sylvatica)* up from 1% in 2006 to 11% in 2023, Hazel (*Corylus avellana*) up by 8% and Oak (*Quercus spp.)* up by 5% - all three are woodland species

Blackthorn (*Prunus spinosa)* declined from 61% to 56% in terms of its frequency of occurrence. This is surprising in that Blackthorn readily propagates itself by suckering.

Bay Willow (LM02)

The frequency of occurrence of recorded shrub layer species is presented below, in Table 7.2.1 with a comparison with the data from 2006.
The '*frequency of occurrence*' is the frequency with which each species is found in one or other of the two sampled 30m strips of each hedge.

Table 7.2.1 Frequency of woody species occurrence in sampled County Leitrim hedges

Latin Name *(*denotes non-native species)*	Common Name	Frequency of occurrence 2006 (%)	Frequency of occurrence 2023 (%)	Increase or Decrease
Crataegus monogyna	Hawthorn	99%	95%	-3%
Fraxinus excelsior	Ash	68%	68%	0
Ilex aquifolium	Holly	63%	61%	-2%
Prunus spinosa	Blackthorn	61%	56%	-5%
Salix spp	Willow	52%	57%	+5%
Ulex europaeus	Gorse	22%	24%	+2%
* *Ligustrum vulgare*	Privet	17%	13%	-4%
Corylus avellana	Hazel	17%	25%	+8%
Alnus Glutinosa	Alder	15%	18%	+3%
Sorbus Aucuparia	Rowan	13%	9%	-4%
* *Acer pseudoplatanus*	Sycamore	13%	11%	-2%
Sambucus nigra	Elder	8%	7%	-1%
Viburnum opulus	Guelder rose	8%	9%	+1%
* *Symphoricarpos albus*	Snowberry	8%	8%	0
Euonymus europaeus	Spindle	5%	6%	+1%
Malus sylvestris	Crab Apple	5%	1%	-4%
Ulmus spp	Elm	3%	6%	+3%
Betula spp.	Birch	3%	4%	+1%
* *Prunus domestica*	Wild Plum	2%	2%	0
* *Aesculus hippocastanum*	Horse Chestnut	1%	0%	-1%
* *Fagus sylvatica*	Beech	1%	11%	+10%
Quercus spp	Oak	1%	6%	+5%
Prunus Avium	Wild Cherry	1%	0%	-1%
* *Syringa vulgaris*	Lilac	1%	1%	0
**Salix – non native*	Osiers		7%	

Guelder Rose in Townland Boundary Hedge (LM08)

Woody Non-Shrub Species / Climbers

A number of woody species and climbers, which are not considered to be hedge forming in their own right are a significant component of the flora of hedgerows.

Bramble (*Rubus fruticosus)* was recorded as being present in a total of 84% of County Leitrim hedges surveyed.

Wild Roses (*Rosa* species) were recorded in 44% of sample hedges with Honeysuckle (*Lonicera periclymenum*) recorded with a frequency of occurrence of 49%.

A number of other woody, non-shrub species were also recorded, including Bindweed (7%), which can be problematic if becoming dominant. Bilberry was also found in the sample strips of 2% of hedges – this is generally indicative of acidic, peat-based soils.

Details of the recordings of woody climbers are presented in Table 7.2.2 below.

Table 7.2.2 Frequency of occurrence of woody non-shrub species occurrence in sampled hedges

Latin Name	Common Name	Frequency of occurrence (%)
Rubus fruiticosus agg	Bramble	84
Rosa spp	Wild Rose	44
Lonicera periclymenum	Honeysuckle	49
Calystegia_sepium	Bindweed	7
Vaccinium myrtillus	Bilberry	2
Solanum_Dulcamara	Bittersweet	2
Clematis_vitalba	Clematis	1

Hedge Species Diversity

The '*species diversity'* of an individual hedge is defined as the number of shrub species found in a representative sample strip (30 metres in this case) of a hedge. As two 30m sample strips were recorded for the majority of hedge in this survey, the average number of species from the two strips is the most representative figure of species diversity for each sampled hedge.

Species Diversity Figures

The average number of all species per sample was calculated. A second assessment was carried out considering just the native species. The breakdown of percentages for the different levels of species diversity found in the sample hedges is shown in Figure 7.2.1. There is very little difference between the two sets of columns indicating that the majority of hedgerow species are native.

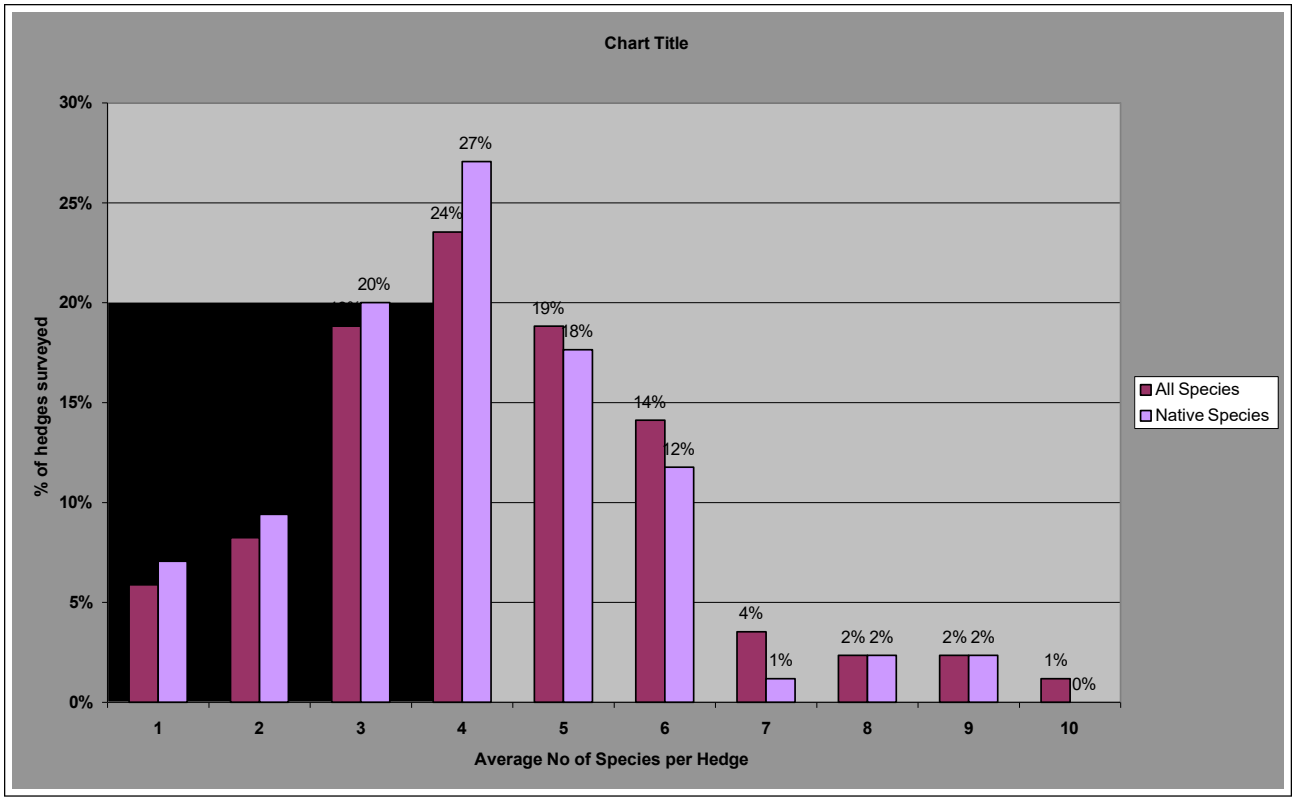


Figure 7.2.1 Percentage breakdown of (average) species numbers in sample hedges (all species)

Townland boundary hedge (LM15)

TREE LAYER

'Hedgerow trees' are any trees within the hedge with a diameter at breast height (DBH) greater than 8cm or that have been deliberately or incidentally allowed to grow distinct from the shrub layer of the hedge.

Consistent with the 2006 survey hedgerow trees were recorded as present in 89% of the recorded hedges in County Leitrim.

A total of 17 tree species were found in sampled hedges in this survey. 12 of the tree species recorded were native species. Ash (*Fraxinus excelsior)* is comfortably the most frequently occurring hedgerow tree in County Leitrim; it was found in 68% of all sampled hedges.

Hawthorn was recorded in tree form in 44% of the sampled hedges. The apparent increase, from 2006, in the percentage of hedges where Hawthorn occurs as a tree is down to a change in the recording methodology.
The percentage of sampled hedges in which Holly was recorded increased significantly from 10% in 2006 to 32% in 2023. Holly is present in the shrub layer in 63% of sampled hedges. It is a slow growing woodland understorey species which has most probably seeded in to the hedgerows and has taken time to reach tree proportions. Reduced management will have allowed these seedlings to develop in to trees.

The two wet ground species, Willow and Alder, were the next most frequently occurring at 29% and 19% respectively; both up slightly from the 2006 study. Rowan (*Sorbus Aucuparia)* was the only other native tree species found in more than 10% of the sampled hedgerows.

Sycamore and Beech were the main non-native tree species recorded in sample hedges at 11% and 9% respectively. They would generally be considered to be unsuitable as hedgerow trees due to the dense shade that they cast on the shrub layer.

Table 7.2.3 lists the tree species recorded and their frequency of occurrence.

Table 7.2.3 Frequency of tree species occurrence in sampled County Leitrim hedges

Latin Name	Common Name	Frequency of	Frequency of occurrence

*(*denotes non-native species)*		occurrence (%) in 2006	(%) in 2023
Fraxinus excelsior	Ash	67%	68%
Crataegus monogyna	Hawthorn	11%	44%
Ilex aquifolium	Holly	10%	32%
Salix spp	Willow	28%	29%
Alnus glutinosa	Alder	16%	19%
Sorbus Aucuparia	Rowan	8%	12%
* *Acer pseudoplatanus*	Sycamore	13%	11%
* *Fagus sylvatica*	Beech	7%	9%
Corylus avelana	Hazel		8%
Ulmus spp	Elm	3%	3%
Quercus spp	Oak	7%	2%
Malus sylvestris	Crab apple	4%	2%
**Prunus domestica*	Wild Plum	2%	2%
Betula spp	Birch	6%	1%
Viburnum opulus	Guelder Rose		1%
**Morus Alba*	Common Mulberry		1%
**Aesculus hippocastanum*	Horse Chestnut		1%
Sambucus nigra	Elder	2%	0%

Venerable Willow Tree (LM02)

Tree Species Diversity

19% of the hedges where trees were recorded had just one tree species. A further 20% contained two tree species, 20% had three species, 14% had four species and 15% had five species or more. One (long) hedgerow in square LM01 contained nine different tree species.

IVY

Ivy is a common component of County Leitrim's hedgerows. It was present in the canopy of 62% of sampled hedgerows.

More significantly, Ivy is present at Frequent, Abundant or Dominant level in the canopy of 16% of sampled 30m strips. This would be of concern in terms of the well being of the trees in the hedgerows concerned.

A well developed canopy of Ivy can pose a threat to the stability or long term viability of hedgerow trees and shrubs. Its presence at high levels in the canopy is often an indication of the demise of the particular plant.

However, any management / control of Ivy must be considered in the context of the importance of Ivy for wildlife in particular for pollinating species.

7.3 GENERAL ECOLOGICAL, HISTORICAL, AND AGRICULTURAL CONTEXT OF HEDGEROWS IN COUNTY LEITRIM.

The context in which hedgerows are set can be a useful indicator of its Historical, and Ecological Significance.

The ecological value of individual hedges is influenced by the general ecology of the area in which they occur and how they interconnect with other natural and semi-natural landscape features. In order to examine the overall ecological context of County Leitrim's hedgerow resource a record is made of both habitat type of land adjacent to the sampled hedges and any end link the hedge makes with other habitat types. The classifications are based on Fossitt (2000).

Corine Land Cover

The 'Coordination of information on the environment' (Corine) is an inventory of European land cover split into 44 different land cover classes. The Corine database is produced in cooperation with European countries. The latest available dataset is from 2018.

The hedgerows assessed in this study fall within just 4 of the 44 land cover classes.

Land principally occupied by agriculture	68.6%
Pasture	18.6%
Other Agricultural Land	10.5%
Natural Grasslands	2.3%

Soil Type

The soil type on which the assessed hedgerows were growing was determined using the Teagasc National Soil Map.

Sampled hedgerows can be broadly classed as being on the following soil types.

Surface Water Gley	59%
Ombrotrophic (peat-based)	23%
Luvisol (Mineral)	15%
Alluvial	3%

Fossitt Classification

A Guide to Habitats in Ireland (Fossitt, 2000) has been the defining classification system for habitats in Ireland since its publication in 2000.

86% of sampled hedgerows were classed as WL1 (Hedgerow) with the remaining 14% classed as WL2 (Treeline) under the Fossitt classification system.

This balance differs in terms of the EPA National Land Cover dataset which indicates a greater proportion of Treelines (24%) – this discrepancy will be addressed in a separate section of this Report.

Adjacent Land Class

Work carried out by Teagasc (Matin (2016) indicates that County Leitrim contains a high proportion of land that is predicted to be of High Nature Value (HNV).

Figure 7.3.1 shows the breakdown of the adjacent land class of the sampled hedgerows. Watercourses are counted separately to other habitats as they may occur in combination with them.

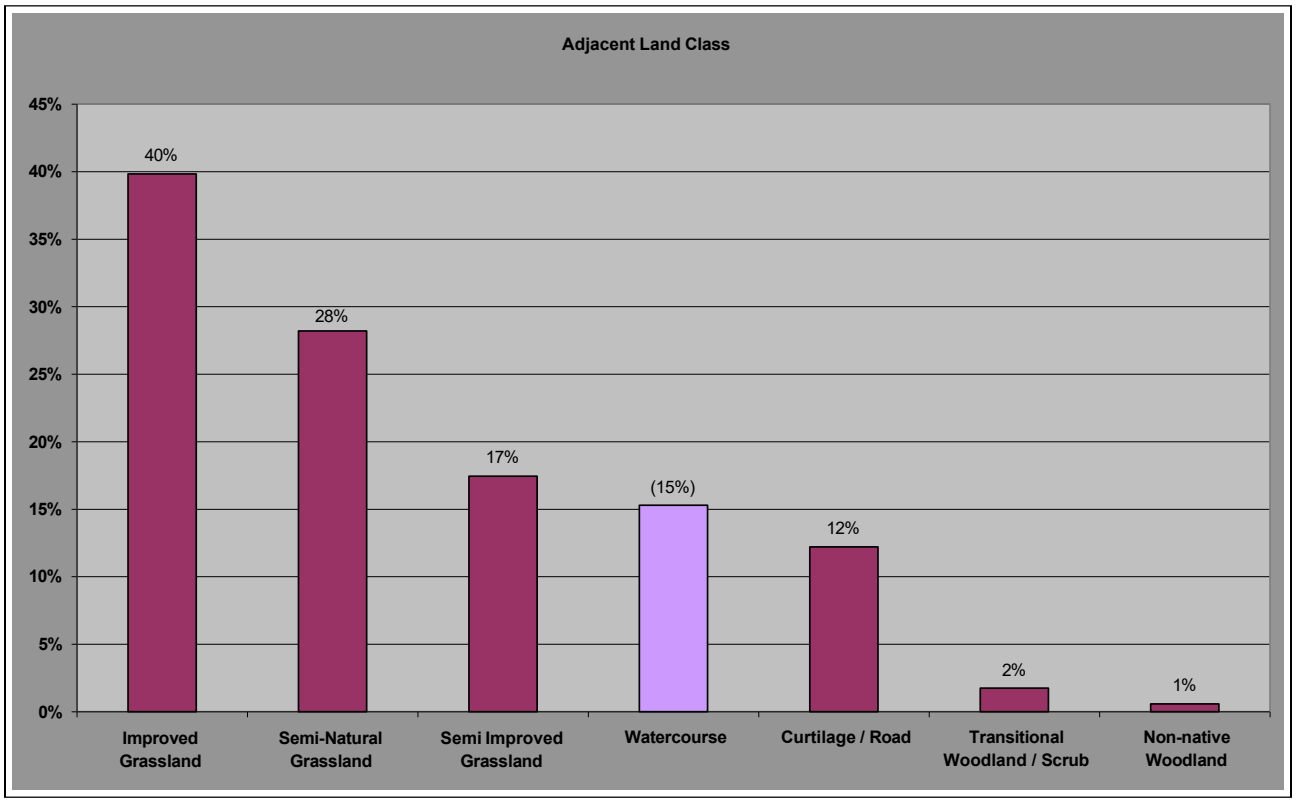


Figure 7.3.1 Habitat category of land adjacent to sampled hedgerows.

Links with Other Habitats

The corridor role of hedgerows in facilitating the movement and distribution of wild flora and fauna through the landscape is understood to be enhanced significantly if hedgerows link into other (natural or semi-natural) habitat features. Figure 7.3.2 shows the breakdown of how the sampled hedges connected with other hedgerows and other habitat types.

Hedgerows have end links with other hedgerows in almost two thirds of the sampled hedgerows.

45% of the sampled hedgerows had no link at least one end with any other natural or semi-natural habitat (including other hedgerows), with 7% having no link whatsoever with other natural or semi-natural habitat.

These results would indicate that the ecosystems of agricultural landscapes are a significant component of any bio-diversity strategy for the county, but fragmentation in some areas is of concern.

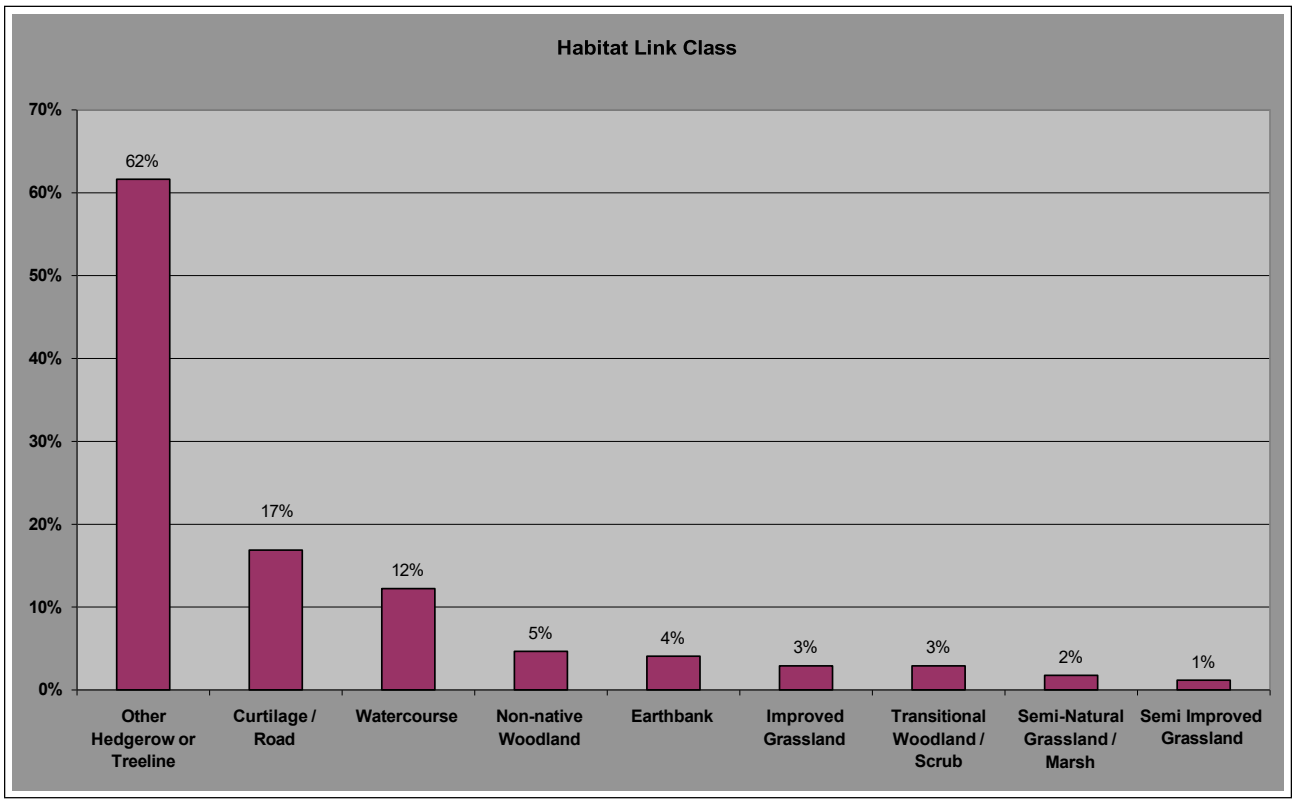


Figure 7.3.2 Links of sampled hedgerows with natural or semi-natural habitats in County Leitrim

Hedgerow History

All sample hedges were compared with boundaries marked on the first and second edition Ordnance Survey maps dating from 1837 and 1907-09 respectively. It cannot be known for certain if the boundaries marked on these maps were hedgerows, but the absence of any boundary marking would clearly indicate the absence of a hedgerow at that period. 66% of the sample hedges were not present on the first edition maps from 1837.

Since there has been a small degree of realignment of townland boundaries between the first and second editions of the Ordnance Survey, townland boundary hedges were identified using the second edition maps. In County Leitrim they accounted for just 7% of the sample; the range from other county hedgerow surveys is from 10% to 15%. Townland boundaries are less likely to be removed in field boundary rationalisation programmes since they often form farm boundaries. Therefore they are more likely to be sampled in counties with larger field sizes since they form a higher proportion of the total hedgerow network.

Roadside hedges are at the forefront of the public's perception of hedgerows. In County Leitrim 12% of hedges surveyed were adjacent to public roads.

Historical and Ecological Context

Over 9% of sampled hedgerows were within or connected to the buffer zone of a site recorded on the Sites and Monuments Record. This does not necessarily mean that the hedgerow itself is of itself of antiquity but the sheer proximity to such protected features renders the hedgerow of historical significance.

3 sampled hedgerows were either within or connected directly to European Designated sites – in each case Lough Gill SAC.

Boundary Function

To assess the relevance of hedgerow boundaries to modern agriculture, a record was made as to whether the hedgerow formed part of an active farm boundary. A '*redundant boundary*' is one where stock would have uncontrolled simultaneous access to the land either side of the hedge. The hedge may or may not be reinforced with other forms of fencing. Hedges along redundant boundaries may not be redundant for shelter or other functions.

69% of hedgerows in County Leitrim are considered still to be part of active divisions or sub-divisions of farms, with 31% adjudged to be redundant. The proportion of redundant boundaries has increased from 22% in 2006 suggesting that hedgerows are declining in terms of relevance to their land division and stock control functions.

7.4 CONSTRUCTION OF HEDGES IN COUNTY LEITRIM

'*Construction*' relates to the physical infrastructure of the hedge. This survey recorded details of the linear outline of sampled hedges, the linearity of the hedgerow shrubs, and details and dimensions of any associated features such as banks, walls and drains.

Results in these categories are broadly the same as those recorded in 2006 as they represent hedgerow features that are fixed and not subject to management influence.

In County Leitrim 78% of the hedges surveyed were considered to be linear and regular in outline. Of the 22% having a more irregular outline 50% were associated with a public road or stream.

Only 12% of sampled hedgerows had no bank, wall or shelf. Only 7% of hedgerows were not associated with a drain or stream which highlights the hydrological significance of the hedgerow network.

7.5 STRUCTURE AND CONDITION OF HEDGES IN COUNTY LEITRIM

Detailing the '*structure'* of the sampled hedgerows involved recording information on the average height, average width, the cross sectional profile, the percentage of gaps, the woody structure of the hedge base, and the presence of hedgerow trees. These features are indicators of the agricultural, ecological and landscape status of the hedge.

Hedge Height

Figure 7.5.1 shows a breakdown of the sample in terms of the hedge height categories between the 2006 and 2023 surveys.

