East Galway Hedgerow Survey 2006

Report prepared for Galway County Council

Dr Janice Fuller
October 2006
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Abstract

Hedgerows are living field boundaries that have been a feature of the Irish landscape for some time. The enormous ecological, archaeological, cultural, agricultural and historical value of hedgerows is well-recognised despite the lack of scientific study of the hedgerow resource in Ireland to date. Hedgerows are currently under considerable threat from development, road schemes and agricultural intensification.

The aim of the hedgerow survey of east Galway was to determine the extent, structure, composition, condition and management status of hedgerows in this part of county Galway. A stratified sampling strategy was adopted to investigate hedgerows using a methodology that has been tried and tested in other county-wide surveys. The multivariate data obtained allows for a detailed analysis of the structural, historical, management and floristic characteristics of hedgerows.

The results indicate that East Galway has an extensive network of hedgerows with an estimated length of 22,256km. While there is a relatively diverse range of shrub and tree species found in hedgerows, only 14.7% of hedges sampled can be described as species-rich based on the floristic composition of the shrub layer. In general roadside hedgerows are more species-rich and therefore should be afforded a higher level of protection.

Five hedgerow ‘types’ were identified based on the floristic composition of the shrubby hedge layer. These included gorse-dominated hedges, species-poor hawthorn dominated hedges, hedges characterised by the presence of holly, hedges characterised by the presence of hazel and/or spindle, and hedges with a significant willow component. These hedgerow types roughly correspond to groups identified in other counties. Many of the hedgerows in east Galway appear to be largely unmanaged or are poorly managed, and without intervention will eventually become tree lines, thus changing their ecological value and agricultural function. The large and bushy structure of many of the hedges surveyed, however, undoubtedly leads to a high wildlife value.

The long-term sustainability of the hedgerow resource in east Galway is in question if appropriate hedgerow conservation and management strategies are not put in place. Several recommendations are made in relation to hedgerow conservation policy, hedgerow management, new planting and future research. The extensive network of hedgerows in east Galway is a huge asset to the county and a credit to the farmers who have been caretakers of this invaluable resource over the years. There is great potential for the enhancement of this network to increase its ecological value (particularly in relation to creating wildlife corridors and ecological networks), and agricultural value.
Acknowledgements

Special thanks to Marie Mannion (Heritage Officer, Galway County Council) for her strong commitment to and support of this project; Neil Foulkes and Anya Murray for helpful advice on their hedgerow survey methodology and data analysis; Heather Lally for her enthusiastic assistance with fieldwork; Brídín Feeney (IT Section of Galway County Council) for providing all the maps and digitising the hedgerow extent data.

Thanks also to Julie Fossitt, Elaine O’Riordain, Micheline Sheehy Skeffington, Tony Collins and Neil Goodwin for providing advice, comments and/or suggestions, and the many landowners who kindly granted permission to access their land. Joanne Reilly, Caroline Sullivan, Michelle Maher and Áine Costello also helped with fieldwork.

The Heritage Council funded the 2005 Hedgerow Survey of a section of East Galway, which is gratefully acknowledged.
1. Introduction

1.1 Aims and project rationale
The main aim of this project is to determine the extent, composition, structure, condition, and management status of the hedgerow resource in East Galway. The main objective is to use the information gathered to produce recommendations for hedgerow conservation and management, and for planting new hedgerows.

Efforts to conserve and appropriately manage the hedgerow resource in East Galway need to be based on an accurate and meaningful assessment of the current resource. To date there has been no detailed and comprehensive assessment of the hedgerows in Galway and therefore no baseline data to quantify the loss of hedgerows in recent times to make way for housing, road schemes and agricultural intensification. Hedgerow removal for one-off housing poses a major threat to the interconnectivity of wildlife habitats in the countryside. It also has a negative impact on the scenic appearance of rural landscapes and on the environment.

The National Biodiversity Plan (2002) recognises that hedgerows are a “prominent feature of the Irish countryside and provide important habitats for a variety of species”. The plan suggests that the overall goal for countryside management should be no net loss of the hedgerow resource. One of the actions in the plan is to “produce guidelines on hedgerows and biodiversity”. In order to manage the national hedgerow resource to ensure its long-term sustainability, a national survey of hedgerows is required. The development of a robust hedgerow methodology (Murray 2003, Foulkes and Murray in press) has greatly assisted efforts to evaluate the hedgerow resource in Ireland. Several counties have already been surveyed (Westmeath, Roscommon, Laois, Offaly, Longford, Kildare, Cavan and Leitrim) to date. The hedgerow survey of East Galway will contribute to the national inventory.

A hedgerow survey produces baseline information on the quantity, composition and condition of hedgerows in a defined area. This data can provide a useful tool for monitoring environmental and landscape change in a region. Recommendations for the future management of the hedgerow resource in can be made and the baseline data can be used to monitor the impact of any changes in management methods or strategies.

The data obtained can inform conservation and planning policies in relation to hedgerows and will provide information that contributes to local biodiversity plans. The data obtained can also compliment...
other studies of flora and/or fauna that are found in or interact with hedgerows e.g. birds, bats, badgers, woodland flora etc.

A hedgerow survey should raise awareness of the importance of hedgerows and how to manage this valuable resource. The survey results and conclusions should be of interest and use to a wide range of people and organisations: Local Authority planners, National Roads Authority, Road Engineers, Planners, Environmental Consultants, Department of Agriculture and Food, Teagasc, Farmers and Land owners, Educational Institutions, National Parks and Wildlife Service, ENGOs etc.

A county-wide hedgerow survey is an action of the County Galway Heritage Plan (2004 2008).

1.2 Value of hedgerows
Hedgerows are a prominent feature on the Irish landscape and help to form the local and regional character of the landscape. Field boundaries are a testament to the history of land use in an area and display evidence of local farming practice. Hedgerows are living boundaries.

Hedgerows have considerable nature conservation interest because they provide range of habitats for many plants and animals, especially those normally found in woodlands or woodland edges. Hedgerows also act as ecological networks linking important wildlife habitats across the countryside and wildlife corridors that permit wildlife to move through the landscape (Clements and Tofts 1992, Hegarty and Cooper 1994, Dawson 1994, Bickmore 2002, Hickie 2004). In the largely agricultural Irish landscape, hedgerows act as a haven for wildlife. The Countryside Bird Survey in Ireland found that of the 110 species regularly recorded, 55 use hedgerows in some capacity. Many small mammals (e.g. hedgehogs and badgers) and invertebrates also utilize the hedgerow resource (Pollard et al. 1974, Feehan 2003).

Attributes of hedgerows that are good for wildlife
From an ecological perspective there is no such thing as a perfect hedge because different species have different requirements. There are however a number of factors that seem to enhance hedge biodiversity. Age appears to be an important factor but there is probably not a linear relationship between age and diversity as was once thought (Hooper 1970). The longer a hedge is present on the landscape the more time there is for plants to become established and other organisms. A bank with dense undergrowth provides shelter for birds and mammals (Feehan 2003). A dense, bushy hedge provides shelter for vertebrates and appears to attract more robins, wrens, hedge sparrows and yellowhammers. Blackbirds and thrushes have a preference for taller but bushy hedges (Feehan 2003). The floristic diversity of
the hedgerow shrubs also influences the overall biodiversity. The more diverse the hedge layer, the wider range of wildlife a hedge can support.

Hedges provide shelter from wind for stock and crops (Pollard et al. 1974). They help prevent the spread of airborne disease; regulate water movement and help prevent flooding. Hedgerows also provide shelter and screening for housing and road users, and absorb road noise. Native hedgerows form excellent boundaries for single and clustered housing.

Hedgerows are part of Ireland’s ecological, cultural, historical and archaeological heritage and therefore should be valued and protected. Hedgerows are being cleared at an alarming rate to make way for one-off housing and road schemes across the country. They have also declined in some areas due to agricultural intensification.

1.3 Study area
Stone walls are a feature of the Galway countryside. Hedgerows are also a common sight, however, and are the dominant field boundary type in some areas. In general, landscapes of east Galway have a mosaic of stone walls and hedgerows growing along their length.

The study area (Figure 1.1), hereafter referred to as East Galway, is the half of the county that occurs east of Lough Corrib (Figure 1.1). This area is a largely low-lying, undulating landscape with no significant upland areas (apart from the Slieve Aughties in south Galway). The landscape is covered with grassland of varying quality, much of it relatively fertile improved grassland on well-drained lime-rich soils. This agricultural landscape is interrupted by several small and medium-sized raised bogs, some of which are afforested in parts and/or cutover. Small areas of mixed woodland occur in association with old demesnes and relatively recent coniferous plantations. The upland area in south Galway, the Slieve Aughties, is dominated by blanket bog and wet heath much of which has been afforested with conifers. There are several turloughs and lakes scattered throughout East Galway. Eskers are also a feature, particularly in the east and north-east of the study area.

Lough Corrib lies to the west of the study area; the River Shannon and the River Suck to the east; and Lough Derg to the south-east. The underlying bedrock for most of this area is Limestone and Carboniferous Limestone which is overlain with glacial drift. The Galway side of the Slieve Aughties are underlain for the most part with Old Red Sandstone. There are a couple of other small areas of Old Red Sandstone to the north and north-east of East Galway.
Figure 1.1 Study area: East Galway. The forty one 1x1km squares sampled in each of the ten kilometre squares sampled are shown. Squares filled in with blue were sampled in 2005 (1-16) and the rest were sampled in 2006 (17-41)
1.4 History of hedgerows on the landscape

Permanent enclosure or fencing of land was not a significant feature of the Irish landscape until relatively recently. Where necessary, such as tilled plots, movable fencing was used to enclose parcels of land (or more importantly to exclude animals) and then moved when no longer required. It was not until the late 17th century that the pace of land enclosure accelerated (Cabot 1999, Feehan 2003).

In late medieval times (mid 14th to the end of the 15th centuries), townlands became the fundamental unit of land tenure. They were bounded by banks and ditches which were sometimes planted with hedgerow shrubs or on which shrubs became established. The land within was largely unenclosed depending on the requirements or preferences of the landowner. As a result, townland boundaries often have larger banks and ditches than other hedgerows, and, because of their age, may contain a more diverse flora (Feehan 2003). Current townland boundaries were regularised by the first Ordnance Survey carried out in Galway in 1843.

The enclosure of land in Ireland increased in popularity with the Agricultural Revolution that started in the early 18th C. In fact, landowners in the 18th century Ireland were obliged by law to erect fences around their holdings (Feehan 2003, Hickie 2004). In the west of Ireland, land enclosure progressed more slowly and was confined to the larger estates for some time (Hickie 2004). In Galway, enclosure was achieved in many areas by building stone walls, as well as planting hedgerows. Other hedgerows probably established opportunistically along stone walls.

Roadside hedgerows were originally planted from the late 1700’s to the early 1800s when our modern road network was beginning to take shape (Hickie 2004).

Agricultural intensification led to the widespread removal of hedgerows on many farms in Ireland in the 1960s and 1970s. Although hedgerow removal was probably quite extensive in Ireland, particularly on the more productive land in the east of the country, the scale of the hedgerow loss doesn’t appear to have been anything like the devastation of the hedgerow resource in Britain. Unfortunately there is no survey data to quantify the extent of loss in Ireland but many of the field boundaries that appear on the original edition of the Ordnance Survey maps for county Galway are the same as those present on the landscape today.

More recently there has been a European Union-lead move to promote environmentally friendly farming and the Department of Agriculture introduced the Rural Environmental Protection Scheme (REPS) in the early 1990s. REPS has evolved over time, with feedback from a wide range of stakeholders, and the
current scheme is called REPS3. Measure 5 of REPS3 sets out various management requirements for farmers that sign up to the scheme, including: retaining and maintaining all hedgerows. Measure 5 includes various options such as hedgerow rejuvenation and new hedgerow planting to encourage land farmers to improve the viability of the hedgerow resource on their land.
2. Methodology

2.1 Introduction
The hedgerow survey methodology developed by Anya Murray and Neil Foulkes was employed for the survey in East Galway (Murray 2003, Murray and Foulkes In prep). The same methodology was used in a survey of hedgerows in a section of East Galway in 2005 (Fuller 2005) and the results from that survey will be combined with this year’s survey data. The hedgerow survey methodology has also been used in surveys of counties Roscommon, Westmeath, Laois, Offaly (Foulkes and Murray 2005a, b, c, d), Leitrim, Kildare, Longford and Cavan.

