FINGAL WOODLAND FLORA SURVEY

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SUMMARY

In spite of proximity to densely populated, urban centres such as Dublin, Blanchardstown and Swords, rather little is known regarding the flora and fauna of Fingal's natural environment. To fill in the gaps of knowledge concerning the biodiversity of the various habitats in the district, a series of ecological surveys encompassing vegetation, birds, mammals, fungi, insects, coastal and amenity habitats have been carried out since 2003 under the direction of the Parks Division of Fingal County Council. Of special botanical interest are the woodlands that occur in many large estates in Fingal, especially since nearly all of the broadleaved woodland resource in the county is to be found only within old demesnes. This report focuses on the vascular plant communities of 13 woodland sites in Fingal and makes recommendations for their conservation.

The targets of this study were:

- To provide a preliminary listing of the higher plant species contained in each site;
- To carry out a detailed botanical survey using established ecological methods;
- To provide baseline rare plant and habitat data for future monitoring purposes;
- To supplement existing ecological data in the County Council's GIS database;
- To provide management recommendations for conservation and possibly expansion of the woodland resource in Fingal to ensure long-term sustainability

Augmenting three demesnes in the Liffey Valley Special Amenity Area (SAAO) surveyed previously (McCourt and Kelly, 2005), ten woodland sites across Fingal were examined over the 2007 growing season and all the higher plant species encountered within each wood were

recorded. Depending on the size and extent of the broadleaved cover in the woodland areas, between two and four representative 100 m² quadrats were recorded at each site, producing a total of 48 woodland quadrats for examination. All data will be incorporated into Fingal County Council's GIS database to facilitate long-term conservation and planning schemes.

With the exception of two woodlands in the western Liffey Valley SAAO, the woodlands of Fingal were found to be rather homogenous in species richness, with woody species diversity being largely a factor of human planting and management and herbaceous species diversity and distribution being an indirect product of woody species distribution, as well as local environmental factors, soils and seed sources. The Liffey Valley sites, especially St. Catherine's Park and Luttrellstown contain a rich array of woodland and woodland margin species, including several rare and protected specialists; as a result, protection and careful management of these sites should be of highest priority. As one the aims of the survey is to facilitate the conservation of woodland biodiversity within the county, site by site recommendations based on observations made during field work are also offered in section 5 of this report.

INTRODUCTION

1.0 Background

Due to the long history of human interference and the removal of most of the original forest cover in historical times, woodlands in Fingal are extremely fragmented and their vegetation is partly anthropogenic in nature. In spite of their artificiality, they are still important habitats for woodland flora and fauna in a more and more intensively exploited landscape. To investigate the importance of these woodland habitats and to provide baseline data for long-term monitoring purposes, Fingal County Council's Parks Division commissioned several wildlife and habitat surveys as part of a biodiversity assessment of the North Dublin County area. This assessment, named Fingal's Local Biodiversity Action Plan programme (LBP), was initiated in 2003 in accordance with guidelines first established under Ireland's National Biodiversity Plan and the EU Habitats Directive (92/43EEC). The LBP attempts to catalogue the biodiversity of Fingal's natural and semi-natural areas while identifying priority areas for conservation and enhancement through the generation of action plans that focus conservation efforts on the most important habitats and flora and fauna species in the county.

As part of the programme, a survey of the flora of woodlands in the Fingal region was commissioned by the County Council. The aim of the study is to provide source data on the species composition, current and previous management methods, and extent of the woodland habitat with suggestions to be made for its future management and long-term conservation.

1.1 History of Irish Woodlands

One of the many ancient names for Ireland is *Inis na Fidbadh*, meaning "the Island of Woods," suggesting a land dominated by trees (Keating, 1657). The *Annals of Ulster* have preserved a record of mast years in ancient times, such as that of 835 CE, which was so great that the number of fallen acorns temporarily altered the course of streams (Mac Airt and Mac Niocaill, 1983). These ancient records are supported by more recent palynological studies, from which it has been determined that Irish woodlands had probably reached their greatest extent between 7000 and 5900 years ago. The primeval woods of Ireland would have been dominated by Hazel (*Corylus avellana*), Oak (*Quercus robur, Q. petraea*), Wych Elm (*Ulmus glabra*), and Alder (*Alnus glutinosa*); with Alder, Oak and Elm eventually dominating the richer lowland soils and Birch (*Betula pubescens, B. pendula*) and Scots Pine (*Pinus sylvestris*) on the better drained upland soils (Mitchell and Ryan, 2001). This climax phase continued until about 5900 years ago, when the pollen record shows a drastic reduction in Elm populations, coinciding with the rise of Neolithic farmers in Ireland (c3900 BCE). The reduction in Elm may have been the result of the spread of disease, (similar to the Dutch Elm disease that plagues many Elms today) the spread of which may have been caused by humans making inroads into formerly undisturbed woodlands. The decline in Elm may also have been caused by farmers clearing the woodland over the more fertile soils on which it grew; the use of Elm boughs and leaves for fodder, or a combination of these factors (Mitchell and Ryan, 2001, Kelly and Kirby, 1982). Later climatic deterioration (about 4,000-5,000 years ago), in which Ireland became wetter and more oceanic, caused even more changes in the woodland communities. These included a reduction in Scots Pine, which eventually became extinct in Ireland (possibly as late as the 10th century CE); an increase in Alder and the expansion of open peatlands as demonstrated in fossil pollen counts and peat core depths (Watts, 1985,

Mitchell and Ryan, 2001). From Neolithic times through to recent centuries, the woodlands of Ireland continued to decline to varying degrees under human influence. The decline is marked by apparent periods of woodland recovery and regeneration in the pollen data, the result of reduced agricultural practices due to factors such as climate change, war, famine, or the migration of peoples during the Bronze and Iron Ages. A long period of woodland recovery between 200 BC and 200 CE was followed by an increase in arable agriculture, as indicated by the increase in cereal (and associated weed) pollen as well as the appearance of crops not previously found in the Irish pollen record (Weir, 1993). The increase in agriculture at this time may have been the result of a warm and dry period that occurred between the 1st and 6th centuries CE. A similar warming period, and associated increase in arable agriculture also occurred in the 12th century, and Irish woodlands at the time were again drastically reduced by the expansion of agriculture and the introduction of new technologies by invading peoples, as well as by a growing human population. After the Norman period, increased exploitation of the landscape caused the remaining forest cover to decline even further, reaching a critical low between Tudor times and the agricultural revolution of the 1700s (Mitchell and Ryan, 2001, Mitchell, 1982, Rackham, 1995, Rackham, 2006).
By 1700, so depleted were the Irish forests that wood and fuel had to be imported. Arthur Young, in his 1780 *Tour of Ireland* wrote:

"the greatest part of the country continues to exhibit a naked, bleak, dreary view for want of wood, which has been destroyed for a century past with the most thoughtless prodigality, and still continues to be cut and wasted as if it was not worth the cultivation" (Hutton and Ruane, 1970).

As a result of the denuded landscape and disputes over land rights that were the result of unfenced land, Parliament enacted many so-called 'Enclosure Acts' mandating the re-planting of trees, often

in the form of hedgerows and field boundaries that gave Ireland much of the "patchwork quilt" pattern it retains today (Aalen, 1978).

The rise of large estate houses in the 18th and 19th centuries saw the owners of these new demesnes planting trees as shelterbelts and for the ornamentation of their landholdings. In addition to native trees, many exotics were planted at this time; some from Europe and others from places further afield that were still being discovered. Many country mansions and estates acquired their ornamental woods at this time and a great number of the exotic trees planted then still stand today. Common areas and the general countryside meanwhile continued to be depleted of trees by a burgeoning human population that grew until the Famine years of 1845-51. In the years following the Famine, a diminished population, the Land Acts and declining landlordism all resulted in a near-cessation of planting, the liquidation of existing timber assets on large estates and the gradual decline and abandonment of many of demesne woods which has continued until recent times (Mitchell and Ryan, 2001, Mitchell, 1982). Efforts to reverse this trend have had mixed results. From the early part of the 20th century to the present day, State-sponsored forestry has helped to counteract the deforestation trend across Ireland, largely through the establishment of plantations of fast-growing, non-native, conifer species for profit. Private plantings of conifers, funded by the State (and, later, by EU grant schemes) have also accelerated since the 1980s. Ireland now has more forest cover than it has had through the last three centuries, yet this gain has been made mostly through the planting of conifers, frequently at the expense of native species.

The prevailing natural vegetation of Ireland is clearly woodland, but centuries of human settlement and exploitation have reduced the native forest cover to less than 1% of the land surface (Higgins et al., 2004, Cross, 1998). In spite of increased establishment of forestry plantations in recent years, Ireland is still the least forested country in Europe and natural and semi-natural woodlands

are among its rarest habitats. The overall land area of the Republic is around 6.9 million hectares; the total woodland cover comprises just 10% (~ 90,000 ha) of the land's surface, with additional treed landscapes, such as hedgerows, small woodlots, parkland trees, and non-woodland scrub bringing this figure up to 14% . The cover of broadleaved and mixed forest from the 1998 Forest Inventory Parcel Survey (FIPS) data was calculated to stand at 85,898.8 ha while the more recent National Forestry Inventory (NFI) gives 151,950 ha, hence the total cover of broadleaved woodland in the Republic of Ireland represents somewhere between 1.2 and 2.2% of the entire land surface (O'Donovan, 2007, Higgins et al., 2004). Every existing broadleaved wood, from the smallest urban woodlot to larger native oak woods, therefore is potentially a valuable reservoir of woodland biodiversity.

1.2 History of Woodland in Fingal

While the full extent of natural woodland cover in Ireland is still being disputed, it is generally agreed that woodland would have been the widespread vegetation type over the deeper, fertile lowland soils, such as those that cover most of north County Dublin (Cross, 1998). The earliest records of human settlement in Ireland describe an ancient plain called the *Sean magh nEalta Eadair* as having existed between the rivers Liffey and Boyne during the early Bronze Age conquest of Ireland (O'Grady, 1862, Keating, 1657). According to Keating, it was "called Sean-mhagh, 'old plain', *because a wood never grew on it* (emphasis mine); and, moreover, it [was also] called Magh n-Ealta, as it was there the birds of Ireland used to come to bask in the sun"**(**1657).This plain, located just to the west of Howth (*Binn Eadair*), would have comprised a

part of the present-day Fingal region, possibly making it a district with the oldest record of woodland clearance in the country. In spite of having been cleared in prehistory, later sources do give tantalizing hints of a time when north Dublin County had more extensive woodland cover. Doctor Meredith Hanmer for instance, in his 1571 *Chronicle of Ireland*, speaks of a great oak wood stretching from Oxmanstown west across much of what is today the Phoenix Park, and from which "*in 1098 King Rufus, by licence of Murchard, had the frames which made up the roofs of Westminster Hall, where no English spider webbeth or breedeth to this day, and that the fair green or common, now called Oxmanstown Green, was all one wood, and he that diggeth at this day to any depth shall find the ground full of great roots*" (Morrison, 1809).

By the time of the Civil Survey in 1655 however, woodland was extremely scarce in most of the northern part of the county. Of the four baronial divisions of County Dublin north of the River Liffey, only 156 acres of "wood" was recorded in the Barony of Coolock and 256 acres of "shrubwood, rock and furr" in the Barony of Castleknock. Of the other two baronies, Balrothery had no record of woodland while Nethercross had only 17 acres of 'underwood' recorded, possibly hazel coppice (Simmington, 1945). Nearly 70% of the county was classified as arable land (suitable for tillage) while the remainder was pasture, meadow, scrub and woodland or else marginal lands of furze, rock, heath or bog that were considered unsuitable for arable use at the time (Smyth 1992, Simmington 1945). Boate (1652), commenting on the unfortunate lack of trees in the Irish landscape stated that "*in some parts you may travel whole days long without seeing any woods or trees except a few about gentlemens houses*" especially within sixty miles of the city of Dublin.

As a consequence of the continuing loss, the 18th and 19th centuries became a time of fashionable tree planting in demesnes, a practice encouraged by the Royal Dublin Society from 1740 onwards.

An estimated 53,500 ha was planted in private woodlands in the 18th century (Aalen et al., 1997). The first conifer plantations also began to be established early in the 18th century; and the first species planted on a large scale was the re-introduced Scots Pine (Mitchell and Ryan, 2001). Other introduced species included Horse Chestnut (*Aesculus hippocastanum*), Spanish Chestnut (*Castanea sativa*), Lime (mainly *Tilia x europaea*), English and Small-leaved Elm (*Ulmus procera, Ulmus minor*), Beech (*Fagus sylvatica*) and many ornamental conifer species, such as Wellingtonia (*Sequoiodendron giganteum*) and Cedar (*Cedrus spp*.).

The years following the Famine saw the eventual sale of most large estate holdings, including those in Fingal. Many estates lost all or part of their woodland trees as landowners strapped for cash sought to liquidate their assets before selling off the property. Some estates, such as Kenure House in Rush, were divided up and auctioned off to developers and neighboring farmers, generally resulting in the destruction of any woodland that remained on site. Others were eventually purchased by the State to be held in public trust for historical preservation, tourism and amenity purposes, yet the proper management of their woodlands continues to be a problem.

In spite of the prevalence of State-sponsored conifer forestry in modern times, few substantial conifer plantations occur in Fingal. However, some north Dublin demesnes occasionally had sections planted out in conifers to generate more revenue for the landholders (Doogue et al., 1998) Most of these small plantations have generally ended up being poorly managed, and most have been more or less abandoned. Examples of conifer stands in Fingal can be seen in the woods at Malahide demesne, St Catherine's Park (Lucan demesne), St. Ita's Hospital (Portrane demesne), Hampton demesne and within the Gormanston College estate.

In 1998, County Dublin had approximately 877 ha of broadleaved and mixed woodlands (including ~27 ha of beech woods), with most of these being concentrated in the south county in and around the Dublin and Wicklow mountains (Higgins et al., 2004, Gallagher et al., 2001). The predominantly agricultural nature of the northern part of the county (Fingal) has resulted in very little woodland survival or re-planting in the district. A map from 1990 records noteworthy broadleaved woodland as existing in Fingal only in the Gormanston region to the north of the district, while large, mixed woodlands are not recorded elsewhere in the county (Aalen 1997). Of the smaller broadleaved woods which exist in Fingal, nearly all of them are contained within private or formerly private demesnes and have been heavily modified by exotic plantings and amenity use. These woods do, nonetheless, contain many native species of both planted and spontaneous trees and shrubs as well as native herbs and lower plants. Fingal is the fastest growing region of Ireland in terms of its human population, and expanding suburban development in the district has meant increased pressures on the remaining woods through increased traffic, tree removal and amenity use (Fingal Development Board 2006).

1.3 Study Area

In the past, the name "Fingal" was given to represent that part of County Dublin stretching between the rivers Delvin to the north and Tolka to the south (Walsh, 1888). The present-day county of Fingal is one of three administrative districts formed in that same region out of the division of the former historical county of Dublin by the Local Government Act (1993, 2001). It comprises a total of 448.07 km² and is a predominantly agricultural region, providing much of Dublin's (and Ireland's) vegetable and glasshouse crops (Figure 1.4). In spite of its traditionally

rural character, the recent population boom in Dublin has resulted in an explosion of one-off housing in Fingal's countryside and the continued rapid expansion of large-scale development in its towns to accommodate the growing commuter population. This change in land use is altering the natural and semi-natural habitats of Fingal and may be contributing to the accelerating loss of natural biodiversity within the county.

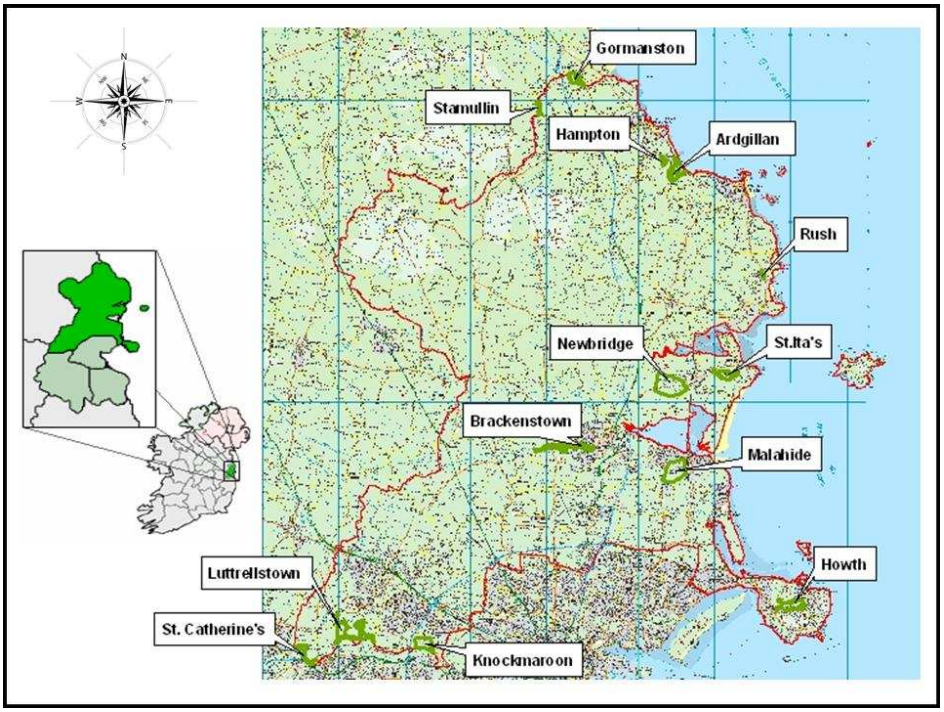

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Figure 1.4. Map of Fingal and the 13 woodland sites included in the survey.

1.3.1 Climate

The climate of Fingal is a relatively mild, oceanic one in which extreme fluctuations of temperature are a rarity. The most recent thirty-year average (1961-1990) at Dublin Airport near Swords, reveals a mean daily maximum air temperature average of 18.9° C in July and a mean daily minimum of 2.5° C in January (Met Eireann 2008). Hard frosts are a rarity, particularly near the coast, and likewise high summer temperatures are rare, with 33.3° C being the highest ever recorded in Ireland (Met Eireann 2008, Mitchell & Ryan 2001). Both yearly and daily temperature ranges are narrow with 6.4° C between yearly minimum and maximum and 5.5- 10° C between the daily minimum and maximum. This narrow range of temperatures produces an environment that sustains many plant species which otherwise would fail in the greater range that occurs on the European Continent. Away from the coast, the protective effects of the Irish Sea lessen and frosts are more frequent in the winter months in the county's hinterland. Fingal is also one the driest parts of the island, with a mean annual precipitation of approximately 770 mm recorded at Dublin Airport, mostly in the form of rainfall as snow seldom lies for long in Ireland (Doogue *et al.* 1998, Central Statistics Office 2005, Met Eireann 2008)

1.3.2 Geology and Soils of Fingal

Fingal, along with much of county Dublin and the adjacent counties of Meath, Louth and Kildare, forms one of the most agriculturally productive areas of the province of Leinster. In most areas of the district, the Carboniferous limestone bedrock is covered with a layer of glacial 'till', which is comprised of a calcareous blend of undifferentiated boulder clay and gravel of Irish Sea origin intermixed with local limestone, shale, the occasional boulder and deposited on the underlying bedrock by past episodes of glaciation (Stillman & Sevastopulo 2005). The varying thicknesses of the till overlying the bedrock give Fingal its slightly hilly terrain, described by the National Soil Survey of Ireland as 'undulating lowland;' this is defined by elevations in the 30 to 90 metre range and consists of soils of association 38 of the National Soil Survey classification system (Gardiner and Radford, 1980). In this association, the soils are made up of approximately 75% grey-brown podsolics and 25% poorly-drained gleys. Grey-brown podsolics are fertile, calcareous to circum-neutral soils suitable for agriculture. In fact, the abundance of this soil type means that nearly 70% of county Dublin is potentially suitable for tillage while of the remainder, 20% is occupied by the city of Dublin and its urban surroundings and just 10% consists of 'marginal' land (Gardiner and Radford, 1980).

Three exceptions to the limestone nature of the bedrock geology of Fingal are the volcanic protrusions at Portrane and Lambay Island, the Ordovician/Silurian mudstones and sandstone around Balbriggan in the northern tip of the county, and the resistant Cambrian quartzites which form the peaks of the Howth peninsula. All of these are overlain by superficial calcareous glacial deposits except for the uplands of Howth, where the exposed quartzites give rise to shallow, acidic soils unsuitable for cultivation and support a calcifuge vegetation unlike that of the surrounding districts (Holland, 1981b, Holland, 1981a).

1.4 Woodland Vegetation Communities

While all of the woodland existing today in Fingal has been altered by centuries of exploitation and destruction, the effects have not been equal everywhere and some small pockets of native woodland communities remain in areas where human activity has been least detrimental, or where the natural growth of woodland has actually been encouraged. Because of the relatively freely-draining, calcareous nature of the parent soils, the plant associations of these woodland communities are typically of the Corylo-Fraxinetum association of the Querco-Fagetea class that occurs over limestone in Ireland (Kelly & Kirby 1982, Cross 1998).

An exception to the generally basiphilous woodland community type of Fingal is found over the shallow, acid soils of the upland areas of Howth. While much of it is covered in a species-poor sub-community of dry, lowland heath of the Calluno-Ulicetalia type (Tüxen 1937), cessation of grazing and burning since the early 20th century have allowed for the natural succession of birch woodland over parts of the heath. Where woodland exists over the acid substrate, both within the demesne and on the adjacent heath, a community more akin to the Blechno-Quercetum typicum association of the acidophilous oak woods of Ireland has developed (Braun-Blanquet and Tüxen, 1952, Kelly and Moore, 1975, Cross, 1998, Cross, 2006).

1.5 Individual Survey Site Descriptions

Presented in this section are brief accounts of each of the 13 demesnes, their history and woodland vegetation. Detailed OSI maps and accompanying aerial photographs (2005) of each site and the location of the woodland vegetation contained therein are to be found in Appendix 1.

1.5.1 Ardgillan Demesne

Ardgillan Demesne is an 81 ha (200 acre) Public Park in the Balbriggan region of north county Dublin, and has been managed by Fingal County Council since opening to the public in 1985 (FCC 2007). The demesne is located on a high hill that slopes in an east-northeast direction towards to Irish Sea and is at an elevation of some 85-90 metres above the town of Skerries, which lies directly to the southeast.