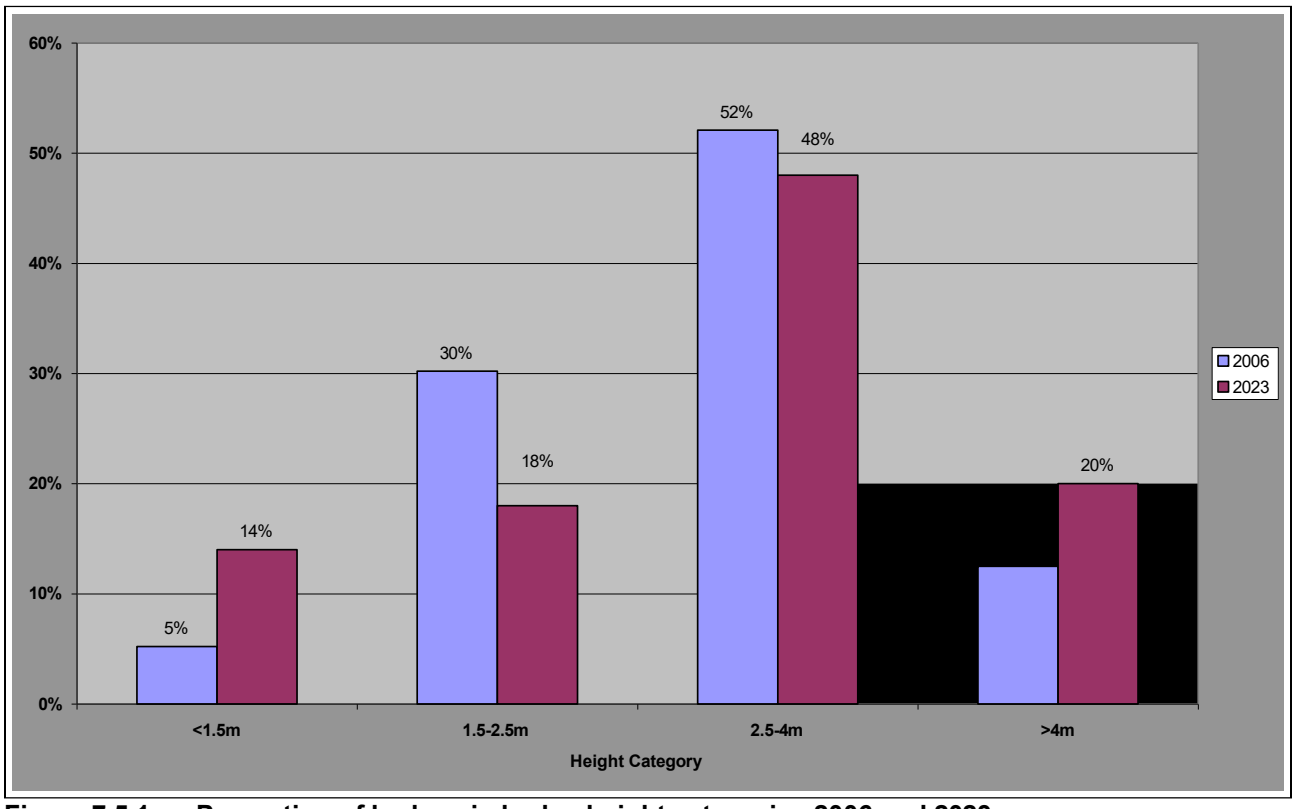


Figure 7.5.1 Proportion of hedges in hedge height categories 2006 and 2023

Research indicates that taller hedges are generally better from a wildlife perspective. Maintaining hedges below 1.5m in height is not considered a desirable feature from a biodiversity perspective.

There has been an increase in the proportions of the height categories at either end of the scale – more very short hedgerows and more tall hedgerows. Less than half of the hedges in the <1.5m category were roadside where low hedges might be justified for safety reasons.

Hedge Width

Increasing width generally correlates with improved biodiversity in hedgerows.

As can be seen from Figure 7.5.2, the results of the survey indicate that there has been an increase in the proportion of hedges at both ends of the scale; more very narrow hedges and more very wide hedges.

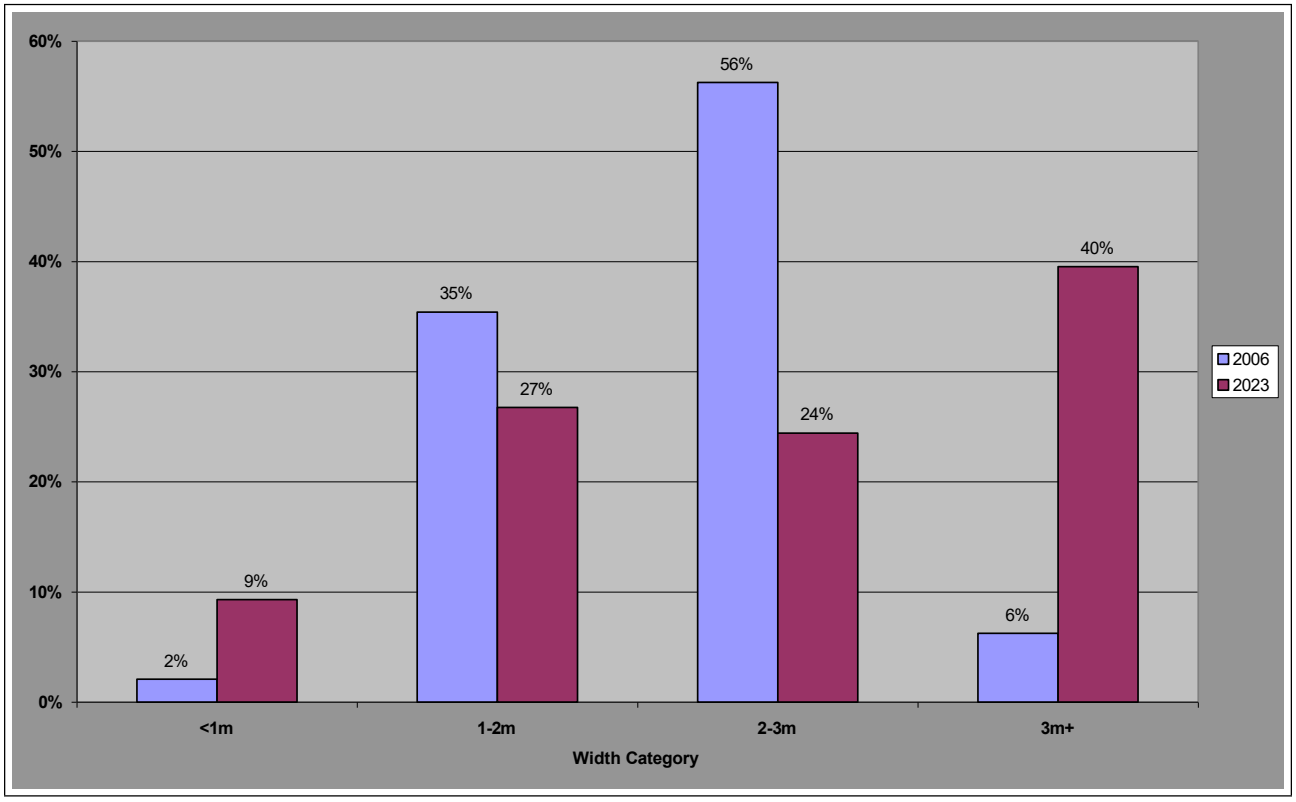


Figure 7.5.2 Proportion of sampled hedges in hedge width categories 2006 and 2023

Percentage of Gaps

'Gappiness' is an assessment of the percentage of the length of the hedge that no longer has a cover of hedgerow shrubs. Gaps are associated with a weak hedge structure and are often a symptom of the deterioration of the hedge often caused by the demise of plants through age or inappropriate management. Some hedges have very well defined individual gaps, other have a low stocking density of shrubs and trees that result in a lateral weakness in the structure.

Figure 7.5.3 shows the breakdown of the sample in terms of percentage gaps over the length of the hedge.

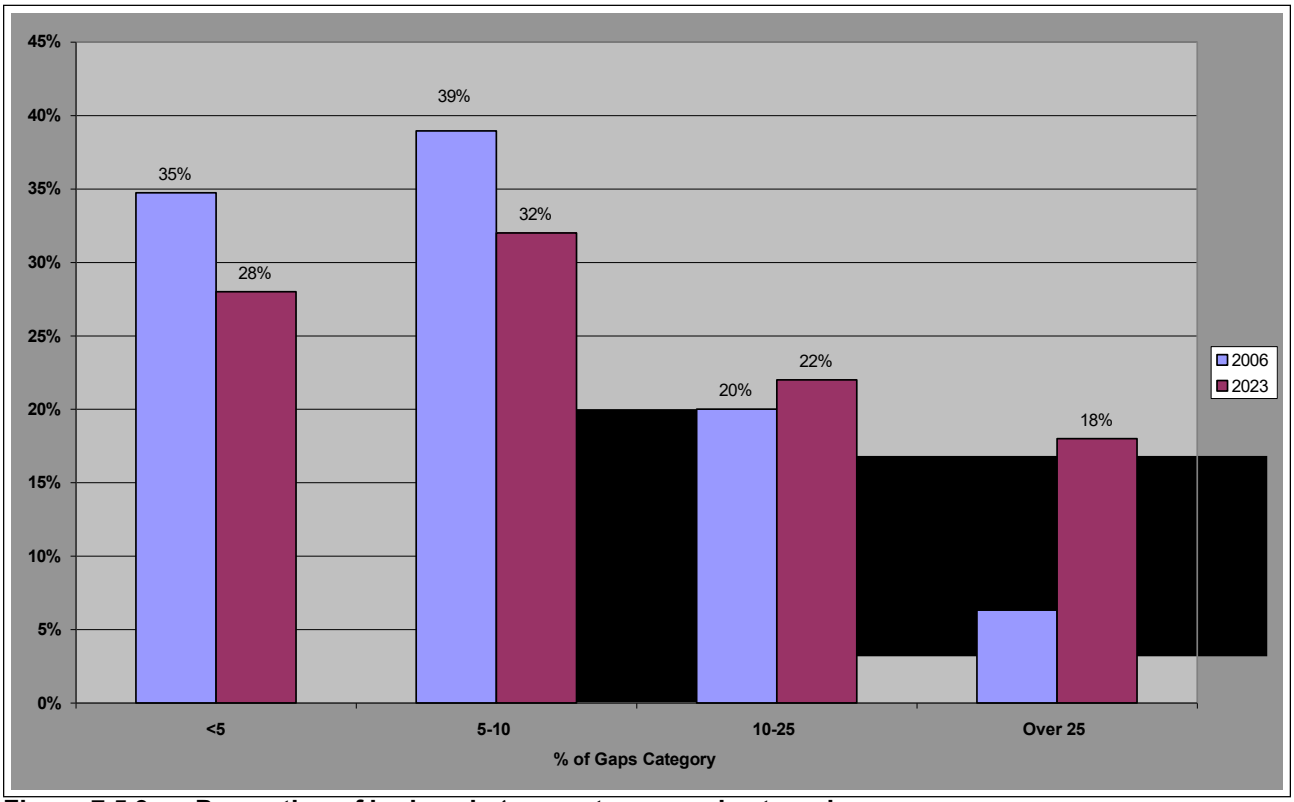


Figure 7.5.3 Proportion of hedges in 'percentage gaps' categories

The comparison with the results from 2006 shows an overall deterioration in the linear continuity of hedgerows over the 17 years between the surveys. The threefold increase in hedges with greater than 25% gaps would be of particular concern.

Basal Density

Recording how dense the growth of hedge shrubs is in the bottom metre of the hedge is an important indicator of the hedge structure both environmentally and agriculturally.

As hedgerow shrubs mature, growth near to the base generally declines as the plant is no longer threatened by browsing. Without management intervention plants can revert to their natural tree form with an empty or open base.

A hedge where the woody shrub growth is dense at the base is obviously better from a stock control perspective but it also considered beneficial for the hedges ability to support wildlife. Figure 7.5.4 shows the breakdown of how the samples fared in terms of the hedge base categories. A direct comparison with the results from 2006 was not possible as the recording categories were modified in the HAS.

Over a quarter of hedges are described as having an open base, with only 19% of hedges having a dense basal structure. The base of many hedgerows would be thickened by the growth of other, non-hedge forming woody vegetation, particularly brambles (*Rubus fruiticosa).* However weak growth of the shrubs in the hedge base would be of concern.

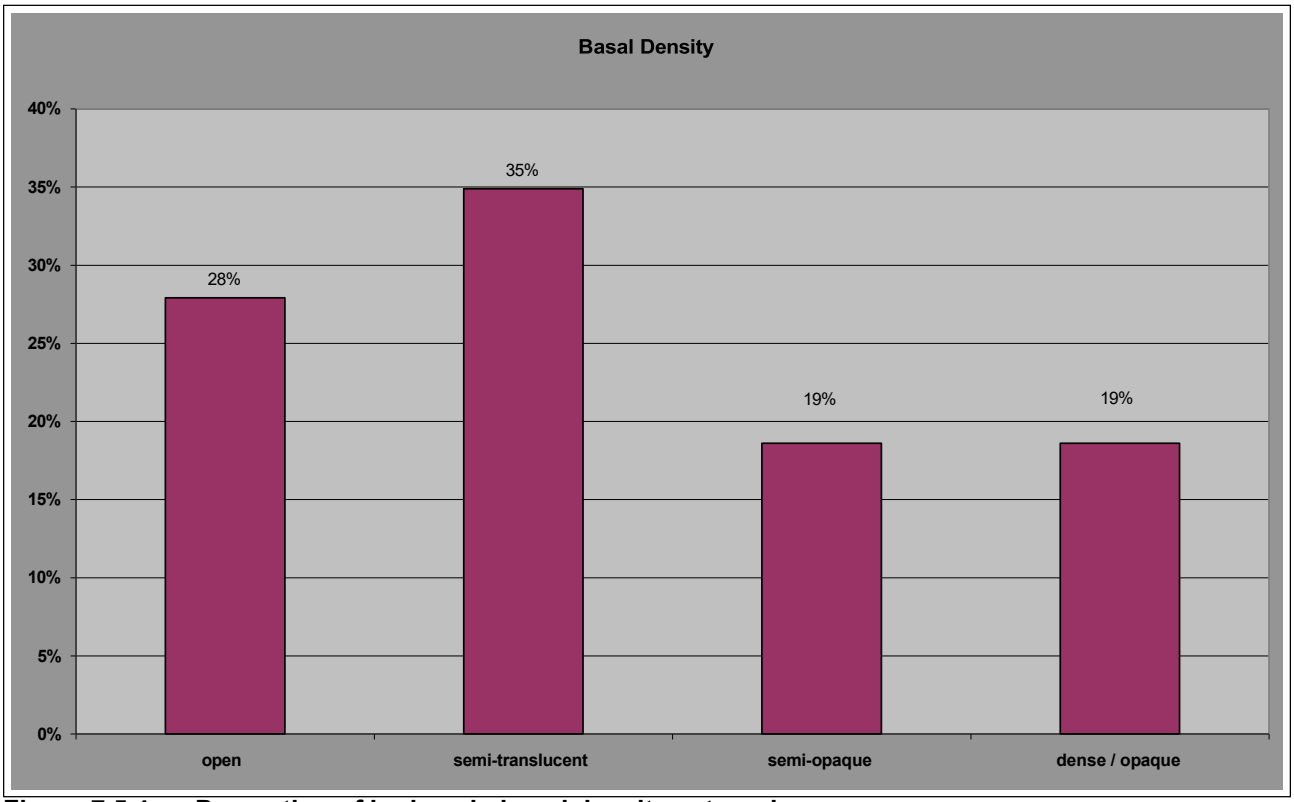


Figure 7.5.4 Proportion of hedges in basal density categories

Hedge Profile (cross section)

Assessing the profile or cross sectional area of a hedge can be a good indicator of its progress through the life cycle. Hedgerows that contain a high proportion of spreading shrubs like blackthorn and gorse can eventually spread to a point where they are no longer considered to be hedges and are re-classified as other habitat types, most commonly scrub/ transitional woodland.

An assessment of the findings in the sample hedges is shown in Figure 7.5.5.

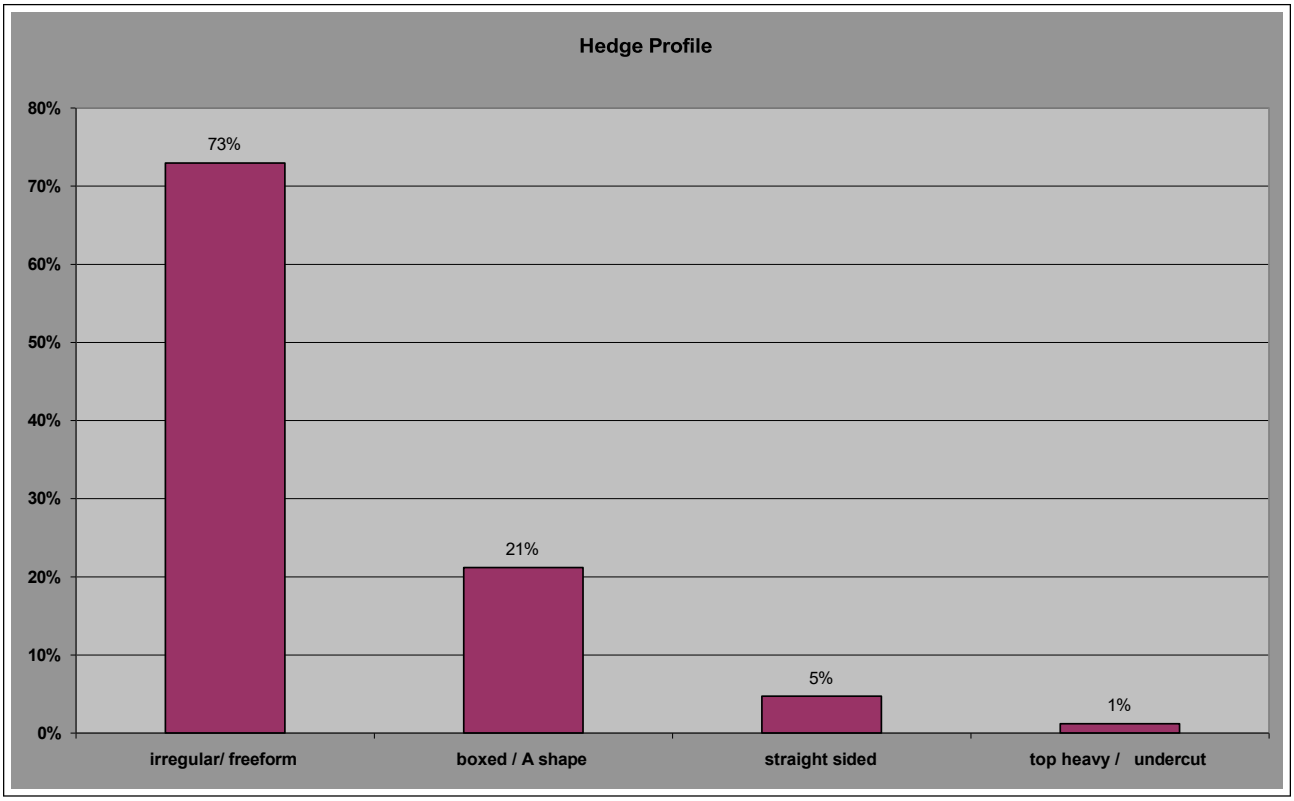


Figure 7.5.5 Proportion of hedges in profile categories

Almost three quarters of the sample hedges in County Leitrim evidenced an irregular or freeform profile indicative of either infrequent management or no management at all. 27% of sampled hedge profiles exhibited evidence of management with 21% being of the typical boxed profile. No examples of the recommended A-Shape profile were recorded.

Low levels of management can bring their own set of problems with 36% of long term unmanaged sample hedges in County Leitrim considered to have an open base structure which can be considered a sign of deteriorating quality. This compares with 28% of sampled hedges with an open base overall. Also, 59% of sample hedges were noted as having outgrowths to the side of the hedge; an indication that the hedge is following the natural process of trying to colonise the adjacent land. This compares with just 20% of hedges in the 2006 survey.

Irregular profile of hedge (LM13)

Hedgerow Trees

This survey recorded the abundance of trees in hedges and compared this with the equivalent data from 2006 (Figure 7.5.6).

Hedgerow trees are a distinct feature of County Leitrim hedgerows being present in 90% of hedges sampled.

The abundance of trees in 2023 is slightly lower than in 2006 but this could be down to the effects of Ash Die Back disease, although the overall frequency of occurrence of Ash remains the same as in the 2006 survey.

Ash is in the same proportion of hedges but possibly not in the same abundance. It is still, however, by far the most dominant tree species in Leitrim's hedgerows.

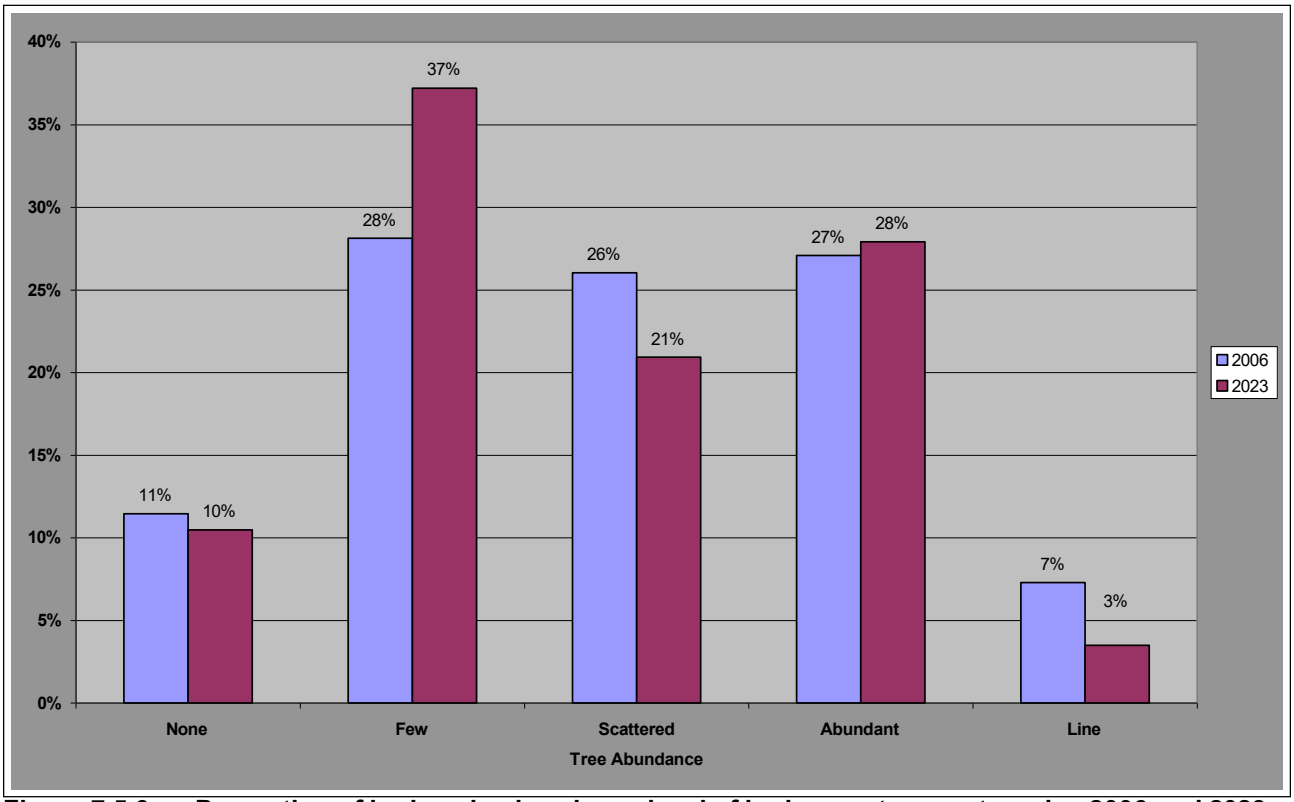


Figure 7.5.6 Proportion of hedges in abundance level of hedgerow trees categories 2006 and 2023

Tree Age Composition

It is generally considered that to achieve sustainable levels of hedgerow trees a balance between young, medium and older trees needs to be maintained. 80% of the County Leitrim hedges which had hedgerow trees recorded young trees as being present. This is a positive sign for the future. However, as Ash is by far the most dominant tree species in Leitrim hedgerows, this positive sign is tinged with concern.

Ash Dieback

Ash Dieback is a highly destructive disease caused by the invasive fungal pathogen *Hymenoscyphus fraxineus*. It was first formally detected in the Republic of Ireland in October 2012 in a forestry plantation near to Ballinamore, Co. Leitrim on plants imported from continental Europe. The disease is now prevalent across the island of Ireland and is likely to cause the death or demise of a significant proportion ash trees over the next two decades.

