

Vegetation Study of Ireland's Eye, Co. Dublin

Report for Fingal County Council



By Alexis FitzGerald

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Chapter 1. Acknowledgements

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Chapter 2. Introduction

Fingal County Council wishes to develop a management plan for Ireland's Eye in 2017 to fulfil one of the Dublin Bay Biosphere action plan commitments. The aim of the management plan is to set out a long term strategy on how the island should be managed in terms of nature conservation, recreation and cultural heritage features. More detailed data is required on the flora and fauna of the island to guide the management plan. The aim of this vegetation study is to map and describe the existing vegetation of Ireland's Eye and to provide recommendations for managing the vegetation and invasive species where necessary.



Figure 1: Ireland's Eye

Chapter 3. Vegetation Assessment

3.1. Assessment:

Ireland's Eye is a small island of c. 30 hectares just off the coast of the Howth Head peninsula. In terms of the geology of the island, it consists primarily of Cambrian greywacke, sandstone and quartzite (Van Lunsen & Max 1975). Therefore, the island has a naturally siliceous soil content and this is reflected in much of the vegetation to be seen here. The north of the island is at a higher elevation to the south and has a large area of siliceous rocky ground (with varying levels of soil development on it) and high coastal cliffs along the northern (and eastern) edge of the island. Consequently, there is a contrast in vegetation between the higher, rockier northern side of the island and the lower southern side.

Beginning from the usual boat entry point to the island at the northwestern corner near the martello tower, short, sandy, coastal, dry grassland occurs. Species such as *Bromus hordeaceus* (Soft-brome), *Sedum acre* (Biting Stonecrop), *Silene uniflora* (Sea Champion), *Carex arenaria* (Sand Sedge), *Spergularia rupicola* (Rock Sea-spurrey), *Plantago coronopus* (Buck's-horn Plantain), *Armeria maritima* (Thrift), large stands of *Carduus tenuiflorus* (Slender Thistle) and others occur commonly in this vegetation. The rare *Erodium maritimum* (Sea Stork's-bill) also occurs here (see **Chapter 5**).

Burrowing activity and nesting birds keep this area of vegetation somewhat disturbed, with sand heaps and the scrapes and burrows of sea bird's nests intermittently present. These scrapes are also present abundantly along the northern edge of the island. An as yet unidentified small mammal or rodent may also be present on the island and may be contributing to the burrowing activity.

On the siliceous rocky outcrops, *Armeria maritima*, the native *Sedum anglicum* (English Stonecrop), the native *Sedum acre* and *Festuca rubra* agg. (Red Fescue) dominate the vegetation. This is reflected along most of the rocky northern edge of the island, with other species like *Festuca ovina* agg. (Sheep's-fescue), *Spergularia rupicola*, *Aira praecox* (Early Hair-grass), *Polypodium vulgare* agg. (Polypody) and *Beta vulgaris* ssp. *maritima* (Sea Beet) occurring occasionally on the rocks. *Teucrium scorodonia* (Wood Sage) grows in some areas on these rocky outcrops, along with *Umbilicus rupestris* (Navelwort) and rarely, *Lonicera periclymenum* (Honeysuckle).

The invasive species *Sedum album* (White Stonecrop) grows on rocky outcrops right across the northern side of the island and indeed on rocky ground throughout the island (see **Chapter 6**). Its larger, spreading and more luxurious habit means that it is not well adapted to the steeper rocky sea cliffs on the very margins of the island and is most abundant on the flatter rocky ground on the northern side. The two native *Sedum* species (mentioned above) are better adapted to the small crevices in the steeper rocky slopes and cliffs, however, they can occasionally be seen growing alongside *Sedum album*.

The vegetation of the steep rocky cliffs and slopes, particularly near the sea stacks and gannet colony at the northeastern corner of the island, has been affected by bird activity. The gannet colony on the island was only established in 1989 and so there has been a marked increase in recent years in nesting gannets here. Bird nesting sites necessarily decrease the area where plants can grow on the steep cliffs and slopes and increase disturbance.

Carrigeen Bay is a beach and dune system at the western/southwestern edge of the island. Moving south towards this bay from the northwestern corner of the island, a *Pteridium aquilinum* (Bracken) scrubland develops, with *Urtica dioica* (Common Nettle), *Heracleum sphondylium* (Common Hogweed), *Anisantha sterilis* (Barren Brome) and *Arrhenatherum elatius* (False Oat-grass) commonly growing amongst the bracken. Some woodland species avail of the shade under the bracken scrub, including *Glechoma hederacea* (Ground-ivy), *Ficaria verna* ssp. *fertilis* (Lesser Celandine), *Hyacinthoides non-scripta* (Bluebell), *Brachypodium sylvaticum* (False Brome) and *Arum maculatum* (Lords-and-Ladies). This vegetation also occurs intermittently across the northern side of the island (and indeed dominates the centre of the island – see below). Occasionally at the edge of these patches of bracken scrubland vegetation, *Chamerion angustifolium* (Rosebay Willowherb, Fireweed) occurs. This is a pioneer species of open, recently disturbed ground, especially following a fire event such as that which occurred on the island in June 2015. The invasive introduction, *Iris foetidissima* (Stinking Iris), occurs sparsely amongst the bracken scrub but is most commonly found at the top of the sand dunes (where they merge with bracken scrub) at the western and southern edges of the island (see **Chapter 6**).

Near the north end of Carrigeen Bay, an area of species-rich sandy coastal grassland is to be found. Here, *Euphorbia portlandica* (Portland Spurge) occurs on thin soil over coastal acidic sandstone/quartzite rock (Van Lunsen & Max 1975). This species is occasional in the Fingal County Council area (Doogue *et al.* 1998). In this same spot, the rare *Scilla verna* (Spring Squill) occurs (see **Chapter 5**), along with *Festuca rubra* agg., *Carex arenaria* and *Armeria maritima*.

On the dunes of Carrigeen Bay, a typical sand dune species assemblage can be found. This includes *Erodium cicutarium* (Common Stork's-bill), *Cakile maritima* (Sea Rocket), *Elytrigia juncea* (Sand Couch), *Carduus tenuiflorus*, *Carex arenaria*, *Euphorbia paralias* (Sea Spurge), *Raphanus raphanistrum* ssp. *maritimus* (Sea Radish), *Anagallis arvensis* (Scarlet Pimpernel), *Ammophila arenaria* (Marram Grass), *Atriplex prostrata* (Spear-leaved Orache), *Rumex crispus* var. *littoreus* (Curled Dock), *Cerastium diffusum* (Sea Mouse-ear), *Ranunculus bulbosus* (Bulbous Buttercup), *Galium verum* (Lady's Bedstraw) and other species. *Pilosella officinarum* (Mouse-ear Hawkweed) can also be found occasionally on the dunes, perhaps indicating the acidic and heavily leached nature of the sandy dune soil. *Salsola kali* (Prickly Saltwort) was found on the lower dunes (see **Chapter 5**). At the north end of the dunes, the rare *Hyoscyamus niger* (Henbane) was also found (see **Chapter 5**).

Bracken scrubland is encroaching on the top of the dunes (see **Figure 2** below). The invasive *Iris foetidissima* occurs commonly on the dunes on Carrigeen Bay and indeed along the southern shores of the island. *Acer pseudoplatanus* (Sycamore) occurs sporadically on the upper margins of the dunes. It is also found sporadically throughout the western side of the island, along with *Salix cinerea* ssp. *oleifolia* (Rusty Willow). Large bushes of *Rosa canina* agg. (Dog Rose) can be found occasionally near the dunes amongst the bracken scrub. The potentially invasive *Rosa rugosa* (Japanese Rose) can also be found in one location amongst the bracken scrub near the dunes (see **Chapter 6**). Here also, the invasive *Crocsmia × crocosmiiflora* (Montbretia) can be found occasionally (see **Chapter 6**).



Figure 2: bracken scrubland encroaching on the dunes at Carrigeen Bay - 12th July 2016

A shingle shore occurs by the southwestern/southern edge of the island. Here, *Leymus arenarius* (Lyme-grass) occurs occasionally. This species was very rare in Co. Dublin in the early 1900's, but is now increasing in the county, having been commonly planted as a sand-binding species. It is therefore believed that it may have been introduced to many of its present sites (Doogue *et al.* 1998).

Honckenya peploides (Sea Sandwort), *Potentilla anserina* (Silverweed), *Tripleurospermum maritimum* (Sea Mayweed) and *Viola tricolor* ssp. *curtisii* (Wild Pansy) also occur here along the shingle shore. Birds such as oystercatchers nest on this shingle ground. Seaweed is dumped onto the shingle shore by the high tide and this increases the nutrient levels of the substrate. Species like *Atriplex prostrata* (Spear-leaved Orache) and *Atriplex glabriuscula* (Babington's Orache) take advantage of this high-nutrient zone of the shingle shore and are often the first plants to take hold here (Doogue & Krieger 2010). These species are adapted to high salinity and low moisture and are usually succulent. The rare hybrid plant *Silene* × *hampeana* (Campion hybrid) was found at the top of the shingle shore/sandy ground here, where it merges with bracken scrubland (see **Chapter 5**).