The park today consists of a mix of woodland, semi-natural wildflower meadows, extensive lawns, a walled Victorian garden and conservatory, a formal rose garden and an herb garden, all surrounding an 18th century castellated mansion house with sweeping views of the Irish Sea and the mountains of Mourne. Its manicured appearance belies the fact that the demesne was previously a heavily wooded site encompassing the three ancient townlands of Kilmainham, Ardgillan and Baltray. The original wood may have given both the demesne and townland of Ardgillan their English name, being derived from the Irish *Árd Chóill* and signifying "High Wood." Much of this wood was removed when the manor house was built in 1738, and Rev. Robert Taylor, Dean of Clontarf, paid labourers a penny a day to clear the land for his new

'Prospect House'. That woodland which now remains around the perimeter of the demesne may be a heavily modified remnant or replacement of the original.

The Taylor family held the castle and lands for over 200 years before Richard Taylor sold the property to Heinrich Pott of Westphalia, Germany in 1962. Dublin County Council in turn purchased the estate and house from the Potts in 1982 for tourism and public enjoyment (Keane et al., 1995).

1.5.2 Brackenstown Woods (Knocksedan)

Brackenstown woodland encompasses a portion of the 89 ha (220 acre) Ward River Valley Regional Park immediately to the west of the town of Swords. The Park is largely made up of former parts of the Brackenstown House grounds as well as parts of the nearby Knocksedan demesne. Brackenstown estate was owned by the Burnell family in the 16th century, but later passed to the Nugents, before being sold to the Bysse family. Through marriage it passed from the Bysses to the famous Molesworth family and the original manor house was built in the 17th Century by Robert, the first Viscount Molesworth, not long after the battle of the Boyne (D'Alton, 1838).

Knocksedan, meaning either a "hill of quicksand" or the "hill of the fairy Dan" is a former demesne overlooking the Ward River Valley and a tributary to the west of Brackenstown. It was built on the site of an ancient circular rath, surrounded by a formerly deep and treacherous moat, which may have given rise to the name of the "hill of quicksand." It is a site of archaeological interest and may have been a battle site due to the number of human remains found there in past (D'Alton, 1838). Large parts of the demesne have recently been developed into suburban housing.

With the exception of a tract of wooded land immediately surrounding Brackenstown House, the woodland areas of Brackenstown and Knocksedan are currently managed by Fingal County Council as part of the Ward River Valley Regional Park. Many open areas have been planted with broadleaved trees, but existing woodland within the park has been seriously degraded. Only within the private demesne of Brackenstown, around difficult to access parts of the artificial lake and along the steeply sloping beechwoods of Knocksedan to the west does the woodland vegetation escape damage.

Compared to other demesne woods in Fingal, woodland in Brackenstown may be relatively new, since Dalton only records Lime (*Tilia europaea*) and Cherry (he gives records for *Prunus cerasus*, but possibly meant *P. avium*) as having existed in the Brackenstown and Knocksedan estates during his survey (1838). However, he also includes records of mushroom species typical of woodland, such as *Agaricus elephantinus* (now named *Russula nigricans*) and several *Boletus* species, including *Boletus igniarius* (*Phellinus igniarius*) which is a 'shelf' fungus or heartwood rot that grows on trees, especially woodland trees (Courtecuisse and Duhem, 1995). It is also possible that he simply omitted the mention of commoner species such as Oak, Beech and Ash, some large specimens of which were found within the wood during the present survey.

1.5.3 Gormanston College

The village of Gormanston lies in County Meath; however, the grounds of Gormanston Demesne straddle the Delvin River that forms the boundary between Meath and Fingal. Gormanston Castle, the finest of the present-day college buildings, and part of its grounds and woods are on the south bank, in Fingal. The Castle was formerly the seat of the Preston family and Sir Jenico Preston, 12th Viscount Gormanston built it in 1786, on the site of a castle erected earlier in 1372 (Matthews 2003). Comprising a total of 11,000 acres in 1883, of which 10,000 were located in County Meath, the size of the estate eventually dwindled under the passage of several Irish Land Acts, including the Irish Free State Land Act that was enacted after 1923. The current (17th) Viscount Gormanston, also called Sir Jenico Preston, sold the castle and grounds in 1947; it is now a boarding college operated by the Franciscan brothers (Tiernan, 2007-2008).

In spite of the predominantly agricultural nature of the northern part of the county, some measure of woodland or scrub has probably always existed along the Delvin River which separates Fingal from County Meath and bisects Gormanston demesne. The trees lining the river's banks would have consisted primarily of Alder, Birch, Willow and Hazel, not unlike the trees that still border the Delvin in both Gormanston and Stamullin demesnes. *Betula pendula* is rare as a native in the county, being usually planted or escaped from plantings. However, Colgan recorded it as a native in Gormanston woods in 1895 (Doogue et al., 1998), where it no longer appears to remain today due to canopy closure and insufficient open areas for the germination of its light-demanding seedlings. It does however, occur in a nearby hedgerow (McCourt & Kelly 2007) and in the woods at Stamullin nearby.

1.5.4 Hampton Hall Demesne

The lands on which Hampton Hall sits were acquired as part of a larger purchase of the lands of Balbriggan in the early 1700s by Alexander Hamilton of County Down, from the Barnewall family (Simms and Fagan, 1992, Pratt, 1999). He built Hampton Hall in 1758 and died the following year, bequeathing his lands and entitlements to his son, Baron George Hamilton Esq., who was instrumental in the development of Balbriggan Village. In later years, the estate as it exists today would pass through many hands before finally passing to the current owners, the Pratt family in 1998 (Pratt, 1999).

1.5.5 Howth Demesne & SAAO

Prior to approximately 3500 years ago, Howth was an island, with its landward-facing shoreline corresponding roughly with the current western boundary wall of Howth Demesne (Mitchell 1956, 1972). A beach has since risen up, connecting the island to the mainland, creating the peninsula as it exists today. Excluding the superficial deposits of this link to the mainland, the island geology itself is comprised of Cambrian rocks of the Bray Group, which consist mainly of quartzites and slates; with a remnant overlying layer of Lower Carboniferous limestone stretching in a line from Balscaddan Bay to southeastern Sutton, along the north and western sides of the former island (Holland, 1981a).

The soils developed over the limestone areas are relatively fertile, but most of this area has seen some of the heaviest development into residential housing, with parts of it also being converted into some of the greens of the extensive Howth (Deer Park) golf course. Where the Cambrian rock

is exposed, as it is over much of the higher ground, the soils are thin, acidic and infertile. Today, these thin soils support acid-loving heath vegetation, with 106 ha or nearly 18% of the peninsula being heath (Tubridy, 1997). What is now heath, in the distant past, may have supported acid oak-woods similar to those found in Wicklow, Killarney, Mayo and other places along the western coast of Ireland. In fact, the Irish name for Howth might possibly lend some credibility to this theory, as it has been suggested that the modern Irish *Binn Eadair* is not necessarily derived from *Benn Etar*, "the peak of Edar," romantically named for an ancient De Danann hero (O'Grady, 1862), but rather, from *Ben na Dair*, the "hill or peak of the Oaks" (McBrierty, 1981). However an expert considers that this suggestion may have no basis in fact, for in spite of there being no known etymology for the Irish word *Etar* (Eadar), it apparently has no connection with the word *daire* or "oak-grove." As the name *Etar* is of considerable antiquity, the translation of Binn Eadair as the "hill of oaks" may be unlikely (Kelly, F.S. pers.comm. 2008). Nevertheless, William Camden and other early writers have indicated that Howth's summit was once clad in oak trees, although it was bare by the Elizabethan era (Ball, 1917). Camden's statements are supported by pollen cores taken from the area on the peak known as the "Bog of Frogs," which have been dated to the mid 15th century. Although counts are not high, the cores do indicate the presence of oak in the area at the time, though it had all but disappeared between the 1500s and modern times, as indicated by the lack of oak pollen in the majority of the sample layers following the 15th century (Cooney, 1994).

1.5.6 Knockmaroon

Knockmaroon is a private demesne owned by the Guinness family, located just east of the M50 bridge over the Liffey and approximately 50-60 meters above the valley floor. Traditional methods

of husbandry are practiced by the owners on the demesne, which raises poultry, cattle and horses. Hay is produced in the traditional method of hand-cutting, stacking and drying, and with no fertilisers added. Grassland areas have also been planted in the distant past with widely spaced trees, mainly beech, for ornamental purposes. Very little replanting has been done in recent years, and the result is a park-like setting of closely cropped grass and enormous old trees, many past their prime. The extremely steep south and western slopes are clothed in broadleaved woodland, with the oldest trees having been planted by the current owner's grandfather. Little woodland management or planting has been done since that time, however, the wood is grazed by fallow deer (escapees from nearby Phoenix Park) and rabbit, while the herb flora is affected by the tunnelling activities of badgers. The wood itself is less than 200 years old, and first edition Ordnance Survey maps from 1843 show the slopes to be a quarry site bare of trees.

1.5.7 Luttrellstown

Luttrellstown derives its name from the 12th century Luttrell family that acquired lands of the current demesne and a great deal of property in County Dublin. The first member of the family, Sir Geoffroi Luttrell was granted lands in Ireland by King John of England for his loyal services; these included the site of the present demesne. His descendants are associated with the area from this time on, and in the 15th century the current residence was built. Succeeding generations of Luttrells held the land, added their own touches to the manor, and built for themselves an enormous fortune; with many Luttrells playing a role in the shaping of Dublin's history (Ball, 1906, Ball, 1920). The estate passed on through the family until the extinction of the male line with the death of Lord Carhampton in 1829; upon which the estate was sold to Luke White, whose son, Henry (Lord

Annaly) renamed the estate 'Woodlands'(Gerard, 1898). The present owner of the demesne is Mr. D. Primat of the PrimWest Group, who acquired the castle and demesne in 1983.

Along with the castle, follies and several outbuildings, the demesne itself comprises a mix of deciduous woods, woodland paths, semi-natural grasslands, lawns, gardens, an arboretum, arable land, pheasant-rearing pens, a world-class golf green, a shooting range, two ponds, and a small stream which courses through much of the property, before entering the Liffey just below the south wall.

1.5.8 Malahide

Malahide Castle, located east of Swords, is the oldest Norman castle in Ireland and was owned by the Talbot family from 1183 to 1973, making it the longest continuously occupied family estate in the country. The Anglo-Norman Richard Talbot, who first arrived in Ireland in 1170, was granted lands and a title at Malahide under Henry II sometime around 1184, while the rest of Leinster was granted to Strongbow. Although the Talbots had lived on their extensive lands at Malahide since this time, the castle was actually built on the present site sometime between the late 13th and early 14th century. An old Norman motte-and-bailey structure was found in Wheatfield, some few miles from the present castle, but still located on the 600+ acres of the former Talbot lands. After the death of the last member of the family, Lord Milo John Reginald Talbot at Malahide in 1973, the contents of the Castle were auctioned off, while the castle and its 268 acre demesne were purchased by Dublin City Council in 1976 (O'Shea, 1991, D'Alton, 1838).

Historical records of the existence of woodland at Malahide are paltry; however the demesne at Malahide is a classic example of ornamental mixed broadleaved woodland, probably planted for

private amenity use by the Talbot family. After its acquisition in 1976 by Dublin County Council, the site was converted into an amenity park for public use. Many of the trees, especially the older Beeches and Oaks may have passed their prime and pose a falling hazard, which results in their removal by the local authority (FCC). A very recent bout of fire blight in the town has devastated many already stressed trees and threatens to spread rapidly throughout the adjacent demesne (Lowes, 2007).

1.5.9 Newbridge (Donabate)

Newbridge Demesne is a 150 ha (370 acre) demesne that has become a multi-functional amenity park and traditional educational farm for public enjoyment (www.fingal.ie). The current site was formed out of parts of two older Anglo-Norman demesnes at Turvey and Lanistown, as well the as additional lands of Donabate and Corballis purchased by Thomas Cobbe, Esq. in the early 17th century. A house existed on the site between 1698 and the 1705 survey of Newbridge; however the present Georgian house was built by the Cobbe family in the mid-1700s. By the time it was surveyed again in 1776, Newbridge Demesne looked much as it does today with orchards, meadows, lawns, a wood around the property's perimeter, and a deer park (Bates 1988, Frizell 1776).

1.5.10. Rush (former Kenure Park Demesne)

The demesne at Rush formerly called Kenure Park no longer exists, nevertheless it has played an important role in the past history of Fingal. The name Rush itself is derived from the Irish *Ros Eo*, meaning 'the wood or headland of the Yew' while Kenure is *Ceann Iubhair*, 'the headland or promontory of the Yew' and the names came from the abundance of Yew that once grew there (Joyce, 1995). Kenure has also been called Kilnure (*Cill Iubhair*), 'the Church of the Yew' for the Early Christian church on the same site. The ruins of this church, dedicated to St. Damnan still stand just to the east of the small remaining wood parcel, near the entrance to the Kenure Park housing development. Although the church on the site predates the Norman invasion of 1169, the first written evidence of ownership of the lands of Kenure is found in the Ormond Deeds of the Anglo-Norman Butler family (Pratt, 1998b, Pratt, 1998a). This family held the lands of Kenure and Rush, leasing it to numerous tenants from the time of acquisition, until it passed briefly from their hands to the Fitzgeralds after the execution of James Butler by Edward VI for treason during the Wars of the Roses. It was returned to the Butlers of Ormond in 1507. Having their primary residence in Kilkenny, the Earls of Ormond became absentee landlords elsewhere, including at Rush, and therefore they leased out their lands to tenants. The Ormond landholdings in Dublin and their tenants were supervised by Christopher Barnewall, whom the 10th Earl appointed as steward in 1556. In 1703, the large Kenure mansion house was built by James, the 2nd Duke of Ormond, but he fell out of favor with George I in 1714 for his support of the Jacobite cause, and Kenure House and lands were confiscated and sold. It was purchased by the Echlin family and eventually passed to the Palmer family, who significantly added to the demesne and the nearby town of Rush during their ownership, especially after fire damaged the original house in 1827. The last Palmer to occupy Kenure was Colonel Roderick Henry Fenwick-Palmer, who was forced by rising debt to

sell off parts of the estate, with the remainder finally being sold, with the house, to the Irish Land Commission in 1964. Local farmers acquired most of the surrounding lands while the demesne and house, having fallen into disrepair, eventually passed to Dublin County Council; the house was demolished in 1978 for safety reasons (Pratt, 1998a, Joyce, 1920). The demesne has since been developed into Kenure Park residential housing development, and the remaining woods have been reduced by felling to a fragment of their former size, as seen when comparing earlier OSI maps with present-day maps and aerial surveys. This fragment, however, still contains Yew trees, possibly descendants of those that gave Kenure and Rush their Irish names.

1.5.11 St.Catherine's Park

The modern townland of St Catherine's Park is derived from a portion of the Parish of Leixlip while the park itself is located in County Fingal, just to the east of the town of Leixlip, County Kildare. At present, it is a mixed-amenity public park consisting of broadleaved woodland, conifers, scrub, semi-natural grassland and football greens managed by the Parks Division of Fingal County Council.

The current site of St. Catherine's Park has a long history going back to the Norman-English conquest in the 12th century. King Henry II granted lands seized from the native Irish to his most loyal knights, who in turn, often redistributed them to their own followers under the feudal system. In this manner, Warris de Peche, Lord of Lucan, acquired the lands of Lucan and surroundings in the early 13th century. In 1219, de Peche gave much of the site of the current park to the Canons of the Order of St. Victor for the establishment of the Priory of St. Catherine's, along with grazing rights, the right to maintain a mill and weir on the river Liffey, and the right to harvest wood from

the surrounding preserve. By 1323, the Priory had become bankrupt and turned their holdings over to Dublin's Abbey of St. Thomas (Joyce, 1920, Ball, 1906). The Abbey then held the site, leasing it out several times until 1569, when the monastery and its lands were confiscated under Henry VIII and redistributed again to Sir Nicholas White. The property stayed in the White family until 1655 when it was sold to Ridgley Hatfield, later the Lord Mayor of Dublin. It passed through many hands from 1664 to the end of the 18th century, when the house was destroyed by fire and never rebuilt (Ball, 1906, D'Alton, 1838). The site has been recently acquired by the Irish Government's Office of Public Works (OPW) as a part of the larger Liffey Valley Special Amenity Area and to produce a core site for the establishment of a multi-county Liffey Valley Regional Park.

A painting of the manor house at St. Catherine's from the late 18th century (before the fire) shows that the site was well-wooded, with woodland occurring on both banks of the river and stretching to the water's edge at the eastern end of the park (Fisher, 1795). The woodland has since become diminished in size, but occurs nearly in the same location as it did in 1795, and as it has likely to have done back to the 12th century and before. Due to the long continuity of records of woodland occurring on the site, St. Catherine's wood may potentially be classified as ancient woodland, making it a site of extreme importance for conservation as ancient woodland (or documented ancient woodland) is exceptionally rare in Ireland. The existence of a number of ancient woodland indicator species (Peterken, 1979, Rackham, 1980) in the ground flora also supports the status of St Catherine's as ancient woodland (Bohan, 1998).

1.5.12 St. Ita's Psychiatric Hospital (Portrane)

Portrane Demesne is situated on the site of the ancient Norman-period church of St. Catherine's, the ruins of which can still be found at the entrance to the demesne. The lands of Portrane had been granted to Christ Church Cathedral by King Sitric of Dublin in 1038, and the archbishops of the Church held the lands until 1204, after which it passed to the nuns of Grace Dieu. The nuns occupied the site until the dissolution of the monasteries in 1538, following which part of the lands of the abbey of Grace Dieu were confiscated and granted to Sirs John and Patrick Barnewall. The remainder of the lands, including the church, buildings, rights and tithes, were divided among successive royalists, the last of whom were the Ball family. The demesne was eventually sold to Eyre Evans Esq. of County Limerick around 1712 and it remained in the Evans family until George Evans, Esq. (Lewis, 1837, D'Alton, 1838, Joyce, 1920). It then passed into the hands of Count James Considine, who eventually sold it before purchasing Lambay Island in 1888. The present-day psychiatric hospital was built on the lands of Portrane demesne in 1896, and at one time housed up to 1600 patients (http://www.rte.ie/tv/theasylum/about.html).The number of inmates has declined since its inception, and many of its buildings have fallen into decay and disuse. The existing hospital system may soon be moved to another site, therefore the future of the demesne and its woodlands is uncertain (FCC).

1.5.13 Stamullin

Stamullin has had a long history of agricultural activity and Bronze Age farming settlements have been recently discovered in the locality (Ní Lionáin, 2007). Very little woodland is present in the district; that which does exist occurs on marginal land unsuitable for cultivation and around large estates or former estates. As at the nearby Gormanston College, the small woodland at Stamullin spans the Delvin River, and thus is located in both County Fingal and County Meath. That part of the wood contained within Fingal is owned by the Talbot Group, in the form of a portion of the 70-acre grounds of St.Clare's Convalescent Home, built in the 1990s.

The wood itself appears to have had a history of coppicing, some of it relatively recent.

MATERIALS & METHODS

2.1. Site Selection

With the aid of maps and aerial photographs from Fingal County Council's GIS database, 13 woodland areas across the district were evaluated in terms of size, history, surrounding land use, current and past management methods, and any potential factors which might affect woodland plant biodiversity.

The woodland sites of this study include 10 demesnes containing woodland, 3 of which are publicly owned (Ardgillan, Malahide, & Newbridge), 2 are privately-owned but with unrestricted public access (Howth & Rush), 4 have restricted public access (Gormanston, Stamullin, Hampton demesne & St. Ita's (Portrane) and 1 site contained a mix of private and public lands (Brackenstown). Also included in the current dataset are the three wooded demesnes of the Liffey Valley SAAO which had been researched previously (McCourt and Kelly, 2005), including the publicly-owned St. Catherine's Park and the privately-owned Luttrellstown demesne and Knockmaroon estate.

For each site, factors such as elevation, ownership, bedrock geology, area, and land use were derived from OSI maps (Discovery Series), aerial orthostat photographs (FCC 2005) Forest Inventory Parcel Survey data (FIPS 1998) (Gallagher et al., 2001), Geological Survey Ireland data and other publicly-owned data added as layers to the GIS database using ArcGIS 9.1. The National Survey of Native Woodland (NSNW) data were also used for comparison purposes in this survey as many of the woodland sites and methods covered in the present survey were also used in the national survey (Higgins et al., 2004).

2.2. Vegetation Survey

A vascular flora survey of 10 of the 13 wooded demesnes was carried out through the growing season between April and October 2007, and all plant species were identified using standard manuals. Data for the three Liffey Valley woods had been collected previously, in the 2005 growing season, but 2 of the 3 sites were revisited in 2007. Vascular plants were identified using Webb, *et al.* (1996), Rose (1996), Scannell and Synott (1987) and Stace (1997). Although not included in the species richness calculations, bryophytes were identified using Smith (2004, 1990). Nomenclature for vascular plants follows Stace, and all species found are listed in Appendix 2.

2.2.1 Relevé Sampling Technique

Relevé sampling is a powerful and versatile tool for detecting patterns in vegetation, which has a long history of development and use among European plant ecologists engaged in phytosociological studies (Mueller-Dombois and Ellenberg, 1974, van der Maarel, 2005). This method involves any kind of plot-based vegetation sample quantifying information on species presence and cover, and describing plant communities using the 'minimal' plot area needed to capture most of the species in the community. This often involves subjectively placing plots in sample plant community stands to most efficiently characterize the vegetation in a study area (e.g., a plot in alder carr, a plot in oak wood, a plot in willow fen, etc). The 'minimal area' needed for woodland sampling and quantification is still debated among phytosociologists with 200 m^2 now being the recommended size for sampling of all types of boreal, temperate and Mediterranean woodlands (Chytry and Otypkova, 2003). In Ireland, however, 100 m^2 is the preferred sampling

size for woodland and it was the size used recently in a national survey of native woodland in the Republic (Higgins et al., 2004).

2.2.2 Application of the Relevé Method in Fingal

For the 13 selected woodland areas in Fingal, two to four 10 x 10 metre quadrats were randomly chosen from larger, relatively homogenous areas of broadleaved vegetation within each wood, away from edges and other disturbance factors that might influence vegetation composition and render it different from that contained within the forest interior. Woodland areas with greater than 25% conifers or other non-native, evergreen canopy cover and areas in which the understory was dominated by laurel-leaved evergreens were avoided as they bear less relation to natural conditions and almost no herbaceous vegetation is to be found under these. Management recommendations to promote the recovery of woodland herbs in these densely shaded areas are provided in Section 5 of this report.