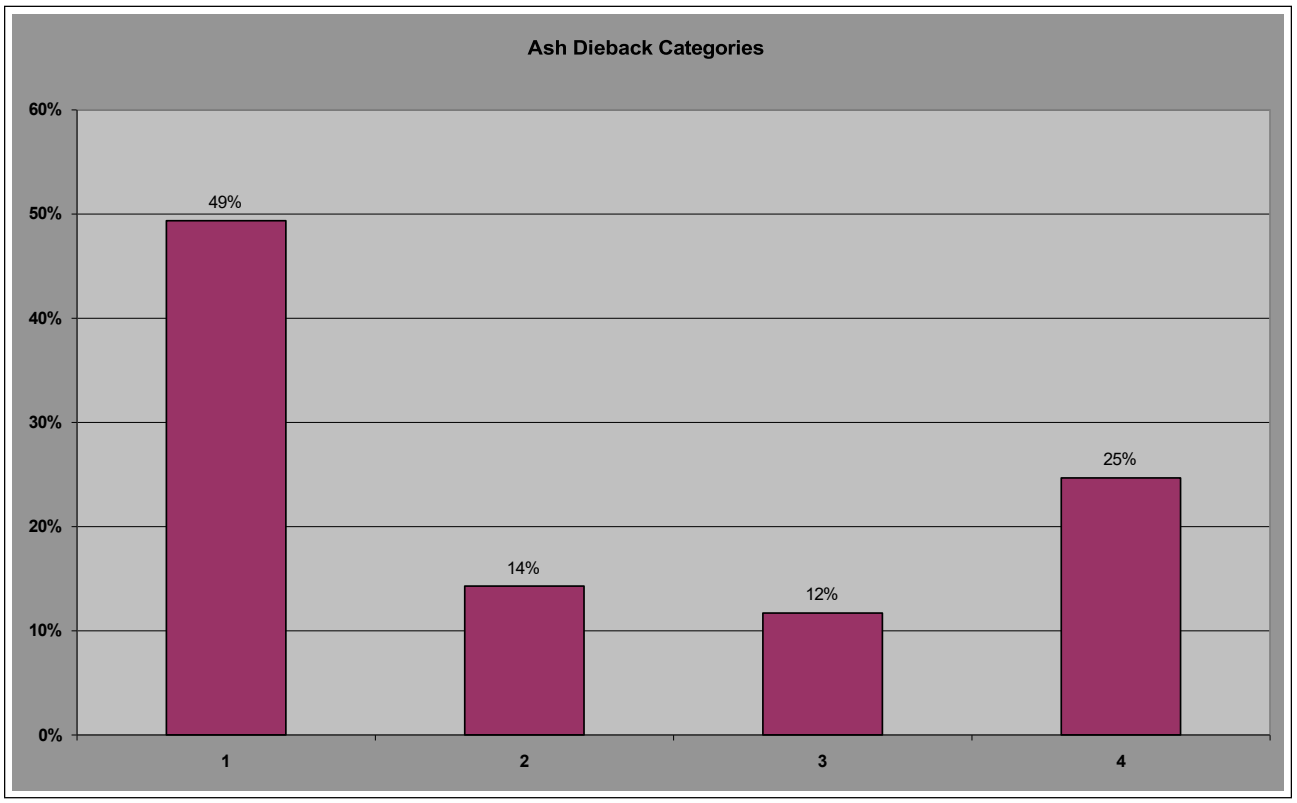
It can be assumed fairly safely that Ash Dieback disease is present to some degree in virtually all Ash trees in Leitrim. The issue is how well the trees are coping with the infection. The HAS was developed before Ash Dieback became established in Ireland so assessment does not form part of the methodology.

This is too important a matter to ignore and for the purposes of this survey the Suffolk County Council Ash Health Assessment System (Tree Council UK, 2021) was used.

In this system, the canopies of the ash trees are scored using four categories, assessing the percentage of the crown that remains. The four categories are:

- Class 1: 100%–76% remaining canopy
- Class 2: 75%–51% remaining canopy
- Class 3: 50%–26% remaining canopy
- Class 4: 25%–0% remaining canopy

Hedgerows contain trees in different classes; therefore a general assessment was made for each sampled hedgerow as to the most representative category for the Ash trees as a whole.



The results are quite polarised with almost 75% of sampled hedgerows being at either extreme. It is unlikely that trees in Class 2 will recover to Class 1 and most unlikely that trees in Class 3 will do anything other than fall in to Class 4 over time. The main objective should be to preserve as many of the Class 1 trees in the hope that they possess a degree of immunity against the disease and can act as a seed source for a new generation of trees.

Bank/Wall Degradation

Where hedgerow shrubs are established in hedge banks the viability of the hedge can be threatened if the bank is damaged. Root systems are exposed to damage, drying and infection with the result that overall stability can be reduced. Ground flora is also compromised. Small amounts of exposure of the bank can be of value to certain wildlife species, particularly solitary bees.

There was a fairly even split between hedgerows showing General Damage, Isolated Damage and No Damage. The degree of damage was also assessed with Minor Damage and Severe Damage being recorded in at least 30% of the sample hedgerows which had hedge banks. 17% of sampled hedges with hedge banks showed evidence of severe, general damage. This is almost three times the figure recorded in 2006 where a slightly different methodology was used. This is a trend that is of concern.

The positive feature of sound structure of the woody component of a hedge can be negated where the hedge bank is badly damaged. Renovation of the damage accompanied by protective fencing may be required to fully remediate eroded banks.

7.6 MANAGEMENT OF HEDGES IN COUNTY LEITRIM

The management of hedges affects the hedge structure, condition and sustainability which in turn impacts on functional, biodiversity and aesthetic values. For these reasons an in-depth assessment of hedge management forms an important part of this survey. The implications of management variables recorded are presented in section 8.0.

Figure 7.6.1 gives a breakdown of the hedgerows sampled by their type of management in comparison with the results from 2006.

Figure 7.6.1 Breakdown of the management type of the sample 2006 and 2023

Management levels in County Leitrim are low with 44%sampled hedges being in the long-term unmanaged category with a further 27% being determined to be short-term unmanaged. Management figures are generally comparable with those from 2006.

Contrasting management of hedge 2006 and 2023 (LM13)

Abandonment of management is regarded by many hedgerow management specialists as the principle cause of dereliction and eventually the demise of hedgerows. It is generally considered that hedge rejuvenation needs to be carried out on most hedgerow types at least every 30 -40 years in order to maintain sustainability. This means that overall 3.3% of hedges would need to be rejuvenated on an annual basis.

In this survey, 2 hedges surveyed showed some evidence of recent rejuvenation (coppicing) within the last few years, although in one case this was only of selected plants rather than the hedges as a whole.

The results from this survey suggest that there is no strong tradition of hedge laying in County Leitrim.

Where hedges have been managed in the short-term past, but not during the current season, detecting the precise means by which the management was carried out can be difficult to establish

The method by which hedges were managed was also investigated. The rotary flail was the tool / machine use to manage 92% of the recently managed hedges.

No hedges were recorded as being managed to the A-shape profile recommended by Teagasc.

The 2006 survey indicated some concern regarding the fact that that 21% of surveyed hedges that were part of management regimes were managed using excavator machines. In some cases this involved breasting with the machine bucket, but more extreme cases were recorded where hedgerow branches and stems were broken down and crushed. This practice is not permitted within Agri-Environment Schemes.

The 2023 survey recorded just 2 hedges that showed clear signs of this type of management. This was not recent (within the last 2 years).

Only 1% of the hedges recorded showed proof of having been laid in the past. Evidence of old hedge laying can be difficult to detect in dense hedges or those with dense ground vegetation so it should be assumed that these results may be on the conservative side. Based on observations in other county hedgerow surveys the tradition of laying hedges tends to be lower in the western half of the country.

Fencing

The principal original function of hedges was for field division and to act as stock-proof barriers.

50% of sampled hedgerows had no additional fencing. This figure fell to 36% where only active boundaries were considered.

56% of active boundaries had some form of stand alone fencing.

21% of sampled boundaries were reinforced by having wire fixed to hedgerow stems. This is undesirable from both hedgerow well-being and public health and safety perspectives. 8% of sampled boundaries had no other form of fencing other than this embedded wire.

7.7 APPRAISAL OF HEDGES IN COUNTY LEITRIM

Heritage Hedgerows

A macro was developed in Excel by the lead author to apply the criteria of the Hedgerow Appraisal System to the data collected in order to appraise each hedge in terms of its significance and condition.

Significance

Figures 7.7.1 to 7.7.4 give a breakdown of the sampled hedgerows within 4 of the 5 Significance classes of the Hedgerow Appraisal System

Historical Significance

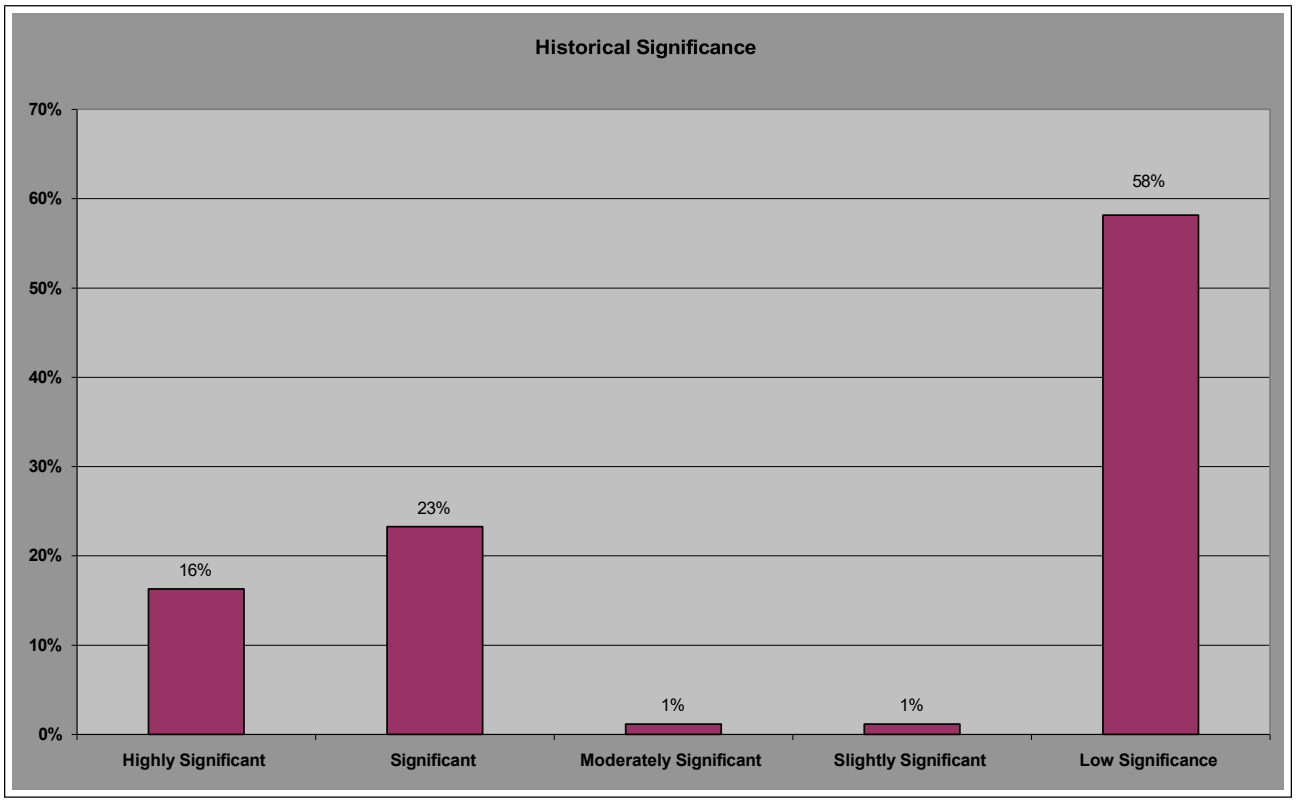


Figure 7.7.1 Historical Significance of sampled hedgerows

Species Diversity Significance

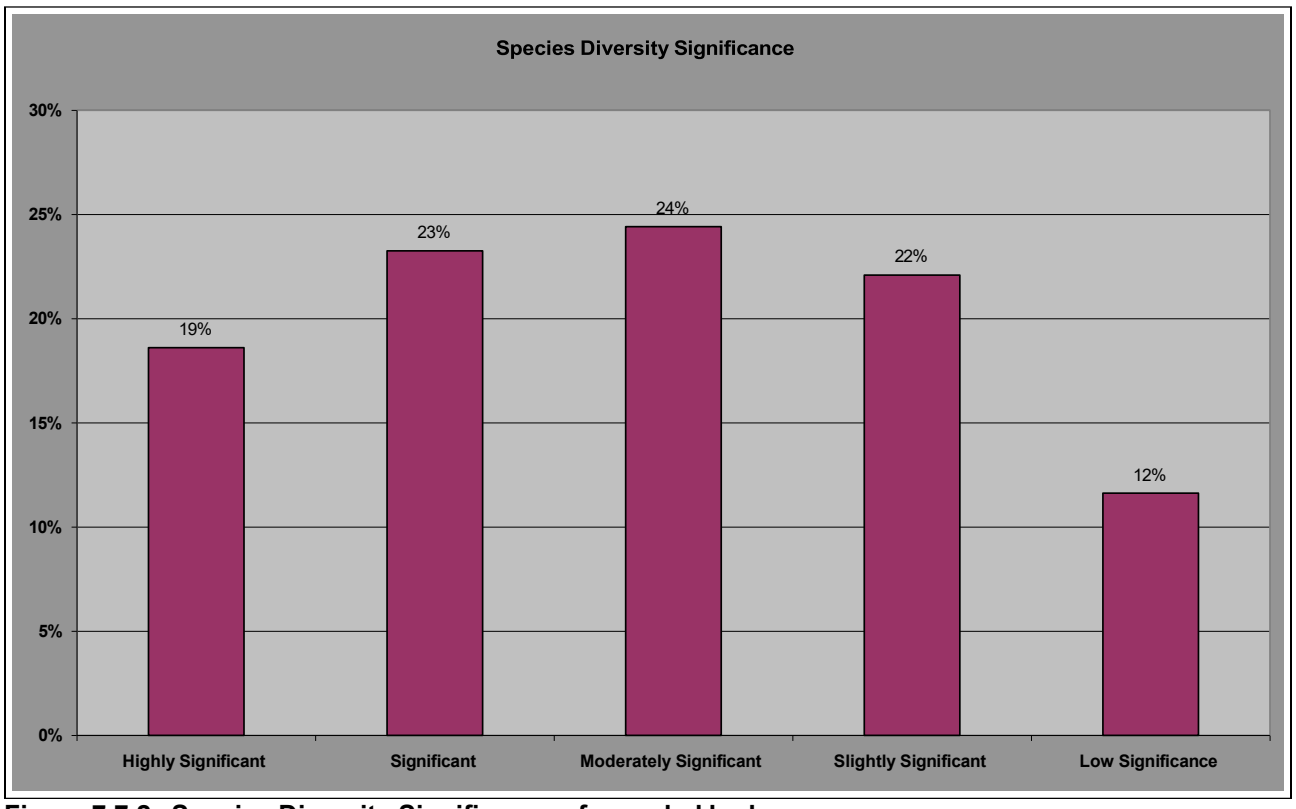


Figure 7.7.2 Species Diversity Significance of sampled hedgerows

Structural Significance

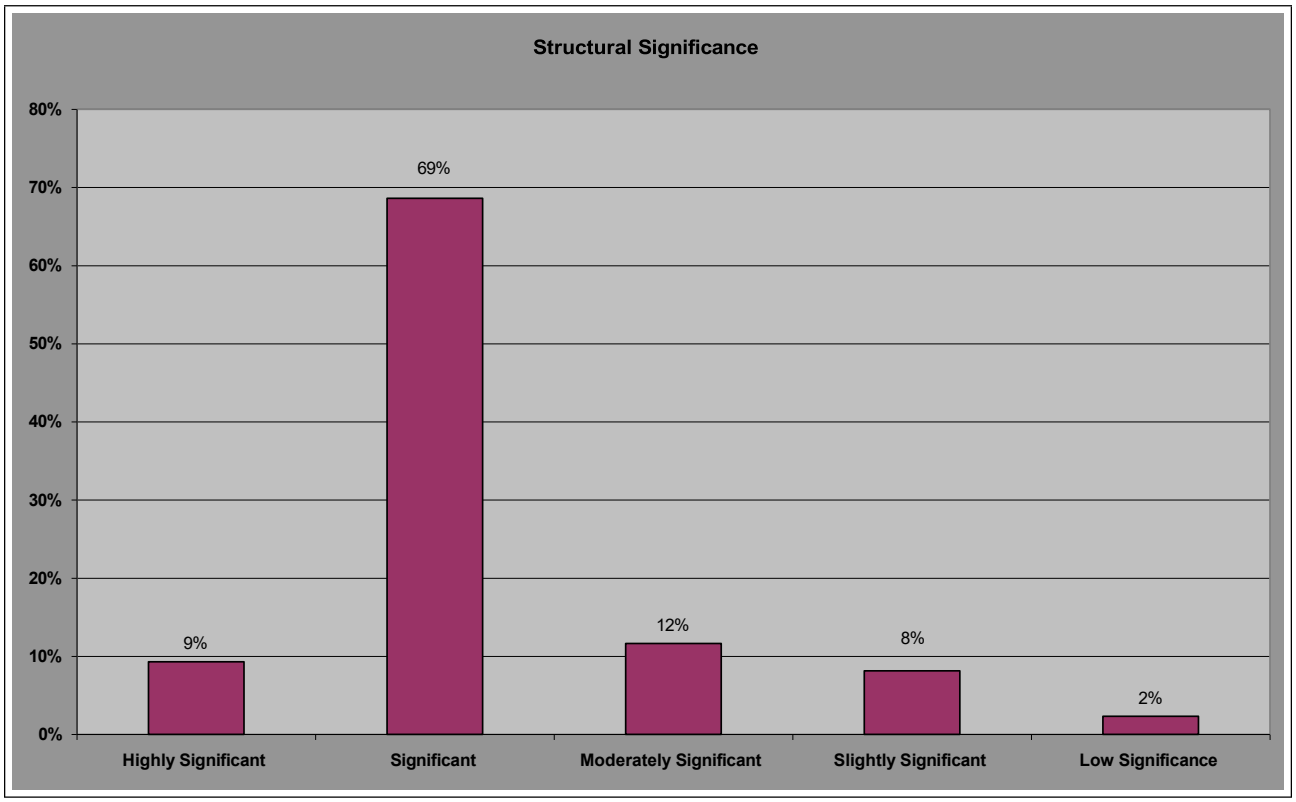


Figure 7.7.3 Structural Significance of sampled hedgerows

Habitat Connectivity Significance

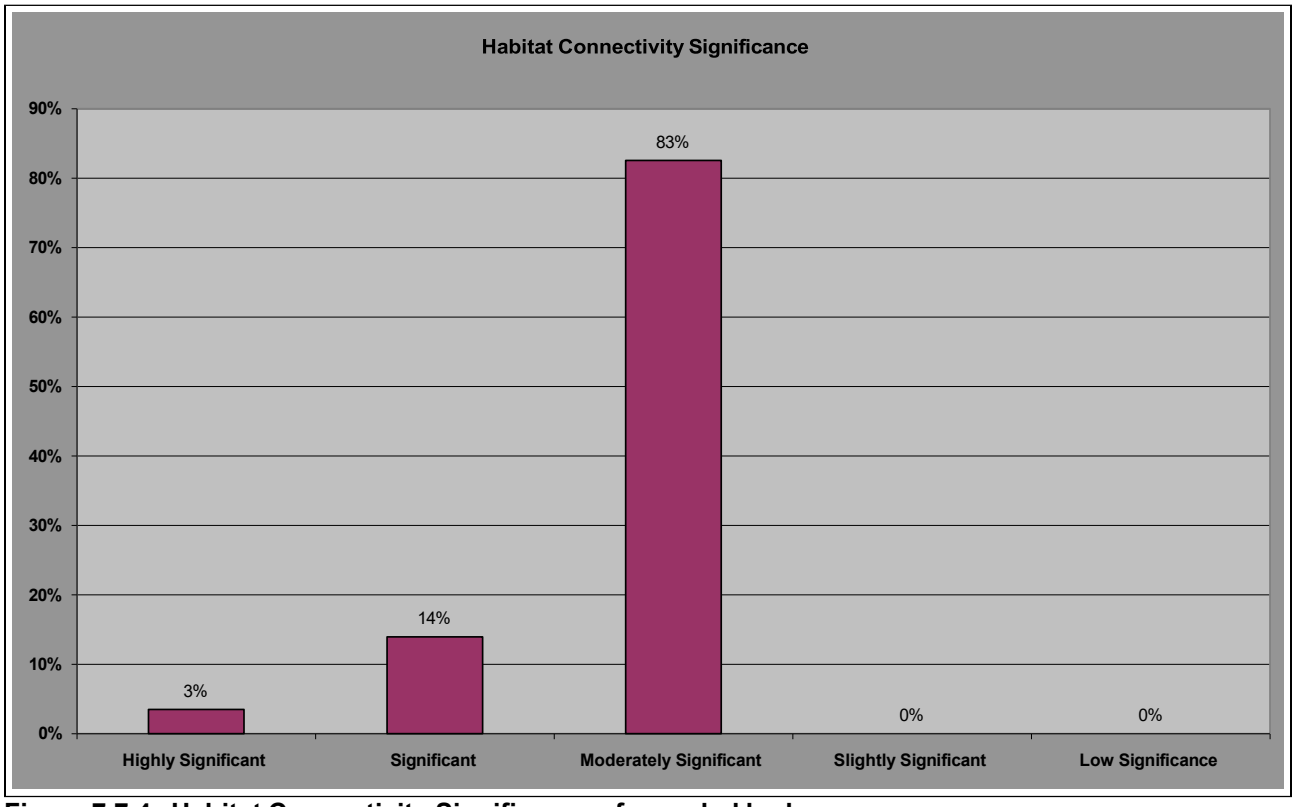


Figure 7.7.4 Habitat Connectivity Significance of sampled hedgerows

Landscape Significance

95% of sampled hedgerows were classed as being Moderately Significant in terms of their Landscape Significance with the remaining 5% classed as being of Low Significance.

Landscape appraisal is a relatively undeveloped aspect of the Hedgerow Appraisal System. It is hoped that this can be addressed in the next review of the HAS.

Heritage Hedgerows

Based on the appraisal 38% of the sampled hedgerows are classed as Heritage Hedgerows

All Townland Boundary hedgerows would be classed as being Heritage Hedgerows. In Leitrim most Townland Boundaries are defined by watercourses many of which have associated riparian vegetation. Some of this vegetation would be classed as Hedgerow or Treeline but much would fall in to the definition of linear scrub. The hedgerows associated with Townland Boundaries which do not have an associated mapped watercourse are of particular interest as they are likely to have a constructed origin rather than one that follows a natural landscape feature. Only one such Townland Boundary was identified in the survey area in Square LM09. This hedgerow had a diverse woodland based ground flora indicating a possible historic woodland origin.

Condition

Overall Condition Score

Condition assessment is scored from a range up to a maximum of 24. The highest score in the Leitrim sample was 16 with the average score being 11. 46% of the sample achieved 50% of the maximum score or greater.

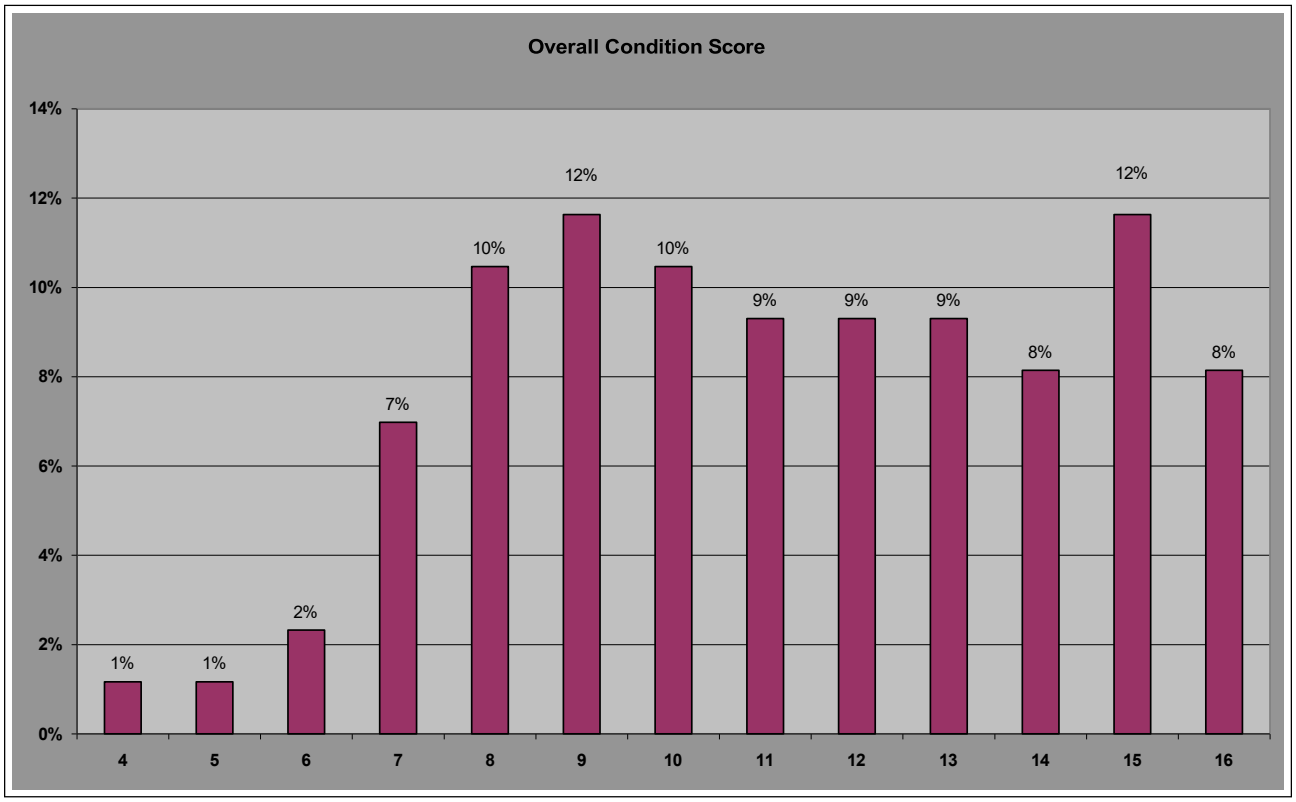


Figure 7.7.6 Overall Condition Score of sampled hedgerows

Condition Status

17% of all sampled hedges are determined to be in Favourable Condition.