In the northern centre of the island, just northwest of Carrigeen Bay, small patches of taller scrub vegetation are to be found. Large *Sambucus nigra* (Elder) trees occur in a small, dense patch here, with a sparse herb layer of *Holcus lanatus*, *Arum maculatum*, *Glechoma hederacea* and other species. A small patch of *Acer pseudoplatanus* (Sycamore) and *Fraxinus excelsior* (Ash) trees occur nearby, some of which appear to be planted, along with similarly planted young trees of *Prunus* species and *Pyrus* species. *Glechoma hederacea* is again abundant in the herb layer under this tall scrub patch.

The centre of the island is dominated by bracken scrubland, with the same typical scrubland species occurring amongst the dominant bracken. These species include *Heracleum sphondylium*, *Cirsium vulgare* (Spear Thistle), *Galium aparine* (Cleavers, Goosegrass), *Anisantha sterilis*, *Urtica dioica*, *Arrhenatherum elatius* (False Oat-grass), occasionally *Teucrium scorodonia*, whilst as explained previously, some shade-tolerant, woodland species thrive under the cover of this tall herb vegetation, like *Glechoma hederacea* and *Hyacinthoides non-scripta*. *Cirsium arvense* (Creeping Thistle) is also frequent. This species is indicative of higher nutrient conditions in the soil. It can also be found near the bird colonies and on recently burnt, ash-rich ground, reflecting the ecology of *Carduus tenuiflorus* and *Anthriscus caucalis* (see below). One burnt *Ulex europaeus* (Gorse) shrub was found in the centre of the island and another on rocky ground near the aforementioned *Sambucus nigra* tall scrub patch. Perhaps surprisingly, there is very little *Ulex europaeus* on the island, especially given its abundance on the nearby Howth Head. This species may have been more frequent on the island before the fire, however, the fire evidently damaged its populations here. *Pteridium aquilinum* is better adapted to surviving fire due to its rhizomatous habit and so is the dominant scrubland species on the island.



Figure 3: view of the bracken scrubland, dominating the centre of Ireland's Eye – church ruin in the centre – 24th August 2016

On the bare soil exposed by the June 2015 fire in the southeast of the island, open wasteground species like *Cerastium glomeratum* (Sticky Mouse-ear), *Aphanes australis* (Slender Parsley-piert), *Myosotis discolor* (Changing Forget-me-not) and *Sonchus asper* (Prickly Sow-thistle) colonise. Bracken scrub also encroaches steadily on the bare soil, and will eventually overcome the open wasteground species, except where the soil is too thin to support the bracken rhizomes. The invasive *Conyza floribunda* (Bilbao's Fleabane) was found in three locations in the north and south of the island amongst this more sparse bracken vegetation (see **Chapter 6**).

Cochlearia danica (Danish Scurvygrass) and *Atriplex littoralis* (Grass-leaved Orache) also occur amongst the thinner bracken scrub near the cliffs, and *Rubus fruticosus* agg. (Brambles) is frequent. The scarce/rare *Senecio sylvaticus* (Heath Groundsel) was also found amongst the the more open bracken scrub in the southeast of the island and a further plant was found on rocky ground in the north of the island (see **Chapter 5**). This species is often indicative of recently burnt acidic heathland/scrubland sites. In the southeast of the island, *Hyacinthoides hispanica* (Spanish Bluebell) has escaped and is spreading. It is competing with the native *Hyacinthoides non-scripta* and may be hybridising with it (*Hyacinthoides* × *massartiana*) (see **Chapter 6**).

On the southeastern and eastern sides of the island, rocky coastal vegetation is common. *Sagina procumbens* (Procumbent Pearlwort), *Catapodium marinum*, *Spergularia rupicola*, *Sedum acre*, *Cerastium diffusum*, *Plantago coronopus* (Buck's-horn Plantain), *Cerastium glomeratum* (Sticky Mouse-ear) and *Sagina maritima* (Sea Pearlwort) occur here. A further population of the rare *Scilla verna* was also found on these coastal, sandstone cliffs in a deep inlet in the southeast of the island (see **Chapter 5**).

Rosa spinosissima was found in this inlet, it is locally common in coastal sand dune and heathland areas of Fingal County Council (Doogue *et al.* 1998). *Crithmum maritimum* was found at a few location growing out of crevices in the rock on steep cliffs at the eastern edge of the island. This species is locally common on Howth and Ireland's Eye and indeed is common in other coastal locations in the Fingal County Council area, however, it is rare in the rest of the Co. Dublin (Doogue *et al.* 1998). *Plantago maritima* (Sea Plantain) (much less common on the island than *Plantago coronopus*) and *Jasione montana* (Sheep's-bit) were also seen growing sparingly on cliffs at the eastern/southeastern edge of the island. The latter species is indicative of acidic heathy ground (Doogue & Krieger 2010).



Figure 4: *Rosa spinosissima* (left of centre) on coastal rock by an inlet at the southeastern corner of the island - 12th July 2016

An old church ruin occurs amongst the bracken scrub in the centre of the island east of Carrigeen Bay. On its walls, *Catapodium marinum* (Sea Fern-grass), *Sedum acre*, *Festuca rubra* agg., *Hordeum murinum* (Wall Barley), *Anisantha sterilis*, *Taraxacum* agg. (Dandelion), *Plantago lanceolata* (Ribwort Plantain) and *Rosa canina* agg. (Dog-rose) occur. A similar vegetation type can be found occurring on the martello tower at the northwestern corner of the island. *Atriplex patula* (Common Orache) was found near the church ruin, perhaps indicative of former human presence in this area.

In the northwest of the island, about 100-150 metres southeast of the martello tower, a small wet hollow occurs with relatively deep soil, amongst the surrounding rocky ground, the only wet freshwater habitat to be found on the island. This site used to be a small pool, however, there is no surface water here anymore due to sedimentation in the pool over the years (Declan Doogue, pers. comm., July 2016). Nonetheless, large wetland grasses and rushes are still present, indicating belowground moisture. The roots of rushes in particular can follow the falling water table in summer and are very indicative species of belowground moisture. *Phalaris arundinacea* (Reed Canary-grass), *Juncus effusus* (Soft Rush), *Ranunculus repens* (Creeping Buttercup), *Eleocharis palustris* (Common Spike-rush), *Callitriche stagnalis* (Common Water-starwort), *Persicaria amphibia* (Amphibious Bistort), *Potentilla anserina*, *Veronica catenata* (Pink Water-speedwell) and other wetland/wet grassland species occur here, further indicating the high moisture levels at this location.

A small area of salt marsh vegetation was found occurring on rocky ground just north of Carrigeen Bay. Thin soil was present over this rocky ground, and brackish water is clearly having an effect on the vegetation. Saltmarsh species such as *Puccinellia maritima* (Common Saltmarsh-grass), *Aster tripolium* (Sea Aster), *Juncus gerardii* (Saltmarsh Rush), *Glaux maritima* (Sea-milkwort), *Spergularia marina* (Lesser Sea-spurrey), *Cochlearia officinalis* ssp. *officinalis* (Common Scurvygrass) and *Triglochin maritima* (Sea Arrowgrass) occur here. *Carex distans* (Distant Sedge) and *Samolus valerandi* (Brookweed) are also present and these species indicate water seepage in the area (Doogue *et al.* 1998). *Samolus valerandi* is "occasional on low and wet cliffs, on shores and in dune-slacks in the north of the county" (Doogue *et al.* 1998). *Juncus gerardii* also occurs on similar rocky ground with a brackish water influence at the southeastern margin of the island but the vegetation here does not have a full saltmarsh species complement.



Figure 5: salt marsh/seepage vegetation on rocky ground, north of Carrigeen Bay. The white-flowered *Samolus valerandi* can be seen in the left foreground – 12th July 2016

A small bird colony island is present near the southeastern edge of the main island. The island was not accessible due to the large numbers of breeding birds there, which ought not to be disturbed, and indeed the hazardous depth of the water between the small island and main island even at relatively low tide. Nonetheless, observations were made on the vegetation using a high-powered spotting scope. This revealed that the vegetation appears to be quite similar to that found at the southeastern corner of the main island. Dry grassland with *Holcus lanatus*, *Rumex crispus* and other species dominate the vegetation, whilst species such as *Festuca rubra* agg. are frequent on the more bare, rocky soils at the edge of the small island. However, a closer survey of the small island may well reveal more interesting botanical information.

3.2. Impact of fire on the vegetation:

A severe wildfire occurred on the island in June 2015 and this has had some clear effects on the vegetation. On rocky patches of thin soil over bedrock that were particularly affected by the June 2015 fire, the bare, ash-rich ground has been colonised by extensive carpets of the moss *Funaria hygrometrica* (Bonfire-moss), a characteristic colonist species of ash-rich burn sites (Atherton *et al.* 2010), along with vascular plant species like *Sedum album*, *Geranium molle* (Dove's-foot Crane's-bill), *Sedum acre*, *Dactylis glomerata* (Cock's-foot) and *Epilobium obscurum* (Short-fruited Willowherb). *Carduus tenuiflorus* occurs occasionally here on the more open, recently burnt ground, where it is not outcompeted by larger, more aggressive herbs like bracken, which require deeper soil development. However, the populations of *Carduus tenuiflorus* certainly thin out as one moves inland from the coast, where bracken is dominant. *Carduus tenuiflorus* is a plant adapted to high nutrient, coastal conditions, especially those associated with bird colonies, guano being a rich nutrient source (Doogue & Krieger 2010). The occasional archaeophyte *Urtica urens* (Small Nettle) can also be found colonising the bare burnt soil in some areas. *Anthriscus caucalis* (Bur Chervil) can also be found occasionally here, early in the year. It has a similar ecology to *Carduus tenuiflorus*, as it is also often associated with sandy coastal sites near bird colonies (Doogue & Krieger 2010).