In each 100 m^2 quadrat, the girth at breast height of all canopy trees was measured and the height and percent cover estimated. The girth of understory trees and woody shrubs was also measured if greater than 5 cm diameter at breast height (dbh), otherwise only species names were recorded, and height and cover estimated. Seedling trees were counted and their species noted. In addition, all vascular plant species of the field layer were recorded and cover-abundance values estimated in percentages. Total vegetation cover was also recorded for each layer (canopy, understory, field layer). Bryophytes were only recorded if cover was significant (>6 cm^2). Difficult-to-identify species were collected, pressed and dried for comparison with herbarium specimens at the Botany Department of Trinity College, Dublin.

2.2.3. Environmental Features

Environmental data including slope, hydrology, soil nutrient availability (N & P), soil pH, management features, evidence of fire, and evidence of trampling were all recorded for each site on accompanying field sheets. To describe the terrain further, the percent cover of leaf litter, plastic litter, inorganic matter (stone), coarse woody debris (dead wood greater than 5cm diameter) and fine woody debris (deadwood less than 5cm diameter) were also recorded.

2.2.4. Permanent Plots and Future Monitoring

A hand-held GPS tracking device was used in the field and readings were taken from the centre of each 100 m² quadrat. The coordinates were then used to plot the quadrats on maps and aerial photographs of each site in an ArcGIS 9.1 database. While the precision of this method may be relatively crude (GPS readings are sometimes accurate only to within 10 metres of location), it generally enables the re-location of each quadrat site for re-surveying and long-term monitoring purposes while avoiding the placement of unsightly permanent markers in private and amenity woods. Permanent markers such as metal stakes are also prone to disturbance or removal in the more frequently visited public woods.

2.3 Data Analysis

2.3.1 Woodland Plant Community Analysis

With the exception of Howth, rather little variation was expected among the woodland plant communities in Fingal demesnes. Variation in the vegetation data was nevertheless explored using a combination of classification and ordination approaches. To accomplish this, the floristic data obtained by quadrat sampling were analysed using PC-ORD, a multivariate statistical analysis package for ecological data (McCune and Grace, 2002).

2.3.2 Soils

Time and financial restrictions limited the extent to which the soils obtained during the survey could be examined, therefore only the pH obtained for each quadrat is presented in Table 3.2b.

RESULTS

3.1 **General Overview**

In all, 36 tree species, 21 shrub species and 80 species of herbs were found at 13 woodland sites in Fingal. Bryophytes were sparse; of those found, *Thamnobryum alopecurum* was the most abundant, often forming dense, 'floating' carpets on the forest floor. The woody component of most woodlands in Fingal is generally anthropogenic in origin, with the most commonly planted and naturalised canopy species being Beech (*Fagus sylvatica*) and Sycamore (*Acer pseudoplatanus*), often interspersed with conifer species such as Scots Pine (*Pinus sylvestris*), Larch (*Larix decidua*), Fir (*Abies spp.*) and planted native species, of which Pedunculate Oak (*Quercus robur*) is the most common. Frequently planted in the shrub layer of demesne woods in the past are the non-native evergreen Cherry-laurel (*Prunus laurocerasus*), and the suckering alien, Snowberry (*Symphoricarpos albus*). Over acid soils, such as those found on Howth, the alien Rhododendron (*Rhododendron ponticum*) replaces *P. laurocerasus* as a very aggressive competitor of woodland plant communities.

In spite of the artificial elements to the woodland flora in Fingal, a natural component does exist, especially in the herbaceous layer of the vegetation. Ferns, mostly *Polystichum setiferum* and *Phyllitis scolopendrium*, but also *Dryopteris filix-mas* and *D. dilatata*, are consistently found in all woods, while nutrient-loving tall herbs such as Nettles (*Urtica dioica*) and Hogweed (*Heracleum sphondylium*) are abundant. With the exception of Wild garlic (*Allium ursinum*) and Lesser Celandine (*Ranunculus ficaria*) which occur at nearly every site, vernal woodland geophytes such as *Anemone nemorosa* (2 sites), *Hyacinthoides non-scripta* (4 sites), and the parasitic *Lathraea*

squamaria (2 sites) are rare in Fingal, and tend to occur only in long-established woodland in the county. Many other woodland specialists such as *Galium odoratum* (2 sites), *Melica uniflora* (1 site), *Carex strigosa* (2 sites), *Luzula sylvatica* (1 site), *Ajuga reptans* (1 site), are also relatively uncommon. One protected Irish Red Data Book species, Hairy St John's Wort (*Hypericum hirsutum*) occurs along woodland rides only at St. Catherine's Park and Luttrellstown (1999). Other rare and endangered species encountered in the Liffey Valley woodlands of St Catherine's and Luttrellstown include Yellow Archangel (*Lamiastrum galeobdelon ssp. montanum*), which is found only under formerly coppiced Ash in the woods at St. Catherine's; Green Figwort (*Scrophularia umbrosa*) at the margin of damp woods and in tall-herb communities along the banks of the Liffey and its tributaries, including at St. Catherine's Park and along the stream that runs through Luttrellstown demesne. Also frequently found only in the Liffey Valley demesnes is the parasitic Ivy Broomrape (*Orobanche hederae*), a protected species in Northern Ireland (Curtis and McGough, 1988).

Among native canopy species, Ash (*Fraxinus excelsior*) is the most abundant, and freely sows itself in gaps and along unmown woodland margins and rides. Alder (*Alnus glutinosa*) and Sally (*Salix cinerea*) are frequent on wetter sites, especially along natural stream courses. Of native understory trees, Whitethorn (*Crataegus monogyna*) and Wych Elm (*Ulmus glabra*) are the most common, followed by Wild Cherry (*Prunus avium*) and Birch (usually *Betula pendula*), with Birch and Cherry tending to occur in large gaps created by past felling or coppicing. Among native understory shrubs, Hazel (*Corylus avellana*) and the evergreen Holly (*Ilex aquifolium*) are often abundant in the county and large, heavy-fruiting Hazels form the canopy in small areas along the Delvin River within Stamullin and Gormanston demesnes. The native Yew (*Taxus baccata*) is less frequent in Fingal woodlands, generally occurring as scattered planted specimens or self-sown individuals from nearby gardens and plantings within the demesnes. At Rush, however, it is

abundant in the woodland canopy as planted and self-sown individuals as well as abundant seedlings and saplings. For species listings from each location, see Appendix II.

3.2. **Relevé data**

Within each of the 13 woodland locations (*Map 1*), four 100m² quadrats were located in homogenous woodland vegetation, producing a total of 48 woodland relevés containing an average of 15.9 species per relevé, with 8.3 woody species and 7.6 herb species (Table 3.2a).

Table 3.2a. Species richness for each of the 13 woodland sites in Fingal.

Woodland Site	**Area of Woodland (km²)**	**No. of relevés**	**Mean no. of species per relevé (100m²)***	**Mean no. woody species (per 100m²)**	**Mean no. herb species (per 100m²)**	**Mean no. alien species (per 100m²)***	**Mean no. native species (per 100m²)***	**Mean no. 'ancient woodland' species (per 100m²)* *(based on Woodland Trust data)***
Ardgillan	**0.201**	**4**	**18**	**7.75**	**10.25**	**3**	**15**	**2.25**
Brackenstown	**0.199**	**2****	**17**	**9.5**	**7.5**	**2**	**15**	**5**
Gormanston	**0.134**	**3****	**18.33**	**10.67**	**7.67**	**3.00**	**15.33**	**4**
Hampton	**0.081**	**3****	**16.00**	**7.33**	**8.67**	**2.33**	**13.67**	**2.33**
Howth	**0.334**	**4**	**10.67**	**5.33**	**5.33**	**1.67**	**9.00**	**2.67**
Knockmaroon	**0.115**	**4**	**14**	**8.25**	**5.75**	**2.5**	**11.5**	**3**
Luttrellstown	**0.405**	**4**	**22**	**11**	**11**	**2.5**	**19.5**	**7.5**
Malahide	**0.183**	**4**	**11.5**	**7.75**	**3.75**	**2**	**9.5**	**2**
Newbridge	**0.267**	**4**	**12.75**	**7.5**	**5.25**	**2.75**	**10**	**2**
St. Ita's	**0.131**	**4**	**13.25**	**8**	**5.25**	**3.75**	**9.5**	**1.75**
Rush	**0.029**	**4**	**17.75**	**8.75**	**9**	**3.25**	**14.5**	**2.25**
St. Catherine's	**0.138**	**5**	**12.8**	**7.4**	**5.4**	**2**	**9.4**	**2.6**
Stamullin	**0.047**	**4**	**23.75**	**10**	**13.75**	**2.5**	**21.25**	**9.75**
Mean	0.174	3.6	15.9	8.26	7.64	2.6	13.275	3.4
Totals	**2.264**	**48**						

**Excludes bryophytes and lichens*

***Exceptionally high numbers of conifers in canopy or Cherry-laurel in understory reduced the potential study area at these sites*

-Highest mean values (lowest values for alien species) are highlighted in red, whilst lowest values (highest for aliens) are in blue..

With a mean total of nearly 16 species per relevé (with a mean minimum of 10 and mean maximum of 24) there is very little difference in overall species richness among the 48 woodland relevés in Fingal. In the calculation of Simpson's Index of species diversity ($D = 1 - \sum p_i^2$) most relevés were found to have an index value in the narrow range of 0.8-0.88 (Table 3.2b), with slightly lower values obtained from sites where decreased tree diversity occurs with dense Ivy (*Hedera helix*) cover and/or large patches of laurel-leaved evergreens in the understory, such as found in parts of Ardgillan, Newbridge and Portrane demesnes. A low diversity value also occurs for the even-aged birch stand on Howth.

Table 3.2b. Number of vascular plant species and associated diversity indices for each of the 48 relevés. For further analysis of the Liffey Valley woodlands, see The Liffey Valley SAAO Survey Report (McCourt and Kelly, 2005)

LOCATION	Relevé ID.	Soil pH	Total No. Species (per 100m²)	Species Evenness (H'/H'$_{max}$)	Simpson's Diversity Index (D = 1- $\sum p_i^2$)
Ardgillan	ARD_W01	**5.87**	**19**	0.67	0.82
Ardgillan	ARD_W02	**4.3**	**23**	0.74	0.82
Ardgillan	ARD_W03	**4.61**	**15**	0.67	0.78
Ardgillan	ARD_W04	**6.22**	**15**	0.77	0.83
Brackenstown	BRAC_W01	**6.52**	**16**	0.71	0.81
Brackenstown	BRAC_W02	**6.98**	**18**	0.8	0.87
Gormanston College	GORM_W01	**5.84**	**19**	0.81	0.89
Gormanston College	GORM_W02	**5.92**	**18**	0.81	0.88
Gormanston College	GORM_W03	**6.02**	**18**	0.87	0.91
Hampton Demesne	HAMP_W01	**5.07**	**16**	0.77	0.84
Hampton Demesne	HAMP_W02	**5.85**	**15**	0.73	0.81
Hampton Demesne	HAMP_W03	**4.97**	**17**	0.82	0.87
Howth Demesne	HOWT_W01	**4.19**	**16**	0.78	0.85
Howth Demesne	HOW_W02	**3.95**	**10**	0.78	0.82
Howth Demesne	HOW_W03	**4.07**	**6**	0.63	0.61
Malahide Demesne	MAL_W01	**6.09**	**10**	0.79	0.81
Malahide Demesne	MAL_W02	**6.55**	**10**	0.8	0.81
Malahide Demesne	MAL_W03	**6.80**	**11**	0.76	0.81
Malahide Demesne	MAL_W04	**6.80**	**15**	0.78	0.86
Newbridge Demesne	NEW__W01	**5.54**	**11**	0.69	0.73
Newbridge Demesne	NEW_W02	**5.92**	**21**	0.81	0.91
Newbridge Demesne	NEW_W03	**6.41**	**7**	0.67	0.67
Newbridge Demesne	NEW_W04	**6.30**	**12**	0.67	0.77
Portrane (St. Ita's)	ITA_W01	**5.80**	**11**	0.64	0.7
Portrane (St. Ita's)	ITA_W02	**6.90**	**6**	0.77	0.69
Portrane (St. Ita's)	ITA_W03	**6.03**	**10**	0.6	0.6
Portrane (St. Ita's)	ITA_W04	**6.40**	**26**	0.79	0.88
Rush Demesne	RUS_W01	**5.51**	**16**	0.71	0.81
Rush Demesne	RUS_W02	**6.30**	**16**	0.72	0.8
Rush Demesne	RUS_W03	**6.90**	**20**	0.78	0.88
Rush Demesne	RUS_W04	**5.70**	**19**	0.8	0.86
Stamullin (St. Clare's)	STA_W01	**4.91**	**22**	0.79	0.88
Stamullin (St. Clare's)	STA_W02	**5.40**	**26**	0.78	0.88
Stamullin (St. Clare's)	STA_W03	**5.50**	**25**	0.79	0.89
Stamullin (St. Clare's)	STA_W04	**6.52**	**22**	0.82	0.89
Luttrellstown	LUTR_W01	**5.16**	**28**	0.73	0.86
Luttrellstown	LUTR_W02	**7.58**	**18**	0.78	0.87
Luttrellstown	LUTR_W03	**7.36**	**14**	0.68	0.80
Luttrellstown	LUTR_W04	**4.32**	**28**	0.80	0.90
Knockmaroon	KNOC_W01	**7.75**	**18**	0.78	0.86
Knockmaroon	KNOC_W02	**6.41**	**12**	0.70	0.74
Knockmaroon	KNOC_W03	**7.25**	**12**	0.75	0.80
Knockmaroon	KNOC_W04	**7.38**	**14**	0.76	0.80
St. Catherine's Park	CAT_W01	**7.26**	**13**	0.74	0.80
St. Catherine's Park	CAT_W02	**7.31**	**11**	0.76	0.80
St. Catherine's Park	CAT_W03	**6.90**	**9**	0.63	0.62
St. Catherine's Park	CAT_W04	**7.23**	**8**	0.74	0.76
St. Catherine's Park	CAT_W05R	**7.48**	**23**	0.65	0.79

3.3 **Ardgillan**

The flora of woodland communities at Ardgillan is poor in comparison to other sites in Fingal (Table 1). The canopy is dominated by Sycamore (*Acer pseudoplatanus*), with occasional Beech (*Fagus sylvatica*) and Pedunculate Oak (*Quercus robur*). Understory trees include Wych Elm (*Ulmus glabra*) and abundant saplings of Sycamore. Also planted in parts of the wood, especially near to the castle, are *Taxus baccata, Rubus tricolor, Symphoricarpos albus* and abundant laurel-leaved evergreens, especially *Prunus laurocerasus* and *Rhododendron spp.* and also, less commonly, *Aucuba japonica.* Where the understory has been cleared of Cherry-laurel, *Sambucus nigra* occurs in abundance with sapling Sycamores. The herb flora is poor, with abundant *Hedera helix* and nutrient-loving species such as *Urtica dioica, Heracleum sphondylium, Galium aparine* and *Carex pendula* predominating. Ferns are also abundant while a few woodland species such as *Primula vulgaris, Chrysosplenium oppositifolium, Ranunculus ficaria, Circaea lutetiana* and *Allium ursinum* may also be found in areas of the wood where the shrub layer is thin.

3.4 **Brackenstown**

The wood at Brackenstown is mixed woodland of Ash interspersed with many planted broadleaved and conifer trees and extends along north- and south-facing slopes at an elevation of 70-75 metres above sea level to just 36 metres at the valley floor. The western end of the wood is a nearly pure Beech stand with a sparse shrub layer and ground flora of mostly spring-blooming wild garlic (*Allium ursinum*). Along the valley floor, directly beside the river is a narrow belt of Alder (*Alnus glutinosa*) and willows (mostly *Salix cinerea*) that grows along the stream bank. The main wood on the slopes is dominated by Ash and Sycamore, but also has a few old oaks (*Quercus robur*)

between 4 and 5 metres in girth. Horse-chesnut (*Aesculus hippocastanum*) and some old beeches are also scattered throughout the wood, while beneath is a thick shrub layer, often impenetrable, of *Prunus laurocerasus, Crataegus monogyna, Ulmus glabra* saplings, *Sambucus nigra* and *Rubus fruticosus agg.* Ferns (*Dryopteris spp., Polystichum setiferum, Phyllitis scolopendrium*) are frequent in the herb layer along with nutrient-loving species such as *Urtica dioica, Geum urbanum* and *Heracleum sphondylium*. The diversity of the terrain and surrounding habitats, which include the Ward River, old walls, ruined buildings, rides, ponds, semi-natural grassland, tall-herb wetland communities, bracken, parkland and new tree plantings may all contribute to a higher than expected species richness at Brackenstown.

3.5 **Gormanston College**

Like many historic estate homes in Fingal, Gormanston College lands are bounded by a wooded perimeter, as well as a central woodland garden spanning both sides of the main drive onto the college grounds. Over the course of its history, the woodland has been planted with Beech, Oak, Sycamore, Elm, and a variety of conifers, including the native Yew. Alder and Hazel are frequent along the banks of the Delvin River. Except where groups of Cherry-laurel had been planted in the past, the majority of the shrubby understory appears to be natural and spontaneous, with abundant Hazel, Wych Elm, Bramble, Holly, and Yew.

The woodland at Gormanston College spans both sides of the River Delvin, and the south side of the wood, contained within county Fingal, is a mixed woodland of Ash, Beech and Sycamore, interspersed with other trees, such as Oak (*Quercus robur*), Common Lime (*Tilia x europaea*), Elms (*Ulmus glabra, U. minor*) and Horse Chestnut (*Aesculus hippocastanum*). Where not overtaken by Cherry-laurel, the understory shrub layer contains Hazel, Elm, Holly and Yew. Along

the river corridor and on the wetter soils in depressions Alder and Hazel are frequent, and occasionally occur with Poplar (*Populus x canescens*), Hornbeam (*Carpinus betulus*) and Sallies (*Salix cinerea, S. caprea*). The herb layer is rich in the older parts of the wood and within the immediate vicinity of the river, where the dark, alluvial soils support plants tolerant of damp conditions and occasional flooding. Among these are abundant large and luxuriant ferns (*Polystichum setiferum, Dryopteris spp.*), the spring-blooming geophytes *Allium ursinum* and *Ranunculus ficaria*, mosses and tall herbs associated with damp soils. Elsewhere the herb flora is sparse, with abundant Ivy and occasional nutrient loving species such as *Urtica dioica* and *Heracleum sphondylium*. There are newer small stands of Beech and Ash that appear to have been appended to the original mixed wood and possess a poor herb flora, with Ivy abundant under the Ash and a nearly bare floor under the Beech groves.

3.6 **Hampton Demesne**

The wooded portion of Hampton Hall demesne is approximately 25 ha in size and is largely comprised of Ash, Sycamore and scattered individuals of Birch (*Betula pendula*) Beech, Horse Chestnut (*Aesculus hippocastanum*) and ornamental conifers. Four enormous Monterey Cypress (*Cupressus macrocarpa*), possibly some of the largest trees in Fingal, overlook occur the western boundary of the wood, adjacent to the Blackhall golf course. The shrub layer is also mostly exotic, with a nearly impenetrable layer of *Prunus laurocerasus* interspersed with *Taxus baccata* and *Symphoricarpos albus*. Among native species, Elder (*Sambucus nigra*) is the only shrub frequently found. Also present within the wood, engulfed by invasive Cherry-laurel, are several gnarled and apparently ancient coppice stools of Spanish Chestnut (*Castanea sativa*). A large section of the wood has been planted in conifers in an attempt at small-scale forestry and the western and

southwestern ends of the wood have dense conifer stands no more than 30 years old. A small, detached parcel just beyond the demesne wall and to the north of the main wood is of interest: located in a depression in the surrounding arable landscape, it is a wetland wood with a canopy comprised entirely of native tree species tolerant of varying degrees of water logging, including Alder, Birch (*Betula pendula, B. pubescens*), Ash and Pedunculate Oak (*Q. robur*). A few Sycamores are also present. The shrub layer is sparse with scattered Sallies (*S. cinerea*, *S. caprea*), Elder (*Sambucus nigra*) and thick patches of Brambles (*Rubus fruticosus* agg.). The herb layer is a dense covering of *Carex pendula* with the occasional tall herb of enriched, shaded soils, including *Urtica dioica*, *Heracleum sphondylium, Calystegia sepium, Galium aparine, Galium palustre, Solanum dulcamara* and *Rumex sanguineus*.

3.7 **Howth**

Most of the woodland within the walled portion of the demesne at Howth occurs over limestone derived soils, therefore the herbaceous plant communities that occur underneath the trees are similar to those found in woodland demesnes elsewhere in Fingal, However, the disjunction between the older Cambrian rocks and the younger, overlying Carboniferous limestone till that occurs just outside the south demesne wall, and the presence of an outcrop within the demesne itself (Muck Rock) has produced two different vegetation communities. Calcifuge plants occur over the thin acidic soils derived from the Cambrian rock, while calcicoles are found in other parts of the demesne. Two relevés were placed in the planted woodland over limestone derived soils within the demesne, and are similar in species composition and diversity to other woodland demesnes within the county, while one was placed just outside of the south wall over acid soils and reflects a natural, species-poor community in which *Betula pubescens* and some *B. pendula* are the main drivers in the conversion of heath and bracken communities to woodland. The difference in

species richness between this site and all others is reflected in the low diversity value obtained for the third relevé (HOW_W03) in Table 3.2b.