24% of Heritage Hedgerows are deemed to be in Favourable Condition.

Negative Indicators Status

Figure 7.7.7 illustrates a breakdown of the factors which resulted in hedgerows failing to meet Favourable Condition Status.

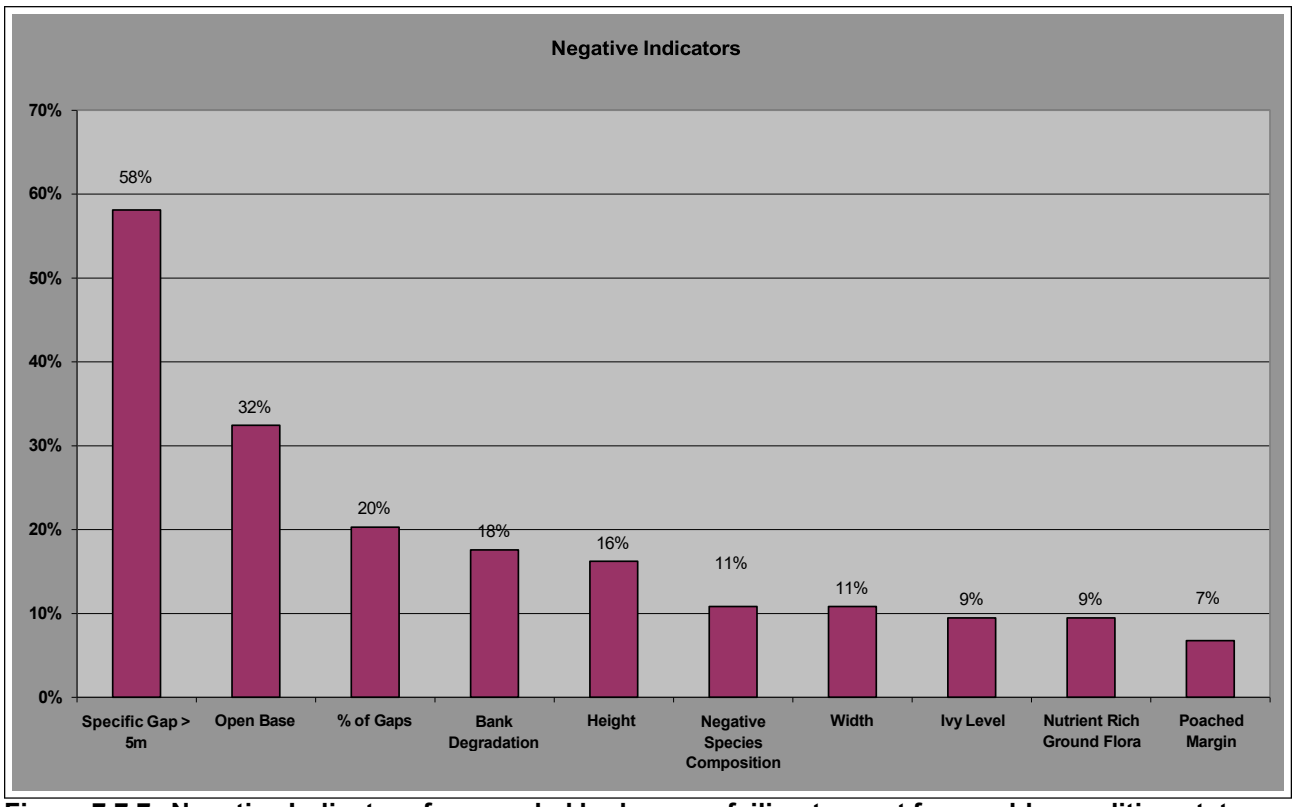


Figure 7.7.7 Negative Indicators for sampled hedgerows failing to meet favourable condition status

65% of hedges that were deemed to be in Unfavourable Condition had more than one Negative Indicator, with 4% of the sample having five or more negative indicators.

Table 7.7.1 Proportion of sampled hedges in Unfavourable Condition by the number of Negative Indicators

Number of Negative Indicators	Proportion of Unfavourable Hedges
1	39%
2	27%
3	15%
4	10%
5	3%
6	1%

An examination of the reasons that hedgerows failed to achieve Favourable Condition indicates that Gappiness and Base Structure are the main issues.

Lack of height and width, probably the two easiest categories to influence through management, are an issue in 16% and 11% of sampled hedges respectively.

Excessive gaps and lack of base structure are factors generally associated with lack of management intervention over a longer time period. Hedges failing in these two categories will almost certainly require greater levels of appropriate management involvement to achieve favourable status.

The non-native species that is present to excessive levels is in most cases Snowberry.

Heritage Hedgerow in Favourable Condition (LM16)

7.8 LANDSCAPE CHARACTER AREAS

The County Leitrim Landscape Character Assessment (RPS, 2020) divides County Leitrim in to 17 distinct Landscape Character Types.

The Leitrim landscape is then further distinguished by division in to 14 Landscape Character Areas (LCA) These are listed in Table 7.8.1.

Table 7.8.1 Landscape Character Areas

Reference Number	Landscape Character Area
1	Tullaghan Coast
2	Lough Melvin Lowlands
3	Lough Macnean Upper
4	Arroo and Mountain Outliers
5	Tievebaun Uplands
6	The Doons and Crockauns
7	Benbo
8	The Boleybrack Uplands
9	The Northern Glens and Central Lowlands
10	Slieve Anierin
11	Corry Mountain
12	Ballinamore Loughlands
13	South Leitrim Drumlins and Shannon Basin
14	Corriga Uplands

Landscape Evaluation

Hedgerows are a significant feature of much of the lowland landscape of County Leitrim, The Landscape Character Assessment addresses the Forces for Change and the Landscape Quality, Condition and Sensitivity for each Landscape Character Area. Where these are relevant to hedgerows they are detailed below:

Forces for Change

LCA 1

Commercial forestry plantations are a relatively recent introduction to the drumlin landscapes inland which have the potential to alter the landscape character;

The continued spread of invasive alien plant species will reduce the biodiversity value of ecological features, including hedgerows;

LCA 2

Commercial forestry plantations are a relatively recent introduction and are a dominating landcover in the vicinity of Lough Melvin. The original lakeside landscape character is much eroded as a result;

The continued spread of invasive alien plant species will reduce the biodiversity value of ecological features, including hedgerows;

LCA3

Coniferous forestry plantations are a relatively recent introduction which have the potential to further erode the underlying landscape character;

The continued spread of invasive alien plant species will reduce the biodiversity value of ecological features, including hedgerows;

LCA4

The continued spread of invasive alien plant species will reduce the biodiversity value of ecological features, including hedgerows;

LCA5

The continued spread of invasive alien plant species will reduce the biodiversity value of ecological features, including hedgerows;

LCA6

The continued spread of invasive alien plant species will reduce the biodiversity value of ecological features, including hedgerows;

LCA7

Commercial forestry plantations feature in the lower lying farmland south west of Benbo Mountain

The continued spread of invasive alien plant species. This will reduce the biodiversity value of ecological features, including hedgerows;

LCA8

The continued spread of invasive alien plant species will reduce the biodiversity value of ecological features, including hedgerows;

LCA9

Commercial forestry plantations feature in the foothills of the surrounding mountainous areas some of which extends down along the valley sides

The continued spread of invasive alien plant species will reduce the biodiversity value of ecological features, including hedgerows.

LCA10

The continued spread of invasive alien plant species will reduce the biodiversity value of ecological features, including hedgerows;

LCA11

Commercial forestry plantations are abundant in the foothills surrounding Corry Mountain

The continued spread of invasive alien plant species will reduce the biodiversity value of ecological features, including hedgerows;

LCA12

Commercial forestry plantations are a frequent occurrence especially in the western part of the LCA

The continued spread of invasive alien plant species will reduce the biodiversity value of ecological features, including hedgerows.

LCA13

Commercial forestry plantations especially in the northern part of the LCA

The continued spread of invasive alien plant species will reduce the biodiversity value of ecological features, including hedgerows.

LCA14

Commercial forestry plantations are apparent resulting in localised changes to landscape character

The continued spread of invasive alien plant species will reduce the biodiversity value of ecological features, including hedgerows.

Landscape Quality, Condition and Sensitivity

LCA1

Although the landscape currently appears relatively well wooded, featuring hedgerows, hedgerow trees, small plantings of coniferous and broadleaf woodlands, it is considered to be sensitive to change due to the visual openness and outlook to the coast and Donegal Bay and also due to the visual relationship with the mountains.

LCA 2

Extensive areas of commercial coniferous forestry have resulted in the loss of hedgerows, pasture and field patterns and thus, key landscape characteristics have become eroded.

In areas where commercial coniferous forestry is absent the landscape is in relatively good condition as evidenced by the strong field patterns defined by a dense hedgerow structure.

LCA 3

The condition of the landscape varies. Its true character, expressed in field patterns defined by hedgerows, has been greatly eroded in places by large tracts of commercial coniferous forestry.

LCA4

The condition and true character of the landscape around Dough Mountain is considerably undermined by extensive commercial coniferous forestry. This has eroded the key landcover characteristics such as vegetation patterns and field boundaries.

LCA5

The lowland areas to the east feature areas of commercial coniferous forestry which has partially eroded the original field pattern as a key aspect of its character.

LCA7

The isolated and uninhabited character of the mountain is particularly sensitive to most forms of built development including road routes and access tracks across the hills. The lower slopes to the west are less sensitive however increases in commercial coniferous forestry would further erode the field pattern of the lowland farmland areas.

LCA8

The landscape character in the southern part of this LCA has been eroded due to large tracts of commercial coniferous forestry which have resulted in the loss of hedgerows and field patterns.

LCA9

Plantation coniferous forestry has, to some extent, eroded the farmed field pattern in the southern part of this LCA.

LCA10

Large coniferous plantations mask vast areas of the underlying landscape and obscure old field patterns, further detracting from the quality of upland landscapes.

LCA11

Large coniferous plantations have eroded the landscape character associated with the lowland farmland and foothills due to the loss of field patterns, defined by hedgerows and earthen banks.

LCA12

The landscape is considered to be in good condition although the character of the western part of the LCA is interrupted by tracts of commercial coniferous forestry which are a frequent occurrence and have somewhat eroded the original character. Elsewhere in the LCA, the distinctive drumlin topography and hedgerow field pattern is intact.

LCA13

The character of the northern part of this LCA has become partly eroded with commercial coniferous forestry replacing much of the pastoral drumlin farmland. Also some poorly managed hedgerow field boundaries are being replaced with post and wire fences.

Sampled hedgerows were assigned to the Landscape Character Areas in which they occurred and Figure 7.8.1 shows a breakdown of how the samples were distributed within the different landscape classifications. The results show that over half of the sampled hedges were in just two of the Landscape Character Areas, both in South Leitrim. These are predominantly lowland areas.

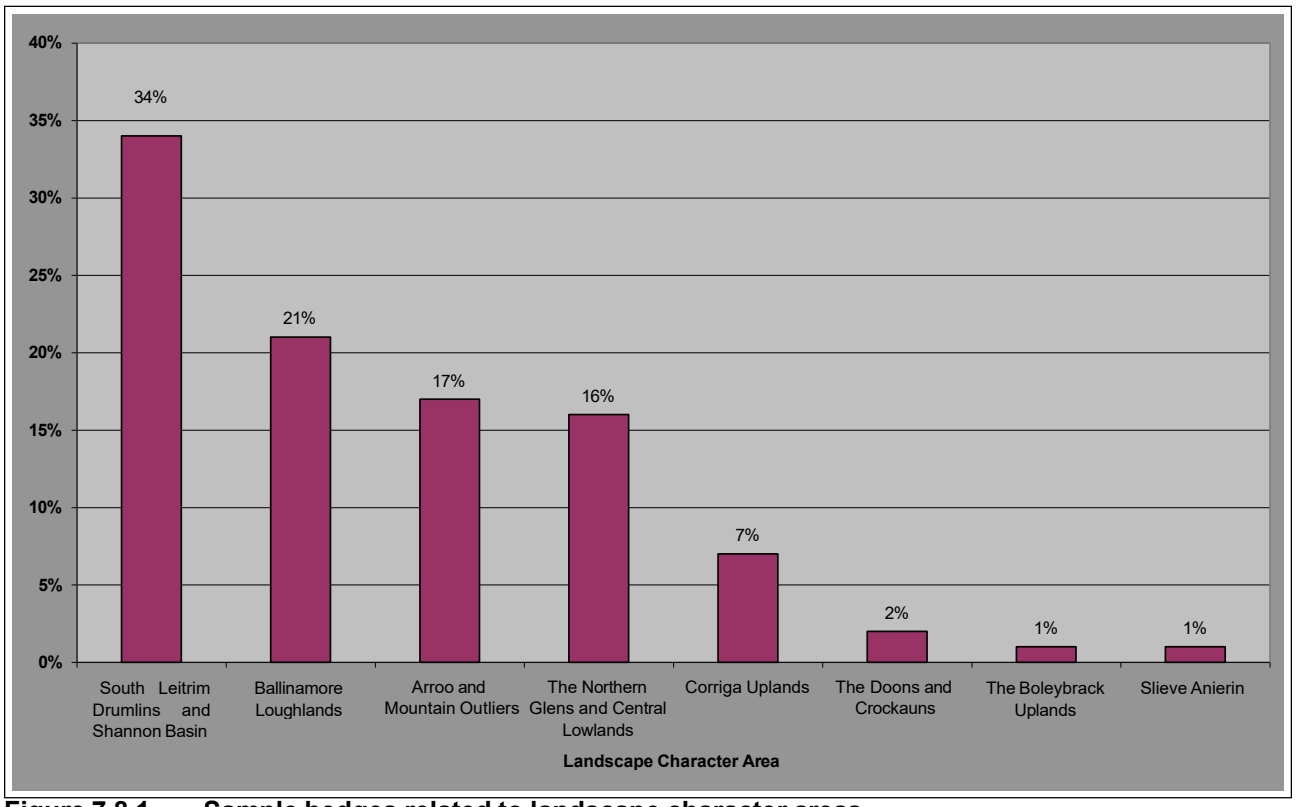


Figure 7.8.1 Sample hedges related to landscape character areas

7.9 OTHER OBSERVATIONS

A number of observations were made during the period of fieldwork which could not be fully recorded as part of the survey methodology but are considered to be worthy of note.

'Out of Season' Hedge Cutting

Cutting hedgerows during the growing season (1st March – 31st August) is potentially damaging to the health of hedgerow shrubs and to much of the wildlife that is dependent on the hedge, particularly nesting birds. It is also contrary to the cross compliance conditions of the Basic Payment Scheme (SMR 2).

O if we but knew what we do
When we delve or hew —
Hack and rack the growing green!
Since country is so tender
To touch, her being só slender,
That, like this sleek and seeing ball
But a prick will make no eye at all,
Where we, even where we mean
To mend her we end her,
When we hew or delve:

Binsey Poplars, Gerard Manly Hopkins

However, some out of season cutting may be necessary in respect of public health and safety.
Accurate assessment of 'out of season' cutting cannot form a part of the overall survey methodology because it can take place at any time from 1st March to 31st August whereas fieldwork may well be completed earlier in the season. Also, it can be almost impossible to ascertain later in the season whether a hedge was cut in February or a few weeks later.
During this survey 3 sample hedges were noted as having been cut after 1st March; only one of those was associated with a roadside hedge.

Roadside hedge cut during nesting season (LM16)

Mulching

The practice of ‘mulching; hedgerows has become more common in recent years although none of the hedges sampled had been ‘managed’ by this method. Mulching is where a heavy duty flail mounted on a tracking machine is used to reduce mature long and short-term unmanaged hedges down to approximately 1 – 1.5m in height. Aside from being unsightly it is very harmful to the plants that are subjected to this treatment.

It is a practice (‘management’ is not an appropriate term) which should be strongly discouraged. Aside from the harm to individual plants it appears to be the norm to have the majority or all of the hedges on a holding mulched at the same time resulting in a devastating impact on the local ecology.

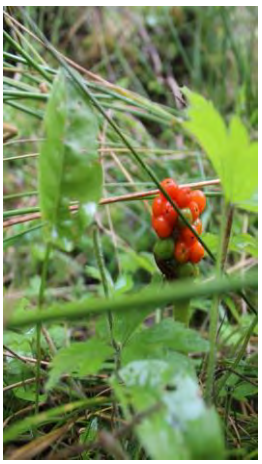
Other Biodiversity

It was beyond the scope of this survey to record all of the biodiversity found within hedgerows. Below is a montage of some of the rich array of species that were observed during the field work.







8.0 DISCUSSION

This section will take an overview of hedgerow conservation in County Leitrim in light of the results of the Appraisal Survey and the 2006 Hedgerow Survey considered in the context of current thinking on best conservation practice.

History and Landscape Context

An examination of the first and second edition maps (6" to the mile) produced by the Ordnance Survey suggests that the majority of the current hedgerow landscape in County Leitrim was established during the period from the mid 19th century up to the early part of the 20th century, although a portion is likely to be older. Townland boundary hedges tend to be of more ancient origins than non–townland boundary hedges. Multiple hedgerow surveys have indicated that they tend to be more diverse than average in their species composition. Older boundaries frequently are non-linear and are often demarcated by natural features such as watercourses. Townland Boundary hedgerows are effectively a subset of Townland Boundaries. These features are of huge historical, cultural and ecological value. By their names they give an insight in to the cultural and ecological history of the land. However, there is limited recorded information on their details. A methodology is needed for the consistent recording of information on Townland Boundaries to include physical and cultural information. From there, consistent recording could be made of these unique features. Such a project would lend itself well to community / citizen science projects. This would be consistent with Action 2D of the County Leitrim Biodiversity Action Plan 2021 – 2026.

In County Leitrim, the first edition O.S. maps were produced in 1837, followed by the second edition in 1907-09. Where a boundary is present on the second edition Ordnance Survey maps, but is absent from the first edition it is possible roughly to date the origin the hedge to the period 1837 to 1909.

The boundaries of approximately a third of sampled hedgerows are present on the first edition maps from 1837. The second edition O.S. maps (1907-09) show that 7% of the sample hedges were not present at that time. The vast majority of Leitrim's hedgerows are likely to be at least 100 years old or more. This means that the soil under those hedgerows has remained undisturbed for at least a century. This presents research opportunities in terms of assessing soil, structure, carbon and biodiversity in comparison with similar soils where lands have been disturbed through agricultural and other land management activities.

Boundary lines shown on the Ordnance Survey maps are not necessarily hedgerows. However, some boundaries shown on the first edition maps include small tree symbols to indicate the presence of timber trees. This could indicate an avenue or tree line but could also represent a hedgerow containing mature trees. More recently established hedges (that are not present on the second edition O.S. maps), are most likely associated with Land Commission property divisions or Agri-Environment Schemes. Land Commission period hedges are almost invariably species poor. The first edition O.S. maps show that much of the county was unenclosed in the period before the famine. In general it is only those lands around the estate houses that show any significant degree of field division. By the time of the second edition Ordnance Survey, land enclosure is well established and broadly similar to the current day.

Appraisal

A report by Robinson (2002) which assessed post war changes in farming and biodiversity in Britain concluded that whilst reduction in habitat diversity was important in the 1950s and 1960s, reduction in habitat quality is now probably more important.

<u>Hedgerow Appraisal System</u>

The Hedgerow Appraisal System was developed by Woodlands of Ireland in 2010 (officially published by the Heritage Council 2014) with a view to permitting a qualitative assessment of hedgerows.

<u>Significance</u>

This Appraisal Survey has been a very worthwhile exercise in determining the significance of Leitrim's hedgerows.

38% of the sample hedgerows were determined to be Highly Significant in at least one of the 5 Significance Categories – Historical (16%), Species Diversity (19%), Structural (9%), Habitat Connectivity (3%) and Landscape (0%).

As well as being useful in determining High Significance the system is also useful in identifying hedgerows which are of lower significance where loss or land-use change would have less of an impact.: – Historical (58%), Species Diversity (12%), Structural (2%), Habitat Connectivity (0%) and Landscape (0%).

It is our view that the results for the Habitat Connectivity Significance of Leitrim's hedgerows do not adequately reflect the important value of how hedgerow networks interconnect with other natural and semi-natural features in the countryside.

Condition Scoring

Condition scoring appraises hedgerows in terms of a series of criteria linked to the concept of favourable condition. There is a broad range in terms of the condition of Leitrim's hedgerows with just 17% of sampled hedges meeting all of the favourable condition criteria; although 24% of Heritage Hedgerows achieved this mark.

Condition Score 14 - Favourable condition (LM15)

The importance of this Appraisal Survey is that it allows us to identify the main issues that are resulting Leitrim's hedgerows failing to meet quality standards. Gappiness is clearly the biggest issue, particularly in North Leitrim. There is a clear need for the design of Agri-Environment schemes to take account of the issues which underpin qualitative failure. Unfortunately, schemes are not directly targeting the issue of quality in a consistent and meaningful way.

39% of hedgerows recorded just one negative indicator. If this indicator could be addressed in each case this would bring the proportion of hedgerows in favourable condition above 50%. At the other end of the scale 15% of hedgerows recorded four or more negative indicators which would be of concern in terms of the capacity and cost for improvement.

It would be beneficial if condition scoring thresholds were agreed by relevant stakeholders as to what constitutes a 'favourable condition' score for Irish hedgerows. Management plans in results-based Agri-Environment Schemes could then be designed to achieve favourable status score.

It is very unlikely that there are sufficient resources, both human and financial, to maintain the whole hedgerow resource of the County (and the country) in favourable condition. Therefore a degree of prioritisation will be required. The HAS was developed, in part, to help decision making on prioritisation.

Review

It is now over 10 years since the HAS was developed and it was always seen as a work in progress. Use of the Appraisal System for a number of County and local surveys has identified a number of areas where the methodology could be improved. A full review and revision of the Hedgerow Appraisal System would be considered timely. There are a number of other County Hedgerows being undertaken in 2023 and it would be desirable for the surveyors involved in those surveys to provide feedback in to any revision of the HAS.

One area that needs to be considered is the sampling methodology for recording representative details of hedgerows of different lengths. When examining individual hedgerows the figure of 30m has generally been used as the standard sampling size for recording information on the floristic composition of the hedge. This is based on the work of Dr. Max Hooper (1970) in Britain. The U.K. Hedgerow Regulations, however, require that one 30m strip per 100 metres of hedge must be surveyed and the result is then averaged to give an average species diversity figure per hedge. Data from this and previous hedgerow surveys have indicated that hedgerows in Ireland can be very variable along their length and that a 30m strip may not be adequate to permit for a sufficiently representative recording of the species composition of an individual hedge. The methodology for this survey states that two randomly selected 30m strips per hedge should be selected from which to record hedgerow species composition data. We are not convinced that this is the optimum method for obtaining the desired outcome and more research works needs to be carried out to determine an appropriate sampling method in Ireland.

This sample survey covers approximately 1% of the area of County Leitrim, with the sample areas chosen on a semi-random basis. It is vital that the data collected during sample surveys such as this one are sufficiently representative of the total area otherwise a false picture can be created. The sampling method outlined in the survey methodology has been used for numerous habitat related studies as a systematic approach is considered to be very efficient for sampling landscape types (Harrison and Dunn, 1993). In Britain it is considered that subdividing the sample into areas or ‘strata’ with similar characteristics is likely to improve the statistical accuracy of the survey sample (Bickmore, 2002). This stratification is usually based on landscape classification. Since there is no landscape classification to cover the whole of the Ireland, using this model in counties where such classifications exist would then make county studies incomparable. However, the authors would advocate a review of the sampling method used for regional based hedgerow surveys in Ireland.

A review and revision of the HAS should address other issues of growing importance, such as Hydrological and Nutrient Buffering Significance in terms of water quality; Carbon Sequestration Significance in terms of climate change and the small matter of Ash Dieback which was not an issue when the HAS was developed.

Key Trends 2006 to 2023

This section is a relative assessment comparing the current situation with that from the comparative study in 2006 to identify trends in hedgerow extent and condition.

Extent

County Leitrim has an extensive network of hedgerows throughout the county, with an estimated total length of 10673km. This is a decrease of 936km from the estimated figure of 11609km in 2006.

Hedgerow Loss

Hedgerow ‘loss’ can be a misleading term. It can reflect, as most people would expect it to, the direct loss or removal of hedgerows for agricultural, development or other purposes. Hedgerow loss figures also include situations where hedgerows are re-classified as other habitats or features. For example, if a hedgerow deteriorates in quality to such an extent, particularly in respect of an increasing percentage of gaps, it can be re-classified as remnant hedgerow. Also of relevance to the current study is the situation where unmanaged hedgerows comprised of a high percentage of spreading or suckering species develop into small thickets or areas of scrub. Once a hedge line is greater than 4m in width it becomes re-classified as a new habitat type. Both of the above cases technically would be included in the figures for hedgerow loss. A similar circumstance can occur where hedged farmland is afforested. Even though there is a requirement under the Forestry Programme to retain hedgerows, unless there is a sufficient setback, as the forestry trees grow, eventually there will be no distinction in the canopy between the forest and the hedge. The hedge is no longer a linear feature within the definition of the survey and the hedges are effectively ‘lost’, despite not having been removed. Where land is afforested with native woodland the hedges can become absorbed in to

the woodland, but where land is afforested with exotic coniferous species there is clearly a negative impact on the local ecology and landscape.

