

FLORA STUDY
of
REDROCK



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2. INTRODUCTION

This botanical study was commissioned by Fingal County Council as part of the council's commitments in the Dublin Bay Biosphere Action Plan. The study area covers the council's land holding at Redrock, Howth.

The importance of the Howth Peninsula as a refuge for rare flora is confirmed by its recognition as an SAC by the National Parks and Wildlife Service as part of the national network of Natura 2000 sites. The Redrock site is included within the SAC. While recognised for its rare flora, little up to date information is available on the precise locations, the abundance, or the habitats in which these rare plants occur. The conservation management of this site is a priority for the survival of these rare species and their habitats. To maintain the unique heritage value of this Redrock site a targeted conservation management plan is outlined.

Nomenclature follows Stace C. (2010). *New Flora of the British Isles*.

2. SURVEY AIMS

1. Map and describe the vegetation of the site.
2. Locate and map rare and protected plants.
3. Establish a series of permanent quadrats at key points within the site with a view to future assessment of the conservation status of rare species and habitats, and the effectiveness of any conservation measures implemented.
4. Propose a management plan for the preservation of rare plants and habitats.

3. METHODOLOGY

Methodology: Habitat Mapping

The entire site was inspected on six occasions and a broad habitat classification based on *A Guide to Habitats in Ireland* (Fossitt 2000) was developed. This inspection disclosed the occurrence of several broad vegetation types on the site. In some instances these habitat types were homogeneous and corresponded closely to the habitat classification as outlined in Fossitt. In other instances due to the complexity of the soil/bedrock interface a mosaic of micro habitats occurred which did not correspond well with existing national habitat classification. These micro habitats proved to be of the greatest botanical significance and required closer inspection and evaluation. Using a combination of aerial photographs and field observations a habitat map was created. Digital photographs were taken of distinctive habitat types and examples of general landscape.

Methodology: Rare Species Survey

Based on personal previous knowledge and published historical data the target rare species were known to be characteristic of shallow soil. They are mainly winter annuals (plants that germinate in Autumn, live through the Winter and flower, set seed and die by early Summer). Therefore an early season (April and May close-focus inspection was conducted in order to ascertain the presence and distribution of the species within the study area. GPS readings and reference photos of each colony of the rare species were taken. From the GPS data a map of the locations of the rare species was created by Fingal County Council mapping section.

Methodology: Vegetation Survey

Sites for the vegetation survey were chosen either because of the presence of rare species or the occurrence of species indicative of rare habitat types or both. For vegetation sampling plant cover was estimated using the DOMIN scale. GPS readings for each sampled area were recorded. From these data a map of the sample locations was created by Fingal County Council mapping section. Detailed vegetation lists were created for twenty separate sample areas, eleven of which were on shallow soils within the rock areas. Three of these were burned in early May. In addition quadrat data were collected for four sample representatives of calcareous grassland with orchids, calcareous grassland with Cowslip *Primula veris*, calcareous grassland with Parsley-piert *Aphanes* sp., heathland with Spring Squill *Scilla verna*, and quadrat data from a heathland/calcareous grassland mosaic.

Throughout the course of the survey the occurrence of invasive and potentially invasive herbaceous species was noted.

4. RESULTS

It can be difficult to accurately define the extent of some habitat types particularly where they form complex mosaics or occur as very small patches within these larger habitat types. Some species, particularly Gorse *Ulex europaeus* may have its roots in deep soil while casting shade over adjoining thin soil vegetation. Fluctuating ground water levels also greatly influence the floristic composition within habitats, giving rise to subtle variations in vegetation composition.

Seven broad category habitat types were identified. In addition Thero-Airion vegetation communities, Spring Squill *Scilla verna* grasslands and calcareous grassland mosaics, and seasonally wet areas were identified. Four out of the six targeted rare species were found.