3.8 **Knockmaroon**

Knockmaroon wood is very open in nature, with Ash and Beech being largely co-dominant, and the field layer sparse or grassy with *Brachypodium sylvaticum*. 19 tree species were found in all, widely scattered throughout the wood; these include abundant Sycamore and exotic planted conifers such as *Pinus sylvestris, Larix decidua, Pinus contorta, and Pinus radiata* and naturalising *Abies alba*. As at Luttrellstown, native Oak (mostly *Quercus petraea*) and Yew occur at Knockmaroon on dry ridges or in steep ravines. Some exotic oaks have also apparently self-sown into the woodland from the estate and neighboring properties. These include mature plants, seedlings and saplings of Turkey Oak (*Quercus cerris*) and Holm Oak (*Quercus ilex*). The understory of Knockmaroon is sparse, with Elm, Hazel, and Holly being less common than in other woodlands in the county, instead the understory contains abundant saplings of Ash, Sycamore, Beech, and locally, Silver Fir (*Abies alba*). Wild Privet (*Ligustrum vulgare*) is a common shrub and Spurge Laurel (*Daphne laureola*) is also scattered throughout the wood, having established from earlier plantings in the demesne gardens (K. Guinness, *pers. comm*). On south facing ridges under Scots Pine, Whitethorn occurs with other species of open sites such as Wild Roses (*Rosa canina, Rosa arvensis*), and Gorse (*Ulex europaeus*). Species of the woodland field layer include *Allium ursinum, Brachypodium sylvaticum, Primula vulgaris, Ranunculus ficaria, Arum maculatum, Anthriscus sylvestris, Sanicula europaeus, Geranium robertianum, Phyllitis scolopendrium, Dryopteris filix-mas, Dryopteris affinis* and *Ranunculus repens,* but these are often

sparse and extremely localised. Ivy cover is also notably poor, and bare ground is frequent in many areas throughout the wood, possibly due to the steepness of the slopes and the activities of badgers, which have built setts on the slopes of the central part of the wood. The herbaceous vegetation and ivy cover may also be low because of grazing by escaped Fallow Deer from the adjacent Phoenix Park. Exposed soils and sparse vegetation have favored the growth of *Mnium hornum* and pleurocarpous mosses, the most abundant of which are *Brachythecium spp.*, *Thuidium tamariscinum* and *Kindbergia praelonga.*

3.9 **Luttrellstown**

While the site is likely to have been wooded since earliest times, the current woodland layout at Luttrellstown was probably formed during the heyday of tree planting of the 17th and 18th centuries, and there is a very high proportion of Oak (*Quercus robur*) and Beech (*Fagus sylvestris*) in comparison with other woodland demesnes in Fingal. The most common canopy tree species in the wood at Luttrellstown is Beech, with Ash and Oak (mostly *Quercus robur*) also being locally abundant. Sycamore is also abundant beneath the taller canopy emergents like Beech, Oak and its saplings are numerous. Yew is common on limestone outcrops where it may found with rare individuals of Sessile Oak (*Quercus petraea*).Active planting by past owners contributed Silver Fir, Spanish Chestnut (*Castanea sativa*), Hornbeam (*Carpinus betulus*), Horse Chestnut (*Aesculus hippocastanum*) Lime (*Tilia x europaea*) and a wide range of exotic conifers, including Sequoia (*Sequoiadendron giganteum*), European Larch (*Larix decidua*), Fir (*Pseudotsuga menziesii, Abies spp.*) and the occasional Pine (*Pinus sylvestris, P. contorta, P. radiata*). Wild Cherry (*Prunus avium*) and more rarely, Silver Birch (*Betula pendula*) can also be found in the margins of the

wood. A small arboretum on the grounds supplies additional tree and shrub species, but unless planted or naturalised in the adjacent wood, they are not listed here.

The understory of Luttrellstown woods is dominated by Holly and Wych Elm as well as locally abundant saplings of Beech, Ash and Sycamore. Hazel is also frequent, while Spindle (*Euonymus europaeus*), Whitethorn, Blackthorn, and Elder are occasional throughout the wood. Though they occur within the wood, these species are all more common in wood margins, rides, banks and open glades throughout Luttrellstown woods. Bramble, Ivy and Honeysuckle (*Lonicera periclymens*) are abundant, with Ivy occurring mostly in the wood interior and Honeysuckle and Bramble abundantly in wood margins and rides. The field layer of the woodland contains slow-spreading, spring blooming geophytes such as *Allium ursinum, Anemone nemorosa*, *Hyacinthoides non-scripta,* and *Ranunculus ficaria* which are followed by summer bloomers such as Bugle (*Ajuga reptans*), Herb-Robert (*Geranium robertianum*), Wood-Avens (*Geum urbanum*), Germander Speedwell (*Veronica chamaedrys*), Enchanter's Nightshade (*Circaea lutetiana*), Sanicle (*Sanicula europaeus*) and violets (*Viola riviniana, V. reichenbachiana*). Carices (sedges) are abundant, especially *Carex sylvatica, Carex pendula, Carex remota* and the rarer *Carex strigosa* and *Carex divulsa.* Grasses are represented by the shade tolerant and uncommon *Melica uniflora* and *Milium effusum.* Ferns are also common, especially *Phyllitis scolopendrium*, *Dryopteris filix-mas* and *Polystichum setiferum*, with *Dryopteris dilatata* and *Dryopteris affinis* also frequent. On stone walls and crevices, the epiphytic ferns *Polypodium vulgare* and *Asplenium ruta-muraria* can be found. Mosses are infrequent, but those found included *Thamnobryum alopecurum, Mnium hornum* and *Thuidium tamariscinum*.

One of the distinguishing features of Luttrellstown is presence of infrequently mown gravel rides which support a number of woodland edge or coppice species not commonly found in the wood interior or adjacent grasslands. Some examples include *Brachypodium sylvaticum, Bromopsis*

ramosus, Festuca spp., Deschampsia caespitosa, Carex flacca, Carex sylvatica, Stachys sylvatica, Glechoma hederacea, Geranium robertianum, Fragaria vesca, Lapsana communis, Ajuga reptans, Anthriscus sylvestris, Linum catharticum, Crepis biennis, Potentilla sterilis, Potentilla reptans, Valeriana officinalis, Primula vulgaris, Ranunculus ficaria, Stellaria media, Veronica officinale, Veronica montana, Rubus idaeus, Viola reichenbachiana, Stachys sylvatica and five *Hypericum* species, including the nationally protected *Hypericum hirsutum* (1999).

3.10 **Malahide**

The woodland at Malahide Castle is a long and relatively narrow planted wood bordering the perimeter of the entire demesne. The length of the wood is in turn bisected by a heavily-used gravel walking path. Relevé placement within the wood was therefore awkward, and confined to larger areas away from the main path. The canopy in these areas is dominated by Sycamore and Ash with Beech and the occasional Pedunculate Oak (*Quercus robur*) also to be found. Understory trees include Wych Elm and abundant saplings of Ash and Sycamore. Holly is also frequent, and in local areas of the wood, Cherry-laurel and Snowberry dominate the shrub layer to the exclusion of all else. Other laurel-leaved evergreens have also been planted in parts of the wood along the main path, including *Aucuba japonica*. The herb flora is poor, with abundant *Hedera helix* and nutrient-loving species such as *Urtica dioica, Heracleum sphondylium* being the most commonly encountered. Ferns are also abundant while a few typical woodland species such as *Primula vulgaris, Geranium robertianum, Ranunculus ficaria, Circaea lutetiana, Arum maculatum* and *Allium ursinum* may be found in areas of the wood where the canopy layer is thinner, such as along the margins of the path. *Ranunculus ficaria* is especially dense along the road-facing side of the

demesne wall bordering on both the main Malahide Road and the Back Road. The most commonly encountered bryophytes at Malahide are *Thuidium tamariscinum* and *Thamnobryum alopecurum*, with the latter forming dense mats on the woodland floor where ivy cover is thin.
Also planted in areas of the wood, especially around the castle, are small conifer plantations consisting of Spruce (*Picea spp*.) and Fir (*Abies spp*.). The herb and shrub flora under these stands is exceptionally poor, with scattered Bramble plants and the occasional Soft Shield Fern (*Polystichum setiferum*).

3.11 **Newbridge Demesne**

The canopy of Newbridge woodlands is generally dominated by Ash and Sycamore, but Ash sometimes also occurs with Beech and the occasional Pedunculate Oak (*Q. robur*) in older parts of the wood in concurrence with a few other native and non-native trees. In the southeastern corner, in particular, are some very large old Ash, Pedunculate Oak and Beech; some of the Beeches measure greater than 5 metres in circumference. Understory trees include Wych Elm and abundant saplings of Beech and Sycamore. Holly is infrequent and local, while planted Yews are found mainly in the woodland nearest to the estate house. Invasive Cherry-laurel and Snowberry, also found mainly near the house, may dominate areas of the shrub layer to the exclusion of all else. In common with Ardgillan, other laurel-leaved evergreens have been planted along paths in the wood, with *Aucuba japonica* being the most widespread. The field layer is very poor, with abundant Ivy and Bramble, as well as nutrient-loving species such as *Urtica dioica*, *Heracleum sphondylium*, and *Rumex sanguineus*. Ferns (*Polystichum setiferum, Phyllitis scolopendrium, Dryopteris spp.*) are also common, while a few woodland species such as Primrose (*Primula vulgaris*), Herb-robert

(*Geranium robertianum*), Lesser Celandine (*Ranunculus ficaria*), Enchanter's Nightshade (*Circaea lutetiana*), Lords-and Ladies (*Arum maculatum*) and Wild Garlic (*Allium ursinum*) are also found scattered throughout the wood where evergreen shrub and ivy cover are thin.
In the western part of the demesne, where the ground is often saturated at any month of the year and standing water is so frequent that drainage channels have been cut in the past, species typical of saturated soils occur with lower densities of Ash and Sycamore. These flood-tolerant species include Alder (*Alnus glutinosa*), Yellow-flag (*Iris pseudacorus*), Water-Cress (*Rorippa nasturtium-aquatica*), Wild Angelica (*Angelica sylvestris*) and Carices (*Carex pendula, C. remota*). The most commonly encountered bryophyte at Newbridge is *Thamnobryum alopecurum* which, as elsewhere over limestone-derived soils in Fingal, forms dense mats on the woodland floor. Due to the abundance of old timber, deadwood is frequent in the woodland and supports a diverse population of fungi, including some uncommon species (H. Fox, *pers. comm*).

3.12. **Rush Demesne**

Woodland at Rush Demesne was in earlier times more extensive, but development of the former Kenure Park site has severely reduced it to the small fragment that remains today. Nevertheless, the wood may still be of historical and ecological interest as it is one of the only woodlands in the county in which Yew is common. The wood itself is a mixed broadleaved woodland in which Sycamore is abundant and occurs in the canopy with Ash, Beech, Dutch Elm (*Ulmus x hollandica*), Common Lime (*Tilia x europaea*), the occasional Oak (*Q. robur*), and some pollarded Horse Chestnut at the western margin of the wood. Yew, generally an understory tree, also reaches canopy height in areas of the wood. The oldest individual Yews have all the appearance of having

been planted, perhaps in association with the adjacent church ruins, but there are also frequent individuals in seedling, sapling and pole stages of growth scattered throughout the wood, indicating a strong affinity for the site.

With these seedling and sapling Yews, the understory also contains abundant sapling and seedling Sycamore, Beech and Elder. Snowberry is dense in local areas of the wood, while planted laurel-leaved evergreens such as *Rhododendron spp.* and *Aucuba japonica* are found near the church site Spurge-laurel may have also been planted in the past, but is now widely naturalised throughout the wood. Brambles and Ivy are common in the field layer where they occur with tall herbs characteristic of nutrient-rich soils, such as *Heracleum sphondylium, Urtica dioica, Rumex sanguineus, Geum urbanum, Smyrnium olusatrum* and *Carex pendula.*

3.13 **St. Catherine's Park**

The wood at St. Catherine's is situated on a gradually sloping, occasionally very steep, glacial ridge facing the River Liffey to the south and west. The majority of the wood is dominated by Beech and Ash, with a mix of other native and exotic species including Silver Birch (*Betula pendula*), Wild Cherry, Pedunculate Oak (*Q. robur*), Sycamore, and the occasional planted Hornbeam (*Carpinus betulus*), Common Lime, Sitka Spruce *(Picea sitchensis*), Douglas Fir (*Pseudotsuga menziesii*), and Silver Fir (*Abies alba*), Spanish Chestnut (*Castanea sativa*), and Small-leaved Elm (*Ulmus minor*). The understory is locally comprised of abundant Hazel and Holly, with Wych Elm scattered throughout the wood. Large colonies of apparently managed Cherry-laurel may also be found in the understory, especially along the paved northeast path. Other shrubs present include Whitethorn and occasionally, Yew. Blackthorn, Elder, and Spindle (*Euonymus europaeus*) may also be found along woodland rides, while Bramble is abundant in the

field layer. Where the wood meets the River Liffey, moisture-loving species such as Alder (*Alnus glutinosa*), Grey Poplar (*Populus x canescens*), Willows (*Salix alba, Salix fragilis,* and *Salix cinerea*) occur, and Snowberry is abundant in the shrub layer along the river banks.

The ground flora of St. Catherine's is particularly rich, being composed of spring-blossoming calcicolous geophytes such as *Anemone nemorosa, Allium ursinum, Arum maculatum*, *Hyacinthoides non-scripta* and *Ranunculus ficaria*; and summer-blooming herbs such as *Ajuga reptans, Geranium robertianum, Geum urbanum, Potentilla sterilis, Primula vulgaris, Galium odoratum, Sanicula europaeus, Brachypodium sylvaticum, Carex sylvatica, Viola riviniana and Viola reichenbachiana,* Rarer species include, *Melica uniflora, Carex strigosa*, the parasitic *Lathraea squamaria* and under an old Ash coppice, the nationally protected *Lamiastrum galeobdelon.* Ferns are also common, and include *Phyllitis scolopendrium*, and *Dryopteris filix-mas,* while in some areas of the wood, particularly along the densely shady northeast road under dense Beech canopy, *Polystichum setiferum* produces nearly pure stands. The Common Polypody fern (*Polypodium vulgare agg*.) can also be found growing as an epiphyte on some trees throughout the wood.

Woodland rides in the park add to the overall herbaceous diversity and species that are typical of coppiced woods are largely confined to rides at St Catherine's; among those found are *Stachys sylvatica, Glechoma hederae, Galium aparine, Stellaria media, Geranium robertianum, Fragaria vesca, Lapsana communis, Potentilla reptans, Potentilla sterilis, Vicea sepium, Hypericum perforatum*, and the nationally protected *Hypericum hirsutum*.

3.14. **St. Ita's Hospital (Portrane Demesne)**

St.Ita's Hospital, situated on the grounds of the former Portrane Demesne, contains some small woodland areas mainly composed of planted exotic trees, including Beech, Sycamore, Horse-chestnut, Lime and various conifers (*Abies spp., Pseudotsuga menziesii, Larix decidua, Picea spp.*). The shrub layer, where developed, contains native Wych Elm, Holly and Elder, but is generally of planted stock- mostly Yew, as well as exotics such as Cotoneaster (*Cotoneaster horizontalis, C. microphyllus*), Japanese Privet (*Ligustrum ovalifolium*), Spotted Laurel (*Aucuba japonica*), Cabbage-Palm (*Cordyline australis*), and New Zealand Broadleaf (*Griselinia littoralis*). New Zealand Broadleaf is apparently becoming naturalised, with abundant seedlings found under Beech in the eastern woodlot. Other exotic plants are now also spreading in the south woodlot, escapees from a rubbish pile for yard waste from other parts of the demesne. These include Japanese Knotweed (*Reynoutria japonica*), Montbretia (*Crocosmia x crocosmiflora*) and Three-Cornered Garlic (*Allium triquetrum*).

3.15. **Stamullin (Milestown)**

Stamullin wood, like the nearby Gormanston demesne, spans both sides of the Delvin River. Unlike Gormanston, however, the wood appears to have had a history of coppicing continuing into recent times. A large portion of the wood beside the river is a hazel copse with some very large, productive individuals bearing dense crops of nuts in early autumn. The remainder of the riverine wood consists of Alder, Birch (*Betula pendula*), Sally (*S. caprea*, *S. cinerea*) and some Beech. On the west-facing slopes is an Ash wood with Beech, Sycamore and the occasional Birch, Wild Cherry (*Prunus avium*), Horse-Chestnut, Spanish Chestnut and Oak (*Q. robur*). Understory shrubs

consist of scattered individuals of Holly and frequent Wych Elm saplings. Unusual for woodlands in Fingal, Stamullin lacks laurel-leaved, alien evergreens such as Cherry-laurel, even though they are present just outside the wood.

The herb flora is rich for Fingal, and includes *Anemone nemorosa, Brachypodium sylvaticum, Circaea lutetiana, Filipendula ulmaria, Hyacinthoides non-scripta (*and *H. x hispanica), Primula vulgaris, Ranunculus ficaria, Rubus idaeus, Sanicula europaea, Veronica spp., Viola riviniana,* and *V. reichenbachiana.* Other spring-blooming geophytes present include abundant *Allium ursinum,* occasional *Arum maculatum.* Ferns are also abundant, including *Dryopteris spp., Phyllitis scolopendrium,* and *Polystichum setiferum.* Where gaps occur, the river margin supports aquatic vegetation and plants of saturated ground, such as *Apium nodiflorum, Carex pendula, C. remota, Cirsium palustre, Chrysosplenium oppositifolium, Epilobium hirsutum, E. palustre, Iris pseudacorus, Juncus effusus, Rorippa nasturtium-aquaticum, Sium latifolium, Sparganium erectum* and *Veronica beccabunga.* Bryophytes are also abundant in Stamullin woods, with identified species including *Kindbergia praelonga, Mnium hornum, Plagiomnium undulatum, Thamnobryum alopecurum* and *Thuidium tamariscinum.*

DISCUSSIONS & RECOMMENDATIONS

4.0 **General Overview**

The isolation and relative stability of Irish demesnes until recent years has enabled the preservation of elements of the Irish landscape that would have otherwise been destroyed over time by periods of change and exploitation. This has made estate lands interesting study sites for various disciplines including history, archaeology, anthropology and the natural sciences. Of special botanical interest are the woodlands that occur in many demesnes, and this is especially true in Fingal, where nearly all of the broadleaved woodland resource in the county is to be found within old demesnes. In historically wooded districts within the county, such as the western Liffey Valley region, the demesnes that were carved out of the woodland are the only places where woodland habitat is still to be found today. Nearly all other wooded areas remaining outside of the walled estates were cleared away for farming, industry and residential development. The survival of known historical woods inside walled demesnes is of significant ecological interest, as these woods may represent the only surviving link to the region's original forest cover, in spite of having been reduced and modified over the centuries. Long-term protection and the careful management of remaining woodland estates are therefore essential for conservation of the diversity of Irish native woodland flora and fauna, while enhancing our own understanding of the character of Ireland's vanished wildwood.

4.1 **Species Diversity in the Woodlands of Fingal**

Woodland species richness was found to be rather homogenous across the county, with the woody tree and shrub diversity being largely a result of past estate planting and management history. The sites with the highest overall species richness are Stamullin and Luttrellstown, with Stamullin also having the highest mean richness (per 100m²) of native species and 'ancient woodland indicator species' *(2008a)*. Sites found to have the lowest species diversity include Howth and Malahide, with Malahide also having the fewest woodland herbs (Table 3.2a)

The majority of trees in Fingal woodlands have been planted at some time in their past and for a variety of reasons. As most demesnes in Fingal are too small for large-scale commercial forestry, the woods were generally planted for their ornamental and amenity values with some timber being produced on a small scale. Ornamental woodland occurs at 11 of the 13 sites, excluding only Stamullin and the larger part of St. Catherine's, in which the woods appear to have been managed chiefly for utilitarian purposes. The role of woodlands as gilding for most demesnes in Fingal is substantiated by the large number of exotic curiosities present in them. The Giant Sequoias, Lebanon Cedars, Horse Chestnuts, Flowering Magnolias, massive Monterey Cypresses, Australian eucalypts and other trees with little commercial value that are still present in many of the demesnes are all living testimony to the former fashion for adorning estates with interesting 'collectibles' from the world over. Some even hold records as the largest trees of their kind in Dublin, including a Giant Sequoia (and formerly a Rowan) at Luttrellstown (2008c). A few highly mobile species such as Ash, Birch, Sycamore, Wych Elm and Alder are likely to have come into demesne woods on their own, but most have been planted or have naturalised from the original planted stock. Coniferisation of woodland for profit, more common elsewhere in Ireland, was rare in Fingal and

only a few estates, including Hampton Demesne, Malahide, Gormanston, St Catherine's and St. Ita's appear to have attempted it on a small scale.

The shrub layers in many woodlands in Fingal likewise appear to have been result of planting, with ornamental broad-leaved evergreens being the most commonly planted in demesnes. In some cases, exotic shrubs, such as Snowberry and Himalayan Honeysuckle were also planted as food and cover for game, and this appears to have formerly been the case at St Catherine's, as well as at Newbridge and Luttrellstown, where pheasant-rearing and shooting are still practiced. Other understory plants such as Holly, Hazel and Elder may have colonised naturally, but their distribution in the woods is largely a factor of the management that was carried out at each site. Holly and Yew, for instance, are rare in St Catherine's and Stamullin, woodlands with a history of coppicing; but shrubs and small trees that respond well to coppicing, such as Hazel, Whitethorn, Wild Cherry, Wych Elm and Birch are abundant. Hazel is even likely to have been favored for its rods and nuts at some sites, including St. Catherine's, Stamullin, Gormanston & Luttrellstown where small copses of Hazel are found.

One of major threats to plant diversity in existing woodlands in Fingal is the naturalisation of heavily-shading exotic trees and shrubs. The planting of alien broadleaved and conifer species for ornamental purposes within woodland demesnes erodes the woodland's natural ecology through shading, competition, potential allelopathy, and the addition of foreign microorganisms and fungi to the native ecosystems.

In part, because of the shading and competition caused by the planting of exotic trees and shrubs, the herb flora in most of Fingal's woodlands is rather poor, tending towards those species that survive dense shade (such as ferns) or flower and set seed before the onset of canopy closure in late spring/early summer. In places where the herb flora is richer, the wood may have either a

history of coppicing and felling, larger numbers of native species in the canopy and understory, or the wood itself is located over a more diverse terrain. Of the 13 sites covered in this study, only St. Catherine's Park and Luttrellstown in the Liffey Valley SAAO were found to contain rare and uncommon woodland specialists in the herb flora. Woodlands with a history of coppicing, including St Catherine's and the small wood at Stamullin, also have unique and diverse plant community assemblages that are associated with coppicing in Britain (Rackham, 2006). Luttrellstown, similarly rich in woodland and coppice guild species, may have been managed as such in the past, but present-day woodland diversity is likely to be associated with the presence of abundant managed rides and margins throughout the wooded part of the demesne.

The remaining woodlands in the county have estate histories going back to at least the 18th century, and were often created where no woodland had existed for some time in the historical period, or by the 'amendment' of existing woodland through planting. High species richness in these woods is therefore not a good measure of biodiversity value, and caution should be used when interpreting the diversity indices obtained for these woodland ecosystems. Woody species richness in Fingal is largely dependent on the whims and needs of former and present landowners and the majority of trees and shrubs existing at these sites were planted. The woody plants in turn, have influenced the development of the herb flora beneath them through factors such as alterations in soil pH and competition for light, space, and nutrients. Management practices have also influenced the development of the herbaceous layer, with silvicultural methods such as coppicing, felling, swiping (removal of shrub layer), planting, and the periodic mowing or trimming of edges all affecting the amount of light that reaches the forest floor, and therefore determining the species of herbs that can grow there. Finally, the herb flora of woodlands tend to be shorter-lived and more mobile than the woody species, and their dissemination may be influenced by the nearest available seed sources as well as the continuity (antiquity) of the existing woodland. In this case, what the

woodland was used for, what kind of herb communities existed nearby at the time of woodland creation, past and present distances to the nearest woodland habitats, what types of herbs existed on site before the wood was planted, amended or coniferised, and what types of woody species were planted, all have a direct bearing on the present-day distribution of the herbaceous flora in Fingal's woods.