The extent of hedgerows in County Leitrim has diminished by an estimated 8.06% in the period between 2006 and 2023. This is principally as a result of the afforestation of hedged farmland, particularly with exotic conifers. This will be discussed in greater detail later in this section.

Other minor loss was identified as a result of removal for agricultural purposes and death as a result of (repeated) herbicide use. No examples of loss as a result of development were noted during the survey but it would be expected that this has occurred to some extent outside the survey area.

Evidence from this survey is that hedgerows are generally increasing in width and that, over time, more hedges will be re-classified as scrub and may eventually develop in to small pockets of native woodland. From a biodiversity perspective this may be beneficial – depending on the wider ecological context.

The net removal of hedgerows in County Monaghan between 2010 and 2020 is estimated to be between 0.5% and 0.88% of the county's hedgerow stock per annum (MacElwain (2022)).

Based on the Northern Ireland Countryside Survey there was a statistically significant net decrease in hedge length of 4.6% in Northern Ireland from a baseline of 119,120 km (1998) to 113,648 km at resurvey (2007) (McCann (2017)).

Hedgerow loss from agriculture, theoretically at least, should be a thing of the past. Since 2009 hedgerows have been defined as Landscape Features under the CAP and can only be removed in 'exceptional circumstance'. Since the new CAP was introduced in 2023 even where hedgerows are removed the landowner must plant twice the length of new hedgerow to compensate for the loss prior to the removal.

Opportunities for new hedgerow planting form part of Agri-Environment schemes (one example was recorded during the survey).

New hedge (LM13)

The authors would have concerns over the quality of new and replacement hedgerows but in terms of linear length there should be a net gain in hedgerows in agriculture. Monitoring and enforcement by DAFM are critical to ensure that this is the reality on the ground.

The EIA (Agriculture) Regulations have been in place since September 2011 which require screening by DAFM where field boundary removal exceeds 500m or results in a field size of 5 ha or greater. However, significant concerns have been identified with the structure and implementation of the Regulations (Foulkes, 2018). Due to pressure from Tipperary based NGO Hedgerows Ireland the Regulations and DAFM's processes for implementing them are now subject to a full review process. A public consultation has taken place but there is no indicated deadline for when the review will be completed. It is imperative that screening thresholds are reduced.

The publication of the EPA National Land Cover Map is a significant step toward having a more complete assessment of the extent of hedgerows of the County (and Country) as a whole.

The fact that this dataset will be regularly updated will permit for more detailed analysis and monitoring on an ongoing basis

The problem at the moment is that it is clear from our comparative assessment that there are teething troubles with the algorithms used to determine Hedgerows and Treelines by the EPA. The EPA data is over-estimating the extent / area of these features. There is a clear need for ground-truthing and subsequent refinement of the EPA model. Also, the EPA mapping is failing to identify certain features as Hedgerows or Treelines that have been identified as such on the ground.

Figure 8.1.1 LM09_08 not identified as a Hedgerow or Treeline by EPA National Land Cover Mapping

The 2006 Hedgerow Survey estimated a total length of hedgerow for the County at 11609 km. At an average width of 2m this would give an area of 2322 ha (1.46%) or 4644ha (2.92%) at an average width of 4m.

The National Land Cover Map from March 2023 indicates a total area of 8593ha of Hedgerow & Treeline, which is 5.11% of the total area of the County. The source for this significant discrepancy needs to be identified and resolved as there has not been an increase in Hedgerow and Treeline in that period.

Ultimately through the EPA National Land Cover mapping the nature of any future hedgerow loss can be accurately classified on a routine basis.

Species Composition and Diversity

Historically, most planted hedges would have been initially established using just one (usually Hawthorn) or possibly two species. A number of factors contribute to the further development of the species composition of hedgerows through colonisation. Soil type and elevation can restrict the suitability for colonisation by certain species, as can the availability of a local source for the seed. Scrub land and small pockets of

transitional woodland would be common in County Leitrim and these could be acting as seed reservoirs for colonising hedgerows giving rise to the relatively high frequency of species rich hedges. Age can also be a factor in the colonisation process. Older hedges have more time to be colonised so are more likely to be more diverse than relatively younger hedges.

The composition and diversity of the species in Leitrim's hedgerows is a very positive feature. Hedgerows are dominated by native species with over 75% of the sampled hedges in County Leitrim containing solely native species

The most notable species differences between this survey and 2006 were with Beech (Fagus sylvatica) up from 1% in 2006 to 11% in 2023, Hazel (Corylus avellana) up by 8% and Oak (Quercus spp.) up by 5% in terms of their frequency of occurrence - all three are woodland species. It would be interesting to assess this data in light of the findings of the Countryside Bird survey to see if there is a comparative increase in the population of Jays which are known to be responsible for the distribution of the seed of larger tree species around the countryside. Also Red Squirrel could be responsible for seed dispersal. Both jay and squirrel populations have increased as a result of coniferous afforestation so there could be a small positive spin-off for hedgerows from afforestation (though hardly matching then negative consequences).

The most remarkable decline was in Blackthorn (Prunus spinosa) which fell from 61% to 56% in terms of its frequency of occurrence. The authors have no definitive explanation for this decline as the opposite would have been anticipated to occur as this is a species that spreads by suckering and proliferates in the absence of management. However, it is possible that a shift to more sheep and less cattle has had an influence as sheep would browse any new suckering growth of Blackthorn preventing it from establishing.

Certain species have been found to occur more frequently in hedges in County Leitrim than in other counties that have conducted hedgerow surveys, most notably Holly, Willow, Alder and Rowan. Conversely Elder and Spindle occur significantly less frequently in Leitrim than in the other counties. The suitability of soils is the most likely explanation. Willow and Alder are both tolerant of wet soils and Rowan thrives in upland areas with poor soils. The relative scarcity of Elder is a little surprising. It is a ready coloniser of hedgerows being spread by birds and has been found in over a quarter of all sample hedgerows in the other county surveys (over a half in counties Kildare and Westmeath). Elder prefers nutrient rich soils and this may be at least a partial explanation for its lack of abundance in Leitrim hedgerows.

Trees

Hedgerow trees are not only a very significant landscape feature; they are, especially when mature, also beneficial to the overall ecology of the hedge. Quantity rather than diversity is the main feature of the tree component of County Leitrim's hedges.

18 tree species, of which 12 are native species, were found in the hedges of this survey with the vast majority of samples hedges (90%) having trees along their length. The figure of 18 species is up from 14 in 2006. Some of this increase may be down to plants that had not attained tree-form in 2006 growing and developing in the interim period. There may be some change due to the sampling methodology between the two surveys.

Most of the hedges with trees have young trees as well as mature trees which is a positive feature from a sustainability perspective.

The most commonly occurring hedgerow tree species in County Leitrim (in common with all other counties) is, by far, the Ash *(Fraxinus excelsior)*, found in 68% of sampled hedges. Sycamore (*Acer pseudoplatanus)* and Beech *(Fagus sylvatica)* are the non-native species found most frequently in County Leitrim hedgerows. Both of these species are not considered by many specialists to be desirable as hedgerow trees on the grounds that they cast a heavy, suppressing shade and being non-native are of less value for wildlife than native tree species – although there are dissenting voices in this regard.

There is potential for allowing a greater percentage of the variety of native species present in County Leitrim hedgerows to develop as hedgerow trees and this would, most likely, be a preferable option from a biodiversity perspective. It would add diversity to landscapes and the trees would serve as a measure of mitigation for the devastating effects of Ash Dieback.

The issue of Ash Dieback disease will be addressed in the section on Threats and Opportunities.

Management of hedgerow trees

For hedgerow condition, trees can pose their own set of problems in terms of competition for light and moisture with the shrub layer. Heavily shading non-native species such Sycamore (11% of hedges) and Beech (9%) can be a particular problem, while the leaf structure of the Ash tree allows greater penetration of light and thus does not impact hedge structure to the same extent.

Infrastructure

Hedgerows vary in their construction based upon numerous factors including soil type, topography, farming practice, tradition and legislation. In wetter areas or where soils are poorly drained, a bank would need to be constructed to prevent shrub roots from becoming water-logged. A drain to carry away surplus water would also be common. Where stony soils are frequent, hedge banks often contain quantities of field stone cleared from adjacent farmland when under tillage. Sometimes there is sufficient stone to construct a wall in association with the hedge.

Hedge banks, walls, and drains create niche environments for many wildlife species adding much to the habitat value of a hedge. As might be expected given the high rainfall and generally poor porosity of soils in County Leitrim, the vast majority of hedges (87%) have an associated drainage ditch.
Hedgerows and their associated banks and drains act as buffers to nutrient loss from agricultural land, but there has been little or no research carried out in Ireland to evaluate to what extent. Given that the EU Nitrates Directive (1991) has been adopted on a national basis in Ireland research is needed to quantify the buffer role of different types of hedgerows in various agricultural situations.

Structure

Many studies have found that taller, wider, denser, and structurally more intact hedgerows are also preferred by most wildlife, including small woodland plants ((Hegarty and Cooper, 1994, Corbit and Marks, 1999, and Murray 2001); invertebrates (Burel, 1989), and hedgerow birds (Chamberlain et al, 2001, Arnold, 1983, and Lysaght, 1990).

Height

Hedgerow height is predominantly a function of their management. Low cut hedges have been shown to be least beneficial to nesting birds. Research indicates that increasing hedgerow height correlates positively with increasing diversity of bird species in a hedge (Arnold, 1983; Lack, 1987). Taller hedges also provide better shelter for farm animals. In terms of farming, landscape and wildlife perspectives the fewer hedges recorded in the <1.5m Height category, the better.

Results from this survey indicate a polarisation in management practices between 2006 and 2023 with an increase in the proportion of very low hedges (over-managed) and very tall hedges (unmanaged). The almost threefold increase (5% to 14%) in the proportion of hedgerows that are below 1.5m in height would be of concern. Taller hedges, which will generally result from the absence of management, are of less concern in the short term.

Soil fertility and exposure, rather than management, can be the limiting factor on the height of certain hedges.

Width

As with hedge height, it is generally accepted that the wider the hedge, the better it is for wildlife, although agriculturally, allowing hedgerows to occupy too much land is less likely to be acceptable.

Again this survey has indicated a stark polarisation in the proportions of hedgerow in the different width categories between 2006 and 2023. In 2006 98% of County Leitrim hedges surveyed were greater than one metre wide; that figure is down to 91% in 2023. The vast majority of hedges are still over the 1m width threshold but the trend towards a greater proportion of hedges in this category is of concern. Conversely, there has been a significant increase in wider hedges with 40% of the sample now in the maximum 3m+ category.

It is unclear why this polarisation is occurring but it is a subject which should be discussed within the farming community. Unless the reasons are understood it will be difficult to address the situation.

Base

It is generally acknowledged that lack of hedge management can lead to a weakening of the hedge base and lead to a gappier structure. Increasing levels of gaps in the hedge structure correlates with lower species diversity (Murray, 2001), as do smaller and lower hedges.

The density of shrub growth in the bottom metre of the hedge is also an important indicator of the hedge structure. Continuous hedges with a good basal structure are more agriculturally valuable as they may not need additional fencing, and good growth from the bottom of the hedge also improves the shelter value for stock. Several studies have shown that density of growth in the hedge base also influences the hedges capacity for supporting wildlife (Arnold, 1983; Osborne, 1984).
32% of the hedges sampled in this survey exhibited an open base so this is an area of hedgerow conservation that could be improved.

The presence of blackthorn and gorse, along with holly can be beneficial in helping to maintain a good base structure, particularly where management levels are low. Holly is very tolerant of low light levels and tends to maintain growth near to ground level where other species (like Hawthorn) tend to grow up towards the light often leaving the base with relatively sparse or scrawny growth.

Management

A hedge is not an object; it is a name for a collection of plants with an infrastructure and structure organised in a particular linear form. To manage hedgerows to a set objective it is necessary to understand how those plants grow and how they respond to injury.

Results on hedge height and width would suggest that hedge management has become more aggressive where it is occurring. Reduced management or abandonment of management can have short term benefits for nature conservation but there are potential longer term consequences if the overall health of the hedgerow is not being monitored.

It is also noticeable that despite over 25 years of Agri-Environment Schemes with hedgerow management advice to landowners and hedge-cutting contractors no hedgerows were recorded during this surveys which corresponded to the recommended ‘A-shape’ profile category. Trimming the hedge sides to taper in to an ‘A-shape’ allows the maximum light to the base of the hedge in order that it continues to produce growth in this area. This management method has the potential for allowing a portion of the top of the hedge to grow freely in order to flower and fruit; something that is prevented when a hedge is completely topped.

The principal of incremental trimming, where the routinely managed hedge is not cut back to the same point at each intervention, but is allowed a few centimetres of incremental growth, is beneficial from a biodiversity and carbon capture perspective.

Hedgerows are predominantly man-made features and most require a degree of management intervention to fulfil agricultural and biodiversity functions and remain sustainable in the longer term.

These longer term concerns are reflected in the increase of degree of gappiness in hedgerows. This is a reflection of the fact that hedgerows are not generally self-sustaining in terms of replacement for the natural mortality of hedgerow trees and shrubs. Although natural regeneration does occur within hedgerows it is often not of the primary hedgerow species. Given the amount of Hawthorn in Leitrim hedgerow and the amount of seed that is produced on an annual basis the proportion of natural regeneration is extremely low.

Over aggressive management and the absence of management can both create problems. Finding the happy medium requires an understanding of the needs of the plants that comprise the hedgerow.

Interestingly, 11% of boundaries considered to be redundant have been managed in the recent past. It would be interesting to canvass the opinion of farmers on what they consider to be the main benefits of hedgerows from an agricultural perspective and of their management objectives where hedgerows that do not have a stock containing function are managed.

The authors are of the view that the terminology used by Teagasc of referring to unmanaged hedgerows as ‘escaped hedges’ is unhelpful. For a livestock farmer an escaped animal has a negative implication regarding the farmer’s husbandry. A similar, pejorative connotation could be perceived with the term ‘escaped’, with an implication that the hedge should be returned to the fold of management. Allowing some hedgerows to grow unchecked by routine management is a feasible and potentially desirable option where

the structure of the hedge is basically sound. It would be far simpler (and more accurate) to refer to hedges that are not routinely managed as ‘unmanaged’ or ‘free-growing’ hedges.

Harvesting woodfuel from hedgerows is common practise in mainland European countries such as France. Recent research at an Organic Research Station in England produced ‘Guidance on bringing England’s hedges back into the farm business by managing them for woodfuel (Chambers et al 2019) which describes a range of harvesting equipment that could be employed in the production of wood chip and log fuel. Many of the options could also be used for Best Practise clean cutting during maintenance where fuel wood production is not practical.

Roadside hedges

Some out of season trimming of hedgerows will almost invariably be necessary for health and safety reasons. This generally relates to the cutting of roadside hedges to remove encroachment and ensure adequate visibility for road users, especially at junctions. Cutting during the restricted period of the Wildlife Acts (under the relevant exemption) should be seen as a last resort; prevention being preferred by ensuring the hedge is appropriately maintained during the open period for cutting. Where such out-of-season cutting is necessary it is important that efforts are made to mitigate, to the fullest extent, against the harm to wildlife.

Section 70 of the Roads Act, under which such hedge cutting is permitted, contains no provision for the mitigation of harm to the nests and eggs of nesting birds. It is questionable as to whether Ireland is in compliance with its obligations under Section 5 of the Birds Directive with the legislation in its current form.

The impact of the use of different types of hedge cutting machinery should be investigated to determine whether certain types of cutter are less damaging to nesting birds; for example is the finger bar more benign than the ubiquitous flail? The use of thermal imaging technology could be explored to identify if there are active nests in hedgerows where there is a safety issue. Where an active nest is detected, methods of addressing the safety issue without damaging the nest could be explored. This is likely to involve cutting short lengths around the nest using the least disruptive method (most likely using hand-tools).

There has been significant and growing uptake of Leitrim County Council’s Hedge Cutting Grant Scheme. The scheme is effectively *de minimis* State Aid to assist certain landowners in complying with their legal obligations. By dint of circumstance certain landowners are excluded from the Scheme. The Scheme does not require best practice standards in management. It merely requires adherence to the basic threshold of compliance with Section 70 of the Roads Act which has no reference to qualitative management standards.

Current and Future Threats & Opportunities

Hedgerow Loss

Hedgerows and Forestry

Afforestation with inadequate setbacks (less than a minimum of 7m) is very clearly the most significant threat to the extent of hedgerows in County Leitrim.

10 hedgerows, totalling 850m in length (6.9% of the sampled length), that were surveyed in 2006 are considered to have been lost to afforestation.

Since the 2006 survey almost 70ha of the survey area has been newly afforested (over 80% as Coniferous High Forest); this amounts to 4.36% of the total survey area.

23% of Square LM12 has been afforested since 2006.

It is an Objective of the Environmental Requirements for Afforestation (DAFM, 2016) to enhance the biodiversity value of the new forest throughout its rotation. As part of this objective, existing hedgerows on afforestation sites must be retained.

All hedgerows must be retained. In general, do not break through hedgerows during afforestation. Similarly, do not use hedgerow trees as makeshift straining posts for fencelines.

However, the reality is that, without adequate setback, hedgerows are undermined in coniferous plantations being starved of light once the plantation grows taller than the hedge. A few hedgerow trees may struggle on but the hedge (no longer a hedge by the definition of this survey) is a different entity to what existed before.

The minimum habitat setback for hedgerows permitted by DAFM is just 3m (from the centre of the hedge) – this is inadequate. Current standards state;

A habitat setback (5 metres minimum) should also be considered in relation to particular hedgerows onsite, to ensure their continued presence as the surrounding canopy develops. This decision should be informed by the quality of the hedgerow (in terms of its age, species composition and structure), its landscape importance, and other attributes (e.g. whether or not the hedgerow represents a townland boundary or if it is associated with another habitat such as a stream).

No further guidance is given as to what characteristics of age, species composition, structure or other attributes should inform any decisions on setback. This statement is virtually an admission that hedgerows will not survive without an adequate setback but inadequate setbacks are still permitted. This is illogical in the context of the biodiversity objectives. The BIOFOREST Report (3.1.3) (Iremonger, 2006) which was an investigation of experimental methods to enhance biodiversity in plantation forests reinforces this view and recommended

"The protective zone around retained habitats should be at least 7 m (on each side) for linear features such as hedgerows, treelines and small streams (not covered by the Forestry and Water Quality Guidelines), to ensure that they do not get shaded out as the plantation matures (the current recommended width is 3 m)."

Inadequate setback from hedgerow (LM09)

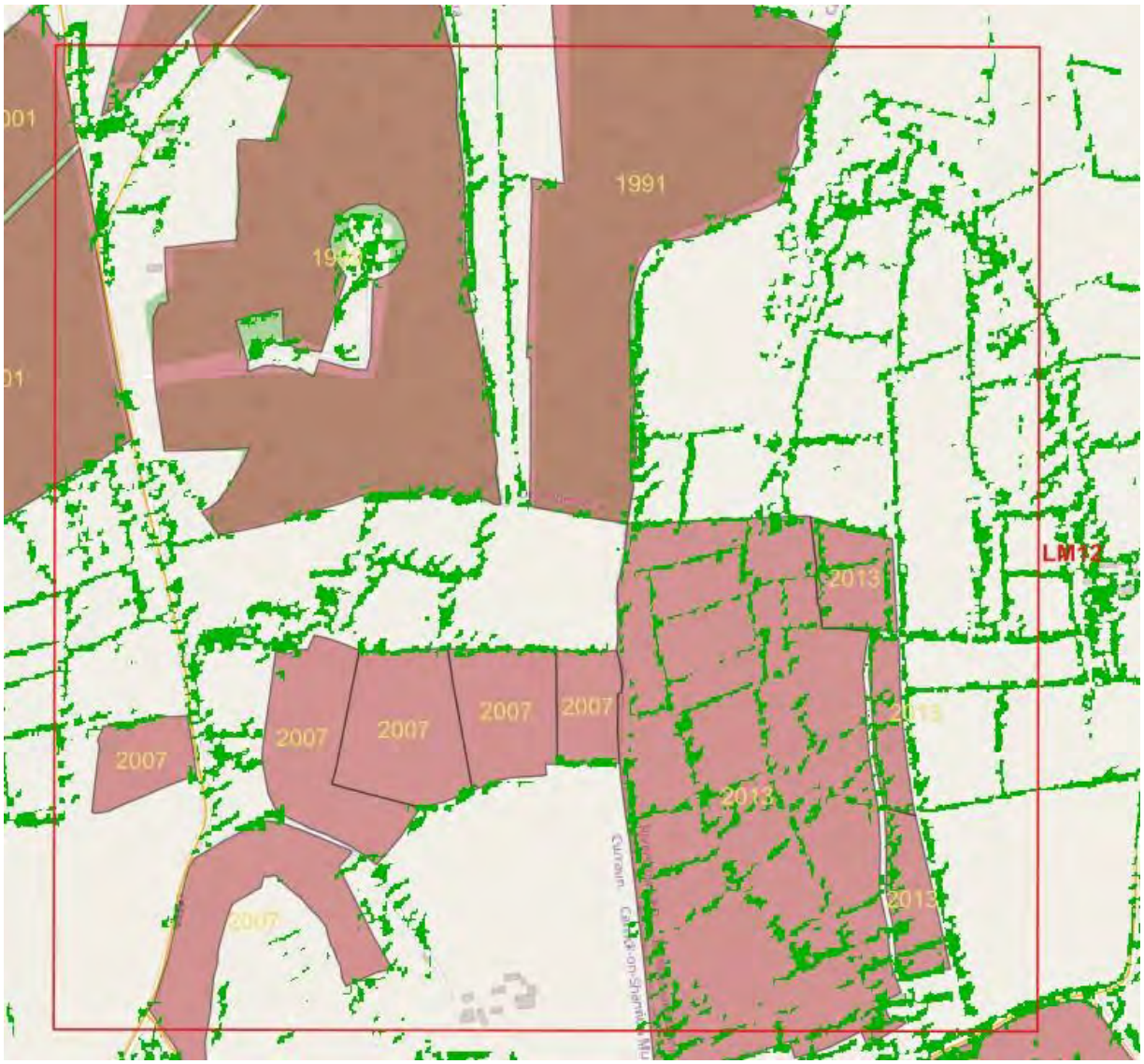


Figure 8.1.2 Data from Teagasc Hedge Map (2011) not identifying hedgerows in plantations from 2007 or earlier (LM12)

The authors of this report are of the view that the Forest Service, in conjunction with key stakeholders, needs to review how existing hedgerows are incorporated in to new forestry plantations. Until such a review is completed the recommendation of the BIOFOREST Report for a minimum 7m setback for all hedgerows is applied to ensure that they are not degraded and their ecological function not excessively compromised.

Removal

Direct hedgerow removal was observed during the survey but only on a very limited scale. The requirements of Cross Compliance under CAP are a reasonably effective measure in terms of limiting hedgerow removal in Leitrim.

Degradation / Age

Loss of hedgerows through progressive degradation would be of greater concern than direct removal. Slow progressive decline is less dramatic and therefore less noticeable than the blunt and obvious removal. The latter has no real positive benefits; however hedgerows would provide a good range of habitat for wildlife in their demise particularly through dead and decaying wood. The art is to try and preserve the value of deadwood by ensuring that this is incorporated in to the structure of the hedge. As with most things to do with nature excessive tidiness should be discouraged.

For nought so vile that on the earth doth live
But to the earth some special good doth give,

William Shakespeare, Romeo and Juliet

Ash Dieback

Evidence from the County Leitrim Hedgerow Appraisal Survey indicates a generally polarised situation in terms of the impact of Ash Dieback disease. The overall status Ash Dieback in sampled hedgerows was assessed in terms of four classes.

- Class 1: 100%–76% remaining canopy
- Class 2: 75%–51% remaining canopy
- Class 3: 50%–26% remaining canopy
- Class 4: 25%–0% remaining canopy

Ash in different dieback classes in the same hedge (LM15)

49% of sampled hedges remain in Class 1 where evidence of the impact of the disease is not severe. However, in 25% of the sample the Ash trees are effective dead or dying.

Many landowners who gave permission for access to their lands expressed concerns regarding the situation with Ash Dieback. One landowner indicated that he could have as many as 400 trees to deal with. Anecdotal evidence indicates that it can cost up to €1000 per tree to engage a qualified tree-surgeon to remove a mature diseased tree at the roadside or near buildings. Trees infected with the disease create a significant and specific set of problems in terms of their safe felling.