Figure 6: recently burnt, ash-rich, rocky ground, with an abundance of the brownish, bonfire moss (*Funaria hygrometrica*) – also *Sedum album* patch in the foreground and tall *Carduus tenuiflorus* plants in the background.

The fire caused a significant short-term ecological shift for much of the island's vegetation. Much open, ash-rich soil was exposed by the fire. This has allowed for the dormant seed of open-ground annuals to germinate and flower. For example, the rare *Myosotis ramosissima* (Early Forget-me-not) was found on this recently burnt ground on the northern side of the island (see **Chapter 5**). This species requires open ground on sandy, free-draining soils to survive. The soil isn't particularly sandy at the northern side of the island, however, the thinness of the soil which is lying over bare rock means that water drains out rapidly from the soil. It is also found growing on sand-dunes and dry banks in other Co. Dublin sites. This open, ash-rich soil has also allowed for the rare *Erodium maritimum* to spread (see **Chapter 5**).

The fire has indeed begun a recolonisation process for much of the island's vegetation, beginning with a flourish of short-lived annuals which now have an opportunity to flower, set seed and replenish their longterm seed bank in the soil. On the thinner rocky soils, these species will often, with time, be shaded out by more aggressive grasses such as *Festuca rubra* agg. and *Holcus lanatus* and invasives like *Sedum album*. On the deeper soils, they will be swiftly overgrown by bracken, which very effectively survives fires using its extensive system of underground rhizomes.

Chapter 4. Vegetation Map

The vegetation map itself was to encompass the entirety of Ireland's Eye. The data for the map was generated over two months from mid-June to mid-August 2016. This involved the recording of 308 2 × 2 metre quadrats across the entire island. All species present in each quadrat were recorded, along with a DAFOR Scale value for each species (D = dominant, A = abundant, F = frequent, O = occasional, R = rare). The quadrats were recorded at roughly equal distances from one another (apart from the bracken-dominated centre of the island where multiple belts of quadrats were recorded) in order to produce representative coverage of all the vegetation on the island. The vegetation quadrats were analysed using the PC-ORD 7 © programme. The quadrat sample data were grouped using both Cluster Analysis and Twinspan into distinct vegetation types, both of which produced very similar results. These vegetation types were also analysed using ordination (NMS and Decorana). 9 main vegetation types were defined for the island. The vegetation types were mapped using the QGIS © programme. The quadrat locations and the vegetation types to which they belong were plotted on a map of the island and the vegetation boundaries were then drawn, aided by the personal field experience of the author. The map is presented below, both as an opaque vegetation map and a more transparent one, so that the underlying topography can be viewed more easily:

Ireland's Eye

Vegetation Map

- Bracken Scrubland
- Dry Grassland
- Rocky Sea Cliff
- Saltmarsh
- Sand Dune
- Shingle Shore
- Siliceous Rock
- Wall
- Wet Grassland



Figure 7: Vegetation Map of Ireland's Eye - opaque

Ireland's Eye

Vegetation Map

- Bracken Scrubland
- Dry Grassland
- Rocky Sea Cliff
- Saltmarsh
- Sand Dune
- Shingle Shore
- Siliceous Rock
- Wall
- Wet Grassland

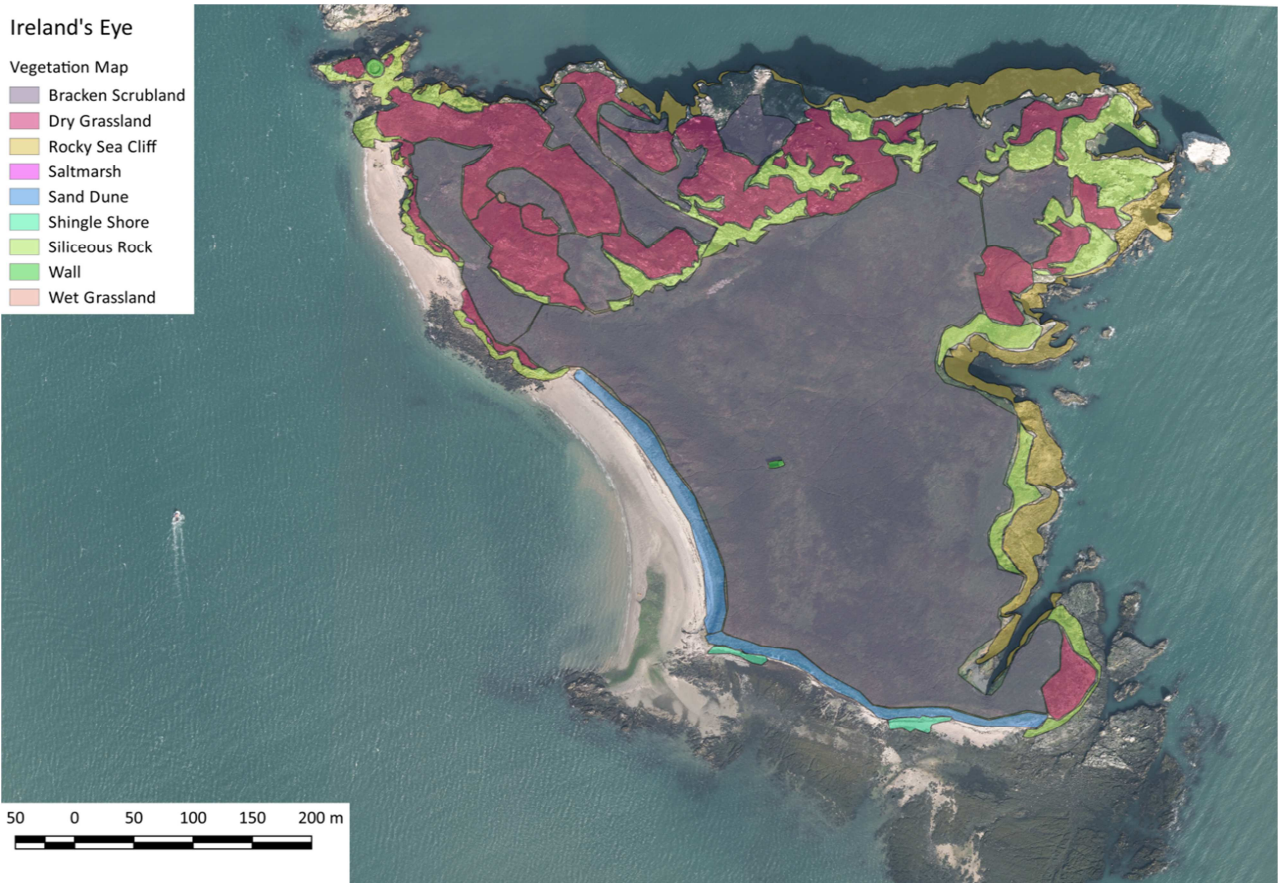


Figure 8: Vegetation Map of Ireland's Eye - transparent

4.1. Bracken Scrubland:

It is clear from **Figures 7** and **8** above that bracken scrubland is by far the dominant vegetation type on the island. It covers most of the centre of the island in a thick tangle of *Pteridium aquilinum*, *Heracleum sphondylium* and other species as explained previously. This vegetation type fits closely with Fossitt's (2000) dense bracken (HD1) vegetation type. The recent 2015 fire has evidently aided this vegetation type by killing off less well-adapted competitors on the island like *Ulex europaeus* and this species is perhaps surprisingly rare on the island. Bracken meanwhile easily survived the fire with its underground system of rhizomes and has been able to spread onto the burnt ground during this year's growth. Small patches of other scrubland species also occur intermittently, especially just south of the siliceous rock at the north end of the island. For example, a patch of *Sambucus nigra* trees can be found. Because of the dominance of bracken scrub over large parts of the island, much of the habitat and vegetational diversity is therefore forced to exist on the edges of the island, where different ecological factors are incidentally at play.

4.2. Siliceous Rock:

The northern end of the island is at a higher altitude and is dominated by a large rocky outcrop with varying levels of soil development over it. In parts, the soil is deep enough (usually in the deeper crevices) for bracken scrubland to take hold and these areas are clear on the maps above. On the higher ground, siliceous rocky outcrops are found, on which a typical (lowland) siliceous (acidic) rock vegetation has developed, including *Sedum* spp., *Festuca ovina* agg., *Festuca rubra* agg., *Umbilicus rupestris*, *Spergularia rupicola*, etc. This vegetation does not fit the exposed siliceous rock (ER1) vegetation of Fossitt (2000) well, however, the rock is indeed siliceous here and the species mentioned by Fossitt are more expressive of the heathland end of the spectrum of species that can occur in this vegetation. The coastal influence on this vegetation type here can be seen in the occurrence of species like *Armeria maritima*.