4.1 **Classification**

With the exception of the upland area of Howth and its associated calcifuge flora, the majority of the woodland sites in Fingal fall into the Querco-Fagetea class of native woodland that occurs widely over limestone in Ireland (Kelly & Kirby 1982, Cross 1998). In Fingal, however, this community is commonly much altered by active planting and the large-scale replacement of the native community indicator species by introduced naturalised and invasive species.

4.2 **Problematic Species in Fingal Woods**

Alien species have been a part of the landscape of Ireland since cultivation began in Neolithic times and, currently, 645 alien taxa have been recorded here since 1987. Of these, less than 20% are considered established problematic species (Reynolds, 2002). In the woodlands of Fingal, the five most widespread aliens are Beech (*Fagus sylvatica*), Sycamore (*Acer pseudoplatanus*), Cherry-laurel (*Prunus laurocerasus*), Snowberry (*Symphoricarpos albus*) and Rhododendron (*Rhododendron ponticum*). Cherry-Laurel and Snowberry frequently encompass large portions of the understory of demesne woods, while over the acid soils of the upland areas of Howth demesne, these are replaced by Rhododendron, which has naturalised throughout the adjacent woodland and

heathland, simplifying the existing vegetation communities through shading and competition and threatening the natural biodiversity of these habitats. Other potentially troublesome plants that have established themselves in Fingal woodlands include the trees Silver Fir (*Abies alba*) and Holm Oak (*Quercus ilex*)*;* the shrubs Himalayan Honeysuckle (*Leycesteria formosa*) Bamboos (*Sasa spp.*), New Zealand Broadleaf (*Griselinia littoralis*), Red-osier Dogwood (*Cornus sericea*), Cotoneaster (*Cotoneaster spp.*) and Spurge-Laurel (*Daphne laureola*). In the ground layer, some alien herbs that may be troublesome competitors are Three-Cornered Garlic (*Allium triquetrum*) which dominates large areas of some woodlands (Howth and St. Ita's) and Pendulous Sedge (*Carex pendula*), of which status as a potential native remains uncertain (Doogue et al., 1998, Reynolds, 2002).

4.2.1. Cherry-Laurel (*Prunus laurocerasus*)

Prunus laurocerasus or Cherry-laurel, is a dense evergreen broadleaved shrub widely planted in the past in demesne woodlands and grounds for ornamental purposes or as cover for game birds. The shrub spreads by layering, and more rarely, by seed, but attains local dominance in woodlands, particularly woodlands over limestone (Kelly and Kirby, 1982). In these woods it often achieves densities and shade sufficient enough to wipe out the ground flora and prevent any natural forest regeneration. As a result, a wood overtaken by this species becomes impoverished (Reynolds, 2002). In spite of its aggressive tendencies, Cherry-laurel is still sold in the nursery trade and widely planted as hedging material in Ireland. Dense stands of Cherry-laurel were found in all of the study woodlands, with the exception of Stamullin. It is especially dense in parts of Ardgillan, Brackenstown, Hampton, Gormanston, Luttrellstown Newbridge, and Portrane demesnes.

4.2.2. Snowberry (*Symphoricarpos albus*)

Symphoricarpos albus or American Snowberry is another shade-tolerant, aggressive species that was widely planted in woodland demesnes as cover for game. It does not often spread by seed in Ireland, but it can persist for years under a densely shading canopy and spreads by underground stems, forming extensive colonies to the exclusion of all else (Reynolds, 2002). It is found to some degree in most of the 13 study woodland areas, and is especially dense at Malahide, Ardgillan and Newbridge, and along the riparian wood at St Catherine's and some woodland rides at Luttrellstown. It appears to be absent from Stamullin. This species, like Cherry-laurel, is favored by landscapers and unfortunately, in spite of its invasive nature, is still widely planted.

4.2.3. Rhododendron (*Rhododendron ponticum*)

Rhododendron ponticum, native to parts of Iberia and the Black Sea region of Eurasia, is an alien plant in Ireland (and Britain) where it is an aggressive invader of acid woodlands and heaths, and an opportunistic invader of drier areas in bog communities (Stout et al., 2006, Cross, 1975)). This large, laurel-leaved evergreen out-competes most native herb and shrub species and freely sets abundant and widely dispersed seed (Stout, 2007). It also re-sprouts readily after fire and is highly unpalatable to grazing animals, factors which further encourage its spread. It is a serious competitor on heath and in acid oak-woods, shading out the ground flora as well as preventing the recruitment of tree seedlings to woodland canopies (Cross, 1975). It is especially problematic in Killarney National Park and other acidophilous oak-wood and heath sites in western Ireland.
In Fingal, Rhododendron is invasive only on the acid soils of Howth, especially on Muck Rock and the Ben of Howth, where it is displacing the native heath vegetation and interfering with

woodland succession. It also occurs as scattered planted individuals in other woods in Fingal, but does not spread. Costly efforts are underway to control this species across Ireland (Higgins et al., 2001).

4.3 **Woodland Soils and pH**

Woodland soils in Fingal generally range from circum-neutral to weakly acidic, with the singular exception being the upland parts of Howth demesne, where the soils are strongly acid and support a calcifuge vegetation (Table 3.2b, Appendix II). A more detailed examination of the soils of Fingal's woods, hedges and wood margins is currently under investigation by the author, in which the influence of nitrogen and phosphorus on the vegetation of these habitats is being examined. This will include an assessment of the possible effects of fertiliser drift or runoff from adjacent agriculture or amenity sites. Also, a general survey of woodland soils in Ireland is being carried out at present as part of Teagasc's national forest soil classification (Bulfin, 1998, Loftus et al., 2002, Lee and Coulter, 1999); this may provide general information on the nature of soils under woodland in Fingal.

4.3. **Management of New and Existing Woods**

With the possible exception of recent motorway landscaping, very little extensive planting of native woodland has occurred in Fingal since its decimation in earlier centuries. Under the right conditions, new plantings can potentially re-colonise adjacent areas or provide propagules of trees

to be used in a concentrated effort to mitigate further loss or create new woodland habitats. Care must be taken to use native trees, preferably those grown from seed collected locally, as they may be genetically distinctive, and are likely to be best adapted to local soil, pH and climatic conditions (Kelleher et al., 2004). While planting may help to enrich sites that have been stripped of most of their woodland trees in the past, in other areas, simply ceasing all management (except the control of alien invasives) and allowing natural succession to occur may produce better woodland habitat than will planting acres of trees. Oliver Rackham has aptly put it in immortal words: "*Tree-planting is not synonymous with conservation; it is an admission that conservation has failed. The land is full of young trees which would grow into big trees if tidy-minded people did not cut them down*" (Rackham, 1986). The 'best practice' approach in Fingal for maximizing woodland biodiversity may be only to control non-natives and to create areas for natural succession to occur, such as wide margins, glades, rides and open grassland or heathland areas that can simply be left unmanaged to succeed to high forest on their own. Current practices tend to create sharp boundaries between habitats, such as that between a wood and an adjacent field or green. These boundaries may be the result of lawns, fields, fences and walls extending to the drip-line or even to the very trunks of woodland trees, leaving little room for plant species that succeed neither in open grassland or closed woodland, but in the zone between the two. Past studies in American forests have documented the tendency of woodland to edges support greater plant densities and more species, especially those with higher light requirements than usually found in woodland interiors (Ranney et al., 1981). Many of the so-called 'coppicing plants' and 'woodland specialists' may simply be plant species that are outcompeted in open, enriched grassland and suffer in the deep shade of closed woodland. Instead, they thrive in the half-shaded transitional zone between the two, which occurs in gaps, rides, edges and the artificial openings created by coppicing. As the creation of gaps through felling or coppicing may not be feasible in small woodlands that have

amenity value, allowing woodland margins to develop would provide an alternative means to facilitate woodland edge, specialist and coppice-guild species, thereby enhancing overall woodland biodiversity.

5.0. **Individual Site Discussions and Recommendations**

5.1. **Ardgillan**

In spite of the potential for a long history of woodland that appears to be preserved in its name, Ardgillan is relatively poor in woodland species, with very few woodland specialists among its herbaceous flora (Table 3.1). Past removal of the wood, poor management of the existing woodland or the abundance of shade-bearing, non-natives like Sycamore, Snowberry and the evergreen Cherry-laurel may be the cause of this species poverty. Ardgillan will need attention, beginning with the removal of non-native shrubs from the understory and the thinning of areas of the wood in which Sycamore is particularly dense. Careful re-introductions of some native species of local provenance and the expansion of unmown woodland margins may also be required to promote diversity. Detailed recommendations to enhance biodiversity in the woodlands at Ardgillan include:

- Remove all Cherry-Laurel *(Prunus laurocerasus)* and other non-native, laurel-leaved evergreens within the wood
- Create of glades or open rides (through thinning of Sycamore) for natural succession to occur

- Expand wood margins to enable succession of shade-intolerant woodland and wood-margin species by allowing at least 6 metres of unmown area around woodland.
- Diversify woody species (especially shrubs) within woodland through planting or seeding of native species, including *Q. robur, Corylus avellana, Ilex aquifolium, Crataegus monogyna, Prunus avium, Betula pendula* collected from local sources (such as nearby hedgerows).
- Expand and invigoration of linking hedgerows by allowing unmown areas beyond the hedgerow drip-line and by carrying out hedgerow management techniques such as laying and the filling in (through planting) of gappy areas in the hedge.

5.2 **Brackenstown**

Brackenstown is a diverse mosaic of habitats, including woodland, scrub, hedgerow, semi-natural grassland, river, stream, pond and wetland plant communities, These in turn, support a great deal of wildlife, including fox, badger, hedgehog, songbirds and birds of prey (A Buzzard (*Buteo buteo*) and several Kestrels (*Falco tinnunculus*) were seen by the author during survey work). The Ward River and its extensions support a seemingly healthy population of salmonids; abundant small fry, fingerlings, and smolts to approximately 23 cm in size were seen all along the stream-course, but these may be threatened by the abundant litter and potential runoff from adjacent greens and residential areas. Monitoring by fisheries biologists will need to be carried out to ensure the long-term survival of the Ward River stock.

Like Ardgillan, Brackenstown wood has dense areas of Cherry-Laurel within the wood which inhibit the development of an herbaceous field layer and any potential recruitment of canopy species. In addition, Sycamore and Beech are abundant and widely distributed throughout the woodland. Unlike the Cherry-Laurel, these trees may only contribute to species poverty where they are exceptionally dense, such as the Beech stand at the western end of the wood and the scattered thick stands of Sycamore saplings that occur elsewhere. In areas along the stream-bank, especially on the current private lands of Brackenstown House, dense stands of Japanese Knotweed (*Reynoutria japonica*) displace the native aquatic vegetation. Besides the abundant alien species, the greatest threat to the flora at Brackenstown may be human activity, including the continuous mowing of grasslands and margins and the acts of vandalism performed by local youths, especially littering and the burning of old trees and stolen cars within the wood. Further recommendations include:

- Establish security measures to control vandalism of trees and natural areas and the burning of abandoned/vandalised cars on-site
- Create/develop paths for public use and expand woodland rides by trimming
- Permit unmown grassland buffer around woodland areas, where possible, to enable succession of shade-intolerant species
- Remove all Cherry-Laurel and other potentially invasive shrubs
- Remove Japanese Knotweed from southern stream bank and vicinity
- Thin dense Sycamore and Beech stands- older trees should be left standing, but saplings and seedlings can be cut and/or removed
- Mulch under new tree-plantings to suppress tall weeds and decrease fertility. In larger plantings, this may enable colonisation by less common woodland herbs from nearby sources

- Control of plastic and other litter (especially abandoned/vandalised cars)
- Develop at least part of the site as a minimal-disturbance, natural protection area (rather than an urban park) for wildlife (birds of prey, songbirds, salmonids, small mammals)
- Long-term monitoring and control of pollution, litter, run-off from new developments in Knocksedan and Swords, and their effects on soil and water quality

5.3 **Gormanston College**

Following the creation of Gormanston demesne in the 18th century, came the enclosure of its lands and the gradual planting at its margins and along the drive of much of the woodland that remains today. This woodland consists of mostly non-native broadleaves and conifers on better ground, but makes a gradual transition to native trees such as Alder, Ash, Sally (*Salix cinerea, S. caprea*), Poplar (*Populus x canescens*), Wych Elm and Hazel as one approaches the river and its surrounding floodplain. Alder and Hazel are especially abundant along the river bank. Other native trees such as Oak (*Q. robur*), Holly and Yew are scattered throughout the wood, with the Oak being likely to have been planted. The southwest portion of the wood is a young wood of Ash and Sycamore, with a dense ground cover of Ivy and ferns (*Polystichum setiferum, Phyllitis scolopendrium, Dryopteris spp.*), while the east end is a dense, young Beech grove with a few scattered seedling and sapling Yews and Hollies and a sparse ground flora of Buckler Fern (*Polystichum setiferum*) and Wood-sedge (*Carex sylvatica*). With the exception of the clearing of pathways and the burning of rubbish in a large pile within the wood, the site appears to have had very little management in recent times, although the vegetation in the southwest end has suffered vandalism by students and local teens. One YouTube post entitled ‘Fun in Gormanston College’

even contains a video of kids destroying vegetation within the wood!

(www.youtube.com/watch?v=N7tVwaBuqxU&feature=related)

Recommendations for management of the site include:

- Control of vandalism by students
- Remove all Cherry-Laurel and other exotic, laurel-leaved evergreens from wood (Invasive plants should also be removed from the gardens adjacent to the wood)
- Remove all Snowberry
- Allow the natural expansion of woodland and margins by leaving wide, unmown areas adjacent to the wood for succession by shade-intolerant species (e.g. *Betula pendula*) to occur.
- Create a grassland/scrub buffer zone between the wood and the adjacent playing fields and golf greens
- Thin conifers or create large gaps in the plantation on the Meath side and along the main drive to enable natural succession to occur and further diversify the habitat
- Explore the possibility of coppicing as a management tool in parts of the wood, especially adjacent to the River Delvin
- Explore the possibility of linking the woodland with hedgerows and other natural wooded habitats in the area to provide corridors for the potential movement of woodland plant and animal species

5.4 **Hampton Hall Demesne**

Species richness is rather poor in the woodland at Hampton Demesne and the number of exotics in the canopy has inflated the diversity index values for this site. The ground flora is exceptionally poor, with only a thick cover of Ivy in most parts of the wood. One of the three relevés (HAMP_W03) was placed in a small woodland occurring outside the walled demesne, and while its species diversity is similar to the others, its canopy is comprised entirely of native species and only one naturalised species, *Acer pseudoplatanus*. The ground flora however is simple, with a dense covering of *Carex pendula* and few other herbs.

The removal of existing broadleaved evergreens and thinning of dense stands of conifers in the main woodland might allow native species to colonise, especially if gaps created by the removals are large enough. Colonisation can then be monitored and the less desirable species, aliens in particular, weeded out in favor of native species. Further recommendations for each of the two woodlands at Hampton Hall are listed below.

The Main Wood:

- Remove all Cherry-Laurel
- Thin conifers or create large gaps in the plantation to enable natural succession to occur and further diversify the habitat
- Create of a grassland/scrub buffer zone between wood and the adjacent playing fields and golf green through cessation of mowing up to drip-line.
- Allow the natural expansion of woodland and margins by leaving wide, unmown areas adjacent to the wood (at least 1.5 times as wide as the height of the surrounding trees) or

creating gaps within the wood for succession by shade-intolerant species (e.g., *Betula pendula*) to occur.

- Establish tree preservation orders for the interesting and potentially ancient *Castanea sativa* coppice stools
- Explore possibility of coppicing as a means for future management of the wood and enhancing its biodiversity potential

Wetland Wood:

- Further explore this small woodlot's potential to be classified as native woodland
- Enable expansion of woodland by leaving wide margins between the wood and adjacent farm fields
- Control of *Carex pendula*?

5.5 **Howth Demesne**

Howth is thought to have been nearly bare of trees from at least the 15th century to as late as the 19th century; however, individual native and exotic trees and shrubs have been planted around the demesne by successive generations of the St. Lawrence family. These include one English Elm (*Ulmus procera*) located near the castle that may have been planted in 1585 AD, possibly one of the first records of tree-planting in Ireland (Doogue et al., 1998). The area around Muck Rock, now tree-clad, was portrayed as bare of trees in an 1820 painting by J.A O'Connor; while the portal dolmen known as Aideen's Grave was illustrated in an early painting by Joseph Banagher from 1760, which also showed the site to be treeless, with sweeping views of the sea, a few small shrubs, and some goats in the foreground of the painting providing evidence of past grazing (McBrierty 1981). Recent pollen analyses carried out near the 'Bog of the Frogs' area have suggested that the site was comprised of open Hazel, Alder and Birch scrub between the 15th century and 1830, with a small amount of Oak occurring on, or near the site throughout the earlier part of this period (Cooney, 1994). Hazel is rare in Howth woodlands today, while Alder persists mostly in a small, mixed Alder-Birch wood over flushed ground located just to the south of the GAA sports ground, at the eastern limits of the demesne. Birch trees (mostly *Betula pubescens* with some *B. pendula* and hybrids), however, are locally very abundant, especially on and around Muck Rock, at the south fringe of the demesne woods, and on the adjacent hills (near Black Linn) where, along with Scots Pine, they are leading woodland succession of the heath in the absence of grazing and burning.

High woodland, however, was not largely established on Howth until the mid 19th century onwards and that which now exists in the demesne is an ornamental wood consisting of a mix of planted native and exotic broadleaf and conifer species. In addition, it contains a number of invasive and

naturalised alien species, especially Rhododendron (*Rhododendron ponticum*), but also Sycamore, Beech Fuchsia (*Fuchsia magellanica*) and Bamboos (*Sasa spp.*). Ordnance Survey maps indicate that the Beech wood now surrounding Aideen's Grave was planted sometime between 1843 and 1870, while the Rhododendron Garden was planted on Muck Rock in 1850 (McBrierty 1981). Some natives do occur in this mix and include *Alnus glutinosa*, *Betula* spp., *Crataegus monogyna*, *Quercus robur*, *Quercus petraea*, *Fraxinus excelsior* and *Ulmus glabra.* The woodland herb flora is relatively poor, but retains some classic native woodland species including Bluebells (*Hyacinthoides non-scripta*), Ramsons (*Allium ursinum*), Enchanter's Nightshade (*Circaea lutetiana*), Dog-Violets (*Viola* spp.), and one large patch of *Luzula sylvatica* that is likely to have been planted. It also has an alien component to it with Three-cornered Garlic (*Allium triquetrum*) dominating large areas of the lower wood.

Figure 5.5a A large Sessile Oak (*Q. petraea*) 'pollard' found in the woods of Howth Demesne. The low branching, possibly caused by past grazing damage, gives the tree its arachnid form. Note the abundance of large shrubs of Rhododendron in the area which preclude any potential natural regeneration.

5.5.1. Oak Woods on Howth?

Oak was formerly abundant on Howth (McBrierty, 1981, Ball, 1917, Seward, 1795) and both native species (*Quercus robur, Q. petraea*) have been planted in the demesne woods in the past. Pedunculate Oak (*Quercus robur*) may have occurred as a native over the limestone-derived soils of the lower parts of the demesne, but its not possible to determine which trees of this species are native and which are planted in Fingal (Doogue et al., 1998). All the individual Pedunculate Oaks found on Howth, including some very large, old specimens in a small, square woodlot to the south of Howth Castle (~1.5m diameter at breast height), are likely to have been planted. Sessile Oak (*Quercus petraea*), the native tree species characteristic of acidophilus oak-woods elsewhere in Ireland, was probably native over acid soils on Howth and is still found there today, as planted individuals within the demesne and as small populations self-sown over the Cambrian rock. While most of the spontaneous individual *Quercus petraea* are likely to have come from acorns derived from planted trees, some older individuals may have persisted on site prior to planting as shrubby, hard-bitten populations, confined to cliff faces and other inaccessible places and producing pollen levels too low to be seen in core samples. They would only have been able to regenerate when grazing pressure eased in modern times, after the final removal of goats in the 1940s (Cooney, 1994). One large, wide-spreading, individual on the south edge of Muck Rock branches very low to the ground (~1 metre) and may be an example of past cutting or coppicing. However, since coppice stools of any kind are rare in the woodland, its more likely to be a tree that managed to escape the goats, its truncated, arachnid form evidence of damage by grazing (Figure 5.5a). The spreading nature of the tree also indicates that the area around it, now closed forest, was once open. A few other younger (and straighter) individuals exist in the main wood below. No recent signs of Oak regeneration were found in the demesne woodland, however seedlings and saplings

have been found in the adjacent young Birch-woods, suggesting that a process of natural succession from heathland to oak woods may be underway.

5.5.2. Woodland Succession on the Heath

Having long been stripped bare of most of its trees and being little suited to tillage, the majority of the uplands of Howth are today covered in dry heath, a species-poor variant of the *Calluna vulgaris-Ulex gallii* plant community defined by Rodwell *et al.* (1991).

Heath lands in Western Europe have usually been derived from former forest vegetation and have been subjected to management by fire and grazing pressure over the last 200 years (Gimingham, 1970), and Howth is no exception. The dominant heath shrub, *Calluna vulgaris*, has a life cycle of approximately 30-40 years, during which it goes through several stages of growth: the pioneer, building, mature and degenerate stages. The nutritional value of *Calluna* to both sheep and wildlife is greatest in the pioneer and building stages, and declines after the plant reaches 15 years of age; therefore when heath is the desired community, prescribed burns are recommended every 15 years (Gimingham, 1970). When fire and grazing are eliminated from the community, most of the heather passes into the degenerate stage, becomes open, and allows for succession to other communities consisting mainly of Birch (*Betula spp*.), Scots Pine (*Pinus sylvestris*) and Bracken (*Pteridium aquilinum*), with *Betula pubescens* and *Quercus petraea* being the major players in natural succession on heath in wetter climates (Rodwell, 1991, Pigott, 1983)

On Howth, the principal factors determining vegetation succession were grazing by goats, woodland management (or lack of it) and the occasional fire. Since 1940, when grazing ceased, small fires and, progressive colonisation by a range of woody species have remained the greatest factors governing heathland vegetation patterns on Howth. Fire and grazing suppression in modern

times have resulted in a re-colonisation of the heath by Bracken, Birch and small populations of Scots Pine, especially on and around Muck Rock and the Ben of Howth (Figure 5.5b). Several studies of the site have been carried out over the last two decades, generally with the goal of conserving the heath (Cooney, 1994, Meleady, 1993, Tubridy, 1997). The oldest of the Birch-woods, now approximately 40 years old, are those closest to the south wall of the demesne (Meleady, 1993). While Birch is a dominant leader in woodland succession on the heath, other woodland colonists that have also been found in small numbers within the developing Birch woods include *Dryopteris dilatata* and *Teucrium scordonia*, These species were also observed during the present survey with significant numbers of seedling and sapling *Quercus petraea* and scattered *Sorbus aucuparia*, and all are probably derived from propagules drifting in from the adjacent demesne (Meleady, 1993). Common Bent-grass, (*Agrostis capillaris*), Wavy Hair Grass (*Deschampsia flexuosa*) and Bilberry (*Vaccinum myrtillus*), less common on the surrounding heath, are dominant species under the developing Birch woods on Howth, and are also characteristic species of Birch succession on heathland elsewhere (Hester et al., 1991). Most of these calcifuge species also make up some of the typical members of the acid Oak-Birch woodland community (W17) defined by Rodwell *et al.* for Great Britain (1991) and the acidophilous oak-wood community in Ireland (Kelly and Moore, 1975).