The aim of the methodology is to determine the extent, character, condition and management status of hedgerows within a defined area by recording a wide variety of relevant features. It is designed to allow for statistical and multivariate analysis of the many hedgerow parameters recorded.

For the purposes of this study, a hedgerow is defined as:

| Linear strips of woody plants with a shrubby growth form that cover >25% of the length of a field or property boundary. They often have associated banks, walls, ditches (drains), or trees (Cooper et al. 1997, Fossitt 2000, Murray 2003). |

2.2 Sampling strategy
The study area, East Galway is composed of 41 ten kilometre National Grid squares (Figure 1.1). Sixteen of these ten kilometre squares were surveyed in 2005 by Janice Fuller (in a study funded by the Heritage Council). Hedgerows within a 1x1km square in the south-western corner of each ten kilometre square were sampled (these squares were also sampled by the National Parks and Wildlife Service for badgers, Smal 1994; and in the Countryside Bird Survey).

Within each 1x1km sample square, 10 hedgerows were selected randomly for investigation. Randomly generated points were marked on a transparent overlay and placed over the aerial photograph of the 1x1km square. The hedge nearest to each point on the overlay was selected for detailed investigation. If there was no hedgerow within a fixed radius (equating to c. 175m) of the randomly selected point, no hedgerow was sampled for that point. In some cases, therefore, less than 10 hedges were sampled in a square. This was to ensure that the sample from a particular square reflected the situation accurately i.e. a lower density of hedgerows.
A length of hedgerow was generally taken as one side of a field. End points were identified as the junction between adjacent sides of a field, or where three or more hedge lengths meet. The exact location (ten figure grid reference) of the two ends of each hedgerow sampled was determined using GPS (Geko Garmin 201). A digital photographic record was made of all the hedgerows surveyed.

Thirty three of the 41 ten kilometre sample squares are full squares and eight are partial squares (i.e. some of the square is in a neighbouring county or taken up by a large lake). Three squares (No.s 1, 36 and 39) had no hedgerows.

Where possible, the landowners were asked for permission to cross their land. This was always granted with the exception of one single hedgerow.

2.3 Maps and aerial photographs
Prior to commencing fieldwork, for every 1x1km square sampled, ortho-rectified colour aerial photographs (taken in 2000), 6” OS maps (second series) and the corresponding vector maps were obtained from the County Council (See examples in Appendix 1).

2.4 Recording hedgerow extent
The extent of hedges within each 1x1km square sampled was recorded by visual inspection in the field of all linear features and field boundaries apparent on the relevant aerial photograph or vector map. Field boundaries were marked on the 6”OS map with a solid red line for hedgerow and a broken red line for remnant hedgerows. Non-hedgerows are noted with a solid green line to prevent duplication of investigation. These include vegetated banks, vegetated drains, fence lines, and small woodland strips. Where clear and extensive gaps occurred in hedges, a green line was used to mark the gap section. Stone walls were noted with a blue line and stone walls with shrubs, where the shrubs cover <25% of the boundary length (i.e. not defined as a hedgerow), were noted with a dashed blue line.

Hedgerow length in each square sampled was later digitised by Brídín Feeney in Galway County Council IT Department, and the total length or extent of hedgerow in all the squares was estimated.

Based on the experience of this study, hedgerow extent cannot be estimated accurately from aerial photos. Field boundaries dominated by bramble or tree lines can easily be mistaken as hedgerows from aerial photos. Hedgerows that are trimmed very low and hard might appear like stone walls on an aerial photo and in the Galway context it was obviously important to avoid this problem. Hedgerow extent is,
therefore, best recorded in the field while recording the structural and compositional features of the hedgerows being sampled in detail.

2.5 Recording structural features of hedgerows
Various structural characteristics and management features were recorded for each of the 10 hedgerows sampled within each square. Each selected hedge was examined in detail along its whole length and the parameters recorded on a Structural Recording Sheet (Appendix 2). Recordings were made in 24 categories and grouped as follows:

**Context**
The surrounding land use or type of farm is recorded along with adjacent land use habitat categories and links with other habitats, if any. Habitats are classified according to the Heritage Councils habitat classification scheme (Fossitt 2000). Potential indicators of hedgerow antiquity (townland vs infill, linear or non-linear in outline) are also noted.

**Construction**
The basic construction of the hedge relates to the linearity of the woody shrubs (single, double or random line), the presence or absence of features such as banks, walls or drains etc.

**Structure/ condition**
Structure relates to the physical dimensions of the hedge (height, width, profile, percentage of gaps etc.). Condition is evaluated in relation to the vigour of the hedgerow shrubs, degree of fruiting, presence of hedgerows trees etc.

**Management**
This includes the type and method of hedge management, past and present. The nature of any fencing present is also recorded.

Target notes were used to record any additional features of the hedgerows sampled and any variability in any of the characters was also noted.

2.6 Recording floristic composition of hedgerows
Hedgerow studies in Britain have concluded that a randomly selected 30m strip is sufficiently representative of floristic composition of woody species (e.g. Clements and Toffs 1992, Bickmore 2002). Results from hedgerow surveys in Counties Westmeath and Roscommon (Foulkes and Murray 2005a &
b), which used two 30m strips indicated that one 30m is not sufficiently representative in Irish conditions. This is because Irish hedges tend to show high degrees of variation in species composition from one end of a hedge to the other (Foulkes and Murray 2005c).

Foulkes and Murray (2005c, d) therefore recommend recording woody species along two randomly placed 30 metre strips. All shrub species present within the length of each 30 metre strip are allocated an appropriate Domin value (See Appendix 2 floristic recording sheet; Kent and Coker 1994). Gaps in the hedge layer, and woody climbers, including bramble, ivy, wild rose and honeysuckle, are also given Domin values.

The shrub (hedge) layer includes shrubs such as thorns, woody climbers and tree species that have a shrubby growth form due to management such as cutting. If the structure is consistent with both tree and shrub species, like ash, can be recorded in the tree and shrub layer simultaneously. Where an additional shrub species was seen in a hedge but not included in the 30m strips, its presence was noted in the target notes.

Hedgerow trees are any trees within the hedge that have been deliberately or incidentally allowed to grow distinct from the hedge layer. All tree species (not individuals) in each hedge were recorded simply as present. Tree species recordings were based on the whole length of the hedge.

2.7 Data analysis
The data collected was entered into an Excel spreadsheet for subsequent analysis. A cluster analysis method, Twinspan (using the computer programme PcOrd, McCune and Mefford 1999), was used to help identify hedgerow ‘types’ based solely on their species composition.
3. Results

Results of the 2005 and 2006 hedgerow surveys are presented here.

3.1 Extent of hedgerows

The estimates of hedgerow and remnant hedgerow extent in the samples squares are listed in Table 3.1.

<table>
<thead>
<tr>
<th>OS Grid Reference</th>
<th>Square reference</th>
<th>Hedgerow Length (km)</th>
<th>Area (km²)</th>
<th>Density (km/km²)</th>
<th>Remnant Length (km)</th>
</tr>
</thead>
<tbody>
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<td>M30 40</td>
<td>GY31</td>
<td>5.99</td>
<td>1.00</td>
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<td>GY15</td>
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<td>1.00</td>
<td>2.52</td>
<td>0.00</td>
</tr>
<tr>
<td>M60 30</td>
<td>GY11</td>
<td>6.91</td>
<td>1.00</td>
<td>6.91</td>
<td>0.26</td>
</tr>
<tr>
<td>M60 40</td>
<td>GY07</td>
<td>5.76</td>
<td>1.00</td>
<td>5.76</td>
<td>0.13</td>
</tr>
<tr>
<td>M60 50</td>
<td>GY03</td>
<td>0.23</td>
<td>1.00</td>
<td>0.23</td>
<td>0.00</td>
</tr>
<tr>
<td>M60 60</td>
<td>GY26</td>
<td>1.80</td>
<td>0.89</td>
<td>2.03</td>
<td>1.45</td>
</tr>
<tr>
<td>M60 70</td>
<td>GY21</td>
<td>2.47</td>
<td>1.00</td>
<td>2.47</td>
<td>0.11</td>
</tr>
<tr>
<td>M60 80</td>
<td>GY17</td>
<td>9.53</td>
<td>1.00</td>
<td>9.57</td>
<td>0.13</td>
</tr>
<tr>
<td>M70 10</td>
<td>GY40</td>
<td>0.60</td>
<td>1.00</td>
<td>0.60</td>
<td>0.25</td>
</tr>
<tr>
<td>M70 20</td>
<td>GY16</td>
<td>7.30</td>
<td>1.00</td>
<td>7.30</td>
<td>0.14</td>
</tr>
<tr>
<td>M70 30</td>
<td>GY12</td>
<td>4.07</td>
<td>1.00</td>
<td>4.07</td>
<td>0.17</td>
</tr>
<tr>
<td>M70 40</td>
<td>GY08</td>
<td>1.98</td>
<td>1.00</td>
<td>1.98</td>
<td>0.00</td>
</tr>
<tr>
<td>M70 50</td>
<td>GY04</td>
<td>3.94</td>
<td>1.00</td>
<td>3.94</td>
<td>0.00</td>
</tr>
<tr>
<td>M70 60</td>
<td>GY27</td>
<td>10.28</td>
<td>1.00</td>
<td>10.28</td>
<td>0.00</td>
</tr>
<tr>
<td>M70 70</td>
<td>GY22</td>
<td>8.40</td>
<td>1.00</td>
<td>8.40</td>
<td>0.38</td>
</tr>
<tr>
<td>M70 80</td>
<td>GY18</td>
<td>8.97</td>
<td>0.90</td>
<td>9.96</td>
<td>0.28</td>
</tr>
<tr>
<td>M80 10</td>
<td>GY41</td>
<td>0.41</td>
<td>0.03</td>
<td>13.66</td>
<td>0.00</td>
</tr>
<tr>
<td>M80 20</td>
<td>GY35</td>
<td>11.28</td>
<td>1.00</td>
<td>11.28</td>
<td>0.06</td>
</tr>
<tr>
<td>M80 30</td>
<td>GY33</td>
<td>7.70</td>
<td>1.00</td>
<td>7.70</td>
<td>0.48</td>
</tr>
<tr>
<td>M80 40</td>
<td>GY32</td>
<td>3.08</td>
<td>1.00</td>
<td>3.08</td>
<td>0.80</td>
</tr>
<tr>
<td>M80 50</td>
<td>GY30</td>
<td>10.27</td>
<td>1.00</td>
<td>10.27</td>
<td>0.95</td>
</tr>
<tr>
<td>M80 60</td>
<td>GY28</td>
<td>13.34</td>
<td>0.94</td>
<td>14.26</td>
<td>0.15</td>
</tr>
<tr>
<td>M90 20</td>
<td>GY36</td>
<td>0.00</td>
<td>0.18</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>M90 30</td>
<td>GY34</td>
<td>5.07</td>
<td>1.00</td>
<td>5.07</td>
<td>1.72</td>
</tr>
</tbody>
</table>

**Totals** 218.50 38.28 238.50 10.08
The total area surveyed was 38.28 km$^2$ which is almost 1% of the total area of East Galway (area 3962 km$^2$). Assuming that the squares sampled are representative of the east of the county as a whole, it can be estimated that East Galway has a hedgerow length of 22,526 km. The landscape of west Galway is quite different to that in the east of the county and therefore the figures estimated in this survey cannot be applied to the county as a whole. This extent of hedgerows is a considerable resource for East Galway.

The corresponding figures for remnant hedgerows in East Galway would give an estimated length of remnant hedgerow of just 1039 km.

3.2 Species composition of hedgerows
The species composition of hedgerows is analysed and discussed in relation to the two woody layers, the shrub layer which forms the main structure of the hedge, and the tree layer.

3.2.1 Shrub layer

a) Shrubs: The frequency of occurrence and abundance of each species in the shrub layer is presented in Figure 3.1 and Table 3.2. Frequency of occurrence is the frequency with which each species was recorded in one or other of the two 30 m strips sampled. Mean abundance represents the cover of each species within the 30 m strips. The mean ‘Domin’ abundance level is an average of the Domin figure estimated for each species in each 30 m strip.