4.3. Dry Grassland:

Where the soil has developed to a greater degree but is not deep enough to allow for bracken to grow, a dry grassland vegetation type has developed with a clear coastal element, such that species like *Carduus tenuiflorus* and *Erodium maritimum* occur. The species listed in Fossitt's (2000) dry-humic acid grassland (GS3) vegetation type does not fit completely with the vegetation seen at Ireland's Eye, however, the presence of *Festuca* spp. and *Rumex acetosella* is an important common thread. There is a certain degree of intergradation between the dry grassland and siliceous rock vegetation types and some species, for example *Sedum album*, are seen to cross over. Both the dry grassland and siliceous rock habitats are also found at the western, eastern and southeastern edges of the island, where the soil becomes too thin for the bracken to colonise.

4.4. Sand Dune:

A large stretch of sand dune occurs along Carrigeen Bay and also more narrowly along the southern edge of the island. Bracken scrubland is encroaching on the sand dunes in some parts (see **Figure 2** above). The sand dune vegetation here combines both the embryonic dune (CD1) and marram dune (CD2) vegetation types in Fossitt (2000), the former being at the lower end of the dunes and the latter being at the upper end. The species on Ireland's Eye match quite closely with the listed species, with *Elytrigia juncea*, *Cakile maritima* and *Salsola kali* on the lower parts of the dune (CD1) and *Ammophila arenaria* and *Carex arenaria* dominating the higher areas of the dunes (CD2). *Ammophila arenaria* can be found amongst the bracken scrub near to the dunes where the two vegetation types intergrade.

4.5. Salt Marsh:

Two very small patches of salt marsh vegetation occur at the western edge of the island, north of Carrigeen Bay. There is clearly some seepage activity here and the vegetation displays elements of both Fossitt's (2000) lower salt marsh (CM1) and upper salt marsh (CM2) vegetation. *Puccinellia maritima* and *Triglochin maritima* are present and indicative of the former, and *Juncus gerardii* and *Cochlearia officinalis* are also present and are indicative of the latter. Species which are more indicative of freshwater seepage also occur, e.g. *Samolus valerandi*.

4.6. Shingle:

Shingle occurs in two patches at the southern edge of the island, evidently where the prevailing wind has moved much of the lighter material away, leaving the heavier stones to make up the shingle. A typical shingle vegetation occurs here, which is comparable to Fossitt's (2000) shingle and gravel bank (CB1) vegetation type. The species include *Beta vulgaris* and *Tripleurospermum maritimum*. A distinctive shingle species, *Hyoscyamus niger*, has also been recorded here (see **Chapter 5**). The vegetation grades into a narrow strip of sand dune vegetation across the southern edge of the island, indicated by the emergence of *Ammophila arenaria* in the vegetation.

4.7. Wet Grassland:

A very small patch of wet grassland occurs at the northwestern section of the island. This patch is the remnant of what was once a wet hollow with most likely typical marsh (GM1) vegetation (Fossitt 2000), but over time has filled in with sediment and now displays a species complement more comparable to Fossitt's (2000) wet grassland (GS4) vegetation type. Species present here which are indicative of such include *Ranunculus repens*, *Juncus effusus* and *Potentilla anserina*. Species like *Callitriche stagnalis* s.s. and *Eleocharis palustris* also occur and indicate a formerly more wet substrate.

4.8. Wall:

Wall vegetation can be seen occurring on an old ruined church in the west of the island and on the martello tower at the northwestern corner of the island. Species like *Catapodium marinum*, *Sedum acre* and *Hordeum murinum* occur and link the vegetation closely with Fossitt's (2000) stone walls and other stonework (BL1) vegetation type.

4.9. Rocky Sea Cliff:

Finally, at the northern and eastern edges of the island, the cliffs are quite high, and are above the 5 metre lower limit of height for classification as rocky sea cliff. The dominant species here fit quite closely with Fossitt's (2000) rocky sea cliff (CS1) vegetation type, including *Armeria maritima*, *Festuca rubra* and *Plantago maritima*. A number of the species are found to occur in both this vegetation type and the siliceous rock vegetation type, for example, *Sedum acre* and *Sedum anglicum*, with the notable exception of *Sedum album*, which evidently does not cope well on the rocky sea cliffs.

Chapter 5. Legally Protected, Rare and Locally Rare Species

Eight rare/locally rare species were found on Ireland's Eye during this survey. Their locations on the island are shown on a map below, along with accounts for each of the species. These accounts do not include an historical appraisal of their presence on the island:

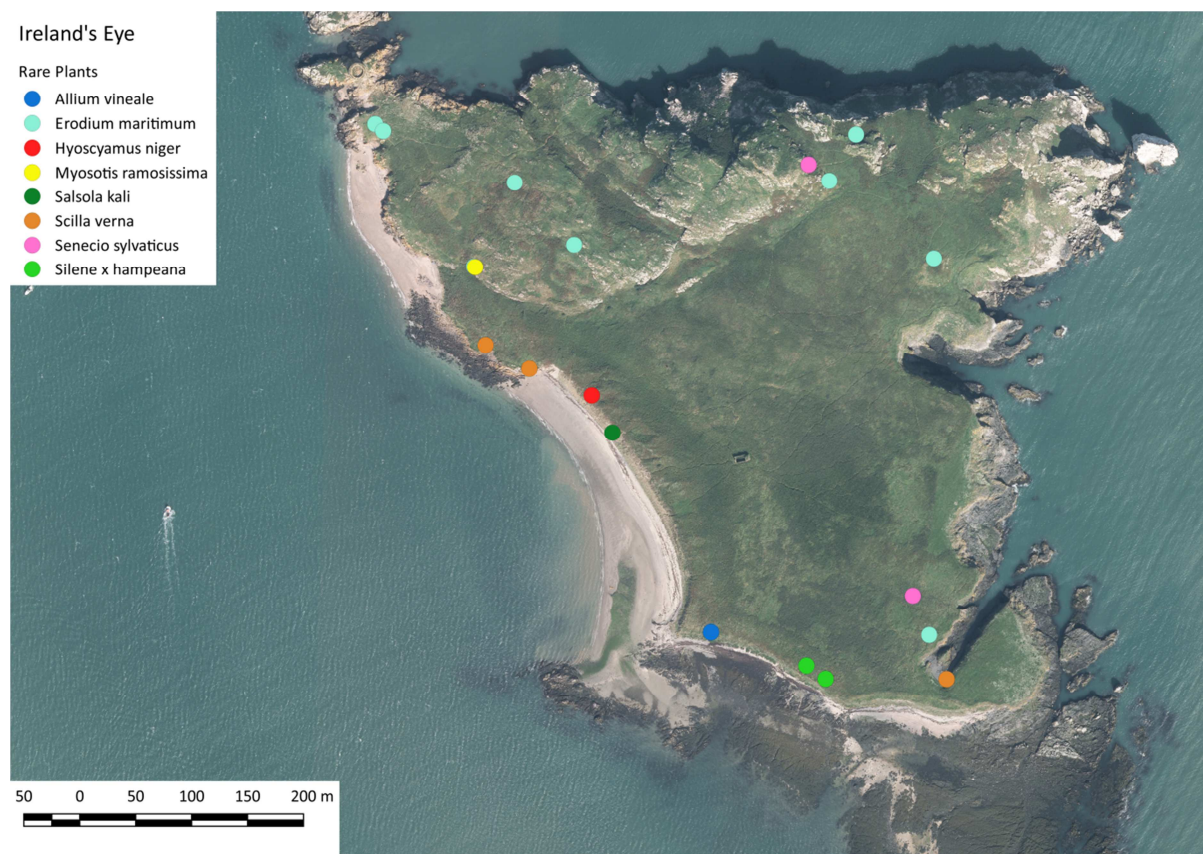


Figure 9: rare/locally rare plants on Ireland's Eye

5.1. *Hyoscyamus niger* (Henbane):

One plant of *Hyoscyamus niger* (Henbane) was found on sandy ground at the top of the dunes (where the dunes merge with bracken scrubland) at the north end of Carrigeen Bay on the western side of the island on 30th April 2016 by the Botanical Society of Britain and Ireland (BSBI) during one of their field recording outings (Maria Long, pers. comm., July 2016). The plant was also seen at the top of the shingle shoreline at the southwestern corner of the island (just south of Carrigeen Bay) by this author on 17th August 2014 (not on above map) and indeed has been recorded in this general area of the island for many decades (Declan Doogue, pers. comm., August 2016). This is a rare coastal species in Ireland.

Its usual habitat is the mid-level zones of shingle shores where it avails of the nutrients from seaweed dumped by the high tide. It can also naturally be found near bird colonies, showing a similar nutrient-demanding ecology to that of *Carduus tenuiflorus* and other species (Doogue & Krieger 2010).

It was previously more widespread inland but was almost eradicated from inland areas over the last century due partly to increased herbicide use in agriculture (Parnell & Curtis 2012). Today, it is only found rarely on coastal sandy or rocky shores (Parnell & Curtis 2012). In Co. Dublin it is extremely rare and this is the only site for the species in the county, other than a single other site, at Corballis, which is also in the Fingal County Council area (Doogue *et al.* 1998). This species is listed as rare in the *Irish Red Data Book 1: Vascular Plants* (Curtis & McGough 1988). This is therefore one of the most important plant species in the Fingal County Council area which is in need of continued conservation. Ireland's Eye is one of the plant's major historic Co. Dublin strongholds. Unlike most of the rare/locally rare species on the island, this species is potentially threatened, as it occurs on the shingle and sand dune habitats which experience the most human visitor traffick. It is therefore at risk of being trampled by unsuspecting visitors. As is mentioned in **Chapter 7**, a nature education board could be erected to inform visitors particularly about sensitive plants such as this one and how to avoid damaging it.