Studies of Birch succession of heath and moorland have suggested that Birch promotes the development of other types of plant communities, including other types of woodland, through changes in soil chemistry, pH and microbial activity (Mitchell et al., 2007, Marrs, 1987, Atkinson, 1992). The reduction in light that occurs under mature Birch also reduces competition by vigorous sun-loving heath and grassland species, thereby facilitating succession by other species tolerant of some shading, including many woodland tree, shrub and herb species. Birch does not regenerate well under itself, however, as the species is shade-intolerant and requires open areas for seed

germination and regeneration (Grime et al., 1988). Birch, therefore, is a pioneer species which alters the habitats it succeeds to, thereby paving the way for colonisation by other species. In spite of the initial reduction in overall species diversity in the colonisation of heathland by Birch, this leads to the development of 'new' woodland habitat which may continue to acquire woodland species over time (provided that propagules are to be found in the vicinity). For that reason, in spite of its replacement of the heath communities, the Birch wood on Howth is of scientific interest, as it provides a rare example of natural succession on dry heathland in Ireland. This, in turn, presents us with the opportunity for a more complete understanding of how natural woodland developed in the past, and may provide us with the tools necessary to sustain and manage woodland biodiversity in the future.

5.5.3. Potential Tools for Management of Woodland & Heath

The primary goal in management of the Birch woodland now developing on upland areas of Howth should involve striking a balance between natural development of the woodland and the conservation of the existing heath. Structural diversity can be created by allowing part of the heath to develop all stages of woodland succession which, in turn, may support an enhanced biological diversity in the form of invertebrate and avian fauna and the development of an acid woodland flora. This can be done through careful management by cutting or burning areas of heath and Birch woodland or the re-introduction of a small population of grazers such as hares, deer or goats. The animals would contribute to the amenity value of the site whilst providing long-term, low-cost management of the heath by browsing back the woody vegetation and reducing dominance by any one species. Some drawbacks of goats and deer include necessity of managing the animals, in the absence of natural predators, to prevent overgrazing and infringement on the surrounding

urbanised landscape. Also, the interactions between herbivores and natural habitats remain poorly understood in Ireland, and there is always the chance that some plant species will become favored food and decline under browsing pressure. Nevertheless, goats have been used in the past, and much of today's heath vegetation on Howth may partly be the result of their former activities. Hares, on the other hand, have extant natural predators on Howth, including foxes and avian raptors (both have been seen by the author during the course of survey work), to keep the populations in check. In addition, recent studies in Scotland have suggested that hares may be effective browsers of woody vegetation in heath lands, where they tend to favor Birch (Rao et al., 2003). More research therefore, will be needed to explore the possibility of introducing grazers as a means of managing woodland and heathland on Howth.

5.5.4. Control of Rhododendron Invasion of Woodland and Heath Communities

Rhododendron ponticum is a serious pest of heath and acid woodland communities in Ireland (Cross, 1975, Cross, 1981). Efforts to control this species are being made on private and public lands in different parts of the country (Cross, 1981, Higgins et al., 2001). Past attempts to reclaim the heath community on Howth have involved getting volunteers such as Conservation Volunteers Fingal (CVF) to clear Rhododendron (and Birch), while also cutting gorse and bracken and maintaining pathways to accommodate the increased number of hill-walkers, however, Fingal County Councils' Parks Division has received funding from the Heritage Council to clear Rhododendron from the Ben of Howth (2008b) .

The Rhododendron Garden, from whence this expensive pink nightmare has escaped, was first established on Howth in 1850 with almost yearly plantings of the over 400 species and 600 named

crosses and hybrids until 1909 (McBrierty, 1981). Of the numerous species and hybrids planted, only *Rhododendron ponticum* has become problematic, threatening not only the surrounding woodland and heath communities, but also the Garden itself, where it has already outcompeted many of its less vigorous cousins (McBrierty, 1981). The Rhododendron Garden of Howth has been made internationally famous by writers such as H.G. Wells and James Joyce, and the garden is now a major tourist attraction. Due to the amenity value and fame of the garden and the surrounding woodland, little has been done to control the spread of *R. ponticum* there. As a result, it will continue to provide propagules for the invasion the heath on Muck Rock and the Ben of Howth, while also suppressing herb, shrub and seedling tree development within the remainder of the woods that have not yet been affected. Where soils are derived from the Carboniferous till, as in the lower part of the wood, *R. ponticum* is rare and does not appear to spread with ease. On the acid soils however, it is a very aggressive invader and competitor. The individual *R. ponticum* that make up the famous gardens can be gradually removed and replaced with less invasive look-alike congeners that do not spread, of which many are already present in the gardens. In the heath and woodland communities however, the adoption of zero-tolerance policy is urged. Further recommendations for the control of Rhododendron and other invasive plants are listed below.

- Remove and control of *Rhododendron ponticum* in woodland and on adjacent heath
- Explore the potential of gradually replacing *R. ponticum* in 'Rhododendron Gardens' with other, non-invasive species of *Rhododendron.*
- Remove other invasive exotic shrubs from demesne woodlands, especially Cherry-Laurel and Snowberry

- Explore the possibility of expanding or linking woodland fragments on site with grassland, scrub, hedgerow or secondary woodland corridors between isolated woodlots.
- Create a grassland/scrub buffer zone between wood and the adjacent playing fields and golf green through cessation of mowing up to tree bases to prevent nutrient runoff/wind drift into woodland.
- Remove Dwarf Bamboo (*Sasa* spp.) from around the megalithic dolmen (Aideen's Grave) where it is expanding rapidly into the adjacent woodland.
- Monitor and control the spread of Chilean Myrtle (*Luma apiculata*) and Ornamental Raspberry (*Rubus spectabilis*) in the Alder grove at the eastern end of the wood
- Monitor and control spread of other potentially invasive plants such as *Fuchsia magellanica*
- Thin Beech and Sycamore saplings (or create gaps within dense stands), whilst suppressing their re-colonisation by encouraging other native species to replace them.

Figure 5.5b. Woodland succession on heath at Howth. The Birch wood in the left-hand picture is now ~40 years old, while new Birch woods are developing on heath in the background of the picture on the right. Note also the occurrence of *Rhododendron ponticum* with the Birch and in the foreground, a juvenile Scots Pine (*Pinus sylvestris).*

5.6. **Liffey Valley (Knockmaroon, Luttrellstown & St. Catherine's Park)**

The entire Liffey Valley region from Phoenix Park west to Kildare may have been wooded in the 11th century (section 1.2 of this report). Luttrellstown and St. Catherine's Park appear to have remained continuously wooded since then, as documentary evidence exists to support the presence of some woodland at each site throughout the course of their history, with the oldest documents indicating the existence of a woodland coppice at St. Catherine's in the 12th century A.D. (Joyce, 1939). The long continuity of woodland at these two sites may also explain why it appears that they alone of wooded demesnes in Fingal support rare woodland specialist species, including Toothwort (*Lathraea squamaria*), Wood Millet (*Milium effusum*), Wood Melick (*Melica uniflora*), Thin-spiked Wood Sedge (*Carex strigosa*), Ivy Broomrape (*Orobanche hederae*), and formerly at St. Catherine's, Yellow Bird's-Nest (*Monotropa hypopitis*) (Doogue et al., 1998). The Irish protected species, Hairy St John's Wort (*Hypericum hirsutum*) is found at both sites as are the rare and endangered Green Figwort (*Scrophularia umbrosa*) and Ivy Broomrape (*Orobanche hederae*), (1999, Curtis and McGough, 1988). Other species associated with woodland margins, rides or coppice rotations were found at St. Catherine's and Luttrellstown and include *Ajuga reptans* (Luttrellstown), *Anemone nemorosa* (St. Catherine's), *Deschampsia caespitosa* (Lutrellstown), *Glechoma hederae* (both sites), *Hyacinthoides non-scripta* (Luttrellstown), *Hypericum* spp. (both sites), the uncommon *Lamiastrum galeobdelon ssp. montanum*(St. Catherine's Park only), *Rubus idaeus* (Luttrellstown) and *Sanicula europaea* (both sites) (Rackham, 2006).

That none of these species have been found in the woodland at nearby Knockmaroon, is most certainly the result of it being recent secondary woodland. The original forest cover was removed in the past, with re-planting by the owner of the estate only occurring when quarrying and agricultural activity ceased on the site sometime after 1863 (OSI, 1863). Some parts of the woodland, in fact, still retain species of the grassland that existed on the site before canopy closure.

Examples of species normally found in open areas rather than closed woodland that were found on the southwestern slopes of the woodland include *Briza media, Carex flacca, Dactylis glomerata, Galium verum, Plantago lanceolata,* and *Ulex europaeus.* Of these, all except *Dactylis glomerata* and *Ulex europaeus* are known associates of species-rich, limestone grassland in Ireland (O'Sullivan, 1982).

Site-by-site recommendations for management of the woodland in the Liffey Valley are listed below. For further details, please see The Liffey Valley SAAO Report that was produced for Fingal County Council's Parks Division (McCourt and Kelly, 2005).

<u>Knockmaroon</u>

- Monitor and control of potentially damaging invasive species, including *Quercus ilex, Quercus cerris, Abies alba* and *Symphoricarpos albus.*
- Thin or remove dense stands of Beech and Sycamore to encourage development of woodland herb flora
- Allow the natural expansion of woodland and margins by leaving wide, unmown areas adjacent to the wood at its north end (at least 1.5 times as wide as the height of the surrounding trees) or creating gaps within the wood for succession by shade-intolerant species to occur.
- Monitor grazing by deer and rabbits within the wood

Luttrellstown

- Remove all Cherry-Laurel, Portuguese Laurel *(Prunus lusitanica*), Snowberry, Himalayan Honeysuckle *(Leycesteria formosa)* and other potentially invasive exotics (especially evergreens) from woodland areas and adjacent arboretum
- Allow the natural expansion of woodland and margins by leaving wide, unmown areas adjacent to the wood (at least 1.5 times as wide as the height of the surrounding trees) or creating gaps within the wood for succession by shade-intolerant species to occur.
- Maintain or expand existing rides by cutting back overhanging woody vegetation
- Cease the use of herbicides along woodland rides and paths to protect threatened species (e.g. *Hypericum hirsutum*) which are found only in this habitat.
- Thin dense stands of Beech and Sycamore (or create gaps in them) to encourage natural recruitment of other native species and create new habitat for gap and wood-margin species.
- Encourage the use of native plants of local provenance in future plantings on the demesne grounds
- Create a grassland/scrub buffer between woodland and the adjacent golf green
- Monitor nutrient runoff in soils and water from golf course and adjust management accordingly

St. Catherine's Park

- Remove of all Cherry-Laurel from the understory of the wood
- Thin and gradually remove most of the conifer stand at the west end of the park,
- Thin dense stands of Beech and Sycamore (or create large gaps within them), especially along the Northeast road, to encourage natural recruitment of other native species (e.g., Birch) and create new habitats for gap and wood-margin species that are now confined to the stone wall along the south path (e.g., the rare *Hypericum hirsutum*)
- Trim back the south and western-facing hedgerow/ wood margin bordering the paved walking path to encourage herbaceous wood-margin species, including *Hypericum hirsutum*
- Remove all Snowberry from the south end of the wood along the banks of the River Liffey, where it is especially dense
- Encourage use of clearly marked trails to discourage trampling of ground flora
- Explore possibility of re-instating coppicing to part of the wood as a means to create structural diversity, maintain the existing herbaceous flora and maximise overall biodiversity potential
- Allow wider woodland, scrub and grassland margins to develop along the River Liffey, thus reducing nutrient runoff

5.7 **Malahide Demesne**

The woodland at Malahide is a planted woodland of mostly exotic broadleaves serving both as boundary and ornamentation of the ancient demesne. The native woodland flora is poor and woodland specialists are very rare in the herbaceous flora, which itself is largely confined to gaps, rides and woodland margins. In the woodland interior, where tree and shrub densities are high, Ivy, Bramble and Ferns *(Polystichum setiferum, Phyllitis scolopendrium)* are generally the only plants of the herb layer. The development of an herb flora and recruitment of tree and shrub seedlings is largely suppressed by trampling and mowing of margins and rides, by shading from the high tree densities and from large areas of competitive exotics in the shrub layer, including Cherry-Laurel and Snowberry. Part of the woodland was made into a small, dense conifer plantation. The ground flora under the conifers includes a sparse covering of Ivy, Bramble and scattered ferns. Enabling more light to reach the floor of the wood at Malahide may facilitate the development of a richer herb flora and recruitment of additional wood species. Recommendations include the creation of gaps, expansion of margins, thinning of dense stands of Sycamore, Beech, and conifers as well as the removal of Cherry-Laurel and Snowberry from the shrub layer. Further details are given below.

- Remove all Cherry-Laurel, Snowberry and other exotic and potentially invasive shrubs (especially evergreen shrubs)
- Thin existing conifer stand or create large gaps in the plantation to enable natural succession to occur and further diversify the habitat
- Repair hedgerows, especially those connecting woodland areas, by replanting gaps

- Allow the natural expansion of woodland and margins by leaving wide, unmown areas adjacent to the wood or hedge (at least 1.5 times as wide as the height of the surrounding trees) or creating gaps within the wood for succession by shade-intolerant species to occur.
- Monitor and remove floral escapees into the wood from gardens and arboretum
- Explore possibility of coppicing part of the wood (especially where the trees are relatively young) as a means for future management of the wood and improving its biodiversity potential
- Control plastic litter and minor acts of vandalism

5.9 **Newbridge Demesne**

As at Malahide, the woodland at Newbridge is a long and relatively narrow, ornamental wood planted to serve both as adornment and the boundary of the demesne. Also like Malahide, the demesne is frequently visited by the public and woodland paths often see heavy use. Unlike Malahide however, the trails do not make a circuit through all of the wooded areas of the demesne, and some harder-to-access areas are seldom visited. Relevé placement within the wood was therefore easier than at Malahide. With the exception of a few apparently self-sown Ashes, nearly all of the trees at Newbridge have been planted, including some Beeches and Pedunculate Oaks (*Q. robur*) of great size and antiquity. The shrub layer is planted in the wood near the main house, but natural at the perimeters, with Elder and Ivy being the most common species. The abundance of Elder may also be indicative of nutrient-rich soils. The herbaceous woodland flora at Newbridge is rather impoverished, with few woodland specialists. Failed attempts have been made in the past to

introduce (or re-introduce?) some common woodland herbs such *Anemone nemorosa* and *Hyacinthoides non-scripta* to enhance the beauty and biodiversity of the woodland (Murphy, P., Tiernan, D. *pers. comm.*). The reason for failure is probably the result of too much shading by the abundant evergreen shrubs and trees and the dense woodland canopy. In spite of the artificiality of the woodland and the relative poverty of its herbaceous flora, it is worth protecting for the many types of fungi found in the woods as well for its abundant birds and mammals. While current plans to restore the grounds and woodlands to their original 18th century layout (Murphy, P. *pers.comm.*) might preclude any recommendations for woodland alteration, some measures to enhance woodland plant biodiversity can be added. These include coppicing parts of the woodland, using native plants in any new plantings, thinning dense stands and removing all exotic evergreens. Cherry-Laurel, in particular, should be removed completely. Further recommendations are listed below.

- Removal of all Cherry-Laurel, Cotoneaster, Snowberry and other exotic and potentially invasive shrubs (especially evergreen shrubs) from woodland areas
- Explore possibility of coppicing younger areas of the wood as a means for future management of the wood and maximising its biodiversity potential
- Allow the natural expansion of woodland and margins by leaving wide, unmown areas adjacent to the wood or hedge (at least 1.5 times as wide as the height of the surrounding trees) or creating gaps within the wood for succession by shade-intolerant species to occur. The circular and moated island wood in the central part of the demesne may benefit most from this treatment as wind-throw appears to be problem and well-developed wood margin would reduce wind shear.

5.10 **Rush Demesne**

The wood at Rush has been reduced in size and a large part of it has been fenced off from the adjacent suburban yards, so further expansion of the woodland is unlikely, however, in the process of reducing the wood, developers left a few scattered mature Yew trees in an area at the north end of the wood and planted the graded soil with ryegrass, presumably for amenity purposes (e.g., dog-walking). The Yews could be protected from further damage by allowing the area between them to develop into semi-natural grassland or scrub and linking it to the existing woodland fragment. This can be accomplished simply by the cessation of mowing between the trees and between the area and the adjacent wood. The proposed area is illustrated in red in Figure 5.10 below. Recommendations for management are as follows:

- Remove of all Cherry-Laurel, Rhododendron, Aucuba, Snowberry and other exotic and potentially invasive shrubs (especially evergreen shrubs) from woodland areas
- Repair wall around church ruins and secure this historical site from further vandalism
- Control plastic litter, especially in the small streamlet running through the wood
- Explore possibility of coppicing younger areas of the wood to create structural diversity and maximise the biodiversity potential of this small woodland

Figure 5.10. Area to consider for cessation of mowing at Rush.

5.12 **St Ita's/ Portrane Demesne**

St. Ita's was formerly a functioning large demesne with a walled garden, woodland, lawns and extensive areas for tillage and grazing. Today, the demesne is largely in a state of neglect and disrepair, and nowhere is this made more obvious than in the overgrown state of its gardens and woodlands. Many of the buildings are currently used for housing and treating mentally-ill and recovering patients, and some of the smaller lawns are maintained for common use, but the remainder of the demesne is largely neglected. This is a shame as there is a growing recognition amongst doctors, scientists, health-care providers and care-takers of the beneficial role of

accessible greenspaces and corresponding outdoor activities in providing valid, therapeutic means of promoting the physical and emotional well-being of the clinically ill. The presence of greenspace is especially useful when combined with voluntary outdoor activities that promote a sense of place, empowerment, belonging and accomplishment, and the recent emergence of "care farming" in Britain and elsewhere attempts to put this in practice. The UK National Care Farming Initiative (NCFI) promotes the well-being of its members through farming activities, many of whom are disaffected youths, recovering drug addicts, or sufferers of depression or other mental illnesses (http://www.ncfi.org.uk/). The NCFI is accomplishes this through partnerships with commercial farms, woodlands and market gardens (Hine et al., 2008). At St. Ita's, similar principles could be utilized and therapeutic educational activities established for resident patients, including the upkeep and maintenance of the grounds of the demesne through clearing the woodland of exotic shrubs, planting and upkeep of a vegetable garden and existing orchards, litter-clearing, farming, maintenance and use of woodland pathways, planting of trees, informative walks, care and maintenance of the existing hedgerows, and many similar actions can all be carried out on-site as cost-effective and ecologically-sound, complementary treatments for patients. More research would be needed in this area, but the site is ideal for this purpose. For the present, recommendations for the maintenance of the woodland and enhancing its biodiversity are listed below.

- Remove of all Cherry-Laurel, New Zealand Broadleaf, Cotoneaster, Aucuba, Snowberry and other exotic shrubs from the understory of the wood
- Thin and gradually remove most of the existing conifer stand, while allowing natural succession to take place.

- Cease using woodland as a dump for yard and garden waste as it enables potentially invasive plants to colonise the woodland. Three-cornered Garlic *(Allium triquetrum),* Montbretia *(Crocosmia x crocosmiflora)* and Japanese Knotweed *(Reynoutria japonica),* all known to have invasive properties; have already begun to naturalise in the woodland within the vicinity of an existing refuse pile.
- Re-introduction of some woody native species of local provenance by planting may be necessary, but should only be used if natural succession does not produce the desire effect.
- Enable the expansion of woodland habitat by leaving wide, unmown areas adjacent to the wood (at least 1.5 times as wide as the height of the surrounding trees), creating gaps within the wood, or allowing some of the existing scrub areas produced by the abandonment of surrounding agricultural fields to develop naturally into woodland.
- Existing walled orchards have potential amenity value to current occupants of the site as well as wildlife value, but are in need of maintenance
- Litter and dumping are serious problems with potentially hazardous materials such as broken glass, metal and household refuse lying in huge pile between the wood and orchards. This should be removed to prevent injury to people and wildlife.

5.13 **Stamullin**

The woodland on the grounds of St Clare's Convalescent Home in Stamullin, like the one at Gormanston, is probably a remnant of a formerly more extensive wood that occurred along the banks of the Delvin River. Unlike Gormanston, however, the wood at Stamullin did not function solely for the ornamentation of a demesne. Coppicing was practiced at Stamullin in the past, and

continued on a small scale into the present, possibly to provide small timber for local farming activities. As a result of the wood's utilitarian function, fewer exotic plants occur in the wood than elsewhere in Fingal, and the invasive Cherry-Laurel, so common elsewhere, is absent. The majority of canopy and understory trees and shrubs are native and naturalised species that respond well to coppicing and the herb flora contains many species associated with coppicing in Britain (Rackham, 2006). Recommendations for Stamullin wood are as follows:

- Explore possibility of re-instating (or continuing) coppicing of part of the wood, (especially the hazel copse along the river banks), as a means to create structural diversity, maintain the existing herbaceous flora and maximise overall biodiversity potential in the woodland
- Enable the expansion of woodland habitat by leaving wide, unmown areas adjacent to the wood or on the opposite side of the river (at least 1.5 times as wide as the height of the surrounding trees), creating gaps within the wood, or allowing some the surrounding agricultural fields to develop naturally into woodland and scrub.