Twenty seven species were recorded in the hedges sampled. Hawthorn and blackthorn are the most frequently occurring shrubs in the hedges sampled and have the highest percentage cover in East Galway hedges. As similar situation is recorded in data from the midland counties, Roscommon, Westmeath, Laois and Offaly (Foulkes and Murray 2005 a, b, c, d).

Other commonly occurring species in the shrub layer in East Galway include elder, gorse, ash (not in tree form), holly, hazel and privet. Gorse and hazel tend to be relatively abundant in the hedges in which they occur whereas elder, ash, holly and privet are not usually dominant. Elder is also commonly occurring species in the midland counties and to a lesser extent gorse. The most frequency occurring non-native shrub in East Galway is privet at 10% of hedges sampled. This species appears to occur much more frequently in the other counties surveyed (Foulkes and Murray 2005 a, b, c, d).
Table 3.2 Frequency of species occurrence in the shrub layer and mean abundance

<table>
<thead>
<tr>
<th>Common name</th>
<th>Latin name</th>
<th>Frequency of Occurrence (%)</th>
<th>Mean Abundance (Domin Scale 1-10)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hawthorn</td>
<td>Crataegus monogyna</td>
<td>90.3</td>
<td>7</td>
</tr>
<tr>
<td>Blackthorn</td>
<td>Prunus spinosa</td>
<td>55.3</td>
<td>6</td>
</tr>
<tr>
<td>Elder</td>
<td>Sambucus nigra</td>
<td>26.5</td>
<td>5</td>
</tr>
<tr>
<td>Gorse</td>
<td>Ulex europaeus</td>
<td>22.8</td>
<td>7</td>
</tr>
<tr>
<td>Ash</td>
<td>Fraxinus excelsior</td>
<td>15.2</td>
<td>5</td>
</tr>
<tr>
<td>Holly</td>
<td>Ilex aquifolium</td>
<td>12.0</td>
<td>5</td>
</tr>
<tr>
<td>Hazel</td>
<td>Corylus avellana</td>
<td>11.1</td>
<td>6</td>
</tr>
<tr>
<td>Privet**</td>
<td>Ligustrum vulgare</td>
<td>10.8</td>
<td>5</td>
</tr>
<tr>
<td>Spindle</td>
<td>Euonymous europaeus</td>
<td>7.1</td>
<td>5</td>
</tr>
<tr>
<td>Willow</td>
<td>Salix spp.</td>
<td>7.1</td>
<td>6</td>
</tr>
<tr>
<td>Grey willow</td>
<td>Salix cinerea</td>
<td>6.5</td>
<td>6</td>
</tr>
<tr>
<td>Sycamore*</td>
<td>Acer pseudoplatanus</td>
<td>3.9</td>
<td>5</td>
</tr>
<tr>
<td>Crab apple</td>
<td>Malus sylvestris</td>
<td>3.7</td>
<td>5</td>
</tr>
<tr>
<td>Snowberry*</td>
<td>Symphoricarpus albus</td>
<td>2.8</td>
<td>6</td>
</tr>
<tr>
<td>Guelder rose</td>
<td>Viburnum opulus</td>
<td>1.6</td>
<td>4</td>
</tr>
<tr>
<td>Birch</td>
<td>Betula pendula</td>
<td>1.2</td>
<td>5</td>
</tr>
<tr>
<td>Wild plum*</td>
<td>Prunus domestica</td>
<td>1.2</td>
<td>6</td>
</tr>
<tr>
<td>Goat willow</td>
<td>Salix caprea</td>
<td>1.2</td>
<td>5</td>
</tr>
<tr>
<td>Elm</td>
<td>Ulmus glabra</td>
<td>1.2</td>
<td>4</td>
</tr>
<tr>
<td>Common osier*</td>
<td>Salix viminalis</td>
<td>0.9</td>
<td>5</td>
</tr>
<tr>
<td>Dwarf box*</td>
<td>Lonicera nitida</td>
<td>0.7</td>
<td>6</td>
</tr>
<tr>
<td>White willow*</td>
<td>Salix alba</td>
<td>0.7</td>
<td>4</td>
</tr>
<tr>
<td>Beech*</td>
<td>Fagus sylvatica</td>
<td>0.5</td>
<td>4</td>
</tr>
<tr>
<td>Wild cherry</td>
<td>Prunus avium</td>
<td>0.5</td>
<td>7</td>
</tr>
<tr>
<td>Gooseberry*</td>
<td>Ribes uva-crispa</td>
<td>0.5</td>
<td>4</td>
</tr>
<tr>
<td>Yew</td>
<td>Taxus baccata</td>
<td>0.5</td>
<td>4</td>
</tr>
<tr>
<td>Broom</td>
<td>Cytisus scoparius</td>
<td>0.2</td>
<td>4</td>
</tr>
</tbody>
</table>

* Non-native; ** Dubious native

Figure 3.1 Percentage occurrence of species in shrub layer of hedgerows sampled
b) Woody climbers

The frequency with which various woody climbers were recorded in the hedges sampled is presented in Table 3.3. Bramble was recorded in 90% of the hedges sampled. Ivy was also commonly found growing on the hedge shrubs (64%). However, it was usually occurring at low abundances and therefore does not pose a threat to the stability of the hedgerow.

![Abundant honeysuckle in a roadside hedgerow](image)

Table 3.3 Percentage frequency of woody climbers in hedgerows sampled

<table>
<thead>
<tr>
<th>Species</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bramble (<em>Rubus fruticosus</em>)</td>
<td>90</td>
</tr>
<tr>
<td>Ivy (<em>Hedera helix</em>)</td>
<td>64</td>
</tr>
<tr>
<td>Wild rose (<em>Rosa canina</em>)</td>
<td>24</td>
</tr>
<tr>
<td>Honeysuckle (<em>Lonicera periclymenum</em>)</td>
<td>13</td>
</tr>
</tbody>
</table>

The frequency of occurrence of bramble in East Galway is similar to that recorded in Laois and Offaly but these latter counties have far higher levels of wild rose and honeysuckle (Foulkes and Murray 2005 c, d).

3.2.2 Tree layer

Hedgerows trees are any trees within the hedge that have been deliberately or incidentally allow to grow distinct from the shrub layer of the hedge. Twenty one tree species were recorded in the hedges sampled
in the survey, seventeen of which are native species (Figure 3.2). The most commonly occurring tree by far is ash (49%). Other relatively common species include hawthorn (in tree form), sycamore and willow. Similar results were recorded in surveys of other counties (Foulkes and Murray 2005 a, b, c, d).

Hedgerow with a large ash tree

Tree species richness in East Galway is generally poor with the tree layer dominated usually by one species.
3.3 Species richness of hedgerows

Species richness is defined here as the number of shrub species found in a 30m sample strip of hedge. Where two sample strips were surveyed (as was case for the vast majority of the hedges sampled), an estimate of species richness was based on the average number of species from the two strips for each sampled hedge.

To date there are no agreed criteria for deciding what is a species rich hedge in Ireland. Foulkes and Murray (2005 a, b, c, d) based their assessment for species richness on the British definition, which considers a species rich hedge to be one that contains five or more native woody species on average in a 30m strip. In northern England, upland Wales and Scotland, the presence of four or more native species in the shrub layer qualifies as hedge as being species rich.

Due to the fact that Ireland’s native flora is poorer than that in Britain, Foulkes and Murray (2005 a, b, c and d) consider that four or more species on average in a 30m strip of hedgerow is species-rich in an Irish context. Only native species based on Webb et al. (1997) are included in the estimation of native species richness.

A breakdown of the percentage of hedgerows with different levels of native species richness found in the hedges sampled is shown in Figure 3.3. An analysis of species richness based on all the species recorded...
(including non-natives) is given in Figure 3.4. Only 14.7% of the hedgerows sampled are species rich (based on the definition given above). If all the species recorded are included in the analysis (i.e. including non-natives), this figure would rise to 18.3%.

A stretch of species rich hedgerow
Figure 3.3 Percentage breakdown of (average) number of native hedgerow species

Figure 3.4 Percentage breakdown of (average) number of hedgerow species (all species)
A further analysis of the species richness data is provided in Table 3.4.

**Table 3.4** Analysis of species richness data in 30m strips in East Galway. Data for Laois, Offaly, and Westmeath (Foulkes and Murray a, b, c, d) are also included for comparison.

<table>
<thead>
<tr>
<th>Species richness criteria in 30m sample strips</th>
<th>% of samples in East Co. Galway</th>
<th>% of samples in Co. Laois</th>
<th>% of samples in Co. Offaly</th>
<th>% of samples in Co. Westmeath</th>
<th>% of samples in Co. Roscommon</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 or more native species in at least 1 strip</td>
<td>21.6</td>
<td>59.1</td>
<td>56.9</td>
<td>20.5</td>
<td>19.3</td>
</tr>
<tr>
<td>4 or more (all) species in at least 1 strip</td>
<td>26.1</td>
<td>69.2</td>
<td>69.2</td>
<td>38.2</td>
<td>29.5</td>
</tr>
<tr>
<td>Average of 4 or more (native) species*</td>
<td>14.7</td>
<td>44.7</td>
<td>31.5</td>
<td>5.1</td>
<td>5.4</td>
</tr>
<tr>
<td>Average of 4 or more (all) species</td>
<td>18.3</td>
<td>52.5</td>
<td>49.2</td>
<td>22.8</td>
<td>14.5</td>
</tr>
<tr>
<td>Combined total of 4 or more native species in the two 30m strips</td>
<td>36%</td>
<td>66.0</td>
<td>66.9</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Definition of ‘species-rich’ hedge as described above.

These results show that the data from East Galway are comparable with Counties Westmeath and Roscommon. Counties Laois and Offaly appear to have exceptionally diverse hedgerows. The hedges in East Galway seem to be more species-rich that Westmeath and Roscommon, however, based on the definition of an average of 4 or more native species in a 30m strip. The hedges in East Galway appear to be a little more consistent in species composition along their length than other counties but the results show that there is variability in species composition of individual hedgerows.

A comparison of average species richness in the five counties in provided in Table 3.5. Again these results indicate that the hedgerows in Laois and Offaly are more diverse than East Galway which appears to be on a par with counties Westmeath and Roscommon.
Table 3.5 Comparison of Mean Species Richness Statistics for East Galway with midland counties (data from Foulkes and Murray a, b, c, d).

<table>
<thead>
<tr>
<th></th>
<th>East Galway</th>
<th>Laois</th>
<th>Offaly</th>
<th>Westmeath</th>
<th>Roscommon</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean Species</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Richness (Native)</td>
<td>2.6 (Std 1.0)</td>
<td>3.56</td>
<td>3.25</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean Species</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Richness (All)</td>
<td>2.8 (Std 1.2)</td>
<td>4.00</td>
<td>3.81</td>
<td>2.5</td>
<td>2.8</td>
</tr>
<tr>
<td>Mean Combined</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Native Total</td>
<td>3.2 (Std 1.4)</td>
<td>4.45</td>
<td>4.09</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean Combined</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total of All</td>
<td>3.5 (Std 1.7)</td>
<td>5.10</td>
<td>4.92</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Species (two 30m strips)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Relationship of individual species to overall species richness

It is interesting to examine the relationship between the presence of individual species and the overall species richness of the hedgerows in which they occur. The overall average species number (based on all the species recorded including non-natives) is 2.8. By looking at the mean species number of the hedgerows in which individual species occur (in at least one of the two 30m strips sampled), it is possible to determine which species tend to occur in species rich hedgerows and which are often associated with species-poor hedges.

Table 3.6 Relationship between species occurrence and species richness (based on all species). Overall mean species number (all species) is 2.8.