There is a serious concern that the current position will lead to excessive pre-emptive removal of ash trees.

To date the main concerns over this disease appear to be focussed on landowners who have lost established Ash forestry plantations to the disease (including in Leitrim) but the problem is much broader.

A high proportion of roadside hedges contain Ash trees. This is already presenting a health and safety issue for road users. Unhealthy trees that present a potential hazard to road users should be made safe. As responsibility for the trees lies with individual land owners and the current situation this creates a significant burden for many landowners in dealing with a problem that was not of their own creation.

It should be remembered that dead and dying trees are very important habitats for wildlife. In making trees safe it may not be necessary on all occasions to remove problem trees completely.

Aside from the public health and safety considerations mitigation for the loss of carbon sequestration, dominant landscape features and habitat for biodiversity should also be part of the agenda.

The establishment of an All-Ireland Ash Dieback Task Force is suggested to address the full range of issue presented by this disease and to ensure that no similar situation is permitted to arise for other species where human action can prevent it.

The debate of dealing with Ash Dieback needs to be broadened to encompass remediation to biodiversity and the landscape. It is critical that suitable native species substitutes are found to replace the lost Ash trees in terms of carbon, landscape and biodiversity.

Roadside Trees

The view has been expressed to the lead author by more than one road engineer that there should be no trees growing within falling distance of a public road. The road engineers' perspective is re-enforced by the current issue with Ash Dieback. However, this position needs to be weighed against the enormous aesthetic and wildlife value of roadside trees. The author's would argue that it is a question of balancing risk and reward.

91% of roadside hedgerows recorded during this survey contained hedgerow trees with 71% having trees above 10m in height.

It was outside the scope of the survey to determine the condition of all trees, but it can be stated as an undeniable fact of life that all of those trees will have to come down at some point.
Healthy trees are of little danger to road users, and can in some circumstances be of benefit. (e.g. – trees can alleviate the blinding effect of low angled sunlight; the microclimate under mature trees can keep road surfaces drier and also reduce the amount of frost on the road). Roadside trees can be subject to (often unintentional) damage by machinery during the course of ordinary hedgerow management work. This can often impact on their health and ultimately their stability.

Responsibility, and hence liability, for the safety of roadside trees rests with the landowner. The costs of dealing with unsafe trees can be considerable. Anecdotal reports from around the county suggest that there is a measure of pre-emptive felling of roadside Ash trees by landowners concerned that they may be considered negligent if the trees were to fall and cause injury or damage. This is an issue that requires some attention at the strategic rather than the "fire-brigade" level.

Where there is a societal benefit it is appropriate that society should subsidise landowners in the management of hedgerows and hedgerow trees. Part of this subsidisation could be by way of supporting the direct employment of arborists and apprentices by local authorities: see https://gretb.ie/arboriculture/ for example.

Hedge banks

In common with the results from the other county hedgerow surveys, damage to banks is a frequent occurrence in County Leitrim. 17% of sampled hedges with hedge banks showed evidence of severe, general damage. Livestock, particularly sheep, are generally the main agents of erosion.

The hedge bank not only underpins the hedgerow itself it provides a niche habitat and micro-climate. Therefore reparation of this basic infrastructure of the hedge should be considered as part of any management plan. Agri-Environment Schemes should cost and support the repair and restoration of severely degraded hedge banks, prioritising Heritage Hedgerows.

Ivy

Ivy is a plant that provokes polarised views from different quarters. Its value for wildlife as a food source, and as nesting or roosting site is unquestionable. However, it is the destructive potential of ivy that provokes controversy. It is generally acknowledged that ivy is not directly parasitic on its host, but the fact that ivy is frequently associated with trees that are in poor condition gives rise to two schools of thought.
One view suggests that ivy can dominate its host and cause it to lose vigour and even eventually kill it. The other view suggests that ivy only dominates trees and shrubs that are already in poor condition and that ivy itself is not destructive. The truth probably lies somewhere between the two.

9% of sampled hedgerows had ivy dominant at the canopy level for over 25% of their length. This is an issue which needs to be monitored, since a further 10% of hedges were in the next category in terms of dominance.

Hedgerow Connectivity

Hedgerows exist in the wider framework of the landscape. How hedges interface with the wider environment can have a significant bearing on their relative value in the landscape and their ability to support biodiversity.

In a Systematic Review which asked the question 'Do hedgerow corridors increase the population viability of woodland species?' Davies et al 2006 stated that :'Connectivity of habitat patches within a landscape has … become a key issue in the conservation of biodiversity' and also reiterated the findings of notable woodland and landscape ecologists that:

'*The creation of new woodland and other semi-natural habitats, such as hedgerows, in suitable locations are thought to reduce the detrimental effects of fragmentation on the biodiversity of woodlands by providing stepping stones or corridors of habitat between isolated species populations.* (Kirby 1995; Peterken 1995; Bennett 1999; Peterken 2000; Spellerberg 1995)'

In addition, there is increasing evidence that '*In agroecosystems ground refuges at the base of hedgerows represent key habitats for many animals.*' Lecq et al 2017

Where hedgerows sub divide improved grassland or arable land their absolute value for supporting a diverse ecology is reduced, but their relative importance for biodiversity in that area is increased. The majority of County Leitrim hedges occur within the context of extensive farming. Maintaining these hedges in a favourable condition for wildlife is relatively less important than for hedges in more intensively managed agricultural areas. In the extensive areas there is likely to be a range of potential habitat, in intensively managed farmland hedges may be the only habitat. In the context of Agri-Environment Schemes it would be beneficial if a full habitat survey of each farm were conducted (in line with Fossitt, (2000)). This should enable greater prioritisation of management actions in order to maintain and enhance biodiversity at the farm or wider local landscape level.

Hedgerow Habitat Zone

Ecologically a hedgerow does not end at the physical edge of the hedge. Dependent on a number of factors the ecological influence extends into the adjacent land, including on micro-climate and drainage. Birds that utilise the hedge for nesting do not live entirely within the hedge. They venture in to adjacent fields but rely on the cover of the hedgerow for security from predators.

The concept of Hedge Habitat Zones (HHZ) is in the process of formation currently. It forms part of the dialogue between Woodlands of Ireland and the National Forest Inventory (NFI) around defining the area of land where the hedge and its associated features such as bank and drain are the most dominant influence on species and structural diversity there. This is relevant to proposals put forward by Woodlands of Ireland that NFI should ground sample hedges and other wooded lands as part of the Inventory they carry out in reporting cycle periods of 5 years. It should enable surveyors to determine where the boundary between hedge and other wooded lands is to be placed, for example where hedge woody vegetation has expanded into adjacent land. It may be useful to determine what degree of protection zone is required around Heritage Hedges to effectively conserve the combination of features connected to the health of the habitat.

A hybrid methodology which combines features of both the NFI and the HAS is currently being worked on, using sample hedge and 'other wooded land' points in Co. Leitrim. Any resulting decision by the NFI to ground sample 'Hedges and Other Wooded Lands' should not diminish the value of repeating County Hedgerow Surveys periodically

Hedgerow Quality

The issue of declining quality in hedgerows is more difficult to address. There is some low hanging fruit in terms of hedge cutting contractors not excessively restricting height and width through management. Dealing with issues of gappiness will involve greater effort and a ready supply of plant material.

Greater effort and a measure of skills training will be required to address the issue of declining structure.

Knowledge and management skills

Rejuvenation of hedgerow structure can be achieved either through coppicing (cutting back to ground level) or laying (partially severing stems and laying them over). Both techniques promote new growth to come from the base of the hedgerow shrubs. Laying is the preferred option as it retains some of the older wood from the hedge and a laid hedge will continue to flower and fruit whereas a coppiced hedge will take at six years or more to start producing flowers and fruit again. Well laid hedges also immediately produce a good structure for nesting birds. Hedge laying is a skilled craft and can be done injudiciously by those not adequately trained and lacking a full understanding of the object of the work. Coppicing and hedge laying are both major surgical interventions to the hedge.

Agri-Environment Schemes

The future drive of agri-environmental policy, for the foreseeable future, should be towards maintaining, enhancing and increasing the area of High Nature Value farmland. If this were the case then County Leitrim, with its network of small fields bounded by native hedgerows, would be well placed to avail of opportunities in this sphere.

An issue in relation to hedge planting in the ACRE Scheme is the use of planting material. The Specification for Tranche 1 specifies

"Plants must be of Irish Origin or Irish Provenance and purchased from DAFM registered professional operators."

It is our understanding that "of Irish Origin" permits plants that have been grown on for a year in Irish nurseries to qualify as suitable for planting under the Scheme. This provides no guarantee of the genetic origin of the plant material.

We consider this position to be based on expediency (lack of availability of plants of Irish Provenance) rather than sound ecological and biosecurity practice.

Research carried out by Jones et al (2001) indicates greater establishment success where hawthorn (whitethorn) provenance is closely matched to the planting site and that locally provenanced plants can be superior to commercially available material. The same report concludes that in Britain the current state of the commercial nursery sector is not sufficiently well regulated to ensure the necessary controls over provenance of material for hedgerow plantings. There is no information to suggest that the situation in Ireland is better and anecdotal evidence would indicate that the vast majority of the planting stock for Irish hedgerows is of non-Irish Provenance, irrespective of the Origin.
More information is needed on the status and production capacity of indigenous genetic stock in the native tree/hedgerow nursery sector in Ireland. A list of most of the current producers of suitable planting stock is available on the Woodlands of Ireland website at https://www.woodlandsofireland.com/links/native-provenance-planting-material/

Woodlands of Ireland (info@woodlandsofireland.com) also organises networking meetings of seed collectors and nurseries regionally.

Imported plants or plants of Irish Origin may be slightly cheaper than those of genuine Irish Provenance. Commercial expediency along with biosecurity measures compromised by EU free trade rules resulted in the importation of Ash dieback disease several years before the disease was officially identified here. DAFM's current approach to the sourcing of plant material for new hedgerows under ACRES risks creating a similar devastating problem in the *Rosa* genus. This genus includes Hawthorn, Apples, Pears and Plums.

A strong commitment from DAFM to the use of Irish Provenance plants would send a positive message to the nursery sector and to those concerned about the risk of introducing new plant pathogens.

The relatively high figure for redundant boundaries in County Leitrim, added to low management must call into question the promotion of new hedge planting under the ACRES. Why plant more hedges when the initial stock is not in optimum condition and where there appears to be a more than adequate degree of field division? Reducing gaps, improving structure and increasing the width of existing active boundaries to increase their biodiversity value may be a better option than creating a new series of boundaries. New hedge planting should be justifiable on agricultural or environmental grounds and not just be an easy option within the Scheme.

ACRES, as with previous schemes, promotes the planting of new hedgerows. The authors would question the benefit of using public money to create additional hedgerows when the existing body of hedgerows is in far from optimum condition. Would it not be better to target resources to improving the quality of our existing hedges rather than add to the management burden? If you can't look after 20 cattle the solution is not to buy more.

One of the key problems in the planting of new hedgerows is that protective fencing is invariably placed too close to the new hedge. This can complicate future management. Within the next two years, Teagasc should carry out a specific study to assess the effectiveness of any new planting under the Agri-Environment Schemes.

Results from this survey and the one from 2006 would indicate that the series of Schemes to date that have been run by DAFM have been failing to deliver results on the ground in terms of hedgerow quality.

There is a move towards a more results-based approach in part of the ACRES schemes but it is still quite superficial.

Agri-Environment Schemes present the best opportunity for increase in hedgerow quality but they also present threats in terms of poor design, implementation and enforcement.

Increased appreciation

The recommendations of the Citizens Assembly on Biodiversity illustrate that there is an appreciation and concern amongst the general public for hedgerows.

123

A new national strategy for the protection, maintenance, restoration and expansion of Ireland's network of hedgerows must be developed urgently. Existing legislation and regulations regarding hedgerows must be reviewed, strengthened and fully enforced, with due regard to public safety. Sufficient results-based incentives must be made available to support all aspects of their proper management. In particular, the new CAP schemes should recognise and reward good hedgerow quality.

125

The Department of Agriculture, Fisheries (sic) and the Marine must implement incentives for State, Semi State and commercial bodies to establish more nurseries for the cultivation of indigenous hedgerow species and indigenous broadleaf tree species.

130

Hedge management courses and certification should be reintroduced and it should be a requirement that all hedge cutting contractors and their employees complete such courses, and be licenced.

The recommendations of the members of the Assembly are both aspirational and practical.

Protection and Enforcement

Legislative protection for hedgerows is weak. There is greater practical protection through the requirements of Cross Compliance than there is through National Law.

The results from the 2020 re-survey of hedgerows in County Monaghan and the Report by Foulkes (2018) on the implementation by DAFM of the EIA (Agriculture) Regulations point to inadequate levels of monitoring and enforcement of procedures to protect hedgerows from removal.

The NPWS is hampered in its enforcement role by the excessive exemptions to Sections 22 and 40 of the Wildlife Acts that would make bringing a legal challenge against an offence under either of these two Sections to be unviable in all but the most extreme circumstances. The Wildlife Acts are under review and it is imperative that the law is modified to empower more effective protection to hedgerows and the ecological role that they serve.
We understand that new legislation to protect hedgerows of significance from removal through a screening process is being drafted. A mechanism for bringing this before the Oireachtas is being explored.

9.0 RECOMMENDATIONS

The recommendations included in this section are based on the results of this survey considered in the light of current best conservation practice. Hedgerow conservation is within the remit of numerous stakeholders who have differing degrees of influence over the resource. In order to better target the recommendations a lead partner is identified where appropriate. A copy of this report should be circulated to a representative of each of the stakeholder groups.

9.1 CONTEXT

In relation to hedgerows, the term 'conservation' does not simply relate to their retention but to their retention in a condition that is conducive to their multifunctional benefits.

Change has been a constant feature of the Irish landscape. It is an insufficient reason to try to conserve hedges just because they are there. Instead, their continuing role needs to be assessed in the context of the changing needs of agriculture, biodiversity, the environment, and the landscape.
For example, whilst wire fencing has reduced the need for hedges as stock enclosures, and shifts in fuel consumption have reduced their value as fuel sources, the importance of hedges for wildlife conservation is more highly regarded. The role played by hedges in maintaining water quality is insufficiently understood but in light of research work in Europe (Viaud et al., 2001), may be very significant.

Hedges along contours can buffer nutrient loss (LM01)

In recent years the conservation of our natural and cultural heritage has gained importance, as reflected in current environmental and conservation policy (see section 4.3 Legislation & Policy) most especially through the National Biodiversity Plan and Heritage Ireland 2030. Within the context of these changes, the heritage and aesthetic aspects of hedgerows must be regarded.

Changes in the Common Agricultural Policy are expected to reduce livestock numbers in Ireland considerably. It is yet to be seen fully how this will affect land utilisation. Will farmers maintain stocking density and put surplus land into forestry or other alternative enterprises, or will the same land be farmed more extensively? Either option has consequences for hedgerows.

The level of native woodland is another dynamic factor. Hedgerows are considered to be sub-optimal woodland edge habitats for wildlife. Most of the species that utilize hedgerows would be more at home in native woodlands. If, in any region, the area under native woodland were to increase significantly, the need

for hedgerows as habitats in that area may diminish yet their importance as habitat corridors in order to maintain viable populations of woodland wildlife might increase.

The key to successful hedgerow conservation policy is that it is formulated in an appropriate and relevant context. This applies from management requirements for a single hedge up to policy decisions at a National (or even European) Level.

The value of a hedgerow or a network of hedgerows in any given environment is relative to its wider environmental context. A species rich hedgerow, in good structural condition, in an area well populated with similar hedges, in an area dominated by semi-natural vegetation, may be of lower relative importance in its setting than a less diverse hedge, in poorer condition, in an intensively farmed area with few hedges or other semi-natural features. The former may be a sub-optimum habitat for many species in its area; the latter might be the *only* habitat.

If hedgerow conservation is to be more than just aspirational then a series of practical, cost effective conservation measures need to be put in place. There are a number of issues which complicate the design of such measures:

- Some of the desirable qualities of hedgerows are subject to value judgements.
- Hedgerows are a multi-functional features. In the absence of a full cost/benefit analysis it in not possible to determine what constitutes a cost effective measure.
- Fencing-off and leaving alone is not an option for most hedgerows. Hedgerows are man-made features of the landscape and the majority need a degree of appropriate active management to ensure their long term viability. Leaving them alone can be appropriate in the short term but is generally not a sustainable long-term option.
- Most hedgerows are on private property. Ownership of hedgerows lies in the hands of thousands of farmers and land owners.
- The variable type, condition and regional differences make uncomplicated management guidelines difficult to frame.
- A significant percentage of the current network has fallen in to disrepair over a period of decades. Reparation of degraded hedgerows involves substantially higher costs than the routine maintenance of hedges in good condition.
- Lack of knowledge/skill base.
    - Intensification of agriculture has tended to diminish the agricultural value of hedgerows. Prior to the introduction Agri-Environment Schemes in the 1990's there were no external incentives for farmers to retain hedgerows whereas grants have been available for land reclamation and drainage which have involved hedgerow removal. Declining agricultural functional value led to a fall off in the practical knowledge and skills needed to manage hedges appropriately.
- Relevance of the resource to the modern landscape.
    - The value of the hedgerow resource to the modern environment is fairly well documented. However, the relevance of a land division system that dates back 200 years is questionable. In 2010, the number of agricultural holdings in Ireland totalled 139,860, compared with 419,500 in 1855, less than a third the number (CSO, 2010).
      County Leitrim had 3,673 holdings with over 3,300 of them being livestock farms. There were just 43 dairy farms and 1 tillage farm.
      Agricultural methods have changed significantly, especially in relation to mechanisation. In addition, the decline in the number of people engaged in agriculture is of consequence.

The recommendations included in this section are based on a review of the recommendations from 2006 and the results of the appraisal, considered in the light of current conservation best practice.

9.2 LEGISLATIVE RECOMMENDATIONS

1.01 Revision of the Wildlife Acts should ensure that the relevant authorities are adequately empowered to enforce the intent of the legislation through clear and precise language.

1.02 Priority should be given by DAFM to the review of the EIA (Agriculture) Regulations and its procedures for implementing the same.

1.03 Section 70 of the Roads Act (1993) should be reviewed and revised to ensure that it is consistent with the requirements of European Law, in particular the Birds Directive.

1.04 National legislation should be developed to put in place specific protection for Heritage Hedgerows as defined in the Hedgerow Appraisal System.

1.05 As part of the planned review of the Wildlife Acts consideration must be given to providing scope for the Minister to extend the restricted period for hedge-cutting on a temporary basis.

9.3 POLICY RECOMMENDATIONS

9.3.1 NATIONAL LEVEL

2.01 Recommendations 123, 125 and 130 of the Citizens' Assembly on Biodiversity Loss should be implemented.

123 - A new national strategy for the protection, maintenance, restoration and expansion of Ireland's network of hedgerows must be developed urgently. Existing legislation and regulations regarding hedgerows must be reviewed, strengthened and fully enforced, with due regard to public safety. Sufficient results-based incentives must be made available to support all aspects of their proper management. In particular, the new CAP schemes should recognise and reward good hedgerow quality.

125 - The Department of Agriculture, Fisheries and the Marine must implement incentives for State, Semi State and commercial bodies to establish more nurseries for the cultivation of indigenous hedgerow species and indigenous broadleaf tree species.

130 - Hedge management courses and certification should be reintroduced and it should be a requirement that all hedge cutting contractors and their employees complete such courses, and be licenced.

2.02 A National Stakeholder Hedgerow Conservation Group should be established under the auspices of the National Parks and Wildlife Service to oversee the implementation of the recommendations of the Citizens' Assembly on Biodiversity Loss and to further guide policy and research, address conflicts, facilitate education and training initiatives and generally support the conservation of Ireland's hedgerows

2.03 All relevant authorities should ensure that they have in place a General System of Protection for Wild Birds consistent with Article 5 of the Birds Directive as this relates to hedgerows.

2.04 Relevant authorities should put in place easy and confidential mechanisms for the public to report damage to, and removal of, hedgerows, including out-of-season cutting.

2.05 All relevant authorities should commit to strict monitoring and enforcement of legislation designed to protect hedgerows and the functions that they perform.

Agri-Environment Schemes

2.06 Agri-Environment Schemes should be focussed on results-based specifications with compliance based on achieving favourable condition.

ACRES plans should prioritise the management of hedgerows of higher significance under the HAS and should show a distinction between active and redundant farm boundaries.

2.07 Heritage Hedgerows should be given particular and carefully targeted management attention, where appropriate. Unless there are specific conservation or management objectives, resources should not be directed into hedgerows that form part of redundant field boundaries.

Resources – financial and skills – should be directed towards achieving value-for-money in achieving conservation objectives. Grants structures that create perverse incentives should be reviewed and modified.

2.08 Conservation of exiting hedgerows should take precedence over the planting of new

hedgerows. The laying of hedgerows should be prioritised over the coppicing of hedgerows.

2.09 The restoration and protection of degraded hedge banks and walls should be fully costed and included in the options for hedgerow management under Agri-Environment Schemes

2.10 The creation/ restoration of a diverse herbaceous layer in the base of hedgerows currently populated with nettles, cleavers and other ruderal species should be fully costed and included in the options for hedgerow management under Agri-Environment Schemes.

The appropriate aftercare of newly planted hedgerows needs to be stressed by advisory bodies. Fencing from livestock must be an adequate distance away from the hedge to prevent browsing and also to allow maintenance.

2.11 Recommended figures should be stated for the spacing of protective fencing from newly planted hedges in the ACRES specifications and considered best practice for non ACRES situations.

Ivy is a valuable wildlife plant but can, when over-dominant, be potentially detrimental to the long term viability of hedgerows. Its control may be deemed to be judicious as part of a long-term hedgerow management programme.

2.12 Guidelines should be given to Agri-Environment Scheme participants as to the timing of cutting ivy so as to minimize the wildlife disruption. This will need to be based on research evidence and then should be considered best practice for non-Agri-Environment situations.

Cross Compliance

2.13 DAFM should identify where hedgerows have been removed on farms since 2009 and ensure that the required replacement mitigation has been complied with.

2.14 Mitigation planting for removed hedgerows should be like for like in terms of construction, and species composition as well as length.

Afforestation / Forestry

Afforestation of hedged farmland has a major impact on hedgerows and the physical and ecological landscape. Inadequate setbacks will result in effective hedgerow loss especially where exotic, evergreen species are used. Hedgerows within forested areas have a very different ecological role than those in an agricultural setting.

2.15 The Forest Service, in conjunction with key stakeholders, should commit to reviewing how it incorporates hedgerows in to new afforestation projects.

In terms of the biodiversity objectives of the Forestry Programme it is important that baseline data is established on the status and condition of the hedgerows that are on sites that are to be afforested.

2.16 As part of the afforestation applications process all hedgerows in and surrounding the project area should be assessed using the Hedgerow Appraisal System.

2.17 The Forest Service of DAFM should commit to applying the recommendation of the BIOFOREST Report in terms of the setback for linear habitat features.

There should be no loss of Heritage Hedgerows to afforestation.

2.18 Hedgerows classed as Heritage Hedgerows under the Hedgerow Appraisal System should be accorded greater setback than the minimum 7m figure recommended in the BIOFOREST Report.

2.19 Where hedgerows form part of the Area for Biodiversity Enhancement on any existing forestry site an assessment should be conducted to determine whether the hedgerows are being adequately conserved. Any issues identified should require remedial action to be taken.

The Forest Service of DAFM should address legacy issues relating to hedgerows in plantation forests.

2.20 The Forest Service should commit to ensuring that Significant Hedgerows that have been degraded as a result of previous afforestation are subject to remediation at the next appropriate management intervention.

2.21 A detailed analysis should be carried out to determine the extent of effective hedgerow loss to Forestry in Co. Leitrim from 2009 when hedgerows were first classed as landscape features.

2.22 Under the Single Consent System for Forest Road Works DAFM, as the consenting authority, should ensure that there is no net hedgerow loss in situations where hedgerows are proposed to be removed to facilitate the project.

9.3.2 Local Policy Level

Local Planning and Development

There is a need for Leitrim County Council to deal systematically with the relevant issues of this report and to give status to the recommendations. A policy document could set policy, standards and targets; and assign areas of responsibility.

3.01 In conjunction with key stakeholders Leitrim County Council should produce and adopt a 'Hedgerow Conservation Policy'

There is currently little or no distinction, in terms of planning and development, between the different types of hedgerow recorded as part of this survey and their relative agricultural, historical, ecological and aesthetic importance. For example hedges of antiquity, hedges with good species diversity or ecological connectivity or those containing rare species, should be safeguarded more stringently in roads, construction, and other development operations.

3.02 The concept of "Heritage Hedgerow" should be recognized by Leitrim County Council for hedgerows which have notable historical, ecological or aesthetic characteristics. These hedgerows should be accorded greater consideration when planning infrastructure and should be incorporated into new developments and landscaping plans.

3.03 Leitrim County Council should consider the use of Tree Preservation Orders for the protection of specific "Heritage Hedgerows".