CONCLUSIONS

The woodlands of Fingal are a complex result of planting, felling and changing land-use patterns that have gone on throughout the course of the region's (and Ireland's) history. Some woods, such as those at Ardgillan, Portrane, Newbridge, and Malahide were constructed during the heyday of the 18th century fashion for wooded demesnes and were probably planted on lands that had been formerly cleared of woodland. Others, such as Luttrellstown, St Catherine's and Howth appear to have supported varying extents of woodland continuity throughout the course of their history, especially in areas of the estates that were unsuitable for cultivation or other use. The steep, south-facing slopes at Luttrellstown or the marginal upland areas of Howth were modified by increased pressure on the landscape in the 18th and 19th centuries and the planting of exotic trees and shrubs. Lastly, some woodlands, such as Stamullin and St. Catherine's Park, have a history of past coppice rotation cycles and, as a result, support a rich woodland herb flora generally associated with coppicing (Rackham, 2006).

The isolation and relative stability of Irish demesnes until recent years has enabled the preservation of elements of the Irish landscape that would have otherwise been destroyed over time by periods of change and exploitation. This has made estate lands interesting study sites for various disciplines including history, archaeology, and the natural sciences. Of special botanical interest are the woodlands that occur in many demesnes, and this is especially true in Fingal, where nearly all of the broadleaved woodland resource in the county is to be found within old demesnes. In historically wooded districts within the county, such as the western Liffey Valley region, the demesnes that were carved out of the woodland are the only places where semi-natural woodland habitat is still to be found today. Nearly all other wooded areas remaining outside of the walled estates were cleared away for farming, industry and residential development. The existence of

known historical woods inside walled demesnes is of significant ecological interest, as these woods may represent the only surviving link to the region's original forest cover, in spite of having been reduced and modified over the centuries. Long-term protection and the careful management of remaining woodland estates are therefore essential for conservation of the diversity of Fingal's native woodland flora and fauna.

Recommendations for all woodland sites in Fingal place primary importance on the removal of invasive species, especially the laurel-leaved evergreens, while encouraging the thinning of densely shading canopies of Beech, Sycamore or the small conifer plantations formerly established in some demesnes. This report also discusses the potential benefits of initiating (or re-instating) the practice of coppicing in some woods, especially for woodland specialists among the herbaceous flora. All sites, especially those having exotics removed, will need frequent monitoring to keep in check the potential regeneration of alien species and their deleterious effects on the native flora.

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Location	**Quadrat no.**	Abies alb	Abies alb	Abies alb	Ace pseu	Ace pseu	Ace pseu	Ace pseu	Ace pseu	Ace pseu	Aego poda	Aesc hipp	Aesc hipp	Aesc hipp	Aesc hipp
	layer	s1	sl	t1	jl	sl	t1	t2	t3	jl	hl	jl	sl	t1	t2
ARDGILLAN	ARD_W01	.	.	.	.	2	95	.	.	.	.	.	.	.	.
ARDGILLAN	ARD_W02	.	.	.	5	2	85	.	.	.	15	.	.	.	.
ARDGILLAN	ARD_W03	.	.	.	.	.	.	.	.	.	.	.	.	.	.
ARDGILLAN	ARD_W04	.	.	.	10	2	15	70	30	.	.	.	.	.	.
BRACKENSTOWN	BRAC_W01	.	.	.	.	.	.	.	.	.	.	.	.	.	.
BRACKENSTOWN	BRAC_W02	.	.	.	.	2	.	10	.	.	.	.	.	.	.
GORMANSTON COLLEGE	GORM_W01	.	.	.	2	.	25	.	.	.	.	.	1	2	.
GORMANSTON COLLEGE	GORM_W02	.	.	.	.	.	.	.	.	.	.	.	.	.	.
GORMANSTON COLLEGE	GORM_W03	.	.	.	2	.	.	.	.	.	.	.	.	.	.
HAMPTON DEMESNE	HAMP_W01	.	.	.	.	.	.	.	.	.	.	.	.	50	.
HAMPTON DEMESNE	HAMP_W02	.	.	.	2	.	55	.	.	.	.	.	.	.	.
HAMPTON DEMESNE	HAMP_W03	.	.	.	.	.	.	5	.	.	.	.	.	.	.
HOWTH DEMESNE	HOWT_W01	.	.	.	2	.	70	.	.	.	.	.	.	.	.
HOWTH DEMESNE	HOW_W02	.	.	.	2	.	10	.	.	.	.	.	.	.	.
HOWTH DEMESNE	HOW_W03	.	.	.	.	.	.	.	.	.	.	.	.	.	.
MALAHIDE DEMESNE	MAL_W01	.	.	.	.	.	20	.	.	.	.	.	.	.	.
MALAHIDE DEMESNE	MAL_W02	.	.	.	5	.	.	.	.	40	.	.	.	.	.
MALAHIDE DEMESNE	MAL_W03	.	.	.	.	5	10	.	.	.	.	.	.	.	.
MALAHIDE DEMESNE	MAL_W04	.	.	.	.	3	60	.	.	.	.	.	.	.	.
NEWBRIDGE DEMESNE	NEW_W01	.	.	.	.	.	.	.	.	.	.	.	.	.	.
NEWBRIDGE DEMESNE	NEW_W02	.	.	.	2	.	.	35	.	.	.	.	.	.	.
NEWBRIDGE DEMESNE	NEW_W03	.	.	.	.	.	20	.	.	.	.	.	.	.	.
NEWBRIDGE DEMESNE	NEW_W04	.	.	.	.	.	50	.	.	.	.	.	1	.	.
PORTRANE DEMESNE	ITA_W01	.	.	.	2	.	.	.	.	.	.	.	.	.	.
PORTRANE DEMESNE	ITA_W02	.	.	.	.	.	70	.	.	.	.	.	.	.	.
PORTRANE DEMESNE	ITA_W03	.	.	.	.	.	2	.	.	.	.	.	.	.	.
PORTRANE DEMESNE	ITA_W04	.	.	5	.	2	.	.	.	.	.	.	.	.	.
RUSH DEMESNE (Kenure)	RUS_W01	.	.	.	.	2	.	.	.	.	.	.	.	.	.
RUSH DEMESNE (Kenure)	RUS_W02	.	.	.	.	2	5	.	.	.	.	.	.	.	.
RUSH DEMESNE (Kenure)	RUS_W03	.	.	.	5	2	25	.	.	.	.	.	.	.	.
RUSH DEMESNE (Kenure)	RUS_W04	.	.	.	.	.	35	.	.	.	.	.	.	.	.
STAMULLIN	STA_W01	.	.	.	.	2	.	.	.	.	.	.	.	.	.
STAMULLIN	STA_W02	.	.	.	2	.	60	.	.	.	.	.	.	.	10
STAMULLIN	STA_W03	.	.	.	.	.	50	.	.	.	.	5	2	.	5
STAMULLIN	STA_W04	.	.	.	.	.	10	5	2	.	.	.	.	.	.
LUTTRELLSTOWN	LUTR_W01	1	3	.	.	.	.	.	.	.	.	.	1	.	.
LUTTRELLSTOWN	LUTR_W02	.	.	.	.	.	.	.	40	.	.	.	.	.	.
LUTTRELLSTOWN	LUTR_W03	.	.	.	20	.	.	85	.	.	.	.	.	.	.
LUTTRELLSTOWN	LUTR_W04	.	.	.	.	.	.	5	.	.	.	.	.	.	.
KNOCKMAROON	KM_W01	.	.	.	.	2	.	.	.	.	.	.	.	.	.
KNOCKMAROON	KM_W02	.	.	.	.	1	5	.	.	.	.	.	.	.	.
KNOCKMAROON	KM_W03	.	.	.	5	2	.	5	.	.	.	.	.	.	.
KNOCKMAROON	KM_W04	.	.	.	10	2	.	5	.	.	.	.	.	.	.
St. CATHERINE'S PARK	SCAT_W01	.	.	.	.	.	30	.	.	.	.	.	.	.	.
St. CATHERINE'S PARK	SCAT_W02	.	.	.	.	5	.	.	.	.	.	.	.	.	.
St. CATHERINE'S PARK	SCAT_W03	.	.	.	.	.	.	10	.	.	.	.	.	.	.
St. CATHERINE'S PARK	SCAT_W04	.	.	.	.	.	.	.	.	.	.	.	.	.	.

St. CATHERINE'S PARK	SCAT_W05	.	.	.	.	5	.	10	.	.	.	.	.	.	.

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Quadrat no.	Aju rept hl	Alliu triqu hl	Alliu ursi hl	Alnu gluti t1	Ang sylv hl	Anthr sylv hl	Aru macu hl	Athy f-fem hl	Bet pend sl	Bet pend t1	Bet pend t2	Bet pube jl	Bet pube t1	Bet pube t2	Brac sylv hl	Brom ramo hl	Caly sep hl
ARD_W01	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
ARD_W02	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
ARD_W03	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
ARD_W04	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
BRAC_W01	.	.	75	.	.	.	.	.	.	.	.	.	.	.	.	.	.
BRAC_W02	.	.	40	.	.	5	.	.	.	.	.	.	.	.	20	.	.
GORM_W01	.	.	40	15	.	.	.	.	.	.	.	.	.	.	.	.	.
GORM_W02	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.
GORM_W03	.	.	60	20	.	.	.	.	.	.	.	.	.	.	.	.	.
HAMP_W01	.	.	.	.	.	.	.	.	0.1	10	.	.	.	.	.	.	.
HAMP_W02	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
HAMP_W03	.	.	.	30	.	.	.	.	.	.	.	.	.	35	.	.	5
HOWT_W01	.	10	50	.	.	.	.	.	.	.	.	.	.	.	.	.	.
HOW_W02	.	.	.	.	.	.	.	.	.	.	.	.	50	.	.	.	.
HOW_W03	.	.	.	.	.	.	.	.	.	.	.	10	100	.	.	.	.
MAL_W01	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
MAL_W02	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.
MAL_W03	.	.	.	.	.	.	1	.	.	.	.	.	.	.	2	.	.
MAL_W04	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
NEW_W01	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
NEW_W02	.	.	.	.	10	.	.	.	.	.	.	.	.	.	.	.	.
NEW_W03	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.
NEW_W04	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
ITA_W01	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
ITA_W02	.	10	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
ITA_W03	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
ITA_W04	.	.	.	.	.	.	.	.	.	10	.	.	.	.	5	.	.
RUS_W01	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
RUS_W02	.	.	.	.	.	.	.	.	.	.	.	.	.	.	10	.	.
RUS_W03	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5	.	.
RUS_W04	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
STA_W01	.	.	.	.	.	.	.	5	.	.	.	.	.	.	.	.	.
STA_W02	.	.	.	.	.	.	.	2	.	4	.	.	.	.	.	.	.
STA_W03	.	.	.	.	.	5	.	.	.	.	.	.	.	.	0.5	.	.
STA_W04	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
LUTR_W01	.	.	15	.	.	.	1	.	.	.	.	.	.	.	.	.	.
LUTR_W02	.	.	45	.	.	.	.	.	.	.	.	.	.	.	.	.	.
LUTR_W03	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
LUTR_W04	1	.	50	.	.	.	.	.	.	.	.	.	.	.	.	.	.
KM_W01	.	.	.	.	.	.	.	.	.	.	.	.	.	.	90	25	.
KM_W02	.	.	.	.	.	.	.	.	.	.	.	.	.	.	50	.	.
KM_W03	.	.	15	.	.	1	.	.	.	.	.	.	.	.	30	.	.
KM_W04	.	.	10	.	.	10	.	.	.	.	.	.	.	.	45	.	.
SCAT_W01	.	.	.	.	.	2	1	.	.	.	.	.	.	.	.	.	.
SCAT_W02	.	.	.	.	.	30	1	.	.	.	2	.	.	.	.	.	.
SCAT_W03	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.
SCAT_W04	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

SCAT_W05	1	.	.	.	.	2	1	.	.	.	.	.	.	.	2	.	.

Quadrat no.	Care flac hl	Care pend hl	Care rem hl	Care stri hl	Care sylv hl	Carp betu t1	Cast sati t1	Chry oppo hl	Circa lute hl	Cory avel jl	Corylus av s1	Corylus av t3	Crata mono jl	Crata mono s1	Crata mono sl	Crata mono t3
ARD_W01	.	50	.	.	.	.	.	1	1	.	.	.	.	.	.	5
ARD_W02	.	10	.	.	.	.	.	5	5	.	.	.	.	.	.	.
ARD_W03	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
ARD_W04	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	2
BRAC_W01	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
BRAC_W02	.	.	.	.	.	.	.	.	.	.	.	.	4	.	.	25
GORM_W01	.	.	.	.	.	30	.	1	.	5	3	.	.	2	.	.
GORM_W02	.	.	.	.	.	.	.	5	.	.	.	15	.	.	.	10
GORM_W03	.	.	.	.	.	.	.	2	.	1	.	25	.	.	2	10
HAMP_W01	.	10	.	.	.	.	.	.	.	.	.	10	.	.	.	.
HAMP_W02	.	5	.	.	.	.	.	.	.	.	.	.	.	.	.	.
HAMP_W03	.	75	.	.	.	.	.	.	.	.	.	.	.	5	.	.
HOWT_W01	.	.	.	.	.	.	.	.	10	.	.	.	.	.	.	.
HOW_W02	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
HOW_W03	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
MAL_W01	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
MAL_W02	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.
MAL_W03	.	.	.	.	.	.	.	.	5	.	.	.	.	.	.	.
MAL_W04	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	5
NEW_W01	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5
NEW_W02	.	.	5	.	.	.	.	.	1	.	.	.	.	.	.	.
NEW_W03	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
NEW_W04	.	2	.	.	.	.	.	.	.	.	.	2	.	.	.	.
ITA_W01	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
ITA_W02	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
ITA_W03	.	.	.	.	.	.	.	.	.	.	.	.	2	.	1	2
ITA_W04	.	.	.	.	10	.	.	.	.	.	.	45	.	.	1	10
RUS_W01	.	.	.	.	.	.	.	.	.	.	.	.	1	.	1	.
RUS_W02	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.
RUS_W03	.	10	2	.	.	.	.	.	.	.	.	.	2	.	.	.
RUS_W04	.	.	.	.	.	.	15	.	.	.	.	.	.	.	.	.
STA_W01	.	.	.	.	.	.	.	.	7	.	.	20	1	1	.	.
STA_W02	.	.	.	.	.	.	.	5	2	.	2	.	.	.	.	.
STA_W03	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.
STA_W04	.	.	.	.	.	.	.	.	2	2	1	.	.	2	1	7
LUTR_W01	.	.	.	.	1	.	.	.	.	.	.	10	.	.	2	.
LUTR_W02	.	.	.	.	5	.	.	.	.	.	.	.	.	.	.	5
LUTR_W03	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.
LUTR_W04	.	.	.	.	.	.	.	.	2	.	10	.	.	.	.	.
KM_W01	20	.	.	.	.	.	.	.	.	.	.	.	.	20	1	.
KM_W02	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.
KM_W03	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
KM_W04	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
SCAT_W01	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.
SCAT_W02	.	.	.	.	.	10	.	.	.	.	.	.	.	.	.	.
SCAT_W03	.	.	.	.	.	.	.	.	.	.	.	.	2	5	.	.
SCAT_W04	.	.	.	.	.	.	.	.	.	.	.	40	.	10	.	.

SCAT_W05	.	.	.	1	.	.	.	.	.	.	.	20	.	.	1	25	

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Quadrat no.	Dact glom hl	Daph lau s2	Desc flex hl	Dryo aem hl	Dryo affi hl	Dryo dila hl	Dryo fil-m hl	Euon eur sl	Fagu sylv jl	Fagu sylv sl	Fagu sylv t1	Fagu sylv t2	Fagu sylv t3	Fili ulm hl	Frax exce jl	Frax exce sl	Frax exce t1
ARD_W01	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5
ARD_W02	.	.	.	.	4	2	.	.	.	.	15	.	.	.	.	2	.
ARD_W03	.	.	.	.	.	1	1	.	10	.	70	.	.	.	.	.	15
ARD_W04	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	2	15
BRAC_W01	.	.	.	.	.	.	.	.	2	.	60	10	.	.	5	.	25
BRAC_W02	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	80
GORM_W01	.	.	.	.	.	.	5	.	.	.	.	.	.	.	.	.	.
GORM_W02	.	.	.	.	.	15	5	.	.	.	.	.	.	.	.	.	80
GORM_W03	.	.	.	.	.	5	2	.	2	.	10	5	.	.	2	2	5
HAMP_W01	.	.	.	.	.	2	2	.	.	.	.	.	.	.	1	.	40
HAMP_W02	.	.	.	.	5	.	2	.	.	.	.	.	.	.	.	.	40
HAMP_W03	.	.	.	10	.	.	2	.	.	.	.	.	.	.	.	1	30
HOWT_W01	.	.	.	10	.	40	5	.	.	.	.	.	.	.	.	.	.
HOW_W02	.	.	.	.	.	20	2	.	.	.	.	.	.	.	.	.	30
HOW_W03	.	.	80	.	.	.	.	.	.	.	.	.	.	.	.	.	.
MAL_W01	.	.	.	.	.	.	5	.	.	.	.	65	.	.	.	.	25
MAL_W02	.	.	.	.	.	.	.	.	.	.	10	.	.	.	.	.	20
MAL_W03	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	70
MAL_W04	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	15
NEW_W01	.	.	.	.	.	.	1	.	.	.	40	.	.	.	.	.	10
NEW_W02	.	.	.	.	2	2	10	.	.	.	.	.	.	25	.	.	10
NEW_W03	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	10
NEW_W04	.	.	.	.	.	.	.	.	10	.	45	30	5	.	.	.	.
ITA_W01	.	.	.	.	.	.	3	.	.	.	65	.	.	.	.	.	30
ITA_W02	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
ITA_W03	.	.	.	.	.	.	.	.	.	.	95	50	50	.	.	.	.
ITA_W04	.	.	.	.	.	2	.	.	.	.	.	.	.	15	.	1	50
RUS_W01	.	10	.	.	2	5	.	.	2	2	50	.	.	.	.	.	50
RUS_W02	.	.	.	.	.	.	.	.	2	.	65	.	.	.	.	1	20
RUS_W03	.	.	.	.	.	.	.	.	.	.	5	.	.	.	.	.	10
RUS_W04	.	0.1	.	2	.	2	.	.	.	.	.	.	.	.	.	.	30
STA_W01	.	.	.	.	.	.	.	.	4	.	10	.	.	.	2	2	65
STA_W02	.	.	.	.	2	.	.	.	.	.	.	.	1	.	.	1	15
STA_W03	.	.	.	.	.	.	.	.	.	.	15	.	5	.	.	.	60
STA_W04	.	.	.	.	4	.	.	.	5	.	20	.	.	.	.	2	60
LUTR_W01	.	.	.	.	1	5	1	0.5	10	.	50	10	6	.	.	.	10
LUTR_W02	.	.	.	.	.	.	.	.	.	.	50	35	.	.	.	5	5
LUTR_W03	.	.	.	.	.	2	.	.	.	.	.	.	.	.	5	.	.
LUTR_W04	.	.	.	.	1	1	4	.	.	.	45	5	.	.	.	.	10
KM_W01	5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.
KM_W02	.	.	.	.	.	.	.	.	.	1	80	.	.	.	.	5	.
KM_W03	.	2	.	.	.	.	.	.	.	1	35	.	.	.	.	5	50
KM_W04	.	5	.	.	.	.	.	.	.	.	.	.	.	.	.	5	75
SCAT_W01	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	45
SCAT_W02	.	.	.	.	.	.	.	.	.	.	80	.	.	.	.	.	10
SCAT_W03	.	.	.	.	.	.	.	.	7	2	85	25	.	.	.	1	15
SCAT_W04	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	65

SCAT_W05	.	.	.	.	.	.	.	.	.	3	30	5	.	1	.	2	25	

Quadrat no.	Frax exce t2	Frax exce t3	Galiu apa hl	Galiu odo hl	Galiu pal hl	Galiu ver hl	Gera robe hl	Geu urba hl	Gle heder hl	Grise litt s2	Grise litt sl	Hed heli hl	Hed heli s1	Hed heli s2	Hed heli t2	Hed heli t3	Hera spho hl
ARD_W01	.	.	.	.	.	.	.	2	.	.	.	100	.	.	.	.	.
ARD_W02	.	.	2	.	.	.	.	4	.	.	.	25	.	.	.	.	3
ARD_W03	10	.	.	.	.	.	.	.	.	.	.	90	.	.	.	.	2
ARD_W04	.	.	.	.	.	.	.	2	.	.	.	35	.	.	.	.	10
BRAC_W01	5	.	.	.	.	.	2	2	.	.	.	10	.	.	.	10	.
BRAC_W02	.	.	.	.	.	.	2	2	.	.	.	35	.	.	.	10	.
GORM_W01	15	.	.	.	.	.	.	.	.	.	.	50	.	.	.	.	1
GORM_W02	.	.	.	.	.	.	.	5	.	.	.	25	.	.	5	.	.
GORM_W03	30	.	.	.	.	.	.	.	.	.	.	10	.	.	.	.	.
HAMP_W01	.	.	.	.	.	.	.	5	.	.	.	85	.	.	.	.	2
HAMP_W02	.	.	.	.	.	.	1	2	.	.	.	100	.	.	.	.	5
HAMP_W03	.	.	.	.	1	.	.	.	.	.	.	5	.	.	.	.	.
HOWT_W01	.	.	5	.	.	.	.	.	.	.	.	10	.	1	10	.	2
HOW_W02	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
HOW_W03	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
MAL_W01	.	.	.	.	.	.	.	.	.	.	.	90	.	.	.	.	5
MAL_W02	.	.	.	.	.	.	.	.	.	.	.	90	.	.	.	.	.
MAL_W03	10	.	.	.	.	.	.	.	.	.	.	90	.	.	.	40	.
MAL_W04	.	.	.	.	.	.	2	.	.	.	.	60	.	.	.	5	5
NEW_W01	.	.	.	.	.	.	.	.	.	.	.	95	.	.	5	.	.
NEW_W02	.	.	.	.	.	.	.	10	.	.	.	10	.	15	.	10	.
NEW_W03	.	.	.	.	.	.	.	.	.	.	.	95	20	.	.	.	.
NEW_W04	.	.	.	.	.	.	.	.	1	.	.	40	2	.	.	.	.
ITA_W01	.	.	.	.	.	.	.	.	.	.	.	100	.	.	2	.	2
ITA_W02	.	.	.	.	.	.	.	.	.	.	.	60	.	20	30	.	.
ITA_W03	.	.	.	.	.	.	.	.	.	10	5	5	.		.	2	.
ITA_W04	.	.	10	.	.	.	2	2	.	.	.	20	.	.	.	.	10
RUS_W01	.	.	.	.	.	.	.	.	.	.	.	90	.	.	2	.	.
RUS_W02	.	.	.	.	.	.	.	1	.	.	.	95	.	.	.	.	2
RUS_W03	.	.	.	.	.	.	.	2	.	.	.	75	.	.	5	.	4
RUS_W04	.	.	.	.	.	.	.	10	.	.	.	80	.	.	5	.	15
STA_W01	.	.	.	.	.	.	2	.	.	.	.	40	.	.	.	.	20
STA_W02	.	.	.	.	.	.	20	4	.	.	.	15	.	.	.	.	.
STA_W03	.	.	.	.	.	.	0.1	2	.	.	.	30	.	.	.	.	10
STA_W04	.	2	.	.	.	.	5	10	.	.	.	40	.	.	.	.	15
LUTR_W01	.	.	15	.	.	.	.	.	.	.	.	100	.	.	.	.	.
LUTR_W02	.	40	2	.	.	.	.	2	.	.	.	100	.	.	.	.	.
LUTR_W03	.	.	1	.	.	.	.	.	.	.	.	100	.	.	.	.	.
LUTR_W04	5	.	3	1	.	.	10	2	1	.	.	20	.	.	.	.	.
KM_W01	.	.	.	.	.	2	.	.	.	.	.	10	.	.	.	.	.
KM_W02	.	.	.	.	.	.	.	10	.	.	.	10	.	.	.	.	.
KM_W03	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.
KM_W04	.	.	2	.	.	.	.	5	.	.	.	.	.	.	.	.	.
SCAT_W01	.	.	.	.	.	.	.	.	.	.	.	100	.	.	.	.	10
SCAT_W02	.	.	.	.	.	.	.	.	.	.	.	90	.	.	.	.	.
SCAT_W03	.	.	.	.	.	.	.	.	.	.	.	10	.	.	.	.	.
SCAT_W04	.	.	.	.	.	.	.	.	.	.	.	90	.	.	.	.	.