<table>
<thead>
<tr>
<th>Hedges containing</th>
<th>Mean species no.</th>
<th>Mean frequency (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crab apple</td>
<td>5.50</td>
<td>3.7</td>
</tr>
<tr>
<td>Sycamore</td>
<td>5.00</td>
<td>3.9</td>
</tr>
<tr>
<td>Snowberry</td>
<td>5.00</td>
<td>2.8</td>
</tr>
<tr>
<td>Guelder rose</td>
<td>4.50</td>
<td>1.6</td>
</tr>
<tr>
<td>Hazel</td>
<td>4.06</td>
<td>11.1</td>
</tr>
<tr>
<td>Holly</td>
<td>4.00</td>
<td>12</td>
</tr>
<tr>
<td>Privet</td>
<td>3.96</td>
<td>10.8</td>
</tr>
<tr>
<td>Spindle</td>
<td>3.96</td>
<td>7.1</td>
</tr>
<tr>
<td>Ash</td>
<td>3.60</td>
<td>15.2</td>
</tr>
<tr>
<td>Grey willow</td>
<td>3.50</td>
<td>6.5</td>
</tr>
<tr>
<td>Elder</td>
<td>3.35</td>
<td>26.5</td>
</tr>
<tr>
<td>Willow</td>
<td>3.22</td>
<td>7.1</td>
</tr>
<tr>
<td>Blackthorn</td>
<td>2.82</td>
<td>55.3</td>
</tr>
<tr>
<td>Hawthorn</td>
<td>2.81</td>
<td>90.3</td>
</tr>
<tr>
<td>Gorse</td>
<td>2.72</td>
<td>22.8</td>
</tr>
</tbody>
</table>
Crab apple was only recorded in less than 4% of the hedgerows sampled, but the hedges in which it did occur are species rich. Interestingly, two non-native species, sycamore and snowberry, also seem to occur in diverse hedges. Hazel and Holly are more common species that also appear to be associated with species-poor rich hedgerows. Hawthorn, gorse and blackthorn appear to be regularly associated with relatively species-rich hedges. These results are similar to those obtained in Laois and Offaly (Foulkes and Murray 2005 c&d).

Relationship between hedgerow history and species richness

88% of hedgerows sampled were infill hedges whereas only 10% were townland boundaries. 30% of all hedgerows sampled were roadside hedges (mostly infill hedges). Results from other counties (Foulkes and Murray a, b, c, d; Condon and Jarvis 1989) have generally found that townland boundary and roadside hedgerows are more species rich than other hedgerows. In the Galway survey, it appears that townland boundaries are no more species rich than other hedgerows. Only 10% of the hedges sampled, however, were townland boundaries and therefore it is difficult to draw any conclusions from these data. A couple of the townland hedges sampled had the typical structural characteristics of a townland boundary (large bank) and were quite diverse (pers. obs).

Table 3.7 Comparison of Mean Species Richness in different hedgerow types

<table>
<thead>
<tr>
<th></th>
<th>East Galway</th>
<th>Laois</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Average Species Richness (All)</td>
<td>Average Species Richness (Native)</td>
<td>Average Species Richness (All)</td>
<td>Average Species Richness (Native)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>All hedges</td>
<td>2.8</td>
<td>2.6</td>
<td>4.0</td>
<td>3.56</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Infill hedges</td>
<td>2.8</td>
<td>2.6</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Townland boundary hedges</td>
<td>2.8</td>
<td>2.6</td>
<td>4.53</td>
<td>4.06</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Infill roadside hedges</td>
<td>3.1</td>
<td>2.8</td>
<td>4.73</td>
<td>3.84</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Distribution of species rich hedgerows

Overall it appears that the proportion of species-rich hedgerows in East Galway is relatively low (14.7%). An examination of the distribution of species hedgerows in East Galway indicates that they are more commonly found in the north-east of the county (Figure 3.5). Species-rich hedges generally not associated with stone walls but with banks where the hedge was probably planted. Many hedges along stone walls may have arisen opportunistically and not be the result of planting.
Figure 3.5 Distribution of species rich hedgerows in East Galway (see Figure 1.1 for map). The 1x1km sample square is shown in the bottom left hand corner of each 10x10km square. Three squares had no hedgerows: 1, 36, 39.
3.4 Floristic classification of hedgerows

All the hedgerows sampled were classified into five hedgerow ‘types’ based on the floristic composition of the shrub layer.

**Group 1: Gorse-dominated hedges**

Hedges in this group are dominated by gorse. Willow can also be abundant; hawthorn and elder are often present. These hedgerows were commonly found in areas with marginal soils, usually acid and often a higher elevations.

![Gorse dominated hedgerow](image)

**Group 2: Species-poor hawthorn hedges**

This variable group is characterized by hawthorn-dominated hedges. In some cases, the hedges are very species poor with maybe one other species such as blackthorn or elder. Ash (cut to form the shrub layer), privet or gorse may also be found. The mean species number (all species) for this group is 2.4.

**Group 3: Hedges characterized by the presence of holly**

The hedges in this group are generally made up of hawthorn, blackthorn, elder, ash and/or privet. They are differentiated by the presence of holly and the fact that they tend to be more species rich than Group 2 hedges; mean species number (all species) 4.4.
Group 4: Hedges characterized by the presence of hazel and/or spindle
These hedges are similar to Group 3 but tend to include hazel and/or spindle and are generally slightly less species rich. Mean species number (all species) is 3.8. Holly is occasionally also present at low abundances.

Group 5: Willow-dominated hedgerows on wet ground
Hedgerows in this group tend to be dominated by willow species and to a lesser extent, hawthorn. Gorse, blackthorn and privet may also be present. Mean species number (all species) is 3.3.

Structural characteristics of the hedgerow groups
The five hedgerow groups or types were determined based solely on species composition. It is interesting to examine the structural characteristics associated with each group and examine whether there are any determining factors.

Group 1: Gorse-dominated hedges
These hedges tend to be gappy with few or no trees along their length. Many of the gorse hedges had drains associated with them as they were often on poorly-drained or marginal ground. Gorse doesn’t like growing in wet soil but the presence of a drain obviously allows it to survive.

Group 2: Species-poor hawthorn hedges
These hedges were predominantly infill hedgerows that are mostly associated with stone walls. The most species-poor hedgerows in this group are single-species hawthorn hedges that probably arose opportunistically along stone walls. Blackthorn is often also present and occasionally elder. Trees, mainly ash, are occasionally found in this group of hedges but less so with the more species-poor hedgerows. The group 2 hedges are probably relatively recent in origin.

Group 3: Hedges characterized by the presence of holly
These hedges are the most species-rich of the hedgerows sampled in the survey. They are usually associated with a medium-sized bank, small to medium drains and often have trees.

Group 4: Hedges characterized by the presence of hazel and/or spindle
The hedges in this group are less diverse than Group 3 but are also mostly associated with medium-sized banks. They also often have trees but not usually drains.
Group 5: Willow-dominated hedgerows on wet ground
Hedges in this group tend not to have any trees and are usually associated with a drain or watercourse. They are often associated with semi-natural habitats (e.g. peatland) on acidic and wet soils.

Frequency of occurrence of hedgerow types (groups) in East Galway
The percentages of hedgerows sampled that were classified in the various groups are presented in Table 3.8. By far the most commonly occurring hedgerow type or group is the Species-poor hawthorn group (Group 2).

Table 3.8: The percentage of hedgerows sampled in each of the hedgerows types identified.

<table>
<thead>
<tr>
<th>Hedgerow type (Group)</th>
<th>Percentage of hedgerows sampled (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Gorse-dominated hedges</td>
<td>8</td>
</tr>
<tr>
<td>2. Species poor hawthorn hedges</td>
<td>61</td>
</tr>
<tr>
<td>3. Hedgerows characterized by the presence of holly</td>
<td>9</td>
</tr>
<tr>
<td>4. Hedgerows characterized by the presence of hazel and/or spindle</td>
<td>19</td>
</tr>
<tr>
<td>5. Willow-dominated hedges on wet ground</td>
<td>3</td>
</tr>
</tbody>
</table>

Geographical distribution of group types
There is a complicated relationship between the groups identified and their geographical distribution (Figure 3.6). The most common type, Group 2, occurs throughout the study area while gorse-dominated hedges (Group 1) mainly occurs in the north and east. The species-rich type (Group 3) mainly occurs in the eastern half of East Galway while Group 4 appears to occur throughout. Only a few hedges fall into the final category, Group 5.

Relationship between group classification, hedge history and species richness
The largest group in terms of number of hedges, is Group 2 (species-poor hawthorn hedges). This group also contains the largest number of roadside and townland boundary hedges. Species-rich hedges appear to be concentrated in Group 3 (hedges characterised by the presence of holly) and Group 4 (hedges characterised by the presence of hazel and/or spindle).
Group 1: Gorse dominated
Group 2: Hawthorn dominated
Group 3: Characterised by presence of holly
Group 4: Characterised by presence of hazel and/or spindle
Group 5: Willow/dominated

**Figure 3.6** Distribution of hedgerow groups in East Galway. The 1x1km sample square is shown in the bottom left hand corner of each 10x10km square. Three squares had no hedgerows: 1, 36, 39.
Figure 3.7 Percentage of hedges sampled in the different floristic groups identified. The percentage occurrence of roadside and townland boundary hedges, and species rich hedges, in the various groups is also shown.

3.5 General ecological, historical and land-use context of hedgerows

The context in which hedgerows occur in terms of land-use and links to semi-natural or natural habitats useful for determining any association with particular types of land-use or farming, and the ecological value of hedges at a landscape scale. While it is difficult to determine hedgerow age, it is interesting to examine the relationship between historical origin (e.g. infill or townland boundary) and other characteristics e.g. species richness.

3.5.1 Adjacent land use

The types of habitat found adjacent to the hedgerows sampled were classified according to the Heritage Council habitat classification scheme (Fossitt 2000) and are presented in Figure 3.8. Improved grassland is the main habitat adjacent to the hedgerows sampled, as might be expected. Semi-natural grassland (mainly wet grassland) was recorded adjacent to less than 10% of the hedgerows sampled. These results reflect habitats within the ‘hedged’ landscape and don’t reflect the occurrence of semi-natural or natural habitat in East Galway. For example, there are quite a few areas of peatland within East Galway but these areas have very few hedgerows.
3.5.2 Links with other habitats

The links, if any, of the ends of hedgerows sampled with other natural or semi-natural habitats are presented in Figure 3.9. Over 70% of the hedgerows sampled linked with other hedgerows, which indicates that they are part of a network of hedgerows on the landscape. This compares with 95% of hedgerows sampled in Co. Laois (Foulkes and Murray 2005c). In East Galway, there is a variety of field boundaries and stones walls or vegetated banks are also quite common. Other linking habitats include scrub, peatland, semi-natural grassland and watercourses.

Hedgerows linking with a large lake and scrub
3.5.3 Hedgerow history

The historical origins of the hedgerows sampled are presented in Figure 3.10. Most of the hedgerows sampled were infill hedgerows within fields. 28% of hedges sampled were infill hedgerows along roads. Only 10% of the hedgerows sampled were townland boundaries (including those in fields, along roads and streams). These boundaries were identified from Ordnance Survey maps. There are all present on the original Ordnance Survey maps from 1842.
3.5.4 Boundary function

It is interesting to examine the function of the hedgerow boundaries sampled in the context of modern agriculture. 94% of the hedgerows sampled are active boundaries. This figure is comparable to data from Laois and Offaly (Foulkes and Murray 2005c & d), which is surprising as agriculture tends to be more intensive in these counties. In many cases in East Galway, the condition of the hedgerow was poor but the presence of a stone wall or bank made the boundary stock-proof.

3.6 Hedgerow construction

Various parameters that related to the construction of the hedgerows sampled were recorded in the survey. 82% of the hedges sampled are linear in outline. Only 18% were non-linear or irregular and 59% of these were roadside hedgerows. There didn’t appear to be a strong relationship between townland boundaries and non-linear outline as found in other studies (Foulkes and Murray 2005c).

Details of the construction of the hedgerows sampled are presented in Figure 3.11. A random line of shrubs along a bank is the most common form of construction (51%) although other construction types were relatively common too. In many cases it appears as if those hedgerows that appeared to be a random line have expanded over time (i.e. a single or double line might have been planted originally). Hedges with an associated wall are also common (36%) which might be expected in East Galway where stone walls are a feature of the landscape. In many cases it appears that hedgerows have arisen opportunistically.
along stone walls over time (i.e. they might not have been planted). Drains are not commonly associated with the hedges sampled (79% of hedges sampled had no drain). Drains appear to be much more common in other counties based on similar surveys (Foulkes and Murray 2005 a, b, c, d).

**Figure 3.11** Boundary construction of hedgerows sampled

The size range of banks, walls or shelves associated with the hedgerows sampled is presented in Figure 3.12. 32% of those sampled had small banks or walls (<0.5m) and 47% had medium-sized banks or walls (0.5-1m). Less than 10% had large banks or walls which is in contrast with the situation in counties Laois, Roscommon and Westmeath (Foulkes 2005 a, b, c) where large banks were more common.