4.1 HABITATS (Map Appendix 1)

4.1a DRY CALCAREOUS GRASSLANDS: Fossitt Code GS1

Species distribution varies throughout these lime-rich sandy grasslands. Variation in topography, drainage and soil depth, give rise to distinct patterns of species composition. The most species-rich area occurs where the top sod was removed. This area supports four species of orchid. Elsewhere sod removal favours the growth of Cowslip *Primula veris*. A combination of grasses with Hairy Tare *Vicia hirsuta*, Yellow-rattle *Rhinanthus minor* and Red Bartsia *Odontites vernus* is abundant in places. A maritime influence is also evident with the presence of Sea Plantain *Plantago maritima*, Thrift *Armeria maritima* subsp. *maritima* and Slender Thistle *Carduus tenuiflorus*.



Calcareous Grassland with Orchids



Calcareous Grassland with Herbs and Grasses

4.1b ORCHIDS WITHIN GS1

A section of this grassland with orchids has an affinity with "EU Annex 1 habitat 6210*. Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Bromatea) (*important orchid sites)".

Fine grasses and herbs are among the earliest flowering species to appear. Among these are Pyramidal Orchid *Anacamptis pyramidalis*, Crested Dog's-tail *Cynosurus cristatus*, Sweet Vernal-grass *Anthoxanthum odoratum*, Glaucous Sedge *Carex flacca*, Bulbous Buttercup *Ranunculus bulbosus* and Field Wood-rush *Luzula campestris*.

This thin sward is then supplemented by taller more vigorous plants, particularly Common Bird's-foot-trefoil *Lotus corniculatus*, Common Knapweed *Centaurea nigra* and Red Fescue *Festuca rubra*.

Among the later-flowering plants are Eyebright *Euphrasia* sp. and Fairy Flax *Linum catharticum*. By mid-August they were in full flower and had not yet set seed.

Four species of orchids were recorded. The orchids appeared in succession with Pyramidal Orchid *Anacamptis pyramidalis* being the first to flower in mid-May followed by Purple Marsh-orchid *Dactylorhiza incarnata* subsp. *incarnata*. *Dactylorhiza* sp. then appeared in profusion with over fifty flowering spikes noted. Bee Orchid *Ophrys apifera* flowered and set seed within a two week period in June.

4.1c COWSLIP *PRIMULA VERIS* WITHIN GS1

Oat-grass *Avenula pubescens* and Red Fescue *Festuca rubra* are among the early-flowering grasses to appear. Rosettes of Cowslip *Primula veris* at varying stages of development are also present. By mid-June grasses and vigorous herbs including, Yellow-rattle *Rhinanthus minor*, Common Knapweed *Centaurea nigra*, and Meadow Vetchling *Lathyrus pratensis* were dominant. By this stage the Cowslips had died back and set seed. The Cowslips grow in an clearly-defined area which is lower than the surrounding ground where sod appears to have been removed.

4.1d DRY MEADOWS AND GRASSY VERGES: Fossitt code GS2

The relationship between grassland management and floristic composition is discernible within the site. Regularly short cut areas adjacent to access paths show little species diversity with grasses and rosette-forming herbs dominant. Uncut areas on drier soil comprise tall, rank, native perennial grasses with sparse, tall, mainly native herbs. Bracken *Pteridium aquilinum* and Bramble *Rubus fruticosus* agg. are encroaching into many of these grasslands. In swards subject to infrequent mowing broad-leaved herbs such as Hogweed *Heracleum sphondylium* and Alexanders *Smyrnium olerastrum* along with Cow Parsley *Anthriscus sylvestris* over-shadow smaller herbs and annual grasses. Uncut damper areas support a mix of native species including Yorkshire-fog *Holcus lanatus*, Tall Fescue *Festuca arundinacea* Hairy sedge *Carex hirta*, Common Nettle *Urtica dioica* and Great Willowherb *Epilobium hirsutum*. This combination of nutrient-demanding and wetland plants grows where natural water flow percolates through or lodges in the lowest lying areas.

4.1e DENSE BRACKEN: Fossitt Code HD1

Avoiding wetter ground and calcareous areas Bracken *Pteridium aquilinum* spreads easily aided by its capacity for prolific spore production and vegetative spread. It appears here to spread predominantly by rhizomes as no sporelings were noted. Intolerant of salt it is restricted in its seaward expansion to sheltered areas among rocks.