Figure 10: *Hyoscyamus niger* - © Jan van der Straaten

5.2. *Scilla verna* (Spring Squill):

Scilla verna (Spring Squill) was found on thin, acidic, sandy, heathy soil over a rocky outcrop at the southern edge of the island on 4th June 2016. 20 plants were counted here, all of them in fruit. Another patch was found nearby where 8 plants were counted. A further 34 plants were found growing on thin soil on a cliff by a deep inlet at the southeastern corner of the island. In Ireland, this distinctive and diminutive spring-flowering species is locally frequent along the east and north-east coasts (Parnell & Curtis 2012). Within Co. Dublin, it is rare but sometimes locally abundant (along the coast). There are 10 recent records for the plant in the Fingal County Council area (including Ireland's eye - 4 of the sites are on Howth Head) (Doogue *et al.* 1998). This species is most often found on "*heathy semi-natural grasslands on headlands along the coast*" and usually grows on thin soil over acidic rocks (e.g. granite, quartzite, etc.) with a small amount of mineral material in the soil, due to the effects of glacial drifts (Doogue & Krieger 2010).



5.3. *Erodium maritimum* (Sea Stork's-bill):

Erodium maritimum (Sea Stork's-bill) was found in short grassland and bare burnt ground in a number of locations in the north (and one site in the southeast) of the island on 4th June 2016 (see map above). In Ireland, it is a rare species of short, sandy/stony, coastal grassland near the south and east coasts (Parnell & Curtis 2012). In Co. Dublin, it is also rare. The Ireland's Eye site is one of only 4 recent records for the plant in the Fingal County Council area (Doogue *et al.* 1998).



Figure 13: *Erodium maritimum* - 4th June 2016



Figure 14: *Erodium maritimum* habitat (plant in left foreground) - 4th June 2016

5.4. *Silene* × *hampeana* (Campion hybrid):

About six plants of *Silene* × *hampeana* (Campion hybrid) were found on 4th June 2016 at the top of the southern dunes, where the vegetation merges with the bracken scrub of the central region of the island. This is a naturally-occurring hybrid between *Silene latifolia* (White Campion) and *Silene dioica* (Red Campion) which has distinctly pinkish flowers, intermediate in colour between the two parents (Stace 2010). True *Silene dioica* could not be found, however, a few plants of *S. latifolia* were indeed found near the hybrid plants. The *Silene dioica* parent was historically recorded on the island by both H.C. Hart, “*in sandy places amongst brambles*” (Hart 1887), and by Dublin Naturalists’ Field Club recorders for Anonymous (1961), however, it may no longer be present on the island, with its genome partly surviving in the hybrid plant. It may yet be refound. The hybrid is highly fertile (Stace 2010). It is a rare hybrid in Co. Dublin, with only two historic sites listed in Doogue *et al.* (1998).



Figure 15: *Silene* × *hampeana*, near shingle shore by southern edge of the island – 4th June 2016

5.5. *Myosotis ramosissima* (Early Forget-me-not):

One plant of *Myosotis ramosissima* (Early Forget-me-not) was found growing on the thin, bare, burnt, ash-rich soil over rocky ground in the north of the island on 4th June 2016 (see **Figure 6** for habitat). This is a rare species in Co. Dublin, with only four recent records for it in the county, three of which are within the Fingal County Council area (Doogue *et al.* 1998). This Ireland's Eye site is a new Co. Dublin site for the species. It was growing with species such as *Sedum album*, *Erodium maritimum* and the moss *Funaria hygrometrica* (see **Chapter 3**). *Myosotis ramosissima* is usually a characteristic and often diminutive species of coastal sand dune systems (Doogue & Krieger 2010). It can also be found growing on short coastal turf and dry sandy banks (Doogue *et al.* 1998). Sometimes, the plant can grow quite large and is often seen to branch extensively (hence its scientific name, '*ramosissima*', derived from the Latin for 'much branched').

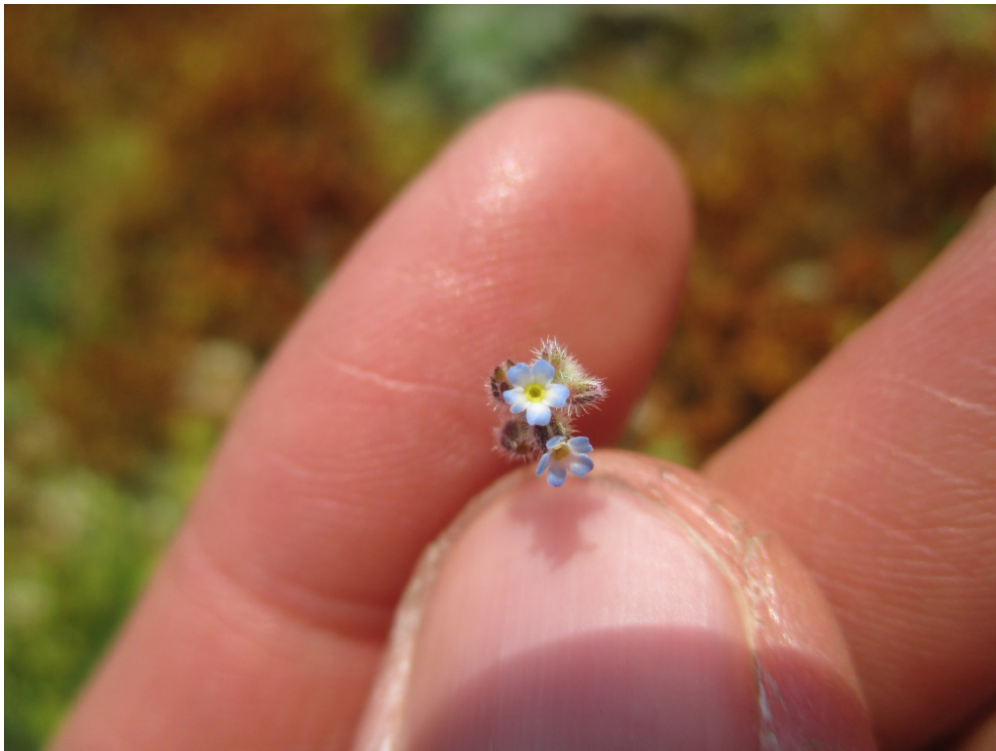


Figure 16: *Myosotis ramosissima* flowers - 4th June 2016

5.6. *Salsola kali* (Prickly Saltwort):

One plant of *Salsola kali* (Prickly Saltwort) was found on 12th July 2016 in an open area on the lower dunes of Carrigeen Bay, at the western edge of the island. This is a scarce/rare plant in the Fingal County Council area and this species has not been previously recorded on the island. It is usually found on sandy or stony beaches in Co. Dublin (Doogue *et al.* 1998). It is a succulent plant, well-adapted to the changeable nature of lower dune systems.



Figure 17: *Salsola kali* plant - 12th July 2016



Figure 18: *Salsola kali* habitat - 12th July 2016

5.7. *Allium vineale* (Wild Onion):

Allium vineale (Wild Onion) was found on 3rd July 2016 on the top of the shingle shore at the southeastern edge of the island (just south of Carrigeen Bay), where the vegetation merges with scrubland. This species is occasional-rare in the Fingal County Council area and is usually found on dry, sandy, often calcareous soils (Doogue *et al.* 1998).