3.04 Leitrim County Council should establish a layer its GIS database for the recording of Heritage Hedgerows.

3.05 Hedgerow removal to facilitate development should be kept to an absolute minimum and, where unavoidable, a requirement for mitigation planting should be incorporated into the planning consent. This should consist of a hedge of similar construction (bank, drain, etc), length and species composition to the original, established as close as is practical to the original and where possible linking in to existing adjacent hedges. Native plants of a local provenance should be used for any such planting.

There is evidence from around the country that although measures to protect hedgerows are included in planning consents, lack of enforcement is resulting in less than optimum performance on the ground.

3.06 A study should be initiated by Leitrim County Council to investigate the impact of development control in relation to hedgerows and to determine degrees of compliance with hedgerow related planning conditions by landowners.

3.07 Enforcement of hedgerow conditions in planning consents could be achieved by making the retention, re-location, or re-establishment of hedgerows in planning consents the subject of a bond sought by the Local Authority from those seeking the planning permission. The bond to be returned on the successful retention, re-location or re-establishment of the hedgerow/s concerned within a given period.

New Planting

3.08 **The use of locally provenanced native plant species should be specified for any hedgerow planting (including hedgerow trees). Encouraging a diversity of native hedge species consistent with the findings of this survey is recommended.**

3.09 **Nurseries and garden centres in the County should be encouraged to carry sufficient stock of the above.**
In this regard A Traders Notice was issued by DAFM Horticulture and Plant Health Division in December 2021: Tree and hedgerow planting proposed under CAP 2023-2027. Plants used are required to be of Native Provenance or 'Irish Grown'. Irish Grown means plants can be imported and grown on for one season's growth and then sold as 'Irish Grown'
https://www.gov.ie/pdf/?file=https://assets.gov.ie/207225/624cb2dd-d5fe-43f7-acea-48fe5c7129b7.pdf#page=null

3.10 **Teagasc should carry commission a specific study to assess the effectiveness of any new planting under Agri-Environment Schemes and make recommendations based on its findings.**

Roadside Hedgerows

Although public roadside hedges make up only approximately 13% of the overall hedgerow extent, the fact that they are at the front line of public perception of hedgerows, and that they tend to be relatively species rich due to historic factors, makes their appropriate maintenance particularly important.

3.11 **Special emphasis should be placed by Leitrim County Council as the local Roads Authority on the best practice maintenance of roadside hedgerows and verges. This should apply to any funding under the Community Hedge-Cutting Grant Scheme.**

3.12 **All relevant Stakeholders should commit to eliminating the cutting of hedges during the period indicated in the Wildlife Amendment Act (2001) (1st March to 31st August) except where absolutely necessary for safety reasons. They should also commit to implement forward planning in order to minimise the necessity for cutting for safety reasons.**

3.13 **Leitrim County Council should review its policy regarding its responsibilities under the Roads Act (1993) as this applies to hedgerows. This should include a review of its implementation of Section 70.**

3.14 **Leitrim County Council should commit to a deadline for the introduction of a requirement for all contractors carrying out hedgerow management works on behalf of the Council to be appropriately certified. No contracts should issue to uncertified contractors after this deadline. Responsibility for acquiring certification should lie with the contractor.**

3.15 **A log should be kept by the local authority (or other authority) detailing all hedge cutting carried out by or for authority during the bird nesting season as stated in the Wildlife Amendment Act (1st March – 31st August). Details to include are the date of cutting; machine operator; location; landowner; details of any Section 70 Notification; length of hedge cut; and precise justification for management. This would be consistent with the derogation requirements of Section 9 of the Birds Directive and will provide a useful record for the council (or other body) in the case of any complaints or actions taken. Recording photographic evidence prior and subsequent to the action would also be recommended.**
A log of all notices served under Section 70 of the Roads Act should be maintained.

Incentives

Not all of the Heritage Hedgerows within the County fall within the protection and support of the ACRES. Given their role as ecological corridors it is important that the appropriate management of these hedgerows on non-ACRES farms be incentivised in order to prevent a fragmented countryside. This could be done through Local Authorities, NPWS, or Heritage Council.

3.16 Incentives for the conservation of, or renovation to, favourable condition of all Heritage Hedgerows should be made available to landowners not eligible to participate in the ACRES.

3.17 Leitrim County Council should ensure that it fulfils the reporting requirements for *de minimis* State Aid in respect of its Hedge Cutting Grant Scheme which is effectively subsidising certain land owners in meeting their legal obligations. It is recommended that the Scheme should require hedgerow management to best practice standards which is over and above basic compliance with the legal requirements of Section 70 of the Roads Act (1993).

Disposal of green waste

Coppicing and hedge laying can generate significant amounts of green waste. From November 2023 the burning of agricultural 'green waste' will no longer be permitted.

3.18 Acceptable alternative methods of addressing the issue of green waste resulting from hedgerow management need to be developed and publicised. Teagasc should take a lead role in this.

Fuel Wood Production

Producing a greater proportion of its fuel demands from hedgerows would be consistent with Ireland's commitments under the Climate Action and Low Carbon Development (Amendment) Act 2021.

3.19 Farmers and landowners should be encouraged to utilise hedgerows for fuel wood production in a sustainable manner.

3.20 Technical advice should be provided to farmers and landowners wishing to produce wood fuel on cyclical basis from hedgerows. Good Energies Alliance Ireland could promote sustainable systems of harvesting.

9.4 Recommendations in relation to Hedgerow Management in County Leitrim

Standards of management activities

Results from the survey indicate that there is room for improvement in the structural quality of hedgerows, which can be achieved by appropriate maintenance.

4.01 Teagasc should commit to reviewing its Mechanical Hedge Trimming certified training module.

4.02 As a base line, in order to achieve management objectives, stakeholders should commit to ensuring hedgerow management works carried out under their responsibility should conform to recognised, basic minimum standards.

- **Routine trimming should be carried out by operators qualified to Teagasc Unit MT 1302 – Mechanical Hedge Trimming.**

  (This module should be reviewed on an ongoing basis to ensure that it is fully compliant with current best practice and remains consistent with standards in operation in other member states of the EU.)

- **Hedge laying should be to National Proficiency Test Council (NPTC) (UK) Standard (AO2098) or equivalent level in the European Framework of Qualifications (EFQ).**

- **Coppicing of hedgerows should be carried out to standards set by the NPTC or EFQ equivalent**

- **Planting of new hedgerows should be to NPTC standard or EFQ equivalent.**

The new National Apprenticeship in Arboriculture (GRETB) may offer the opportunity for inclusion of these training modules within its programme, when requested by employers: https://gretb.ie/arboriculture/

In order to achieve these standards, more opportunities for training need to be made available to farmers and landowners who wish to undertake hedgerow management activities, especially in connection with the ACRES

4.03 Opportunities for training to recognised Standards in hedgerow management should be made more widely available through SOIAS, the ETBs or Agriculture and Forestry course providers.

Hedge trimming

Breasting hedges but allowing the top to grow freeform is a management technique that potentially satisfies both ecological and agricultural functions. It is also well suited for the management of many roadside hedges.

4.04 Breasting hedges but allowing the top to grow freeform should be encouraged as a management option for routinely managed hedges. Incremental trimming should also be encouraged to achieve greater height and width in managed hedgerows.

4.05 Farmers and landowners in County Leitrim should be encouraged to not reduce hedge height below 1.5m during routine maintenance other than in exceptional circumstances.

Hedge rejuvenation

Sustainable hedgerow networks will only be achieved if appropriate management regimes based on long term needs are implemented. Levels of hedgerow rejuvenation need to increase significantly from those detected in the survey.

4.06 A greater degree of rejuvenation of old and degraded hedgerows should be encouraged.

Hedgerow Trees

The species diversity in the shrub layer of Leitrim hedgerows is not proportionately reflected in the frequency of occurrence of many of those species in the tree layer.

4.07 Landowners should be encouraged to allow more of the variety of native species already present in hedges to mature into trees.

4.08 Landowners who have lost Ash trees to Ash Dieback should be encouraged and incentivised to ensure the establishment of suitable replacement native species.

Safety

4.09 Farmers and Landowners should be strongly discouraged from attaching fencing to hedgerow stems and trees.

4.10 Removal of old wire/ netting/ staples from hedgerow stems should be encouraged for safety reasons.

9.5 Ash Dieback Recommendations

Current efforts to address the problems created by Ash Dieback have focussed on ameliorating the economic impact on plantation owners. The problems caused by Ash Dieback extend well beyond the economic impact on this sector. Landowners should not have to bear the brunt of dealing with this disease.

5.01 A National Task Force comprised of key stakeholders should be established to address the landscape, biodiversity and public health & safety implications of the disease in a prompt, effective and just manner.

5.02 A pilot programme for the assessment of the condition and potential hazard of roadside hedgerow trees should be undertaken by arborists. This should be done with a view to informing and supporting landowners in complying with their legal obligations under the Roads Act (1993). It is essential for each Roads Authority to have its own trained and equipt arboriculture crew who can work in conjunction with utility companies in the interest of public safety on transport corridors.

At County level if the relevant stakeholders (local authority, farmers and landowners, arboriculturalists, telephone and electricity service providers, etc.) were to come together and devise a project that allows for an assessment of the condition and potential hazard of trees, removal of potentially dangerous specimens, and mitigation through alternative planting (in safer areas?), this issue could be tackled in a constructive, proactive and much more cost effective way than if it is tackled piecemeal. Such a programme would not only protect the interests of the landowner and road users but would also recognize the enormous aesthetic and nature conservation value of roadside trees. Appropriate management implemented in advance of crisis situations would result in a greater retention of roadside trees. In the absence of EU funding being available for such a programme, local authorities should take the lead, backed by Exchequer funding. Remote sensing technology can be employed to make the job of assessing the local scale easier (Gasparovic et al 2023)

5.03 Trees identified as being in Class 1 of the Ash Dieback assessment categories should be retained as far as possible.

5.04 It is recommended that the Ash Dieback element of this survey is repeated at more regular intervals than the whole survey in order have a more dynamic assessment of the progressive impact of the disease.

9.6 Infrastructural Recommendations

Registration/ certification of local provenance planting stock

The ability to source planting material of a known genetic provenance is important. The origin of plants or seeds determines their adaptability, quality, and wildlife value. More information is needed on the status and production capacity of the hedgerow nursery sector in Ireland.

6.01 A study should be conducted of nursery suppliers and garden centres to determine the availability of native planting stock (including provenance) for the range of hedgerow tree and shrub species recorded in the County Leitrim Hedgerow Appraisal. This information should be disseminated to interested parties.

6.02 A programme should be developed for the identification, registration, and certification of local provenance seed sites for woody hedgerow shrubs in County Leitrim.

Nurseries and Nursery Stock

Contact with nursery growers and other professionals has indicated a likely shortfall of native provenance whitethorn for the 2023/24 season. Plans need to be made to ensure that the planting requirements predicted as a result of the introduction of ACRES can be met from indigenous stock. This will require a degree of forward planning.

6.03 The production capacity of nurseries producing Irish hedgerow stock from Irish seed sources should be determined.

Individuals wishing to establish, develop or expand tree nurseries with a view to supplying

hedgerow plants of a local provenance should be actively encouraged through the Development Agencies. DAFM could look at providing funding through its direct provision of support services. The Forest Service, which is part of DAFM, have begun to facilitate this: see Circular 7 0f 2023: Investment Aid for the Development of the Forest Tree Nursery Sector.

6.04 Financial and technical support should be given to individuals and groups wishing to develop nurseries to supply woody hedgerow shrubs from local seed sources.

Machinery Contractors

The vast majority of hedgerow management is carried out by operators using tractor mounted machinery. Some anecdotal evidence has suggested that, given the restricted legitimate season of cutting, business viability may be threatened.
At a technical level the message promoted by Teagasc and DAFM through Agri-Environment Schemes, to cut hedges to an A-shape profile, does not appear to be getting through at ground level. The reasons why this recommendation is not being heeded should be investigated.

6.05 A survey should be undertaken of hedge-cutting machinery operators, to assess the operation and requirements of the sector.

9.7 Education and Awareness Recommendations

A chain is only as strong as its weakest link. All individuals in the process from decision making to implementation need to be sufficiently well informed so as to be able to direct, implement and evaluate best practice actions.

7.01 Stakeholders should ensure all relevant staff (and any contractors used) have the necessary skills and data sources to implement or evaluate best practice hedgerow conservation.

7.02 Stakeholders should provide appropriate training for staff in aspects of hedgerow conservation relevant to their position.

Education in terms of best practice management is best implemented with reference to good examples.

7.03 A number of showcase sites of best practice covering different aspects of conservation and management should be developed around County Leitrim.

7.04 General Awareness of the values of hedgerows should be encouraged among rural communities through circulation of educational materials, an increase in targeted education for schools, in Citizen Science Projects and with the introduction of initiatives such as the Golden Way Competition.

Managing species rich hedges depends on the ability to identify species.

7.05 A pictorial information leaflet should be produced to show all of the species native to County Leitrim Hedgerows. This should be distributed to Teagasc offices, hedge-cutting contractors, marts, creameries, garden centres, etc.

9.8 Recommendations for Future Research

Ecology

8.01 Studies should be undertaken to determine the extent to which adjacent land type and use influences biodiversity in hedgerows, particularly species rich hedges. The concept of the Hedgerow Habitat Zone should be introduced to reflect the area over which a hedgerow has a significant ecological influence.

Since a certain amount of hedge cutting will be necessary during the summer months for health and safety reasons it would be beneficial to try and minimise the impact of the work from a wildlife conservation point.

8.02 The impact of different types of hedge cutting techniques and machinery should be investigated to determine whether certain techniques or types of cutter are less damaging to birds during the bird nesting season (1st March – 31st August).

8.03 The use of thermal imaging technology should be investigated to determine its effectiveness in terms of identifying the presence of active wildlife (birds nests, etc) ife) in

hedgerows that are required to be managed for health and safety purposes.

Ivy

8.04 Research should be initiated to examine the causes of the development of ivy in hedgerow trees and shrubs and the impact that different levels of ivy growth have on the host plant.

8.05 Research should be initiated to determine the optimum time for the cutting of ivy (where necessary) to minimize the disturbance to dependent wildlife.

Water Quality

8.06 Research should be initiated to quantify the nutrient buffer effect of hedgerows in different agricultural situations. The Hedgerow Appraisal System needs to be adapted to enable recording to facilitate a Significance score for Water Quality for hedgerows.

8.07 Research should be conducted to investigate the difference between soil structure, carbon and biodiversity beneath hedgerows in comparison with soils where other land management activities take place. Also soils beneath Townland Boundary hedgerows can be compared with that from more recently established boundaries.

Investigating Data Sets from other surveys

This survey uses the same sample areas as the Badger and Habitats Survey of Ireland, the Countryside Bird Survey and other surveys carried out by NPWS (e.g. hare survey). This should allow some comparison of data sets. The greater capacity for recording of habitat data and how these habitats change over time should allow for a greater understanding of the factors that govern the fluctuations in wildlife populations.

8.08 Data from this Hedgerow Appraisal Survey should be examined and assessed in relation to previous surveys which have used the same sample area to enable more specific analysis.

9.9 RECOMMENDATIONS IN RELATION TO THE SURVEYING OF HEDGEROWS

National Database

The hedgerow database that was hosted at the National Biodiversity Data Centre (NBDC) website until it was taken down in January 2018 comprised of a collation of 16 surveys mainly at county level which were carried out before 2013. Errors in the presentation of data were reported to the NBDC in January 2018 but at the time of writing NBDC have not resolved the issue. It is likely that once resolved, data from previous, current and future surveys may be accessible on an individual county basis.

Data that has been collected under this and comparable county hedgerow surveys should be co-ordinated into an open-source dataset available in GIS format.

9.01 Co-ordinate and make publicly available all data collected under the Hedgerow Appraisal System and comparable methodologies.

9.02 A full review and revision should be conducted of the Hedgerow Appraisal System. This should include closer alignment with the methodology of the National Forest Inventory.
The previous Woodlands of Ireland Technical Advisory Panel sub group which produced the HAS can be reformed to include those involved in using the system in new surveys or resurveys in other counties currently.

9.03 EPA National Land Cover Mapping Unit needs to investigate issues with the incorrect identification of Hedgerows and Treelines

9.04 An appropriate method of assessing the representative species composition for hedgerows in Ireland should be determined through research.

Standardising data input into Geographic Information Systems

9.05 A standard format for the presentation of hedgerow survey data in GIS should be agreed.

9.06 A repeat of this Appraisal Survey should be carried out no later than 2033

Hedgerows and Townland Boundaries are inextricably linked. A methodology is needed for the consistent recording of information on Townland Boundaries.

9.07 Funding should be made available for the development of methodology for the recording of Townland Boundaries to include the Habitat Type, Vegetative Composition and Condition; this could include an assessment of threats and pressures.

10.0 CONCLUSIONS

The information gathered from this survey adds to the existing and growing knowledge of hedgerows in Ireland, and should be of value to a wide range of interests and stakeholders in County Leitrim and the rest of the country. Recording and analysis of the various hedgerow characteristics should also foster a greater appreciation of the unique nature of these hedges, and enable a strategic approach to the conservation of an often under-valued resource that should be a source of pride to the County.

The social and economic landscapes of Ireland have changed (and continue to change) significantly over the last two to three decades. These changes impact on the physical, ecological and social landscape.

One significant feature of the current study compared to that of 2006 is the number of landowners who now live at some remove from the land in their care. As surveyors, we experienced this as a difficulty in identifying and gaining permission to access land for the survey but the ramifications are more wide reaching. It is much more difficult for a landowner to monitor and manage something in a place where they do not live and perhaps more significantly it is less likely that the local knowledge of and attachment to place will endure to the same degree as for those who live with their land.

Levels of management have decreased and while this is not a negative fact, *per se,* it does not bode well for the long term conservation of hedgerows which as a result of their man-made nature are not naturally self-sustaining as hedges.

In absolute terms, there is plenty of scope for improvement in the resource to maximise its full multi-functional potential and the influence of Agri-Environment Schemes will be critical to successfully guiding future conservation of hedgerows in County Leitrim

Ad hoc afforestation has been identified in this study as the greatest current threat to the hedgerow network in the County. The impacts of afforestation extend well beyond just the hedgerow network and there needs to be a land use / land care policy developed for this region to ensure that future changes in the fabric of land use have overall positive impacts in terms of the interacting layers of the natural environment, human society and the economy of that society. Leitrim is the canary in coal-mine.

Hedgerows link archaeological, geological, social and natural heritage. They have utility in the present but mark the past. Their values are multi-functional in both practical and spiritual terms. They enrich our understanding of history, ecology, rural society and farming practices. They give character to an area giving aesthetic appeal and creating a sense of place.

The recommendations presented in this report, if implemented, should support the efforts of the numerous stakeholders whose roles and responsibilities engage them in the protection, preservation and enjoyment of our wonderful native hedgerows.

Ashamed of what I loved
I flung her from me and called her a ditch
Although she was smiling at me with violets.

But now I am back in her briary arms;
The dew of an Indian Summer morning lies
On bleached potato-stalks -
What age am I?
I do not know what age I am,
I am no mortal age;
I know nothing of women,
Nothing of cities,
I cannot die
Unless I walk outside these whitethorn hedges.

Final verse of *Innocence* by Patrick Kavanagh

11.0 REFERENCES AND BIBLIOGRAPHY

Author	Title	Publisher
	"U.K. Hedgerow Regulations (1997)" (S.I. Number 1160)	
Aalen, F.H.A, Whelan, K., and Stout, M. (Editors) (1997)	"Atlas of the Irish Rural Landscape"	*Cork University Press*
Andrews, J.H. (1985)	"Plantation Acres"	*Ulster Historical Foundation*
Arnold, G.W. (1983)	"The Influence of Ditch and Hedgerow Structure, length of Hedgerows, and area of Woodland and Garden on Bird numbers on Farmland."	*Journal of Applied Ecology* **20**, *731-750.*
Aulino Wann & Associates (2009)	"Hedgerow Survey of County Donegal"	*Donegal County Council*
Bickmore, C.J. (2002)	"Hedgerow Survey Handbook: A standard procedure for local surveys in the UK."	*Department of Environment, Food, and Rural Affairs*
Biffi, S., Chapman, P.J., Grayson, R.P., & Ziv, G. (2022)	"Soil carbon sequestration potential of planting hedgerows in agricultural landscapes"	*Journal of Environmental Management Vol. 307*
Black, O'Sullivan, Lanigan, O'hUallachain, (2023)	"Biomass carbon stocks and stock changes in managed hedgerows"	*Science of the Total Environment 871 (2023) 162073*
(1970)	"Journal of Cuman Seanchais Breifne"	BreifneVol. IV No. 13
Buckley, C., and Donnellan,T., (2020)	"National Farm Survey 2019 Sustainability Report."	*Teagasc*
Burel, (1989)	"Landscape structure effects on Carabid beetles' spatial patterns in Western France"	*Landscape Ecology,* **2**, 215-226
Central Statistics Office (2010)		*Central Statistics Office*
Chamberlain, D.E, Vickery, J.A, Marshall, E.J.P., & Tucker, G.M. (2001)	"The effects of hedgerow characteristics on the winter hedgerow bird community."	*In: Hedgerows of the World: Proceedings of the 2001 Annual IALE (UK) Conference.* Pp 197-206
Chambers (2019)	"A guide to Harvesting woodfuel from hedges"	*https://www.organicresearchcentre.com/manage/authincludes/article_uploads/project_outputs/TWECOM%20ORC%20Best%20Practice%20Guide%20v%201.0.pdf*
Citizens' Assembly (2023)	"Report of the Citizens' Assembly on Biodiversity Loss"	*Government Publications*
Clements, D.K., and Tofts, R.J.	"A Methodology for the Ecological	*Countryside*

(1992)	Survey, Evaluation, and Grading of Hedgerows."	*Planning and Management, UK*.
Clutterbuck , R. (2015)	"Rural landscapes of improvement in Ireland, 1650-1850: An archaeological landscape study"	*National University of Ireland Galway PhD thesis, School of Geography and Archaeology. p.134, p.255*
Condon, F.A. & Jarvis, P.J. (1989)	"Trees and Shrubs in the Hedgerows of Knock, Co. Mayo, Western Ireland"	*Irish Naturalists Journal,* Vol. **23** No 1, 12-16
Cooper, A., McCann, T. and Rogers, D. (2009)	"Northern Ireland Countryside Survey 2007: Broad Habitat Change 1998-2007.)"	*Northern Ireland Environment Agency Research and Development Series No.09/06*
Corbit, M. and Marks, P. and Gardescue, S., (1999)	"Hedgerows as Habitat Corridors for forest herbs in central New York, USA."	*Journal of Ecology,* **87**, 220-232
Council for the Protection of Rural England (2000)	"CPRE Hedgerow Survey Pack"	*CPRE*
Critchley C.N.R., Wilson L.A., Mole A.C., Astbury S.S. & Bhogal A. (2010)	"Restoration of Herbaceous Hedgerow Flora: Review and Analysis of Ecological Factors and Restoration Techniques. Phase 1"	*DEFRA Project BD5301 Final Report*
Crowe, O., Coombes, RH., Tierney, T.D., Walsh, A.J. & O'Halloran, J., (2017)	"Countryside Bird Survey Report 1998-2016"	*BirdWatch Ireland, Wicklow.*
Crowley, J., Smyth, W.J., Murphy, M. editors (2012)	"Atlas of the Great Irish Famine"	*Cork University Press*
Cuarta, B. (2001)	"The plantation of Leitrim, 1620–41"	*Irish Historical Studies, 32(127), 297-320. doi:10.1017/S00211 21400015030*
Davies, Z.G. & Pullin, A.S. (2006).	"Do hedgerow corridors increase the population viability of woodland species?"	*Systematic Review No. 8. Part A. Centre for Evidence-Based Conservation, University of Birmingham, Birmingham, UK.*
DEFRA (2000)	"Countryside Survey (UK)"	
Department of Agriculture, Food and the Marine (2016)	"Environmental Requirements for Afforestation"	
Department of Agriculture, Food and the Marine (2022)	"ACRES Specification Revised November 2022"	
Department of Agriculture, Food and the Marine (2022)	ACRES Scorecards	
Department of the Environment (2001)	"Urban and Rural Roles"	*Government Publications Office*