Stands of Bracken find a range of niches throughout the site. It covers areas of formerly grazed grassland. Among stands of Downy Birch *Betula pubescens* and within the coniferous woodland it is the dominant component of the herb layer, where it is often accompanied by Bramble *Rubus fruticosus* agg. It establishes in pockets of soil among gaps in rocks. Succeeding pioneer colonisers, it quickly establishes in disturbed and burnt ground with young coverage evident in areas burned within the last few years. Bracken rhizomes scorched by fire in mid-May were producing new fronds by mid-July. Confined to the fringes of mature dense scrub where it is shaded out, it thrives in gaps among younger scrub.

Early-germinating, typically woodland species among the emergent fronds are scarce. Bluebell *Hyacinthoides non-scripta*, scramblers such as Greater Stichwort *Stellaria holostea* and Honeysuckle *Lonicera periclymenum* are among the few that occur around the outer fringes and along track-way edges through the dense Bracken.



Tall herbs and grasses



Bracken on dry slope

4.1f CONIFER PLANTATION: Fossitt Code WD4

Formerly part of Sutton Castle Gardens, this planted woodland is managed by the local authority. Sycamore *Acer pseudoplatanus*, and various Pines now form the bulk of the tree canopy, following recent clearance of some scrub and removal of some mature trees.

Cleared areas have been replanted with Pines with a view to encouraging red squirrels.

Holly *Ilex aquifolium*, Elder *Sambucus nigra*, and Sycamore *Acer pseudoplatanus* with some Rowan *Sorbus aucuparia* form part of the shrub layer. Blackthorn *Prunus spinosa* suckers, form dense thickets in places.

Patches of Bluebells and Common Ivy *Hedera helix* form the herb layer in an uncleared area among the mature Pines.

Bramble *Rubus fruticosus* agg., Bracken *Pteridium aquilinum* and Broad Buckler-fern *Dryopteris dilatata* are abundant among cleared areas. Other open-ground opportunists here are Rosebay Willowherb *Chamerion angustifolium*, Spear Thistle *Cirsium vulgare* and Cleavers *Galium aparine*.

Downy Birch *Betula pubescens*, covers part of the higher slopes of the wood. This area has not been cleared. The herb layer comprises Bracken *Pteridium aquilinum* and Bramble *Rubus fruticosus* agg. The open track-way through this section of the woodland supports Foxglove *Digitalis purpurea*, False-brome *Brachypodium sylvaticum*, Herb Robert *Geranium robertianum*, Honeysuckle *Lonicera periclymenum*, Creeping Soft-grass *Holcus mollis* and Lesser Stitchwort *Stellaria graminea* along its edges.

Species of rare or local botanical conservation value were not noted within this woodland. No references to it being of particular botanical interest were found.

4.1g SCRUB: Fossitt Code WS1

Gorse *Ulex europaeus*, Blackthorn *Prunus spinosa*, Bramble *Rubus fruticosus* agg. and Elder *Sambucus nigra* are the dominant species among the scrubland with less coverage of Hawthorn *Crataegus monogyna*, Downy Birch *Betula pubescens* and Rusty Willow *Salix cinerea* subsp. *oleifolia*. Scrub grows everywhere throughout the site stopping short of grasslands that are currently managed by mowing and where soil depth is insufficient for root growth.

The presence of scrub is greatly influenced by historic land use, patterns and frequency of burning, and recent scrub clearance.

Gorse *Ulex europaeus* establishes throughout the site, wherever it can gain a foothold.

By virtue of its suckering habit and ability to tolerate wind exposure, Blackthorn *Prunus spinosa* extends its range seaward and forms thickets adjacent to the coastal path.

Aided by its suckering ability and abundant fruit production Elder *Sambucus nigra* is prolific. It forms canopies and also occurs as scattered bushes particularly in more sheltered areas on deeper soils.

Bramble *Rubus fruticosus* agg. is invading formerly grazed rank grassland where it is often accompanied by Bracken *Pteridium aquilinum*. In areas where scrub has been cleared, Bramble is among the early colonisers.