*Old hedge with large bank*
Most of the hedges sampled in East Galway had no drain (79%) and those that did were mostly small drains (<0.5m).

### 3.7 Structure and condition of hedgerows

The structure and conditions of hedgerows provides an insight into their long-term viability and sustainability, and their value to wildlife.

#### 3.7.1 Hedgerow height

The hedgerows sampled were placed into various height categories and the results are presented in Figure 3.13.
Most of the hedgerows sampled in East Galway are quite tall (>1.5m) and few (<5%) were less than 1.5m. This probably reflects the lack of management in many cases. While roadside hedges might be cut on one side, the low tightly cut ‘box’ shape is not as common as in other counties. In Laois, for example, >25% of hedges were in the shortest height category (Foulkes and Murray 2005c).

**3.7.2 Hedgerow width**

Most of the hedgerows sampled in East Galway are greater than 1m wide (Figure 3.14). This is similar to the situation recorded in other counties (Foulkes and Murray 2005 a, b, c, d).
3.7.3 Percentage of gaps

Hedgerow gappiness or percentage of hedgerow with no shrub cover is another reflection of the condition of a hedge. Gaps are associated with a weak hedge structure and reflect the deterioration of a hedge. If hedge shrubs are not cut over long periods the hedge will start to resemble a tree line with open space around the trunks. Similarly if inappropriate management methods are employed (e.g. an excavator) hedge shrubs may die leading to the formation of gaps.

Hedgerow with gappy base
Only just over 20% of hedgerows sampled were more or less complete i.e. no gaps (Figure 3.15). Approximately 18% of hedgerows appeared to have gaps 10% or more. This figure appears quite good when compared with data from other counties where a greater percentage of hedgerows had gaps of 10% or more, although it may reflect the subjective nature of the assessment.

### 3.7.4 Basal density

*Species-rich hedge with dense growth*
The density of shrub growth at the base of a hedge is another important measure of the structure and condition of a hedge. Hedges that are not managed often become open at the base thus reducing the functionality of a hedge in terms of acting as a stock-proof boundary. A dense basal structure is also good for wildlife as it provides cover.

Nearly 40% of the hedgerows sampled have dense growth of shrubs at the base (Figure 3.16). This figure is quite good when compared with results from other counties (Foulkes and Murray 2005 a, b, c, d).

![Figure 3.16](image)

**Figure 3.16** Structure of the base of the hedgerows sampled (including remnants)

### 3.7.5 Hedgerow profile (in cross section)

The profile of a hedgerow reflects the management status of a hedgerow. All hedgerow shrubs will grow up into a tree form if not cut periodically to produce dense and bushy growth. Examining the profile of the hedgerow will provide insights into the structural dynamics of a hedge. For example, whether it is producing dense bushy growth or loosing structure and moving towards a tree line structure. An assessment of hedge profiles of the hedgerows sampled hedgerows is presented in Figure 3.17.
Figure 3.17 Profile structure (in cross section) of the hedgerows sampled

The majority of the hedgerows sampled were either ‘loosing structure’ (31%) or ‘overgrown’ (27%). Only 12% of hedges were ‘boxed/ A shape’. 7% were remnant hedges.

Hedgerow with ‘overgrown’ profile
3.7.6 Hedgerow trees

66% of hedgerows sampled had some hedgerow trees along their length (Figure 3.18). The majority of these only had a few trees.

![Figure 3.18](image.png)

**Figure 3.18** Percentage of hedgerows sampled with trees

52% of the hedgerows sampled had mature trees growing along their length. Only 14% of hedges had some young trees (Figure 3.19). This low level does not bode well for the future of trees in East Galway hedges.

![Long-term unmanaged derelict hedgerow](image.png)

*Long-term unmanaged derelict hedgerow*
3.7.7 Bank/ wall degradation

Where hedgerow shrubs are established in a hedge bank, the long-term viability of the hedge may be threatened if the bank is damaged. Root systems are exposed to damage which may affect the overall vigour and stability of the hedge. Walls that are closely associated with hedgerows may also cause damage to the hedge plants if they start to subside and fall apart. The level of degradation, if any, of the hedge banks and walls is presented in Figure 3.20.

Figure 3.20 Proportion of hedgerows sampled with degraded banks or walls
In most cases (nearly 70%) the bank or wall was intact which bodes well for these hedges. The percentage of hedges with some damage to the wall or bank is still of some concern however.

### 3.7.8 Fruiting levels

The amount of flower production or fruiting levels were estimated mainly based on the flowering/fruiting of hawthorn which was the most abundant species in the hedges sampled. It was not always easy to make such an estimate depending on the time of year or hedge composition, but it was worth attempt to record because of the value for wildlife.

![Figure 3.21 Fruiting levels in hedgerows sampled (including remnants)](image)

Just over 30% of hedges sampled had sparse flowers or fruit (Figure 3.21). This figure is considerably lower than the situation in Laois where half the hedges sampled had below average levels (Foulkes and Murray 2005c). In Laois a much higher proportion of the hedges are tightly cut than would be the case in East Galway. There is evidence to suggest that regular cutting significantly reduces levels of fruiting in hawthorn (Sparkes et al. 2000, J Fuller pers. obs).
Figure 3.22 Fruiting levels in relation to profile (in cross section) of hedgerows sampled

Hedges that were derelict, loosing structure and overgrown generally had average or heavy fruiting levels in Galway. The highest proportion of hedges with particularly good fruit cross was recorded in hedges that are loosing structure. Hedges that were cut to a boxed or A-shape had the highest levels of sparse or no fruit.

Hedgerow that has been trimmed to a ‘box’ shape. No flowers or fruit were observed.
3.7.9 Vigour

An assessment of hedgerow vigour provides some insight into the long-term viability of the hedges sampled. The results of this assessment are presented in Figure 3.23. Quite a few of the hedges sampled (40%) appear to have poor vigour, a figure which is some cause for concern. Many of these hedges are either short-term or long-term unmanaged. 60% of hedges sampled have average or good vigour. Those with good vigour generally have a boxed/A shape or straight-sided profile.

![Vigour Assessment](image)

**Figure 3.23** Assessment of the vigour of the hedges sampled (including remnants)

*Bushy hedge with hawthorn in flower*
3.8 Management status and methods

Appropriate management of hedgerows is critical for the long-term sustainability of the hedgerow resource. Lack of management leads to the disintegration of hedge structure and eventually the demise of hedges. The various types of management encountered in the hedgerows sampled are presented in Figure 3.24. Many of the hedgerows sampled are either short-term unmanaged (35%) or long-term unmanaged (28%). 72% of hedgerows have received some form of management in the recent past (last 8 years). These figures are comparable with results from Laois where the figure is 75% (Foulkes and Murray 2005c).

![Management status of hedgerows sampled](chart.png)

Figure 3.24 Management status of hedgerows sampled

An effort was also made to determine the method by which hedges were managed. In several cases determining the precise means by which the management was carried out was not possible unless the hedgerow had been managed very recently. The results are presented in Figure 3.25.
Figure 3.25 Management method used in hedgerows sampled

In a high proportion of cases it was not possible to ascertain the management method used. The most common management tool employed (almost 40%) appears to be the flail.

Presumably the original function of most of the hedges sampled was as a stock-proof barrier (apart from those that arose opportunistically along stone walls). Additional fencing is used in many fields to reinforce the stock proof capacity of the boundary.

Large hazel shrub that was coppiced hard
Just over 45% of hedgerows sampled are not reinforced with some other means of fencing (Figure 3.26). It should be noted, however, that proportion of these hedges have a stone wall as a significant part of their structure and the stone wall may be maintained by the landowner to keep the hedge stock proof.

Unfortunately there was no evidence of hedge laying recorded apart from one example of a hedge laid in the past. No evidence of recent hedgerow rejuvenation was observed in the sampled squares.
3.9. Hedgerow condition

Foulkes and Murray (2005c) compared data on the condition of hedgerows surveyed midland counties, Laois, Offaly, Westmeath and Roscommon. They based their comparison on a UK system to determine whether hedgerows are in ‘favourable condition’ i.e. for wildlife (UK Biodiversity Action Plan www.ukbap.org.uk). Only five of the criteria used in the UK system are sufficiently consistent with the data collected in the surveys by N. Foulkes and A. Murray, and the East Galway survey.

1. Average height at least 2m
2. Average width at least 1.5m
3. Less than 10% gaps, with no individual gap wider than 5m
4. Base of woody component closer than 50cm to the ground
5. Less than 10% introduced non-native species

Of the 218 hedgerows sampled in East Galway, 32 (14.7%) are classified as species rich (based on the definition that they contain 4 or more shrub species on average in two 30 strips). Although it is not possible to exactly match the data collected in the East Galway survey with the criteria above, 28 (12.8%) of these species rich hedges could be described as in ‘favourable condition’. These data can be compared with results from other counties compiled by Foulkes and Murray (2005c).
Table 3.9 Comparison of hedges in favourable condition data among several counties including East Galway (Data for Laois, Offaly, Roscommon and Westmeath from Foulkes and Murray 2005 a, b, c, d).

<table>
<thead>
<tr>
<th>County</th>
<th>No. of samples</th>
<th>No. of species rich hedges</th>
<th>% of species rich hedges</th>
<th>No. of species rich hedges in favourable condition</th>
<th>% of total sample in favourable condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>East Galway</td>
<td>218</td>
<td>32</td>
<td>14.7</td>
<td>28</td>
<td>12.8</td>
</tr>
<tr>
<td>Laois</td>
<td>159</td>
<td>71</td>
<td>32.4</td>
<td>23</td>
<td>14.5</td>
</tr>
<tr>
<td>Offaly</td>
<td>130</td>
<td>41</td>
<td>31.5</td>
<td>10</td>
<td>7.7</td>
</tr>
<tr>
<td>Roscommon</td>
<td>189</td>
<td>9</td>
<td>4.8</td>
<td>5</td>
<td>2.6</td>
</tr>
<tr>
<td>Westmeath</td>
<td>152</td>
<td>7</td>
<td>4.6</td>
<td>1</td>
<td>0.7</td>
</tr>
</tbody>
</table>

Most of the hedges in Galway would meet the height and width criteria for favourable condition. Many however would be too gappy and open at the base. The non-native species present (e.g. privet, wild plum) don’t appear to be posing a threat to the integrity of hedges in East Galway. None are particularly invasive (although snowberry can be) and are generally found at low abundances.

3.10 Other observations

Copious notes and observations were made while conducting the field survey. Some interesting and relevant points are summarised below.

a. Summer cutting: Despite the fact that hedgerow cutting is prohibited from March 31st to August 31st, numerous examples of cutting were seen during July and August, particularly in the north and east of the county. There didn’t appear to be any obvious justification for this activity from road safety grounds. Cutting of hedgerows during this period can potentially damage the health of hedgerow shrubs and cause serious disturbance to wildlife dependent on the hedgerow resource.

b. Hedgerow quality: As has been observed in other county hedgerow surveys (Foulkes and Murray 2005), high quality hedgerows in East Galway tend to be associated with land that appears to be well-managed with stock in good condition e.g. Kilimor area.

c. Active management detrimental to hedgerows: The use of excavators or other similar equipment to ‘bash’ over or crush hedgerows shrubs in an attempt to ‘tidy’ up hedgerows can lead to the death of shrubs which are integral to the vigour and long-term viability of a hedge. Large hedge shrubs are knocked over and used to fill gaps in hedges. This is a short-sighted attempt to make a hedge stock proof. As hedge shrubs die they loose their ability to form a stock proof barrier.
d. Flora and fauna: Notes were taken on the composition of the ground flora and any signs of animal activity. In many cases the ground flora of hedges includes plants normally found in woodlands e.g. lords and ladies (*Arum maculatum*), primrose (*Primula vulgaris*), wood speedwell (*Veronica montana*) and occasionally bluebell (*Hyacinthoides non-scriptus*). Badger sets and abundant bird life were also observed.

*Bluebell flowers growing at the base of a hedgerow*
4. Discussion

The results of the East Galway hedgerow survey are discussed in detail below. They are compared with results from other counties and considered in terms of conservation and management issues.