Doherty, Gillian M. (2004)	"The Irish Ordnance Survey"	*Four Courts Press*
Dondina, O., Saura, S., Bani, L. et al. (2018)	"Enhancing connectivity in agroecosystems: focus on the best existing corridors or on new pathways?"	*Landscape Ecology*
Duffy, P. J. (2007)	"Exploring the History and Heritage of Irish Landscapes"	*Four Courts Press.* *https://en.wikipedia.org/wiki/Muintir_Eolais accessed 20/10/2023*
EPA (2014)	"Carbon Sequestration by Hedgerows in the Irish Landscape"	*The Environmental Protection Agency. Wexford.*
EPA (2019)	"BRIAR: Biomass Retrieval in Ireland using Active Remote sensing. Report No. 305."	*Prepared for the Environmental Protection Agency by Teagasc*
EPA (2023)	National Land Cover Map	*Acquired under licence by Leitrim County Council from Tailte Éireann*
Hubert de Foresta, Eduardo Somarriba, August Temu, Desiree Boulanger, Helene Feuilly and Michelle Gauthier. (2013)	"Towards the Assessment of Trees Outside Forests"	*Resources Assessment Working Paper 183. FAO Rome.*
Fossitt, J.A. (2000)	"A Classification of Irish Habitats"	*The Heritage Council*
Foulkes, N. and Murray, A. (2005)	"A Hedgerow Survey Methodology for Ireland"	*Unpublished*
Foulkes, N. and Murray, A. (2005b)	"Roscommon Hedgerow Survey Report"	*Roscommon County Council*
Foulkes, N. and Murray, A. (2005c)	"Westmeath Hedgerow Survey Report"	*Westmeath County Council*
Foulkes, N. and Murray, A. (2005d)	"County Offaly Hedgerow Survey Report"	*Offaly County Council*
Foulkes, N. and Murray, A. (2005e)	"County Laois Hedgerow Survey Report"	*Laois County Council*
Foulkes, N. (2006a)	"County Leitrim Hedgerow Survey Report"	*Leitrim County Council*
Foulkes, N. (2006b)	"County Kildare Hedgerow Survey Report"	*Kildare County Council*
Foulkes, N. (2006c)	"County Longford Hedgerow Survey Report"	*Longford County Council*
Foulkes, N. (2007)	"County Mayo Hedgerow Survey Report"	*Mayo County Council*
Foulkes, N. (2008a)	"County Sligo Hedgerow Survey Report"	*Sligo County Council*

Foulkes, N. (2008b)	"West Kerry / Dingle Peninsula Pilot Hedgerow Survey Report"	*Kerry County Council*
Foulkes, N. (2008c)	"Hedgerow Translocation"	*Heritage Office, Roscommon County Council*
Foulkes, N. (2009)	"North Kerry Hedgerow Survey Report"	*Kerry County Council*
Foulkes N. (2010)	"County Monaghan Hedgerow Survey Report"	*Monaghan County Council*
Foulkes N., Fuller J., Little D., McCourt S. & Murphy P. (2014)	"Hedgerow Appraisal System Best Practise Guidance on Hedgerow Surveying, Data Collation and Appraisal"	*The Heritage Council*
Foulkes, N. (2018)	"'Assessment of Environmental Impact Assessment (Agriculture) Regulations on Field Boundary Removal'."	*Unpublished*
Gašparović, M.; Pilaš, I.; Klobučar, D.; Gašparović, I. (2023)	"Monitoring Ash Dieback in Europe—An Unrevealed Perspective for Remote Sensing?"	*Remote Sens. 2023, 15, 1178.* https://doi.org/10.3390/rs15051178
Gowran, J. (2017)	"Hedges on ancient boundaries"	*unpublished Masters Thesis NUIG*
Hegarty, C.A. and Cooper, A. (1994)	"Regional variation of Hedgerow Structure and composition in Northern Ireland in relation to management and land use."	*Biology and Environment: Proceedings of the Royal Irish Academy,* **94 B**, 223-236
Heritage Council (2010)	"High Nature Value Farming in Ireland"	*The Heritage Council*
Hickie, David	"Irish Hedgerows – Networks for Nature"	*Environmental Publications Ltd. Dublin*
Hooper, M. D. (1970)	"Dating hedges"	*Area* **2**, 63-5
Howard, D.C. (2001)	"Sources of error in the estimation of lengths of hedgerows."	*In: Hedgerows of the World: Proceedings of the 2001 Annual IALE (UK) Conference.* Pp 99-104
Iremonger, S. et al (2006)	"Investigation of experimental methods to enhance biodiversity in plantation forests"	*BIOFOREST PROJECT 3.1.3 FINAL REPORT, COFORD*
Jones, A.T., et al (2001)	"The effect of provenance on the performance of *Crataegus monogyna* in hedges"	*Journal of Applied Ecology, Vol.* **38**, 5
Kenny, K. (2004)	"The Farmer and the Hedgerow: Farmer attitudes and Woody species composition of Hedgerows in the	*Research Thesis for M.Agr.Sc. UCD.*

	Castlerea district of County Roscommon."	
Kent, M. and Coker, P. (1992)	"Vegetation Description and Analysis"	*John Wiley and Sons*
Lack, P.C ((1987)	"The effects of severe hedge cutting on breeding bird populations"	*Bird Study* **34,** 139-146
Leitrim County Council (2023)	"Leitrim County Development Plan 2023-2029"	*Leitrim County Council*
Leitrim County Council (2021)	"County Leitrim Biodiversity Action Plan 2021-2026"	*Leitrim County Council*
Lysaght, L. (1990)	"An Investigation of Habitat Selection in hedgerow nesting birds in mid-west Ireland."	*Department of Geography, Trinity College Dublin*
MacAtasney, Gerard (1997)	"Leitrim and the Great Hunger"	*Carrick-on-Shannon and District Historical Society*
MacCotter, P. (2008)	"Medieval Ireland Territorial, Political and Economic Divisions"	*Four Courts Press, Dublin*
MacElwain, L. (2022)	"Monaghan Hedgerow Appraisal Survey, 2021"	*Monaghan County Council*
Matin, S., Sullivan, C. A., Ó'Uallacháin, D., Meredith, D., Moran, J., Finn, J. A., & Green, S. (2016)	"Predicted distribution of High Nature Value farmland in the Republic of Ireland"	*Journal of Maps, DOI: 10.1080/17445647.2016.1223761*
McCann, T. (2012)	"The Woody Species Diversity of Hedges in Relation to Environment, Landscape, History, Management and Structure in Northern Ireland"	*PhD Thesis, Queen's University of Belfast*
McCann, T. et al. (2017)	"How hedge woody species diversity and habitat change is a function of land use history and recent management in a European agricultural landscape"	*Journal of Environmental Management 196 (2017) 692e701*
McCollin, D. (2001)	"Contemporary Themes in Hedgerow Research in the UK"	*In: Hedgerows of the World: Proceedings of the 2001 Annual IALE (UK) Conference.* Pp 17-29
McCune and Mefford (1999)	"PC-Ord (Version 4): Multivariate Analysis of Ecological Data, User's Guide."	*MjM Software Design*
McDonnell, S. (2005)	"The Impact of One-off Housing on Hedgerow Boundaries in Stuake/Donoughmore, Co. Cork"	*Unpublished thesis*
McParlan, J. (1802)	"Statistical Survey of County Leitrim"	*Royal Dublin Society*
Meyen, S. (1997)	"Cost comparison of boundary options"	*Unpublished report*

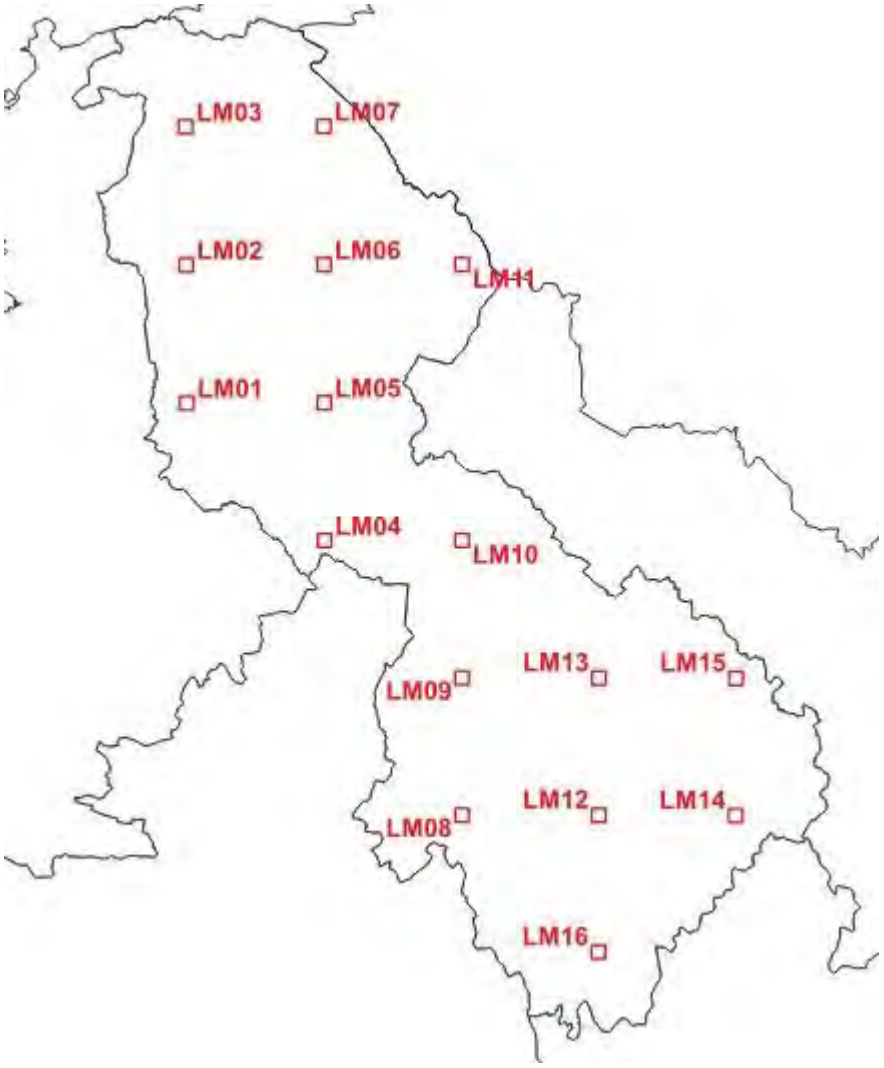
		produced by Donegal Farm Relief Services Ltd. for Crann
Murray, A. (2001)	"The Comparative Ecological Wealth of Townland Boundary and more modern Hedgerows in Co. Kildare."	*Irish Wildlife Trust, Dublin*
National Biodiversity Data Centre (2016)	All Ireland Pollinator Plan "Hedgerows for Pollinators, How-to-guide 3."	*National Biodiversity Data Centre Series No.7, Waterford.*
Nicholls, K. W. (2003)	"Gaelic and Gaelicized Ireland in the Middle Ages."	*Lilliput Press, Dublin*
Noteworthy (2021)	"Whole ditches disappearing overnight': hedgerows falling foul to larger farms."	*The Journal.ie*
O'Dowd, M. (1991)	"Power, Politics and Land- Early Modern Sligo 1568 – 1688"	*Belfast: Institute of Irish Studies, Queen's University of Belfast*
Osborne, P. (1984)	"Bird numbers and habitat characteristics in farmland hedgerows"	*Journal of Applied Ecology* **21,** 63-82
O'Sullivan, A., McCormick, F., Kerr, T. and Harney, L. (2010)	"Early Medieval Ireland: Archaeological Excavations 1930-2009"	*Text for Royal Irish Academy Early Medieval Archaeology Project (EMAP) Report 4.5 December 2010 Report submitted for Irish National Strategic Archaeological Research (INSTAR) programme 2010 Ref: AR01055*
Parker, Rob. (Year unknown)	"Estimating the Length of Hedgerow In Suffolk"	*English Nature Research Reports, No. 366.*
Perrin, P.M. et al, (2008)	"National Survey of Native Woodland in Ireland 2003-2008"	*National Parks & Wildlife*
Pollard, E., Hooper, M.D. & Moore, N.W. (1974)	"Hedges"	*Collins, London*
Reeves, W, (1861)	"On the Townland Distribution of Ireland"	*Proceedings of the Royal Irish Academy (1836-1869), Vol. 7 (1857 - 1861), pp. 473-490. Royal Irish Academy. http://www.jstor.org/stable/20489906*
Robinson, R.A., and Sutherland, W.J.	"Post-war changes in arable farming and biodiversity in Great Britain."	*Journal of Applied Ecology, Vol.* **39***,* 1

Royal Society for the Protection of Birds (RSPB) (date unknown)	"Hedges and Hedgerow Birds":	*Birds and Agriculture Paper No. 1, RSPB*
RPS Group (2020)	"County Leitrim Landscape Character Assessment"	*Appendix VI of the Leitrim County Development Plan 2023 – 2029*
Smal, C.(1994)	"The Badger and Habitats Survey of Ireland"	*Department of Agriculture.*
Sparkes, T.H., Robinson, K.H., & Downing, S.L (2000)	"Hedgerow Management and the yield of hawthorn *Crataegus monogyna* berries"	*Aspects of Applied Biology* **58***,* 421-424
Stace, C. (2010)	"New Flora of the British Isles"	*Cambridge University Press*
Staley, J.T. et al (2012)	"Long-term effects of hedgerow management policies on resource provision for wildlife"	*Biological Conservation, Volume 145, Issue 1,2012,P. 24-29,*
Teagasc (2003)	"Hedgerow Management Leaflets, Countryside Management Series 2"	*Teagasc*
Teagasc (2011)	"The Irish Hedge Map Version1.0"	*Teagasc, Technology Updates*
Teagasc (2020)	"Hedges for rejuvenation"	*Teagasc Agriculture and food Authority*
Tree Council, UK (2021)	"Ash Dieback: An Action Plan Toolkit for Scotland"	*Tree Council, London*
Viaud, V., Caubel, V., Grimaldi, C., Baudry, J., & Mérot, P. (2001)	"The influence of hedgerow systems on water and pollutant fluxes: from the local to the catchment scale"	*In: Hedgerows of the World: Proceedings of the 2001 Annual IALE (UK) Conference.* Pp 281-288
Webb, D.A. (1977)	"An Irish Flora"	*Dundalgan Press, Dundalk*
Webb, D.A., Parnell, J., Doogue, D. (1996)	"An Irish Flora"	*Dundalgen Press, Dundalk*

Websites Consulted	**Address**
Birdwatch Ireland	www.birdwatchireland.ie
Central Statistics Office	www.cso.ie
DAFM	www.agriculture.gov.ie
Lecg (2017)	https://www.researchgate.net/publication/307978173_Importance_of_ground_refuges_for_the_biodiversity_in_agricultural_hedgerows
National Biodiversity Data Centre	www.biodiversityireland.ie
National Parks and Wildlife Service	http://www.npws.ie/en/
The Down Survey of Ireland	https://downsurvey.tchpc.tcd.ie

12.0 APPENDICES

12.1 OVERVIEW OF SAMPLE SQUARES



12.2 SAMPLE SQUARE TOWNLANDS

OS Grid Reference	Square Reference	Nearest Town / Village	Townlands
G 80 30	LM01	Dromahair	*Ardakip Beg* *Ardakip More* *Dromahair* *Drumlease* *Killananima*
G 80 40	LM02	Gurteen	*Gleneigh* *Leean* *Mulkaun*
G 80 50	LM03	Largydonnell	*Drummans* *Keelogues*
G 90 20	LM04	Drumkeerin	*Greaghnaslieve* *Liscuillew Upper* *Moneenatieve* *Seltannasaggart or Corry*

			Mountain
G 90 30	LM05	Killargue	*Gubaderry* *Tullinwannia* *Tullynacross* *Tullynamoyle* *Tullynasharragh*
G 90 40	LM06	Manorhamilton	*Cashelaveela* *Donaghbeg* *Skreen Little* *Tawnyfeacle*
G 90 50	LM07	Rossinver	*Ardagh (Gilbride)* *Ardagh (Sheeran)* *Drungan* *Mollynadinta*
H 00 00	LM08	Drumsna	*Aghintober* *Corlisheen* *Curraghmartin* *Dristernan* *Lisduff* *Lislea* *Lismannagh* *Lismoyle* *Lisnagera*
H 00 10	LM09	Drumshanbo	*Carrickaport* *Cornaleck* *Crey* *Curragha* *Dereen (Southwell)* *Edinavow* *Moherrevogagh*
H 00 20	LM10	Ballinagleara	*Cleighran Beg* *Cleighran More* *Drumristin* *Tullyveacan*
H 00 40	LM11	Glenfarne	*Ardmoneen* *Carrickrevagh* *Laghtybarr* *Loughros*
H 10 00	LM12	Gorvagh	*Curraun* *Drumbeighra* *Drumgowla*
H 10 10	LM13	Ballinamore	*Ardrum* *Creevy* *Killaneen* *Tomloskan*
H 20 00	LM14	Aughavas	*Corriga* *Drumderglin* *Drummerkeane* *Tully South*
H 20 10	LM15	Newtowngore	*Aghaleague* *Carrickateane* *Mullyaster* *Newtown Gore*

			Woodford Demense
N 10 90	LM16	Tooman	*Clooncar* *Clooncoe* *Tooman* *Tulcon*

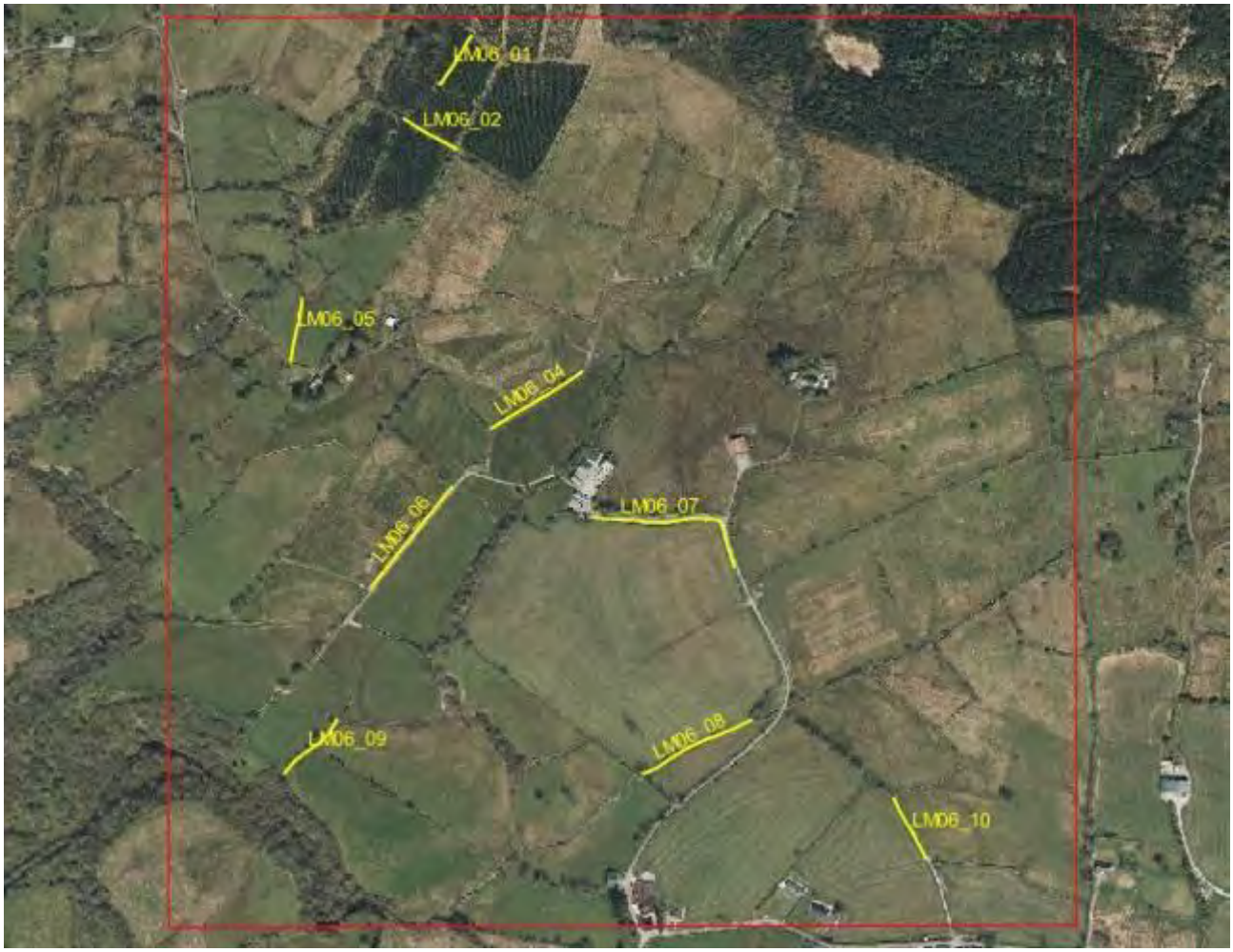
12.3 SAMPLE SQUARES IDENTIFYING SAMPLE HEDGEROWS

LM01

LM02

LM03

LM05


LM06_01
LM06_02
LM06_05
LM06_04
LM06_06
LM06_07
LM06_09
LM06_08
LM06_10

LM06

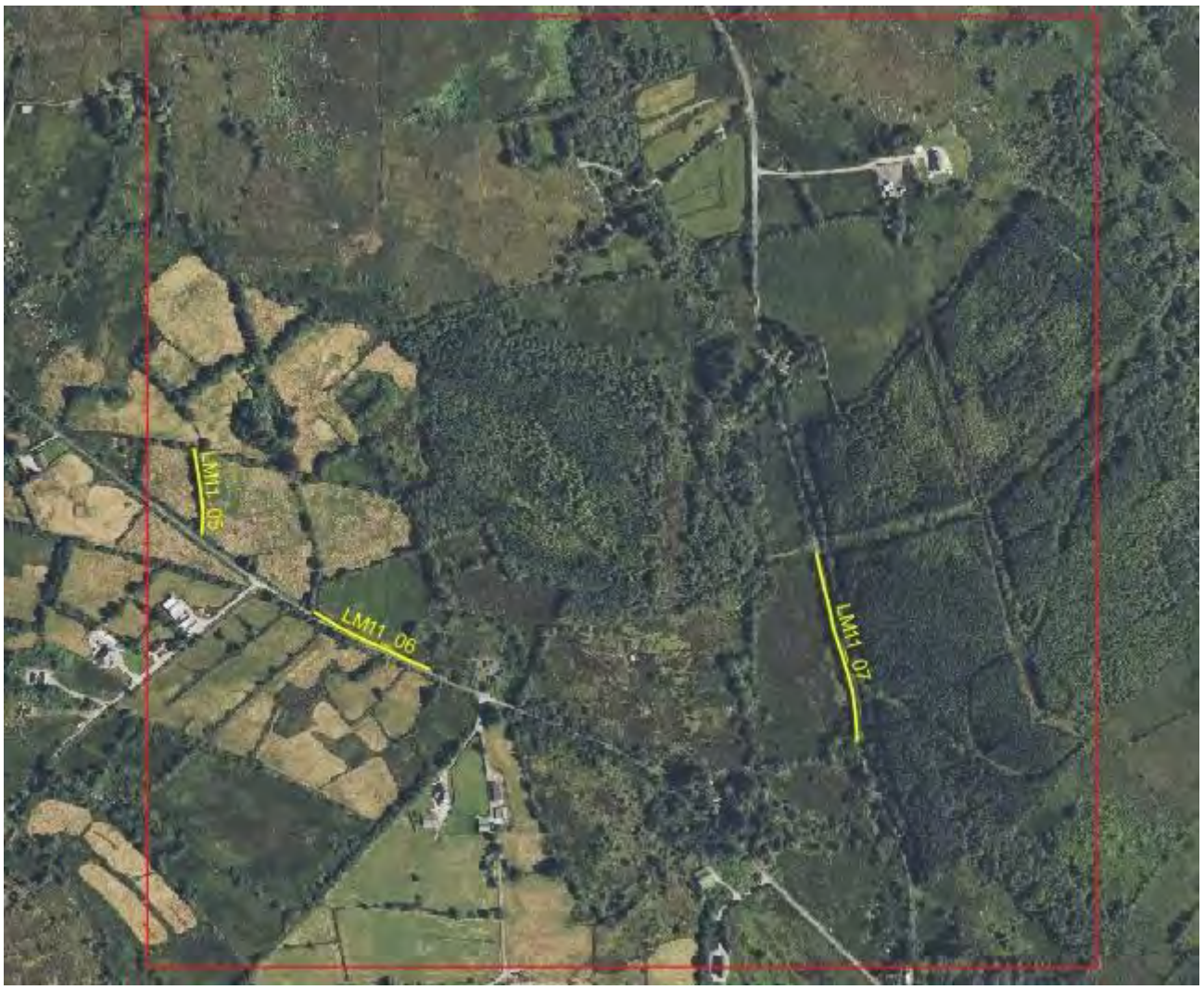

LM08_01
LM08_02
LM08_03
LM08_04
LM08_05
LM08_06
LM08_07
LM08_08
LM08_09
LM08_10

LM08


LM09_01
LM09_03
LM09_02
LM09_05c
LM09_07
LM09_06
LM09_08
LM09_09
LM09_10

LM09

LM10



LM11


LM12_02
LM12_03
LM12_05
LM12_04
LM12_06
LM12_07
LM12_08
LM12_09
LM12_10

LM12


LM13_01
LM13_02
LM13_03
LM13_04
LM13_05
LM13_06
LM13_07
LM13_08
LM13_09
LM13_10

LM13


LM14_01
LM14_02
LM14_03
LM14_04
LM14_05
LM14_06
LM14_07
LM14_08
LM14_09
LM14_10

LM14


LM15_02
LM15_03
LM15_04
LM15_05
LM15_06
LM15_07
LM15_08
LM15_09
LM15_10

LM15

LM16