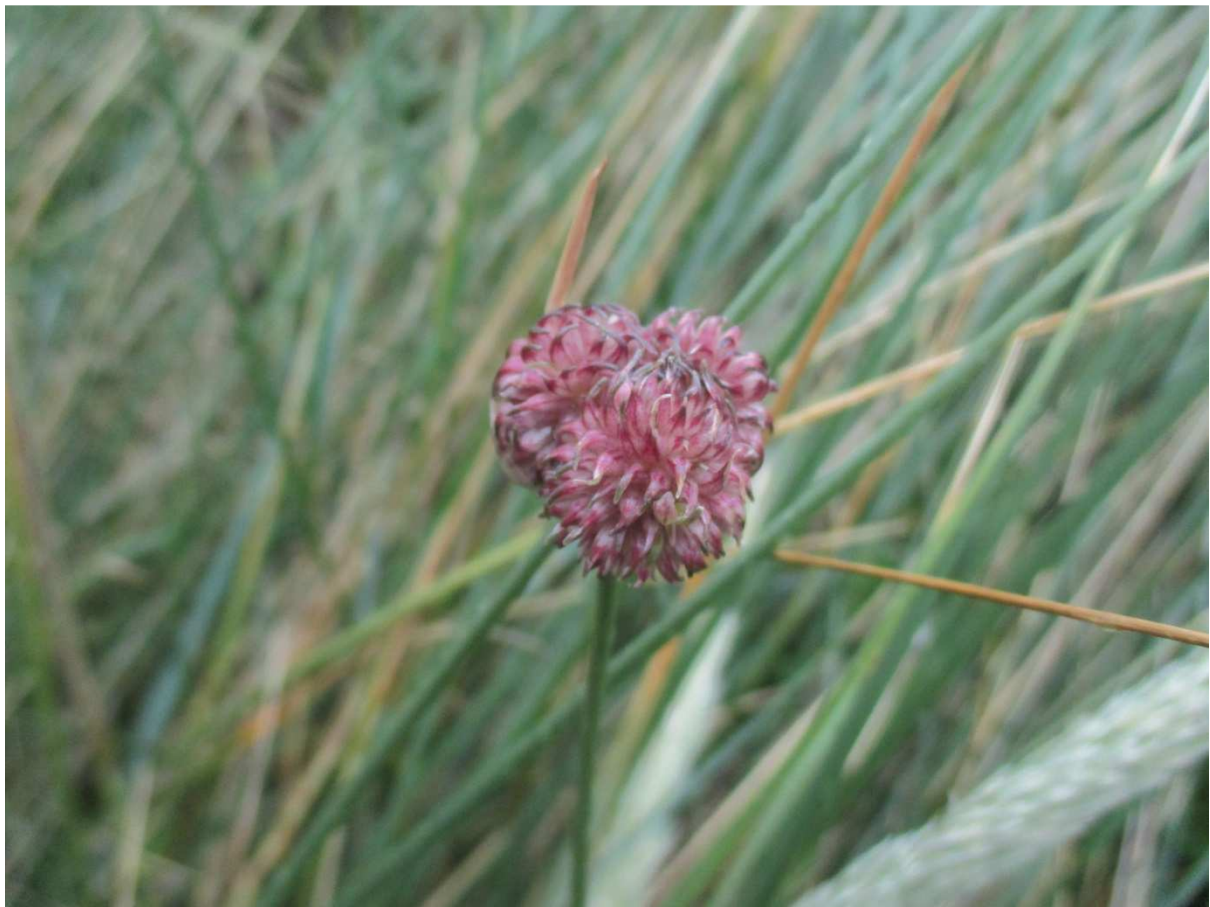


Figure 19: *Allium vineale*, 30th June 2016

5.8. *Senecio sylvaticus* (Heath Groundsel):

Two plants of *Senecio sylvaticus* (Heath Groundsel) were found on the island on 4th June 2016, one in the southeast and the other in the north, both amongst the thinner bracken scrub, on ash-rich, burnt ground. This species is rare in Co. Dublin as a whole, but is locally common on Howth Head and a few other sites in the county (Doogue *et al.* 1998). It is a characteristic species of recently burnt scrubland/heathland on acidic soils, along with *Ceratocarpus claviculata* (Climbing Corydalis) and other species.



Figure 20: *Senecio sylvaticus* (middle foreground), 4th June 2016

Chapter 6. Invasive Plant Species on Ireland's Eye

Seven invasive/potentially invasive species were found on Ireland's Eye during this survey. For most of these species, it is not fully clear how they managed to migrate to the island. Some of them are likely to have arrived on the island by being carried in/on animals (endozoochorously, meaning inside the animal body, and/or exozoochorously, meaning on the animal's body surface, e.g. feathers, or in the case of humans, on clothing/shoes), especially birds and perhaps even humans. For example, *Iris foetidissima* (Stinking Iris) and *Rosa rugosa* (Japanese Rose) were most likely transported to the island by bird-sown seed. Some species, such as *Conyza floribunda* (Bilbao's Fleabane) and *Senecio inaequidens* (Narrow-leaved Ragwort), may have migrated to the island via wind-transported seeds (or perhaps attached to birds or even humans).

The arrival mechanism for different invasive species is important for the success or otherwise of future removal efforts. Species that have the ability to be wind-transported to the island are likely to replenish their populations over time, despite removal efforts. Species which are transported by birds are also likely to replenish populations over time as there are very significant breeding and visiting bird populations on the island. For the most extensive invasive on the island, *Sedum album* (White Stonecrop), it is not clear how it may have originally migrated to the island, but it may have been transported by birds to be used as nesting material. However, in this author's opinion, it does not seem likely that its populations would be easily replenished, if indeed it can be comprehensively removed from the island (see below). *Acer pseudoplatanus* has been found on the island but is not regarded as invasive or potentially invasive by this author, given its long-naturalised and widespread status in Ireland and its small and fairly self-contained presence on the island. The locations of all the species on the island are shown on a map below, along with accounts for each of the species and recommendations for their removal:

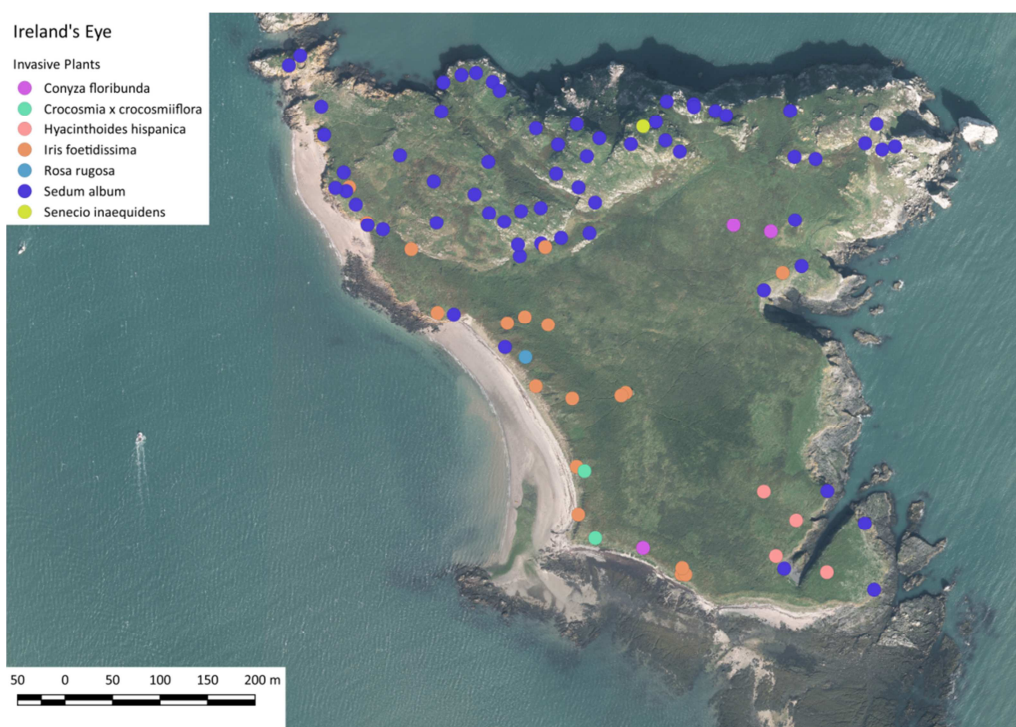


Figure 21: invasive species on Ireland's Eye

6.1. *Sedum album* (White Stonecrop):

Sedum album (White Stonecrop) is abundant on the island and has become a serious invasive species here. It is present in great quantities on most areas of bare rocky ground and thin soil over rocky ground, throughout the island, but especially on the higher rocky ground on the north side. It is most likely more abundant than even the numerous points on the map suggest. On this rocky ground, it is a dominant species and is outcompeting most others, except perhaps *Festuca rubra* agg., in some parts. *Sedum album* appears to prefer flatter rocky ground and is usually out-competed by other rocky ground species on the steeper slopes at the edges of the island. Its larger, spreading and more luxurious habit means that it is not as well adapted to the steeper slopes as the two native *Sedum* species are (see below). Therefore, there is for the most part ready access to the plant for the purposes of removal. The species is native to continental Europe (Stace 2010). It is not clear how the species managed to migrate to the island, however, it may have been transported by birds to be used as nesting material.

Physical removal is the primary method of controlling the species. Through experiment, it has become clear that one of the most effective way of getting rid of the species is to physically remove the plant by hand. Due to its shallow rooting system, entire mats of the plant can be relatively easily lifted off the rocky ground/thin soil on which it grows and can be carefully bagged, taking care not to spread vegetative parts of the plant around in the process. The species can propagate easily from stem pieces and also produces viable seed. The downside of this method is that it often means removing large portions of the thin rocky soil along with the *Sedum album* root system, however, this soil will naturally replenish itself over time as the native *Sedum* species and other natives regain dominance in the habitat (the native *Sedum* spp. in particular require very little soil to take root).

The use of herbicide on the plant is not advisable as it would be far too damaging to the surrounding native species, and herbicide runoff from the rocky higher ground in the north onto other areas of the island is a serious risk. Furthermore, *Sedum album* is reported to be highly resistant to herbicide application. Mouga & Almeida (1997) studied the effects of herbicide application on wall vegetation in Conímbriga in central Portugal and found that *Sedum album* was the most resistant of all the wall plants to herbicide application. Uniquely, the species was not killed at all, until much higher doses of Roundup © (25 ml) were applied to it, and it was not killed at all by any doses of the herbicide Ricochet © (Mouga & Almeida 1997).