Growing within the shelter of the largest rock outcrop is a grove of Downy Birch *Betula pubescens*, with an under-story predominately of Bramble and Bracken with some Honeysuckle *Lonicera periclymenum* scrambling through it. The trees appear to be of a relatively uniform age. Birch saplings and seedlings occur throughout the site.

4.1h DRY SILICEOUS HEATH: Fossitt Code HH1

Within the heathland three distinct vegetation types may be recognised.

Calluna vulgaris-Ulex gallii heath
Thero-Airion vegetation community
Scilla verna heathland

Calluna vulgaris-Ulex gallii heath (within HH1)

Calluna vulgaris-Ulex gallii heath occurs on the highest rock outcrop on the site, where the effects of wind shear are clearly visible. Here a dense-knit structure of woody species, Heather *Calluna vulgaris*, Western Gorse *Ulex gallii* and Bell Heather *Erica cinerea* leave little or no space or light for grasses and herbs to develop. (Early in the course of the survey this area was completely burned. Later in the season little new growth was observed with just bracken rhizomes forming new fronds in Mid-July.)

Heather *Calluna vulgaris* and Western Gorse *Ulex gallii* are very slow growing and as they age, over the years drop a lot of incendiary material. When the accumulated litter of leaves and twigs ignite, the ground layer gets burnt. Few species survive burning and regrowth can take years.

Spontaneous or accidental fires have led to heathland occurring in varying successional stages within the site. Heather *Calluna vulgaris* and Western Gorse *Ulex gallii* cover occurs in various successional stages ranging from senescent to seedling stage depending on the duration and extent of the burning.

Thero-Airion Vegetation Communities (within HH1)

These vegetation communities include a number of winter annual species whose seeds germinate in early Autumn. These species flower and set seed within a short period of time the following Spring. Adapted to the prevailing conditions of shallow soil with low water holding capacity, and low nutrient availability these specialised plant communities are confined to thin soils on the tips of rock outcrops within the heathland. Here they form a climax vegetation as successional vigorous woody species cannot establish a foothold within the thin soils. Maritime species including Thrift *Armeria maritima* subsp. *maritima* and *Silene uniflora* Sea Campion merge into this community on rocks nearest the sea, with grassland species merging further inland. Where soil depth increases, vigorous woody and herbaceous species growing next to these communities cast deep shade.

This is both the most important and the most vulnerable habitat at Redrock. It supports some of the rarest species in Ireland with Howth being their stronghold in Dublin. The floristic composition of this community is reported in Appendix 5.

Scilla verna heathland (within HH1)

On the vegetational interface between dry siliceous heath (**HH1** *sensu* Fossitt) and cliff-top grassland influenced by sea spray, several substantial colonies of Spring Squill *Scilla verna* occur. Unlike the rare clovers on the site, Spring Squill is a bulb-forming species and produces dense clusters of flowering stems in late spring. Its bulb-forming character enables it to flower, set seed and die back early in the year. Its bulbs and roots then lie dormant through the arid summers, even on shallower soils. However it can also grow on slightly deeper soils where it has the capacity to compete with lighter grasses such as Sheep's-fescue *Festuca ovina* or Red Fescue *F. rubra*.

Its usual associates in Howth include species characteristic of leached glacial till such as Thyme *Thymus praecox* and Crested Dog's-tail *Cynosurus cristatus* as well as more coastal species – Thrift *Armeria maritima* subsp. *maritima*, Sea Plantain *Plantago maritima* and Buck's-horn Plantain *Plantago coronopus*, - all of which by virtue of their low growth form and strong rooting systems can cling to the ground, and grow together in wind-planed vegetation.

Correspondingly, within the vegetation mosaic other desiccation-proof mat-forming species such as Mouse-ear-hawkweed *Pilosella officinarum* form virtual monocultures. On exposed rocks English Stonecrop *Sedum anglicum*, a succulent with the ability to retain moisture in its thick leaves can survive extended periods of drought.