SCAT_W05	.	.	.	.	.	.	.	2	.	.	.	100	.	.	.	.	5

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Quadrat no.	Hya x mas hl	Hype andr s2	Ile aqui jl	Ile aqui s1	Ile aqui s2	Ile aqui sl	Ile aqui t3	Iris pseu hl	Kind prae ml	Ligu vulg s1	Ligu vulg sl	Loni peri s1	Loni peri s2	Loni peri t3	Mniu horn ml	Orob hede hl	Oxa acet hl
ARD_W01	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
ARD_W02	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
ARD_W03	.	.	.	.	.	.	15	.	.	.	.	.	.	.	.	.	.
ARD_W04	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
BRAC_W01	.	.	.	.	.	.	5	.	.	.	.	.	.	.	.	.	.
BRAC_W02	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
GORM_W01	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.
GORM_W02	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.
GORM_W03	.	.	1	.	.	.	25	.	2	.	.	.	.	.	.	.	.
HAMP_W01	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
HAMP_W02	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
HAMP_W03	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
HOWT_W01	.	.	2	.	2	1	.	.	.	.	.	.	.	.	.	.	1
HOW_W02	.	.	2	10	.	1	.	.	.	.	.	.	.	10	.	.	.
HOW_W03	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
MAL_W01	.	.	.	.	.	.	20	.	.	.	.	.	.	.	.	.	.
MAL_W02	.	.	.	.	.	.	10	.	.	.	.	.	.	.	.	.	.
MAL_W03	.	.	.	.	.	.	20	.	.	.	.	.	.	.	.	.	.
MAL_W04	.	.	.	.	.	.	.	.	10	.	.	4	.	.	.	.	.
NEW_W01	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
NEW_W02	.	.	.	.	.	.	.	5	1	.	.	.	.	.	2	.	.
NEW_W03	.	.	.	.	.	.	.	.	5	.	.	.	.	.	.	.	.
NEW_W04	.	.	4	.	.	1	85	.	.	.	1	.	.	.	.	.	.
ITA_W01	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
ITA_W02	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
ITA_W03	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.
ITA_W04	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.
RUS_W01	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
RUS_W02	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
RUS_W03	.	.	.	.	.	.	.	.	10	.	.	.	.	.	.	.	.
RUS_W04	.	.	.	.	.	.	.	.	.	5	.	.	.	.	.	.	.
STA_W01	.	.	.	.	.	.	2	.	2	.	.	.	10	.	.	.	.
STA_W02	2	.	.	.	.	.	10	.	2	.	.	.	2	.	.	.	.
STA_W03	2	.	.	.	.	.	10	.	.	.	.	.	.	.	.	.	.
STA_W04	.	.	.	.	.	1	20	.	.	.	.	.	.	.	.	.	.
LUTR_W01	2	.	.	10	.	.	.	.	.	.	.	.	20	.	.	.	1
LUTR_W02	.	.	.	10	.	10	.	.	.	.	.	.	60	.	.	.	.
LUTR_W03	.	.	.	50	.	.	.	.	.	.	.	.	10	.	.	.	.
LUTR_W04	.	.	.	25	.	.	.	.	.	.	.	.	2	.	.	.	.
KM_W01	.	.	.	.	.	.	.	.	.	20	.	.	.	.	.	.	.
KM_W02	.	.	.	5	.	1	.	.	.	.	.	.	.	.	.	.	.
KM_W03	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
KM_W04	.	.	.	10	.	1	.	.	.	.	.	.	.	.	.	.	.
SCAT_W01	.	.	.	10	.	1	.	.	.	.	.	.	.	.	.	.	.
SCAT_W02	.	.	.	30	.	3	.	.	.	.	.	.	.	.	.	.	.
SCAT_W03	.	.	.	15	.	.	.	.	.	.	.	.	.	.	.	.	.
SCAT_W04	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.

SCAT_W05 . . . . . 1 . . . . . 1 .

Quadrat no.	Pelli end ml	Peta frag hl	Phyl scol hl	Pice abi jl	Pice sitch t1	Pice sp t1	Pinu sylv t1	Plagi und ml	Plant lan hl	Poa trivi hl	Poly seti hl	Pop x can t1	Pote ster hl	Primu vulg hl	Prunu avi sl	Prunu avi t1	Prunu avi t2
ARD_W01	.	15	2	.	.	.	.	.	.	.	20	.	.	2	.	.	.
ARD_W02	.	.	5	.	.	.	5	.	.	.	10	.	.	1	.	.	.
ARD_W03	.	.	1	.	.	.	.	.	.	1	2	.	.	2	.	.	.
ARD_W04	.	.	2	.	.	.	.	.	.	.	35	.	.	5	.	.	.
BRAC_W01	.	.	5	.	.	.	.	.	.	.	15	.	.	.	.	.	.
BRAC_W02	.	.	5	.	.	.	.	.	.	.	50	.	.	.	.	.	.
GORM_W01	.	.	1	.	.	.	.	.	.	.	5	15	.	.	.	.	.
GORM_W02	.	.	2	1	.	.	.	.	.	.	25	.	.	.	.	.	.
GORM_W03	.	.	5	.	.	.	.	.	.	.	10	.	.	.	.	.	.
HAMP_W01	.	.	.	.	.	.	.	.	.	.	50	.	.	5	.	.	.
HAMP_W02	.	.	.	.	.	.	.	.	.	.	25	.	.	2	.	.	.
HAMP_W03	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
HOWT_W01	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
HOW_W02	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
HOW_W03	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
MAL_W01	.	.	2	.	.	.	.	.	.	.	5	.	.	.	.	.	.
MAL_W02	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
MAL_W03	.	.	.	.	.	.	.	.	.	.	5	.	.	2	.	.	.
MAL_W04	.	.	.	.	.	20	.	.	.	.	.	.	.	.	.	.	2
NEW_W01	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.
NEW_W02	.	.	1	.	.	.	.	1	.	.	.	.	.	.	.	.	.
NEW_W03	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.
NEW_W04	.	.	.	.	.	.	5	.	.	.	.	.	.	.	.	.	.
ITA_W01	.	10	2	.	.	.	.	.	.	.	5	.	.	.	.	.	.
ITA_W02	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
ITA_W03	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
ITA_W04	.	.	5	.	.	.	.	.	.	.	2	.	.	.	.	.	.
RUS_W01	.	10	2	.	.	.	.	.	.	.	50	.	.	1	.	.	.
RUS_W02	.	.	2	.	.	.	.	.	.	.	25	.	.	.	.	.	.
RUS_W03	.	.	2	.	.	.	.	.	.	.	25	.	.	1	.	.	.
RUS_W04	.	.	5	.	.	.	.	.	.	.	25	.	.	2	.	.	.
STA_W01	.	.	2	.	.	.	.	.	.	.	25	.	2	2	.	.	.
STA_W02	.	.	.	.	.	.	.	.	.	2	15	.	.	5	.	5	.
STA_W03	.	.	5	.	.	.	.	.	.	2	25	.	.	5	.	.	.
STA_W04	.	.	5	.	.	.	.	.	.	.	15	.	.	2	.	.	.
LUTR_W01	.	.	.	.	.	.	30	.	.	.	2	.	1	.	.	.	.
LUTR_W02	.	.	2	.	.	.	.	.	.	.	5	.	.	.	.	.	.
LUTR_W03	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.
LUTR_W04	.	.	2	.	.	.	.	.	.	.	2	.	.	.	.	.	.
KM_W01	.	.	.	.	.	.	90	.	1	.	.	.	.	.	.	.	.
KM_W02	.	.	.	.	.	.	5	.	.	.	.	.	.	.	.	.	.
KM_W03	.	.	.	.	.	.	5	.	.	.	.	.	.	.	.	.	.
KM_W04	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.
SCAT_W01	.	.	.	.	.	.	.	.	.	.	2	.	.	.	1	.	25
SCAT_W02	.	.	5	.	.	.	.	.	.	.	20	.	.	.	.	.	.
SCAT_W03	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.
SCAT_W04	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.

SCAT_W05 . . . . 2 . . . . . 1 . . .

Prunu laur
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Quadrat no.	Prunu spin s1	Prunu spin s2	Pter aqui hl	Quer rob sl	Quer rob t1	Quer sp sl	Quer x rosa t1	Ranu acr hl	Ranu fica hl	Rhod ponti s1	Ribe rubr s2	Rosa arv s2	Rosa can s1	Rosa can s2	Rubu fruti s1	Rubu fruti s2	Rubu fruti t3
ARD_W01	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.
ARD_W02	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20	.
ARD_W03	.	.	.	.	15	.	.	.	.	.	.	.	.	.	35	.	.
ARD_W04	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5	.
BRAC_W01	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20	.
BRAC_W02	2	.	.	.	20	.	.	.	.	.	.	.	5	.	.	2	.
GORM_W01	.	.	.	.	.	.	.	.	5	.	.	.	.	.	.	.	.
GORM_W02	.	.	.	.	.	.	.	.	30	.	.	.	.	.	.	30	.
GORM_W03	.	.	.	.	25	.	.	.	.	.	.	.	.	.	.	10	.
HAMP_W01	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	10	.
HAMP_W02	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
HAMP_W03	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	35	.
HOWT_W01	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	1	.
HOW_W02	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	90
HOW_W03	.	.	10	.	.	1	.	.	.	10	.	.	.	.	.	.	.
MAL_W01	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20	.
MAL_W02	.	.	.	.	15	.	.	.	.	.	.	.	.	.	.	70	.
MAL_W03	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	30	.
MAL_W04	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	90	.
NEW_W01	15	10	.	.	25	.	.	.	.	.	1	.	.	.	.	10	.
NEW_W02	.	.	.	.	15	.	.	.	.	.	.	.	.	.	.	50	.
NEW_W03	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
NEW_W04	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
ITA_W01	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.
ITA_W02	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
ITA_W03	.	.	.	0.5	3	.	.	.	.	.	.	.	.	.	.	5	.
ITA_W04	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	95	.
RUS_W01	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	5	.
RUS_W02	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.
RUS_W03	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	35	.
RUS_W04	.	.	.	.	.	.	.	.	10	.	.	.	.	.	.	10	.
STA_W01	.	.	.	.	.	.	.	.	15	.	.	.	.	.	.	5	.
STA_W02	.	.	.	.	.	.	.	.	30	.	.	.	.	.	.	.	.
STA_W03	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.
STA_W04	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	7	.
LUTR_W01	.	.	.	.	.	.	.	.	15	.	5	.	.	.	.	10	.
LUTR_W02	.	.	.	.	25	.	.	.	3	.	.	.	.	.	.	5	.
LUTR_W03	.	.	.	.	.	.	80	.	.	.	2	1	.	.	.	1	.
LUTR_W04	.	.	.	.	25	.	15	.	10	.	.	.	.	.	.	5	.
KM_W01	.	.	.	2	.	.	.	.	.	.	.	5	25	.	.	30	.
KM_W02	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	10	.
KM_W03	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5	.
KM_W04	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	10	.
SCAT_W01	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	10	.
SCAT_W02	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
SCAT_W03	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
SCAT_W04	.	.	.	.	.	.	.	.	10	.	.	.	.	.	.	.	.

SCAT_W05 . . . 1 . . . . 2 . . . 5 .

Quadrat no.	Rubu idae s2	Rubu spect t3	Rume sang hl	Salix alb t1	Salix cine jl	Salix cine s1	Salix cine sl	Sambu nigr jl	Sambu nigr s1	Sambu nigr s2	Sambu nigr sl	Sani euro hl	Scroph nod hl	Smy olusa hl	Symp albu s1	Symp albu s2
ARD_W01	.	.	1	.	.	.	.	.	10	.	.	.	.	.	.	.
ARD_W02	.	.	1	.	.	.	.	.	5	.	.	.	1	.	.	.
ARD_W03	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.
ARD_W04	.	.	.	.	.	.	.	.	5	.	.	.	.	.	.	.
BRAC_W01	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	1
BRAC_W02	.	.	.	.	.	.	.	.	.	10	.	.	.	.	.	.
GORM_W01	.	.	.	.	.	.	.	.	3	.	.	.	.	.	.	.
GORM_W02	.	.	.	.	.	.	.	2	10	.	.	.	.	.	.	.
GORM_W03	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
HAMP_W01	.	.	.	.	.	.	.	.	20	.	.	.	.	.	.	.
HAMP_W02	.	.	1	.	.	.	.	.	15	.	1	.	.	.	.	.
HAMP_W03	.	.	2	.	5	10	2	.	.	10	.	.	.	.	.	.
HOWT_W01	.	.	.	.	.	.	.	.	5	.	.	.	.	.	.	.
HOW_W02	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.
HOW_W03	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
MAL_W01	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
MAL_W02	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	25
MAL_W03	.	.	.	.	.	.	.	.	5	.	.	.	.	.	.	.
MAL_W04	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.
NEW_W01	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
NEW_W02	.	.	.	.	.	.	.	.	2	.	.	.	.	.	15	.
NEW_W03	.	.	.	.	.	.	.	.	10	.	.	.	.	.	.	.
NEW_W04	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
ITA_W01	.	.	.	.	.	.	.	.	5	2	1	.	.	.	.	.
ITA_W02	.	.	.	.	.	.	.	.	10	5	.	.	.	.	15	.
ITA_W03	.	.	.	.	.	.	.	.	.	.	.	.	.	.	25	.
ITA_W04	.	.	3	25	.	.	.	.	.	.	.	5	.	.	.	.
RUS_W01	.	.	.	.	.	.	.	.	12	.	.	.	.	.	.	.
RUS_W02	.	.	5	.	.	.	.	.	5	.	.	.	.	2	.	.
RUS_W03	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
RUS_W04	.	.	2	.	.	.	.	.	15	.	.	.	.	.	.	.
STA_W01	2	.	.	.	.	.	.	.	.	.	.	5	.	.	.	.
STA_W02	.	.	.	.	.	.	.	.	0.1	.	.	0.5	.	.	.	.
STA_W03	.	.	1	.	.	.	.	.	5	.	.	5	.	.	.	.
STA_W04	.	.	.	.	.	.	.	.	.	.	.	5	.	.	.	.
LUTR_W01	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
LUTR_W02	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
LUTR_W03	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
LUTR_W04	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.
KM_W01	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
KM_W02	.	.	.	.	.	.	.	.	5	.	.	1	.	.	.	.
KM_W03	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
KM_W04	.	.	.	.	.	.	.	.	20	.	.	.	.	.	.	.
SCAT_W01	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
SCAT_W02	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
SCAT_W03	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
SCAT_W04	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

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Quadrat no.	Taxu bacc jl	Taxu bacc sl	Taxu bacc t1	Taxu bacc t2	Taxu bacc t3	Thamn alop ml	Thuid tama ml	Ulex euro s1	Ulmu gla jl	Ulmu gla s1	Ulmu gla sl	Ulmu gla t1	Ulmu gla t2	Ulmu gla t3	Ulmu min t2	Urti dio hl
ARD_W01	.	.	.	.	.	.	75	.	.	.	.	.	.	.	.	1
ARD_W02	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2
ARD_W03	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4
ARD_W04	.	.	.	.	.	50	.	.	2	.	.	.	.	5	.	5
BRAC_W01	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.
BRAC_W02	.	.	.	.	.	.	.	.	.	.	1	.	.	2	.	.
GORM_W01	.	.	.	.	.	2	10	.	.	.	.	.	.	2	.	.
GORM_W02	.	.	.	.	.	.	70	.	.	.	.	25	.	.	.	.
GORM_W03	.	.	.	.	15	.	50	.	.	.	.	.	.	.	5	.
HAMP_W01	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2
HAMP_W02	.	.	.	35	.	.	.	.	.	.	.	.	.	.	.	.
HAMP_W03	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	25
HOWT_W01	.	.	.	.	.	15	10	.	.	.	.	.	.	.	.	.
HOW_W02	.	.	.	.	.	5	25	.	.	.	.	.	.	.	.	.
HOW_W03	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
MAL_W01	.	.	.	.	.	.	10	.	.	.	.	.	.	5	.	.
MAL_W02	.	.	.	.	.	.	.	.	.	.	.	.	.	10	.	.
MAL_W03	.	.	.	.	.	.	20	.	5	.	.	.	.	20	.	.
MAL_W04	.	.	.	.	.	40	.	.	4	.	.	25	25	15	.	10
NEW_W01	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
NEW_W02	.	1	.	.	.	40	.	.	.	.	.	.	.	.	.	5
NEW_W03	.	.	.	.	.	.	.	.	.	.	.	60	.	.	.	.
NEW_W04	.	1	.	.	5	.	.	.	.	.	.	.	.	.	.	.
ITA_W01	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
ITA_W02	.	.	.	.	.	.	.	.	.	.	.	5	.	.	.	.
ITA_W03	.	0.1	.	.	5	.	.	.	.	.	.	.	.	.	.	.
ITA_W04	.	.	.	.	.	.	.	.	.	.	.	.	10	.	.	5
RUS_W01	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.
RUS_W02	1	.	10	.	.	.	.	.	.	.	.	.	.	.	.	25
RUS_W03	.	.	65	.	.	35	.	.	5	.	.	.	.	10	.	5
RUS_W04	1	0.5	.	.	.	5	.	.	.	.	.	.	.	.	.	5
STA_W01	.	.	.	.	.	3	1	.	.	.	.	.	.	.	.	.
STA_W02	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
STA_W03	.	.	.	.	.	.	2	.	10	.	.	.	.	15	.	.
STA_W04	.	.	.	.	.	.	10	.	.	.	1	.	.	.	.	.
LUTR_W01	.	.	.	.	.	1	.	.	.	.	1	.	.	10	.	.
LUTR_W02	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
LUTR_W03	.	.	.	.	.	.	.	.	25	.	.	.	.	.	.	.
LUTR_W04	.	.	.	.	.	.	.	.	.	5	.	.	.	.	.	.
KM_W01	.	.	.	.	.	.	.	50	.	.	.	.	.	.	.	.
KM_W02	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
KM_W03	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
KM_W04	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.
SCAT_W01	.	.	.	.	.	.	.	.	.	.	1	.	.	30	.	.
SCAT_W02	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
SCAT_W03	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
SCAT_W04	.	.	.	.	.	.	.	.	.	30	.	.	.	.	.	.

SCAT_W05 . . . .

Quadrat no.	Vacci myrs2	Vero chamhl	Vero monthl	Vero serphl	Vici sephl	Viol reichhl	Viol rivihl
ARD_W01	.	.	.	.	.	.	.
ARD_W02	.	.	.	.	.	.	1
ARD_W03	.	.	.	.	.	.	.
ARD_W04	.	.	.	.	.	.	.
BRAC_W01	.	.	.	.	.	.	1
BRAC_W02	.	.	.	.	.	.	1
GORM_W01	.	.	.	.	.	.	.
GORM_W02	.	5	.	.	.	.	1
GORM_W03	.	.	.	.	.	.	.
HAMP_W01	.	.	.	.	.	.	2
HAMP_W02	.	.	.	.	.	.	.
HAMP_W03	.	.	.	.	.	.	.
HOWT_W01	.	.	.	.	.	1	.
HOW_W02	.	.	.	.	.	.	.
HOW_W03	5	.	.	.	.	.	.
MAL_W01	.	.	.	.	.	.	.
MAL_W02	.	.	.	.	.	.	.
MAL_W03	.	.	.	.	.	.	.
MAL_W04	.	1	.	.	.	.	2
NEW_W01	.	.	.	.	.	.	1
NEW_W02	.	1	.	1	.	.	.
NEW_W03	.	.	.	.	.	.	.
NEW_W04	.	.	.	.	.	.	2
ITA_W01	.	.	.	.	.	.	.
ITA_W02	.	.	.	.	.	.	.
ITA_W03	.	.	.	.	.	.	.
ITA_W04	.	1	.	.	.	.	6
RUS_W01	.	.	.	.	.	.	.
RUS_W02	.	.	.	.	.	.	.
RUS_W03	.	.	2	.	.	.	.
RUS_W04	.	.	.	.	.	.	.
STA_W01	.	.	5	.	.	.	0.5
STA_W02	.	.	1	.	.	1	2
STA_W03	.	.	2	.	.	.	5
STA_W04	.	.	2	.	.	2	2
LUTR_W01	.	.	4	.	.	.	1
LUTR_W02	.	2	.	.	.	.	1
LUTR_W03	.	.	.	.	.	.	.
LUTR_W04	.	.	1	.	.	.	2
KM_W01	.	.	.	.	.	.	5
KM_W02	.	.	.	.	.	.	.
KM_W03	.	2	.	.	.	.	2
KM_W04	.	.	.	.	.	.	2
SCAT_W01	.	.	.	.	.	.	.
SCAT_W02	.	.	.	.	.	.	.
SCAT_W03	.	.	.	.	.	.	.
SCAT_W04	.	.	.	.	.	.	.

SCAT_W05	.	1	.	.	1	.	1