A volunteer effort could be brought to bear to physically remove the species from the island. When conducting a *Sedum album* control trail, it must be made clear that two other native species of *Sedum* (*Sedum anglicum* and *Sedum acre*) are also occur frequent on the island, and these should not be removed. Any persons removing the invasive *Sedum album* should be aware of the natives and should know how to identify them and thus avoid removing them.

Therefore, a dichotomous key is provided below for the identification of flowering and non-flowering (vegetative) *Sedum* species on the island, for use by removal personnel:

Dichotomous Key for flowering material (adapted from Parnell & Curtis 2012):

1.
Flowers yellow *S. acre* (native)
Flowers white or pink 2

2.
Leaves 2-5 mm, long, petals often pink at base *S. anglicum* (native)
Leaves 5-12 mm long, petals white *S. album* (invasive)

Dichotomous Key for vegetative material with no flowers (adapted from Poland & Clement 2009):

1.
Stems with short hairs on surface, leaves 5-12 mm long, without spur *S. album* (invasive)
Stems without short hairs on surface, leaves 2-5 mm long, with short spur at base 2

2.
Leaves light green, overlapping *S. acre* (native)
Leaves blueish to reddish, spreading outwards *S. anglicum* (native)

Photos of the three *Sedum* species are also provided on the next page:



Figure 22: *Sedum acre* – native



Figure 23: *Sedum anglicum* – native



Figure 24: *Sedum album* flowers - invasive



Figure 25: *Sedum album* leaves - invasive

6.2. *Iris foetidissima* (Stinking Iris):

Iris foetidissima (Stinking Iris) is also invasive on the island. It was found in a number of locations in the west and southwest of the island, particularly near the dunes at Carrigeen Bay. This species is native in southern Britain but not in Ireland (Stace 2010). It is long-established in a number of sandy coastal sites in the county and is also spreading to new sites (Doogue *et al.* 1998). It is likely to have migrated to Ireland's Eye via bird-sown seed. This species is rhizomatous, so any removal of the species will have to take into account the underground rhizomes. Careful removal will avoid renewal of colonies. The plant flowers in June/July and produces fruits in August, so removal should ideally take place before fruit set. Any fruiting stems found should also be bagged carefully so as not to spread any fruit material around the area. Alternatively, plants could be killed using the application of a weedwipe to each plant. However, physical removal is the most reliable way of eradicating it from the island. This species is not likely to be confused with any other, native species.



Figure 26: *Iris foetidissima* on top of dunes at Carrigeen Bay - 12th July 2016

6.3. *Hyacinthoides hispanica* (Spanish Bluebell):

Hyacinthoides hispanica (Spanish Bluebell) is invasive on the island. This species was found in a few locations in the southeast of the island, growing under the shelter of the bracken scrub. It is competing with the native *Hyacinthoides non-scripta* and may be hybridising with it (*Hyacinthoides* × *massartiana*). It is a spring-flowering plant and finishes flowering and fruiting in June. Therefore, it may have been under-recorded on the island during this survey and there may be more sites than are represented in the above map. The plant is reported to be strongly resistant to herbicide so physical removal is the most reliable removal method (Johnson & Marshall 2012). It is an underground bulb-forming plant and so physical removal of the species will have to take into account the presence of bulbs. Any fruiting stems should also be bagged carefully so as not to spread any fruit material around the area. The species flowers from April to May, along with the native species, so it should be removed during this time of the year. *Hyacinthoides hispanica* is native to Spain and Portugal (Stace 2010). Care should also be taken not to confuse it with the native species, which has narrower leaves and pendent (hanging) upper flowers with white anthers (Stace 2010). *Hyacinthoides hispanica* on the other hand has wider leaves and erect or spreading upper flowers with purplish anthers (Stace 2010).



Figure 27: *Hyacinthoides hispanica* (right) & *Hyacinthoides non-scripta* (left) - © Willem van Kruijsbergen

6.4. *Conyza floribunda* (Bilbao's Fleabane):

Conyza floribunda (Bilbao's Fleabane) was found in two locations (two plants at each location) in the north of the island and one location in the south of the island. It may be present elsewhere, hidden amongst the bracken scrub. This species has spread rapidly in Co. Dublin in recent years and may become invasive on the island. It is an annual species which produces abundant seed, so the plants can be directly uprooted from the ground, ideally before they produce seed in July/August. The species is native to South America (Stace 2010). This species is not likely to be confused with any other, native species.



Figure 28: *Conyza floribunda* © Zoë Devlin

6.5. *Crocoshmia* × *crocoshmiiflora* (Montbretia):

Crocoshmia × *crocoshmiiflora* (Montbretia) was found as single plants in two locations on the top of the dunes at the southern end of Carrigeen Bay, where the dunes grade into bracken scrub. This is a corm-producing, rhizomatous plant and so removal of the species will have to take into account the presence of underground corms and rhizomes. It is a very persistent plant in many sites and so comprehensive removal of the plant parts is vital. This species flowers from July to November. Alternatively, the species could be eradicated using the application of a weedwipe. This species is not likely to be confused with any other, native species.



Figure 29: *Crocoshmia* × *crocoshmiiflora* © Zoë Devlin

6.6. *Senecio inaequidens* (Narrow-leaved Ragwort):

One plant of *Senecio inaequidens* (Narrow-leaved Ragwort) was found at the northern edge of the island on relatively thin soil over rocky ground. It is probably a relative newcomer on the island (probably via wind-transported seed) and may well spread to other parts of the island. Therefore, all populations should be removed, ideally during flowering (July to September) and before fruit set. It is currently spreading rapidly in Co. Dublin. It is a spreading perennial plant, so removal of the species will have to take into account the presence of extensive root systems. These root systems should be thoroughly removed from the soil. The species is native to South Africa (Stace 2010). This species is not likely to be confused with other, native *Senecio* species occurring on the island as it is the only species here with distinctly long narrow leaves.



Figure 30: *Senecio inaequidens*, on rocky ground at north edge of the island, 8th August 2016

6.7. *Rosa rugosa* (Japanese Rose):

One plant of the potentially invasive *Rosa rugosa* (Japanese Rose) was found at the top of the dunes at Carrigeen Bay on 4th June 2016. This plant was probably bird-sown here. This species can become invasive on dune systems. It is a large perennial shrub, which can be removed with its rootstock before it produces fruit in August/September. It is, as its English name suggests, native to eastern Asia (Stace 2010). This species is listed as an invasive in natural/semi-natural habitats by Stokes *et al.* (2004). The native *Rosa canina* agg. also occurs on the island, however, this species has much smaller leaves, flowers and fruits.



Figure 31: *Rosa rugosa* © Jan van der Straaten

Chapter 7. Permanent Quadrats and Monitoring the Vegetation of Ireland's Eye

The 20 permanent quadrats (PQ) were recorded on 5th June 2016. For each 2 × 2 metre PQ, a high-resolution ITM grid reference was recorded and 4 metal tent pegs were placed accurately using a measuring tape, one at each corner of the PQ. The habitat and all vascular plant species were recorded for each PQ, along with an abundance estimate for each species. This was based on a version of the Braun-Blanquet scale (Braun-Blanquet *et al.* 1932), as outlined below:

- 1 = cover <5%
- 2 = cover 5-24%
- 3 = cover 25-49%
- 4 = cover 50-74%
- 5 = cover 75-100%

The locations of the PQ's are shown below on a map of the island:



Figure 32: permanent quadrats - Ireland's Eye

The PQ data, along with ITM grid references for the PQ's, are presented below as a table:

Permanent quadrat (PQ) and habitat description	Species present and abundance (version of Braun-Blanquet)	PQ Grid reference (ITM) (Eastings, Northings)
1 – bare ground/scrubland	<i>Sagina procumbens</i> 2, <i>Cerastium glomeratum</i> 1, <i>Pteridium aquilinum</i> 2, <i>Sonchus asper</i> 2, <i>Holcus lanatus</i> 4, <i>Aphanes australis</i> 2, <i>Plantago coronopus</i> 1, <i>Hyacinthoides hispanica</i> 3, <i>Urtica dioica</i> 1, <i>Rubus fruticosus</i> agg. 1	728857.17 741020.812
2 –bare ground	<i>Plantago coronopus</i> 1, <i>Sedum anglicum</i> 1	728875.841 741046.259
3 – shingle	<i>Tripleurospermum maritimum</i> 5, <i>Potentilla anserina</i> 2, <i>Euphorbia paralias</i> 2, <i>Heracleum sphondylium</i> 1, <i>Ammophila arenaria</i> 1, <i>Poa pratensis</i> agg. 1, <i>Rumex crispus</i> ssp. <i>littoreus</i> 1	728846.417 740983.111
4 – dry grassland	<i>Urtica urens</i> 3, <i>Festuca rubra</i> agg. 4, <i>Tripleurospermum maritimum</i> 3, <i>Beta vulgaris</i> ssp. <i>maritima</i> 2, <i>Atriplex prostrata</i> 2, <i>Silene uniflora</i> 2, <i>Spergularia rupicola</i> 1	728313.038 741527.677
5 – siliceous rock/dry grassland	<i>Silene uniflora</i> 3, <i>Festuca rubra</i> agg. 4, <i>Holcus lanatus</i> 3, <i>Sedum album</i> 1, <i>Lotus corniculatus</i> 1, <i>Tripleurospermum maritimum</i> 2	728333.229 741528.891
6 – dry grassland	<i>Carduus tenuiflorus</i> 3, <i>Silene uniflora</i> 1, <i>Holcus lanatus</i> 5, <i>Tripleurospermum maritimum</i> 2	728385.221 741488.324
7 – scrubland	<i>Pteridium aquilinum</i> 4, <i>Heracleum sphondylium</i> 2, <i>Holcus lanatus</i> 5, <i>Urtica dioica</i> 3	728410.061 741453.034