Individual colonies of Spring Squill *Scilla verna* might therefore belong to the *Scilla verna* sub-community of **H8** *Calluna vulgaris* – *Ulex gallii* heath or the *Festuca rubra*-*Scilla verna* sub-community of **CG1** *Festuca ovina* – *Carlina vulgaris* grassland (*sensu* Rodwell). In reality, because of their contrasting species composition, they constitute a distinctive feature, positioned physically and phytosociologically in an intermediate zone between the attenuation of pure heathland communities on base-poor soils and the more base-rich mineral soils influenced by more maritime factors such as salt-spray and south-easterly winds.



Spring Squill *Scilla verna* habitat



Calcareous grassland / Heathland mosaic

4.1i WATER COURSE

A patch of Rusty Willow *Salix cinerea* subsp. *oleifolia* both scrub and mature trees mark the presence of an underground water course from which a small stream emerges. It is flanked by a number of Hawthorn *Crataegus monogyna* bushes, with Great Willowherb *Epilobium hirsutum* tracking its full extent. It measures approx 50x30 metres. Flowing seaward it continues underground emerging as a seepage line on the low cliffs on the coast.

Water Star-wort *Callitriche* agg. and Water-cress *Nasturtium officinale* occur within the confines of a small pool which forms part of the water course. Surrounding this pool and elsewhere along the course edges, Field Horsetail *Equisetum arvense*, Rough Meadow-grass *Poa trivialis*, Common Couch *Elytrigia repens*, False Oat-grass *Arrhenatherum elatius* and Common Nettle *Urtica dioica* grow in profusion.

The presence of vigorous and mostly nutrient demanding species, could be explained by the use of the pool as a drinking spot by dogs.

A clump of the noxious weed, Giant-rhubarb *Gunnera tinctoria* marks the south eastern corner of this water course.

4.1k SEASONALLY WET AREAS

Within the grasslands fluctuating water levels give rise to seasonally wet areas which are often sparsely vegetated. In recent years these areas supported species typically associated with wet mud. In the course of this survey, in this dry summer these wet areas dried out completely. As evidence of their former existence a few plants of Toad Rush *Juncus bufonius* agg. were noted early in the season where an abundance of Turnip *Brassica rapa* covered the ground.

As the ground dried out and cracked, a typical open habitat community with Creeping Buttercup *Ranunculus repens*, Creeping Bent *Agrostis stolonifera*, Common field-speedwell *Veronica persica*, and Scarlet Pimpernel *Anagallis arvensis* developed.

Two small dug out pools at the north-east of the site dried out retaining a few plants of Blue Water-Speedwell *Veronica anagallis-aquatica* at the edge of one and the terrestrial form of Amphibious Bistort *Persicaria amphibia* fringing the other.



Seasonally wet area in foreground with water course outlined in blue

4.2 RARE SPECIES

Of the six targeted rare species, four were re-found and despite extensive searching the other two were not located.

***Trifolium striatum* Knotted Clover**

Eight individual plants in three colonies of this species were located within Thero-Airion vegetation communities on rock outcrops.

***Ornithopus perpusillus* Bird's-foot**

Four colonies of this plant were located - three within Thero-Airion vegetation communities on rock outcrops and one within a calcareous grassland/*Calluna vulgaris* - *Scilla verna* heath community H8 sensu Rodwell (2006).

***Trifolium ornithopodioides* Bird's-foot Clover**

One colony comprising just four individual plants was located, growing alongside a track in very short turf.

***Scilla verna* Spring Squill**

Spring Squill occurs within a complex mosaic of calcareous grassland and dry heathland. It spreads seaward beyond the boundary of the Redrock site onto the cliffs.

***Trifolium scabrum* Rough Clover**

This rare species was not re-found during the course of the survey.

***Trifolium micranthum* Slender Trefoil**

This rare species was not re-found during the course of the survey.

4.3 HERBACEOUS INVASIVE SPECIES

***Smyrnum oluastrum* Alexanders**

Throughout the GS2 grasslands Alexanders is prolific and has spread into parts of the GS1 calcareous grasslands. Attempts have been made to control this plant by cutting. Low growing shoots with flowering heads were noted growing from root-stocks, within three weeks after cutting.

***Bryonia dioica* White Bryony**

This plant occurs in abundance at the west end of the site along the track-way. It is established within the heathland spreading and shading out rare plants. It was unaffected by the summer drought and stayed green throughout the season.