4.1 Hedgerow extent

The results from the survey demonstrate that East Galway has an extensive network of hedgerows with an estimated length of 22,526km. In order to facilitate meaningful results with other counties hedgerow extent is best expressed as density (km/km$^2$). The hedgerow density results from Galway are comparable with those from Laois and Offaly (Table 4.1; Foulkes and Murray 2005 c, d), which is somewhat surprising considering that East Galway also has an extensive network of stone walls (estimated length just over 8000 km) unlike the two midland counties. Average field size in Galway is smaller in general than in Laois or Offaly, leading to a higher density of field boundaries and thus comparable results.

<table>
<thead>
<tr>
<th>County</th>
<th>Length (km)</th>
<th>Average density (km/km$^2$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Galway</td>
<td>22,526</td>
<td>5.88 std 4.17</td>
</tr>
<tr>
<td>Laois</td>
<td>12,427</td>
<td>7.28 std 3.15</td>
</tr>
</tbody>
</table>

Table 4.1 Comparison of hedgerow length and density figures between counties Laois and East Galway.
The results from Galway compare favourably to England, which has an overall average density of 2.91km/km² (Foulkes and Murray 2005c). This is presumably a function of much larger field size in England and the history of land use which saw many hedgerows being ripped out in the recent past.

The landscape in the west of county Galway is very different to that in the east of the county and the results from this survey cannot be applied to the county as a whole. As much of west Galway is covered with peatland and moutainous habitats, there are far fewer hedgerows. It would still be worthwhile to survey the hedgerows in west Galway to complete the picture for the county as a whole.

4.2 Species composition
Twenty seven species were recorded in the shrub or hedge layer of the hedges sampled in East Galway, eighteen of which are native. Hawthorn is the most abundant species recorded and it is often the dominant shrub present. The results show, however, that several other shrub and tree species commonly occur in the hedge layer of hedges in the east of the county including blackthorn, elder, gorse, ash, holly, hazel and privet.

Woody climbers and trees are also contribute to the species and structural diversity of East Galway hedgerows. While woody climbers of high wildlife value such as dog rose and honeysuckle didn’t occur with particularly high frequency (as compared with Laois, Foulkes and Murray 2005c), where they did occur it was often at reasonable abundances. Ash is the most common species found in the tree layer but twenty one species were recorded in total in the tree layer, which reflects the potential diversity.

Species richness (defined as hedges with an average of four or more native species in two 30m strips) is not particularly high in East Galway. Only 14.7% of hedgerows sampled were classified as species rich. Species diversity in East Galway is, however, nearly three times higher than that recorded in Westmeath or Roscommon (Foulkes and Murray 2005 a, b).

Richness in Laois and Offaly appears to be particularly high (Foulkes and Murray 2005c, d). Several theories are suggested by the authors to explain the particularly high diversity recorded in these counties including high occurrence of links with semi-natural woodland habitats, possibly favourable soil characteristics, old age of boundaries, and regular management (Foulkes and Murray 2005 c, d). Further study is highly warranted to determine which factors are most important in controlling species richness in hedges.
East Galway has very different landscape characteristics and land use history to Laois and Offaly. Field enclosure began later and was more sporadic to begin with, concentrated in the large estates. 69% of the 32 hedges classified as species rich are associated with banks. These hedges are located in the north and north-east of the study area, in some cases associated with old estates. Many hedgerows, particularly in the west and north-west of the study area appear not to have been planted but have originated opportunistically along stone walls and/or are relatively recent in origin (i.e. single line infill hedges).

Few hedgerows in East Galway link with semi-natural woodland habitats (native woodland is a relatively rare habitat in this part of the country) or scrub and therefore the potential seed source for colonisation of hedgerows is low. Many hedgerows in East Galway link with other hedgerows but the proportion (75%) is lower than in Laois (95%).

Only 10% of the hedgerows sampled are townland boundaries. Unlike results from other counties (Foulkes and Murray 2005 a, b, c, d; Hegarty and Cooper 1994), the townland boundaries sampled did not display higher levels of species diversity. Roadside hedgerows, by contrast, were more species rich and this is probably a function of the fact that they are regularly trimmed at least on one side, for road safety purposes. Trimming of hedges tends to restrict tree species such as ash, sycamore and beech to the hedge layer. Ash is a common component of roadside hedgerows in East Galway.

It is unlikely that soil factors in East Galway would have any negative impact on hedgerow diversity except in those limited areas with extremely marginal soils. Species associated with species-rich hedges in East Galway (similar to those recorded in other counties) are not particularly frequent e.g. crab apple, guelder rose, hazel, holly, spindle.

The low number of species rich hedgerows in East Galway is probably a function of relatively recent origin in many cases, land-use history and lack of management.

Five groups or ‘hedgerow types’ have been identified in East Galway based on species composition. These are more or less comparable with hedgerow types identified in other counties. Ideally the data obtained from all the counties surveyed to date should be analysed together.
Table 4.2 Comparison of floristic hedge groups identified among counties Roscommon, Laois, Offaly (Foulkes and Murray a, c, d) and Galway.

<table>
<thead>
<tr>
<th>Galway</th>
<th>Roscommon</th>
<th>Laois &amp; Offaly</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group 1 Gorse-dominated hedges</td>
<td>Group 5 Gorse hedges</td>
<td>Group 7 Gorse group</td>
</tr>
<tr>
<td>Group 2 Species-poor hawthorn hedges</td>
<td>Group 2 Species-poor hawthorn hedges</td>
<td>Group 2 Hawthorn, blackthorn and elder group</td>
</tr>
<tr>
<td>Group 3 Hedges characterised by presence of holly</td>
<td>-</td>
<td>Group 4 Elm and holly group</td>
</tr>
<tr>
<td>Group 4 Hedges characterised by presence of hazel and/or spindle</td>
<td>Group 4 Relatively species-rich hedges</td>
<td>Group 5 Species rich hazel and holly group</td>
</tr>
<tr>
<td>Group 5 Willow dominated hedges on wet ground</td>
<td>Group 1 Hedges characterised by willow</td>
<td>Group 6 Wet species rich group</td>
</tr>
</tbody>
</table>

4.3 General historical and landscape context

Only 10% of the hedgerows sampled were townland boundaries and only a couple of these displayed the typical features of hedged townland boundaries e.g. large bank and ditch. More typical townland boundaries do occur on the East Galway landscape (J Fuller pers. obs.) but the objective random stratified sampling strategy used in this survey didn’t pick them up. Further study of townland boundaries in Galway is certainly warranted because of their cultural, historical and ecological interest.

The hedged landscape in East Galway is generally associated with active farming and improved grassland. The level of farm activity is probably not as intensive as in Laois or Offaly and the level of arable farming in Galway is negligible. Most hedgerows sampled (94%) form part of active field boundaries indicating they are still relevant in the current context of agricultural activity.

The hedgerow resource in East Galway provides invaluable habitat for wildlife in the context of an agricultural landscape with very little semi-natural woodland. A high proportion of the hedgerows sampled link with other hedgerows indicating their role in providing corridors for wildlife to move through the landscape. Links with other natural or semi-natural habitats are low but not insignificant.

4.4 Hedgerow construction

There is considerable variation in the construction details of hedgerows in East Galway. The vast majority of hedgerows are linear in outline but they vary in terms of whether they are single, double or random lines of shrubs; many hedgerows have a bank but a high proportion are associated with a wall. This variation suggests that hedges in East Galway originated at different times and in different conditions.
Land in commonage is a common feature of the Galway landscape and this may also influence boundary origin and management.

Hedgerow construction depends on a number of factors: farming practice, environmental conditions (soils, exposure, topography), tradition and legal requirements. It appears that a relatively high proportion of hedges in East Galway have originated opportunistically along stone walls and their survival is dependent on the attitude of the land owner or farmer i.e. whether they decide to let the shrubs establish and spread or whether they cut them back and prevent further spread.

A high proportion of hedges in East Galway are associated with banks (55%) and these tended to be associated with the more species rich hedgerows as discussed above. The presence of a bank suggests the hedgerows were planted although because in many cases they were so overgrown, it was difficult to examine for any signs of laying. Only 23% of the hedges with banks also were associated with drains. The bank in most cases was built for the sole purpose of field enclosure and not as a product of digging a drain.

Thin, stony soils are probably not suitable for digging a bank and a study of soil characteristics as well as land use history may provide an insight into why we find banks in some areas and stone walls in others.

Many hedges in East Galway are associated with walls. The prevalence of stone walls on the Galway landscape reflects the glacial history of the landscape and the abundance of stony soils. Stones would have been used to make field boundaries because they were to hand, and to improve conditions for tillage (which was practised much more widely in Galway in the past) and hay or silage production. In some cases stone appear to have incorporated into hedge banks.

Drainage is required in wetter areas to improve the quality of agricultural land. Hedges are usually planted on banks or mounds in these areas often in association with drains. Only approximately 20% of hedgerows sampled were associated with drains.

Hedge banks, walls and drains increase the range of habitats associated with hedgerows and therefore increase their wildlife value. They also improve the stock-proof capacity of hedgerow boundaries. Over 50% of hedges sampled, however, had additional fencing which indicates that the potential of the hedgerow to retain stock is not being utilised or valued.
4.5 Hedgerow structure and condition

Hedgerow structure and condition needs to be considered in terms of agricultural functionality as well as biodiversity or wildlife value. The primary function of hedgerows is as stock-proof field boundaries and their long-term survival depends on their value to farmers and landowners.

The majority of hedgerows in East Galway are quite tall (>1.5m) and bushy. There is evidence to suggest that increasing hedgerow height is positively correlated with diversity of bird species in a hedge (Arnold 1983, Lack 1987, Clements and Tofts 1992). These tall hedges are good for wildlife and they provide shelter for farm animals.

![Tall, bushy hedgerow that has not been managed for some time (loosing structure profile)](image)

Most hedges in East Galway are also quite wide (>1m or even >2m). Increasing hedge width is also considered good for wildlife (Clements and Tofts 1992). In many cases in Galway, however, the base of the hedgerow is quite open and gappy and the bushy growth is up high rather than at the base. These hedgerows would generally not be stock-proof in the absence of additional fencing or a wall, thus loosing their agricultural value.

Many of the hedgerows in East Galway are either short-term or long-term unmanaged thus leading to the development of tall and wide bushy hedges. While tall, wide hedges are generally good for wildlife, the open base with scrawny growth is not (Arnold 1983, Lysaght 1990, Clements and Tofts, 1992, Hegarty
and Cooper 1994). Studies have suggested that dense growth of shrubs at the base of a hedgerow increases wildlife value of the habitat (Arnold 1983, Osborne 1984, Clements and Tofts 1992). The hedgerows in East Galway appear to be comparable to those in Roscommon and Westmeath (Foulkes and Murray 2005 a, b) in terms of structure. While hedgerows in Laois tend to be managed more regularly with a dense structure and high shrub diversity (Foulkes and Murray 2005 c), the structure of East Galway hedgerows is possibly more favourable to a wider range of wildlife.

The profile of most hedgerows in Galway reflects the lack of management. Over 30% are ‘loosing structure’ which means they are tending towards becoming a remnant hedge or a tree line. Over 10% are derelict and therefore would require quite a bit of intervention in order to convert them back to functional hedges. The hedgerows that fall into the ‘overgrown’ category are probably very good for wildlife and in reasonable condition but they should be trimmed periodically to prevent them from loosing structure. The majority of hedgerows in East Galway produce good crops of fruit (hawthorn being the most common) with the exception of the few hedges that are cut into a box or A-shape. Very few hedgerows were cut into an A-shape as recommended by REPS.

In remnant hedges the component shrubs have reverted to their tree form with significant gaps between the main stems or trunks. 7% of the hedges sampled are remnants. This figure is probably a considerable underestimate. It is sometimes difficult to identify remnant hedgerows in East Galway because of the regular presence of a stone wall which confused the situation. The extent of stones walls with shrubs (<25% cover length of field boundary) was also measured to fully reflect the Galway situation. Remnant

Remnant hedgerow
hedges can not be rejuvenated by laying and would have to be replanted in order to re-established a sustainable hedgerow. 12% of hedges sampled are relict or derelict and these will soon become remnants without intervention.