8 – dry grassland	<i>Glechoma hederacea</i> 3, <i>Bromus hordeaceus</i> 4, <i>Festuca rubra</i> agg. 3, <i>Rumex acetosella</i> 3, <i>Holcus lanatus</i> 3, <i>Geranium molle</i> 2, <i>Carduus tenuiflorus</i> 1, <i>Poa pratensis</i> agg. 3, <i>Cerastium fontanum</i> 2, <i>Silene uniflora</i> 2, <i>Lolium perenne</i> 2	728434.112 741422.289
9 – wetland/wet grassland	<i>Phalaris arundinacea</i> 4, <i>Eleocharis palustris</i> 4, <i>Potentilla anserina</i> 3, <i>Ranunculus repens</i> 3, <i>Juncus effusus</i> 2, <i>Persicaria amphibia</i> 4	728455.905 741418.425
10 – wetland/wet grassland	<i>Callitriche stagnalis</i> 3, <i>Phalaris arundinacea</i> 5, <i>Persicaria amphibia</i> 3, <i>Holcus lanatus</i> 1	728457.947 741411.8
11 - scrubland	<i>Pteridium aquilinum</i> 4, <i>Holcus lanatus</i> 4, <i>Dactylis glomerata</i> 2, <i>Urtica dioica</i> 2, <i>Rubus fruticosus</i> agg. 1, <i>Rumex acetosa</i> 2, <i>Galium aparine</i> 1, <i>Arrhenatherum elatius</i> 1	728564.887 741452.553
12 – siliceous rock/dry grassland	<i>Lolium perenne</i> 4, <i>Silene uniflora</i> 4, <i>Sedum album</i> 2, <i>Festuca rubra</i> agg. 2, <i>Dactylis glomerata</i> 1, <i>Hordeum murinum</i> 1, <i>Holcus lanatus</i> 1	728689.577 741439.79
13 – dry grassland	<i>Arrhenatherum elatius</i> 4, <i>Holcus lanatus</i> 5, <i>Urtica dioica</i> 1, <i>Hyacinthoides hispanica</i> 1	728807.021 741436.632
14 – dry (sandy) grassland	<i>Euphorbia portlandica</i> 2, <i>Festuca rubra</i> agg. 4, <i>Holcus lanatus</i> 3, <i>Carex arenaria</i> 2, <i>Taraxacum</i> agg. 1, <i>Malva sylvestris</i> 1, <i>Galium verum</i> 1, <i>Heracleum sphondylium</i> 1, <i>Glechoma hederacea</i> 2, <i>Scilla verna</i> 2	728467.84 741284.81

15 – dry (sandy) grassland	<i>Carex arenaria</i> 5, <i>Poa pratensis</i> 2, <i>Rumex crispus</i> 1, <i>Sonchus oleraceus</i> 1, <i>Festuca rubra</i> agg. 1, <i>Glechoma hederacea</i> 1	728489.268 741269.914
16 - sand dune	<i>Ammophila arenaria</i> 4, <i>Raphanus raphanistrum</i> ssp. <i>maritima</i> 2, <i>Euphorbia paralias</i> 3, <i>Carex arenaria</i> 2, <i>Pteridium aquilinum</i> 3, <i>Sonchus oleraceus</i> 2, <i>Holcus lanatus</i> 2, <i>Anagallis arvensis</i> 1, <i>Cerastium diffusum</i> 1	728577.567 741222.873
17 - sand dune	<i>Ammophila arenaria</i> 5, <i>Cakile maritima</i> 3, <i>Atriplex prostrata</i> 1, <i>Tripleurospermum maritimum</i> 2, <i>Carex arenaria</i> 1, <i>Elytrigia juncea</i> 2	728606.168 741183.901
18 - scrubland	<i>Pteridium aquilinum</i> 5, <i>Urtica dioica</i> 3, <i>Arrhenatherum elatius</i> 2, <i>Heracleum sphondylium</i> 3, <i>Glechoma hederacea</i> 3, <i>Arum maculatum</i> 1, <i>Rubus fruticosus</i> agg. 2	728651.631 741183.13
19 - scrub-invaded sand dune	<i>Ammophila arenaria</i> 4, <i>Pteridium aquilinum</i> 3, <i>Heracleum sphondylium</i> 2, <i>Arrhenatherum elatius</i> 2, <i>Glechoma hederacea</i> 2, <i>Cirsium vulgare</i> 2, <i>Tripleurospermum maritimum</i> 1	728649.609 741112.933
20 - scrub-invaded sand dune	<i>Glechoma hederacea</i> 3, <i>Brachypodium sylvaticum</i> 2, <i>Tripleurospermum maritimum</i> 2, <i>Galium verum</i> 1, <i>Carex arenaria</i> 2, <i>Holcus lanatus</i> 2, <i>Urtica dioica</i> 1, <i>Dactylis glomerata</i> 1, <i>Rumex crispus</i> 1, <i>Cirsium vulgare</i> 2, <i>Ammophila arenaria</i> 4, <i>Arrhenatherum elatius</i> 2	728662.35 741035.676

Establishing permanent quadrats (PQ) is an important method for the standardised monitoring of vegetation over long periods of time. The PQ's were placed in various different vegetation types/habitats throughout the island in order to produce an overall evaluation of the island's vegetation. These included sand dunes, dry grassland, siliceous rock, bracken scrubland, shingle, etc. A saltmarsh vegetation type was found on thin, wet (brackish) soil over rocky ground near the north end of Carrigeen Bay. Unfortunately, the soil was too thin here to place a permanent quadrat. However, this vegetation type is discussed in further detail in **Chapter 3**. Most of the PQ's were placed at the (western) margins of the island as these are the locations with the most diverse habitat types and species. The centre of the island is for the most part relatively uniform, dense, bracken scrubland and this reduces diversity (and indeed accessibility).

As part of Fingal County Council's commitment to the UNESCO Dublin Bay Biosphere, the vegetation of Ireland's Eye must be described and monitored closely, in order to develop a management plan for the island in 2017. These PQ's can now be used to monitor, in a standardised way, the changes to vegetation brought about as a result of the June 2015 fire. Therefore, as a central part of a future vegetation monitoring program for the island, these PQ's should be recorded on an annual or biennial basis. Doing this will allow Fingal County Council to closely monitor the effects that fire and other environmental impacts (including direct human impacts) are having on plant species diversity at the site. It is also important to maintain the permanent quadrats in order to monitor the effect of any potential increased human visitor rates to the island.

Although no detailed vegetation survey was completed for the island before the fire of June 2015, records of rare species have been made on the island for over 100 years. Some of these species are still present on the island (.e.g. *Hyoscyamus niger*) and they must be monitored on a continual basis to observe the effects that fire, human visitors and other environmental factors are having on them. This is especially important following any further fire events. Furthermore, vegetation classification surveys could be completed every 5/10 years, as a way of monitoring the vegetation types on the island.

Permanent quadrats (PQ's) should also be established in areas heavily invaded by *Sedum album*, in order to monitor changes in the vegetation following any large scale removal projects. These should be recorded annually or biennially. Some of the PQ's established during this survey can also be used for monitoring this. If negative effects on the vegetation are detected during these monitoring schemes, caused by humans or by invasive species, measures can be taken to mitigate these negative effects.

Chapter 8. Conclusions & recommendations

This survey was carried out during the summer months of 2016. Nine vegetation types were found to occur on the island during the survey period, along with eight rare/locally rare species (three of these species being new to the island) and seven invasive/potentially invasive species. The future management of the island's vegetation is to focus on the removal of invasive species, as well as the continued monitoring of all rare/locally rare species and the vegetation development over the coming years.

Pets such as dogs should be prohibited from coming onto the island as their excrement will artificially increase nutrient levels in the soil and they are also a danger to breeding bird colonies on the island. There is much human activity on the dunes at the western and southern edges of the island in particular, with campers commonly staying here. Irresponsible dumping of waste by campers was evident at the top of the dunes on Carrigeen Bay, near an *Acer pseudoplatanus* tree. The blanket banning of camping on the island should therefore be considered, given the risk of damage to rare species, the causing of fires, the spreading of waste and litter, etc. If this step is taken, ferry service personnel should be advised of this ban and they should be tasked with making visitors aware of it. Sign posts could be erected at entry points to the island with codes of conduct. A nature education board could also be erected here, to educate people about the sensitive and rare species occurring on the island and how to avoid damaging them, particularly for the case of *Hyoscyamus niger* (and indeed for nesting birds like oystercatchers) on the shingle shore and dunes, which may be in danger of trampling by the frequent human visitors to the island.

Widespread clearing of invasive species should be carried out on the island as soon as possible, especially for the highly invasive *Sedum album*. However, for the most part, the most favourable way of managing the island's vegetation is to leave it alone. The island is in a very natural state, even compared with the nearby Howth Head.

Chapter 9. References

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