***Gunnera tinctoria* Giant-rhubarb**

A clump of this noxious weed, marks the south eastern corner of the stream which flows through part of the grasslands.



Alexanders Smyrnum oluastrum
© Shannon, P



White Bryony Bryonia dioica
© P. Shannon

5. DISCUSSION

5.1 HABITATS

The Howth Peninsula benefits from an unique botanical historical record created by preceding generations of botanists. The availability of such a wealth of knowledge is a valuable resource which botanists still rely on today. This report builds on that knowledge, confirming some plant records, with added location data and noting the apparent loss of other plants from the Redrock site.

The Redrock site lies within the Howth Peninsula SAC. It supports part of the designated EU Annex 1 habitat European dry heaths 4030.

A section of the calcareous grassland with orchids has an affinity with EU Annex 1 habitat 6210*. Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Bromatea) (*important orchid sites). (Appendix 2 Area 2)

The Calcareous Grasslands at Redrock are outstanding for their botanical diversity. "Unimproved", and farmed in the past by traditional methods they remain intact to a large extent today. Four species of orchid occur here making this the most orchid-rich habitat on the Howth Peninsula. Cowslip *Primula veris*, a declining species within the Dublin area also occurs here. (Appendix 1.2. Area 1). The importance of these grasslands cannot be overstated in light of their rapid disappearance in Dublin and throughout Ireland. It is estimated that they form less than 1% of grassland coverage in Ireland.

Grassland management has an impact on the composition of grassland species. While the orchid rich grassland is managed appropriately, potential for increased species diversity may lie within the seed bank of some of the uncut, unmanaged areas of grassland.

Spring Squill *Scilla verna* accompanied by a rich diversity of species occurs within the calcareous grassland/heathland mosaic (Appendix 2 Area 4). One of the most striking features of the early spring flowering season it spreads seaward beyond the boundary of the Redrock site onto the cliffs.

Redrock supports some of the rarest plant species in Ireland, with Howth being their stronghold in Dublin. These species are all found within the Thero-Airion vegetation communities which occur in thin soils overlaying the tips of rock outcrops. (Appendix 2 Areas 3 & 5).

Little information on the status of these communities is available for this habitat in Ireland. Emphasis therefore was put on describing the composition of these communities for the vegetation survey. These communities include a rich and diverse range of species. (with up to twenty three species recorded within one 3m x 3m area).

This highly vulnerable habitat and its included rare species is in imminent danger of being lost through human pressure (trampling and horse riding) and lack of appropriate management. The areas under greatest human pressure are the areas with the rarest species.

Creation of buffer zones around sensitive habitats is essential for plant conservation, where rank grassland, Bracken or scrub pose an invasive threat. Often young scrub and early stage Bracken and Bramble are not obvious within the landscape, particularly among areas of rank grassland.

Water availability greatly influences the species composition of a habitat. On relatively level ground fluctuating ground water levels give rise to variations in vegetation composition. On sloping ground, obstruction of natural flow or soil compaction can interfere with water availability to plants. Any planned actions should not interfere with or impede existing water flow and water retention through the site.

5.2 RARE SPECIES

Of the six targeted rare species, four were re-found and despite extensive searching the other two were not located. (Section 4.2)

Historical Records mainly from the 19th century were brought together and included in Colgan N.1904 *Flora of County Dublin* and are cited as such below within the individual species accounts.

Knotted Clover *Trifolium striatum*



Knotted Clover *Trifolium striatum*



Knotted Clover Habitat

"Kilbarrack and Howth" (Moore) *Cyb.* "Plentiful above the Martello Tower Sutton" *Praeger* 1895.

It was rediscovered by this author on rocky outcrops at Redrock in 1992 (*FCD* 1998).

This is a very rare plant in Ireland and is confined mostly to the south and east coasts. (see Appendix 3 for distribution in Ireland)

Eight individual plants of this species were located within Thero-Airion vegetation communities on rock outcrops.