Trees growing in hedgerows add to the structural and floristic diversity of hedgerows. Trees are also of value to wildlife, particularly bird, bats and invertebrates (Pollard et al. 1974). They contribute greatly to the scenic appearance of the countryside and landscape character. 66% of the hedges sampled in Galway had trees and ash was the main species recorded. This is similar to the situation recorded in Roscommon, Offaly and Laois (Foulkes and Murray 2005 b, c, d). Ash trees do not cast a particularly heavy shade and therefore generally do not negatively impact on hedge structure. On the other hand, sycamore, which is also a relatively common hedge tree in East Galway, casts a dense shade and therefore competes strongly with the hedgerow shrubs which may lead to a decline in vigour and an opening up of the shrub layer canopy.

Only 14% of hedges sampled had young trees which is not a sustainable level to maintain hedgerow trees on the landscape. Management strategies should try to encourage a reasonable number of hedgerow trees on the landscape.

There is some concern among the public and landowners about roadside trees from a health and safety perspective. Roadside trees have considerable aesthetic and wildlife value but this must be weighed
against the road safety aspects. In a Galway context where woodland cover is particularly low, hedgerow and particularly roadside hedgerow trees greatly contribute to the scenic appearance of the countryside. Healthy trees should not pose a threat to road users and may be of benefit (e.g. shelter and screening). Landowners are liable for any damage caused by trees on their land, including roadside trees. The costs of dealing with unsafe trees can be considerable and therefore the issue of responsibility for roadside trees can be a heavy burden for some landowners. Some assistance should be provided for landowners to help with the costs of dealing with potentially dangerous roadside trees. This may prevent pre-emptive action taken by a small minority landowners who remove all roadside trees in case they become a threat in the future.

A worrying trend that is particularly visible in Galway is that when home owners remove the road frontage hedgerow, they leave hedgerow trees in situ. While it is desirable to retain these trees, it would be better if the hedgerow was also retained and the option of a splayed entrance to the new dwelling was considered. Isolated trees on the roadside must be considerable road safety issue.

4.6 Hedgerow management

Hedgerows need to be managed in order to fulfil their role as stock-proof boundaries, to remain viable as hedgerows (and not loose their structure and revert to tree lines) and to maximise their wildlife value. Lack of management leads to the disintegration of the hedgerow structure with a resultant loss in wildlife and agricultural value.
Many of the hedgerows in East Galway have not been managed for some time. As a result many are loosing their structure or are derelict. Those that are managed appear to be trimmed with a flail and/or to a lesser extent, cut with a circular saw. Numerous examples of poor cutting (with inappropriate equipment) can be seen in the Galway countryside leading to frayed and damaged stems which can have a detrimental effect of the health and stability of hedgerow shrubs and trees.

There is little consistency in terms of hedge profile achieved by trimming. Few of the hedges appear to be trimmed to an A-shape as recommended by Teagasc and in REPS. Most hedges that were cut recently were cut to a boxed shape or cut on one side only (if roadside hedge). The failure to trim hedges according to best practice in terms of profile and methods is a problem recorded in other surveys (Foulkes 2005 c & d). Education and training of flail operators could lead to improved standards of hedgerow care. Teagasc run a FETAC accredited training course to hedge-cutting machinery operators. The hedgerow resource in Galway could be greatly improved with higher levels of management that follow best practice (see Recommendations).

Ideally hedgerows that are well-managed should require no additional fencing to reinforce the stock-proof capacity of the field boundary. Over 50% of the hedges sampled in East Galway were associated with some type of fencing. Fortunately only 11% involved wire being attached to hedgerow stems. Attaching wire to the living stems can have negative implications for the health of the shrubs (may lead to bacterial or fungal infection) and can impede efforts to manage the hedgerow by cutting with machinery (as the wire could be hazard).

Only one hedgerow sampled had clear evidence of having been laid. By contrast a fifth of hedges surveyed in Laois displayed evidence of past laying (Foulkes and Murray 2005 c). It was difficult in many cases to see the basal stems of the hedges sampled in East Galway and therefore it is possible that some evidence of hedge laying was missed. Hedges in Laois and Offaly are probably older than those in Galway and may have a longer history and tradition of active management. Hedge laying is a viable option for rejuvenation many of the hedgerows currently loosing their structure in East Galway. Coppicing (cutting stems close to their base so that they will resprout) is another useful option which appears to be employed sometime in Galway, particularly along roadside hedges. There needs to be a major increase in rejuvenation of hedges in Galway if the hedgerow resource is to be sustainable.

4.7 Favourable condition of hedgerows
‘Favourable condition’ is a measure of the range of conditions required to maintain a habitat such as a hedgerow in a state where its distribution, abundance, structure or function throughout the biogeographic
region is sustained over the long term (English Nature website). Only 12.8% of hedgerows sampled in East Galway appear to be in ‘favourable condition’ based on the UK measure modified by Foulkes and Murray (2005 c). Now that hedgerow surveys have been completed in several counties in Ireland, agreed criteria for species richness and favourable condition should be developed for assessing our hedgerow resource. Measures such as species richness and favourable condition are useful when developing Biodiversity Action Plans for habitats or areas because they can be used to determine the effectiveness of any changes in management regime and they reflect the value of hedgerows from an ecological and agricultural perspective.
5. Recommendations

5.1. General comments on hedgerow conservation

Hedgerows differ from other semi-natural or natural habitats considered worthy of conservation (e.g. bogs and woodland) in that they are dependent on human intervention for their survival. Hedges that are not managed eventually become tree lines and thus change in terms of their function, structure and ecological value. Hedgerow conservation cannot be considered in isolation from agricultural function. Agriculture in Ireland is in transition due to changes in European Union policy and the numbers of people interested in a career in farming have dropped markedly in recent times. Evidence from East Galway suggests that farmers are relying heavily on fencing to maintain stock proof capacity of field boundaries. While they still provide shelter for animals and crops, the agricultural value of hedgerows may be diminishing. The question is how can the value of hedgerows being increased for farmers? Hedgerows have to be a cost-effective boundary option in order to meet the needs of the farmer or landowner.

The rural landscape of Galway is likely to change somewhat as the level and nature of agricultural activity will probably change in the next few years and forestry becomes an increasing attractive option. These changes will undoubtedly have an impact on the hedgerow resource in terms of it’s relative ecological value and functional value.

The landscape context in which hedgerows occur is important in terms of their ecological value. Hedgerows which link with other semi-natural and natural habitats are likely to be of more value in terms of acting as part of an ecological network than those that have no links. On the other hand, hedgerows that are located in an area of intensive agriculture will provide the only refuge for wildlife in that locality. Hedgerows that link with other hedgerows help create greater interconnectivity of wildlife habitats across the landscape than those that occur in isolation.

Successful hedgerow conservation requires practical, cost-effective conservation measures to be agreed upon and put in place. There are a number of issues to consider when developing hedgerow conservation strategies (modified from Foulkes and Murray 2005c):

- Some of the desirable qualities of hedgerows are subject to value judgements (e.g. help form landscape character).
- Hedgerows are a multi-functional resource. In the absence of a full cost/benefit analysis it is not possible to determine what constitutes a cost-effective measure.
- Hedgerows require active management to ensure their long-term viability.
• Most hedgerows are private property. Policies for hedgerow management and conservation must be
cognisant of the fact that the resource is owned by thousands of farmers and landowners.
• Variation in the type, condition and management status of hedgerow resource mean that it is hard to
make simple set of guidelines to fit all situations.
• Much of the hedgerow resource, particularly in Galway, has fallen into disrepair over a period of
decades. Rejuvenating these hedgerows will require substantially higher costs that would be the case
if only trimming or cutting was required.
• The decline in the agricultural function of many of our hedgerows has led to a fall off in the
practical knowledge and skill base to manage hedgerows appropriately.
• In addition, the number of agricultural holdings in Ireland has declined considerably in recent years
and the number of people involved in agriculture has also declined.

Recommendations that relate mainly to Galway are described below. Foulkes and Murray (2005c, d)
make comprehensive recommendations for National policy in their reports.

5.2 Recommendations for hedgerow conservation policy in Galway

Local planning and development
National Biodiversity Plan states that the ‘overall goal should be to have no net loss of the hedgerow
resource’ (NBP 2002). Galway County Council, therefore, have a responsibility to develop appropriate
policies for the conservation of the hedgerow resource in the county. Policies which adopt appropriate
standards for management and conservation, and set achievable and fully costed targets (that incorporate
a timeframe) are likely to be most effective. The County Galway development plan (2003- 2009)
promotes the retention of hedgerows, where possible, in developments.

a. A county-wide hedgerow conservation policy should be developed. This could form part of
Biodiversity Action Plan for the county and should be referred to in the County Development
Plan.

b. Species-rich hedgerows, townland boundary hedges and hedgerows that rare species should be
safeguarded more stringently in new developments and road-widening schemes.

c. Best practice guidelines should be produced in relation to hedgerow management and
conservation for planners, road engineers and other council officials.

d. As roadside hedgerows frame the countryside for all road users and increase the scenic value of
the landscape, they should be retained where possible. The retention of roadside hedgerows helps
maintain the integrity of the rural character of the landscape and lessens the impact of one-
housing on the landscape.
e. Hedgerows should be retained where possible in small and large developments. They help maintain the wildlife value of new developments and integrate them into the landscape.

f. Hedges of agricultural land that has been re-zoned for development should be surveyed and those with significant biodiversity, historical value and/or containing rare species should be identified, incorporated into a GIS database, and retained where possible.

g. If a hedgerow must be removed, a new native hedgerow should be planted to mitigate against the impact of the hedgerow loss. The new hedgerow should link in to existing adjacent hedges where possible.

h. Enforcement of conditions that pertain to hedgerows should be enforced. This could be achieved by making the retention, re-location and/or re-establishment of hedgerows in planning consents the subject of a bond sought by the Galway County Council from those seeking planning permission, especially for large developments.

i. Local authority road schemes should plant native hedgerows where existing boundaries have to be removed (see below). The National Roads Authority has already committed to planting native trees and shrubs in all new road schemes.

j. No cutting during bird nesting season (31st March until 31st of August) unless absolutely necessary from a road safety perspective. Ideally approval in writing from NPWS should be sought prior to any hedgerow cutting on behalf of the County Council that occurs within the prohibited period.

New planting

a. Native shrubs and trees should be specified for all new hedge planting or for infill planting of existing hedges. Where possible, locally provenanced native plant species should be used.

b. Nurseries and garden centres in county Galway should be encouraged to carry sufficient native stock.

Incentives for hedgerow conservation and management

a. Incentives should be put in place for farmer and landowners to manage their hedgerows appropriately. REPS provides a mechanism for hedgerow conservation but not all farmers are in REPS.

Fuel wood production

a. A working group composed of all the relevant stakeholders should be established to investigate the possibility of managing some hedgerows for fuel wood production.
5.3 Recommendations for hedgerow management in Galway

The results from the survey in East Galway indicate that the hedgerow resource is poorly managed or not managed at all in many cases. The long-term sustainability of the hedgerow resource is in doubt if appropriate management measures are not put in place. Many Galway farmers are in REPS (c. 5767 farmers- Teagasc website) but the lack of managed hedgerows, particularly those managed according to Teagasc guidelines, suggests that this scheme has not had significant impact on the level of management to date. This may change however, as REPS 3 places even greater emphasis on hedgerow management and planting. As stated above, the issue of incentives for landowners, especially those not in REPS, needs to be overcome otherwise it is not likely to be economically viable for farmers to invest in hedgerow management.

Prior to managing and/or conserving any resource, the objectives must be decided upon by all the relevant stakeholders. The general objective for hedgerow management and conservation is to create a stock-proof boundary (i.e. with an agricultural function) of high wildlife value. In general hedgerows of high wildlife value have dense basal growth with a bushy top; are tall height (>2m) and relatively wide (>1m); and finally are composed of plants with good vigorous growth due to periodic cutting.

Standards of management activities

a. All the stakeholders involved in hedgerow management at some level should commit to ensure that management operations conform to recognised, basic minimum standards (see Appendix 3 for more information about these standards).
   i. Teagasc Unit MT 1302 Mechanical Hedge Trimming
   ii. Hedge laying to National Proficiency Test Council (NPTC) (UK) Standard (AO2098) or equivalent
   iii. Coppicing to standards currently being developed by the Coppice Association of Ireland in conjunction with Coppicing Standards bodies in the UK
   iv. Planting of new hedgerows to NPTC standard

b. Training to these standards should be made available to all those interested, particularly farmers and landowners, especially those in REPs.

c. Farmers and landowners should be strongly discouraged from attaching fencing to hedgerow stems and trees due to the safety implications that arise during management operations.

Hedgerow trimming

There appears to be little consistency in terms of how hedges are cut across the county. A diversity of hedgerow structure is valuable to wildlife but certain structural characteristics are most beneficial.
a. Hedgerows should be cut on their sides and shaped roughly into an A-shape but leaving the top to grow free-form. *Cutting to this profile should produce hedgerows that are functional from an agricultural perspective (i.e. stock-proof) and have a high ecological value. Teagasc ‘Hedgerow Management Leaflets’ currently promote the A-shape profile with a high peak and bushy top (see www.teagasc.ie).*

b. Hedge height should not be reduced below 1.5m. *Good hedgerow management does not mean heavy cutting and producing ‘neat’ hedgerows.*

c. Hedgerows should be trimmed in rotation approximately every three years according to Teagasc guidelines. *This will ensure some is left undisturbed for wildlife. Annual trimming may be required in some locations for road safety reasons.*

**Hedgerow rejuvenation**

Many hedgerows in East Galway require some serious intervention because they are becoming tree lines. Rejuvenation involves relaying a hedge and in some cases infill planting may be required. Again the issue of providing incentives for farmers and landowners arises.

a. A greater degree of rejuvenation of degraded hedgerows should be encouraged. *Rejuvenation efforts may not be successful with old plants or those with low vigour and new planting may have to be considered.*

**Hedgerow trees**

Increasing tree planting and retention of saplings in hedgerows is required to increase the level of trees in hedgerows in East Galway.

a. Farmers and landowners should be encouraged plant more hedgerow trees and retain more saplings in hedgerows where the numbers of hedgerow trees are low.

b. Farmers and landowners should also be encouraged to allow a wider diversity of native species present in hedges to mature into trees (e.g. whitebeam, hazel or spindle).

c. Invasive non-native trees such as sycamore should be controlled.

**5.4 Recommendations for new planting of hedgerows**

Planting of new hedgerows requires incentives such as inclusion in planning conditions, REPS requirements or other measures. New planting could greatly enhance the wildlife and scenic value of the existing hedgerow network and will help mitigate against the impact of new developments on the landscape.

a. Native species, preferably of local provenance, should be used for planting new hedgerows.
b. Landowners, community groups and householders should be made aware of the benefits of planting native hedgerows through an awareness campaign, which should also provide information on where to obtain suitable stock and how to plant a hedgerow.

c. Nurseries and garden centres should be encouraged to stock native hedging species and to source material locally as far as possible.

d. The information produced in this survey in relation to hedgerow types, their geographical distribution and environmental preferences (e.g. wet or dry soil) should be made available to the general public, developers and especially landowners to help decide what are the most appropriate species to plant in a native hedgerow in a particular area.

5.5 Recommendations for education and awareness

The appears to be a lack of awareness of the value of hedgerows in East Galway and best practice in relation to hedgerow management. Education is required at all levels from policy and decision makers (including planners, road engineers, council officials, public representatives etc.) to those involved in land management, as well as house-holders and community groups, in order to promote hedgerow conservation and best practice in hedgerow management.

   a. Best practice in hedgerow conservation needs to be promoted and directed at all levels in the decision making process and the implementation. Best practice should be promoted through training aimed at the various target groups and by showing practical examples in the field.

   b. Best practice hedgerow management, which is critical for hedgerow conservation, should also be promoted and directed at all levels in the decision making process and the implementation. 

   Training with practical experience is essential for those actively involved in hedgerow management.

   c. An awareness campaign of the multiple benefits of hedgerows should be mounted and directed at a wide target audience from the general public to farmers, landowners, council officials, community groups and education institutions.

5.6 Recommendations for future research and monitoring

There is still much to be learnt about hedgerows and continuing research is essential if we are to successfully manage and conserve this resource for future generations. Questions that warrant further investigation include the factors that control species richness in hedgerows, particularly the relationship between age and diversity; the optimal management regime and the relationship between hedgerow floristic and structural diversity and invertebrate diversity.
a. A resurvey of East Galway should be conducted no later than 2016 to determine the success of any management and conservation strategies implemented, and to monitor the rate of hedgerow removal.

b. The data collected from all the counties to date should be analysed by suitably qualified persons to put the data from each county into a national context and to help floristically classify the hedgerow resource in Ireland.

c. Education institutions in county Galway should be encouraged to conduct research in and around hedgerows to increase the knowledge base. *This research could include investigating traditional methods of hedgerow construction and management, and folklore of hedgerows, as well as examining ecological questions.*
6. Conclusions

The conclusions from the hedgerow survey of East Galway can be summarised as follows:

- East Galway has an extensive network of hedgerows with an estimated length of 22526km.
- Twenty seven species were recorded in the shrub or hedge layer of the hedges sampled indicating the variety and potential diversity of hedgerows in East Galway. An assessment of species richness, however, indicates that only 14.7% of hedgerows in the county are species rich. The reasons for the low diversity may be a factor of relatively recent origin in many cases, widespread lack of management and land use history.
- In general roadside hedgerows are more species rich and therefore should be protected as an invaluable habitat for wildlife, as well as for their scenic value. Hedgerow surveys in other counties find that townland boundaries are also generally more species rich. This was not the case in the townland boundary hedgerows sampled in this study but further investigation is required because of the age and historical value of these boundaries.
- Five groups or hedgerow types were identified based on species composition, and these roughly correspond to hedgerow types identified in other county surveys.
- There is considerable variation in the construction details of hedgerows in East Galway. This variation suggests that hedges in East Galway originated at different times and under different conditions. Land in commonage is a common feature of the Galway landscape and this may also influence boundary origin and management.
- The majority of hedgerows in East Galway are relatively tall (>1.5m), wide (>1m) and bushy and therefore are probably good for wildlife. (Arnold 1983, Lack 1987, Clements and Tofts 1992, Feehan 2003, Lysaght 1990, Pollard et al. 1974). Many hedgerows, however, do not have dense growth at their base and are quite gappy thus reducing their cover value for some wildlife (Arnold 1983 and Osborne 1984).
- Many hedgerows in East Galway appear to have not been managed for some time or are poorly managed. An increase in the quality and quantity of management would greatly improve the ecological and agricultural value of the hedgerow resource, and ensure long-term sustainability.
- Although most hedgerows are associated with active field boundaries, fencing is commonly used to re-enforce to the stock proof capacity of the boundary which indicates that the value of the hedgerow to act as a stock proof boundary is either not valued or practicable.
- In order to ensure the long-term sustainability and conservation of the hedgerow resource in Galway, the main issues that need to be addressed in Galway are lack of appropriate management and awareness of the value of hedgerows. Several specific recommendations are made in relation to hedgerow conservation policy, hedgerow management, new planting and future research and monitoring.
7. References


Lack, P.C. 1987. The effects of sever hedge cutting on breeding bird populations. Bird Study 34, 139-146.

**Websites consulted**
www.ukbap.org.uk (UK Biodiversity Action Plans site)
www.teagasc.ie

**Other texts consulted**
Appendix 1: Example of (i) aerial photos of 1x1km sample square and corresponding 6” OS (ii) and vector maps (iii). The blue square indicates the boundaries of the 1x1km sampling square.
Appendix 1 (ii) Corresponding 6” Ordnance survey map
Appendix 1 (iii) Corresponding vector map
# Appendix 2 (a): Structural recording sheet

## 2006 EAST GALWAY HEDGEROW SURVEY

<table>
<thead>
<tr>
<th>Square ref.:</th>
<th>Survey duration:</th>
<th>Date:</th>
<th>Surveyors: JF</th>
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</table>

### Context

- **LAND USE**
  - tillage
  - dairy
  - cattle
  - sheep
  - mixed stock
  - mixed stock + crops
  - stud

- **HISTORY**
  - infill
  - townland boundary
  - canal side boundary
  - railway line boundary
  - + roadside
  - + stream

### Adjacent Land Use & Links with other Habitats

- arable (BC)
- improved grassland (GA)
- semi-natural grassland (GS)
- non-native woodland (WD)
- semi-natural woodland / scrub (WN)
- scrub/transitional woodland (WS)
- curtilage/built land (BL)
- peatlands (P)
- lake/pond (FL)
- watercourse (FW)
- Other hedgerow (WL1)
- other (target note)
- none

### Boundary Function

- hedge redundant
- active boundary

### Construction

#### F OUTLINE

- linear /regular
- non-linear/irregular

#### G BOUNDARY TYPE

- Single Line Hedge
- Double Line Hedge
- Random Line
- + Bank
- + Wall
- + Shelf
- + External Drain
- + Internal Drain
- + Internal Path, Track-way, etc.
- None of the above features

### Structure/Condition

#### J PROFILE

- remnant
- relict (derelict)
- losing structure
- boxed / A shape
- overgrown
- overgrown + outgrowth at base
- top heavy / undercut
- straight sided

#### K HEIGHT

- <1.5m
- 1.5 – 2.5m
- 2.5 – 4m
- >4m

#### L WIDTH

- < 1m
- 1– 2m
- 2 – 3m
- 3 m+

#### M GAPINESS

- complete
- < 5 % gaps
- 5 – 10 % gaps
- 10 – 25 %
- 25 – 50 %
- > 50 %

#### N BASE

- open
- open + vegetation
- scrappy + vegetation
- dense
- very dense

### Management

#### U MANAGEMENT

- cut box profile
- cut ‘A’ shape
- cut on one side
- cut on both sides
- topped only
- excavator
- fully laid
- laid in part
- coppiced
- short term unmanaged
- long term unmanaged
- infill planting

#### V MANAGEMENT METHOD

- flail
- circular saw
- bar cutter
- hand tools
- excavator
- other
- unsure
- not applicable

#### W EVIDENCE OF LAYING

- no evidence
- past evidence
- recent evidence

#### X FENCING

- none
- fixed to stems
- electric
- post & wire
- sheep wire

---

Where there is significant variability in any feature being recorded, include the suffix ‘v’ after the recorded category digit/s.
### Floristics Recording Sheet

#### 2006 East Galway Hedgerow Survey

<table>
<thead>
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<th>Option</th>
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Appendix 3: Management standards: relevant bodies and organisations

1. **Mechanical Hedge Trimming**: Teagasc Unit MT 1302 is a FETAC (Further Education and Training Awards Council) accredited course that is available through various Teagasc colleges. Information about Teagasc courses and training available can be obtained from local Teagasc offices. See www.teagasc.ie.

2. **Hedge laying standards**: Details about The National Proficiency Test Council (NPTC) (UK) Standard (AO2098) can be obtained on www.nptc.org.uk

3. **Coppicing**: Contact the Coppice Association of Ireland for information about current standards and best practice. They can be contacted at: 071 9145504 (Joe Gowran)

4. **Planting new hedgerows**: Details about the NPTC standard can be obtained on www.nptc.org.uk.

**Other useful contacts:**

- The Heritage Council www.heritagecouncil.ie
- Crann www.crann.ie
- The Tree Council www.treecouncil.ie
- Hedge Laying Association of Ireland hlai@eircom.net
Appendix 4: Consultation

Prior to commencing the pilot project in 2005, two consultation meetings were held with interested parties. The first was a meeting in the Agricultural College in Mountbellew with the County Galway Heritage Officer (Marie Mannion), the People and Nature Project Manager (Elaine O’Riordain), hedgerow experts (Neil Foulkes and Anya Murray), academics (Michael Gormally and Kevin Corrigan), and several environmental science students. The aim of this meeting was to learn more about a hedgerow survey methodology developed by Anya Murray and Neil Foulkes. This methodology was discussed during the meeting and on a field walk around the College grounds.

A second meeting was held to discuss the approach to this project further and to discuss links with other related projects that are also underway in the county. This meeting was attended by Marie Mannion, Julie Fossitt (National Parks and Wildlife Service), Elaine O’Riordain, Sara Crangle (student) and I. Marie Mannion circulated all the members of the County Galway Heritage Forum with details of the Hedgerow Survey project and has kindly made available mapping and GPS facilities of the County Council.

The author spent a day in the field in Co. Offaly with Neil Foulkes to completely familiarise herself with the hedgerow survey methodology.

All members of the Heritage Forum were contacted about the hedgerow surveys in 2005 and 2006.