Bird's-foot *Ornithopus perpusillus*



Birds-foot *Ornithopus perpusillus*



Birds-foot Habitat

Bird's-foot was first recorded from Howth, "on bare sandy pasture fields on the south side of Howth" *Mack. Rar.* Bird's-foot *Ornithopus perpusillus* was recorded regularly from then on with *Colgan 1902* describing it as "in fair quantity on a rocky knoll north of the Redrock, south side of Howth". It was seen here by this author in 1992 (*FCD 1998*).

Redrock is the only known site for this plant in Dublin County which is categorised as "rare" in the *Irish Red Data book*. (see Appendix 3 for distribution in Ireland)

Four colonies of *Ornithopus perpusillus* Bird's-foot were located - three within Thero-Airion vegetation communities on rock outcrops and one occurred within a calcareous grassland/*Scilla verna* heath community.

Bird's-foot Clover *Trifolium ornithopodioides*



Bird's-foot Clover *Trifolium ornithopodioides*



Bird's-foot Clover Habitat

First recorded by Moore in 1843, this and subsequent sightings for this plant were recorded within the vicinity of the roadway to the Baily Lighthouse. It was then located at Redrock by Howard J. Hudson in 1932. (*Supplement. Anon 1961*). It was rediscovered at Redrock by this author in 1991 (*FCD 1998*). There appear to be no records from Howth for it since. Confined to the south and east coasts this is a very rare plant in Ireland. Howth is one of the two known areas in which it grows in Dublin (see Appendix 3 for distribution in Ireland).

In the course of this survey it was located in similar habitat within the vicinity of the 1991 record. One colony comprising just four individual plants was located, growing alongside a track in very short turf.

Spring Squill *Scilla verna*



Spring Squill *Scilla verna*



Spring Squill *Scilla verna* Habitat

Spring Squill *Scilla verna* is included in Walter Wade's publication on rare plants in Ireland in 1804. It continued to be recorded mostly from the east side of the Howth Peninsula, up until the publication of the *Flora of County Dublin* (1998) where it is described as "Plentiful from Redrock towards Drumleck".

This is a rare species in Ireland with an eastern coastal distribution extending from Wexford to Derry (see Appendix 3 for distribution in Ireland).

Spring Squill occurs within a complex mosaic of calcareous grassland and dry heathland. It spreads seaward beyond the boundary of the Redrock site onto the cliffs.

Rough Clover *Trifolium scabrum*

"Sandy fields on the Sutton side of Howth" *Wade 1804*. H.C. Hart recorded it at Greenfields in 1887. The site has since been built upon. It was seen by this author in 1991 on a rocky outcrop at Redrock (*FCD 1998*). It was recorded at Redrock by Declan Doogue in 2004.

It is a nationally rare species and is categorised as near threatened on the Irish Red Data List (NPWS 2016). There are no recent records for it in Dublin County.

Rough Clover *Trifolium scabrum* was not refound during the course of this survey.

Slender Trefoil *Trifolium micranthum*

It was recorded "at Howth" (Moore *Cyb*). This is the first known record for this plant at Howth.

In 1991 it was recorded west of Redrock in the vicinity of Drumleck Point (*FCD 1998*).

This rare species was not refound during the course of the survey.



Rough Clover *Trifolium scabrum*
© K.J. Walker, BSBI



Slender Trefoil *Trifolium micranthum*
© G. Toone, IWNHAS

6. MANAGEMENT

6.1 INTRODUCTION

Traditionally habitat diversity and quality were maintained by livestock and rabbit grazing. Habitats were also greatly impacted upon by spontaneous or deliberate fires. Fire is still an important factor in habitat structure and succession today. Human pressure is an added influence, often impacting to the extent of serious habitat damage. Some aggressive plant species feature prominently within the site and are a threat to habitat survival.

Controlled fire and re-introduction of grazing animals are often recommended as means of maintaining habitats similar to those found at Redrock. Neither of these approaches are deemed appropriate in this situation.

The fragmented occurrence of dwarf shrub heath (Heather and Western Gorse) and its close proximity to taller scrub particularly Gorse *Ulex europaeus* would not suggest that controlled burning is a prudent option. Controlled burning needs to be assessed by experts in that field.

Grazing animals, are costly to confine and maintain and would be subject to an underlying threat from fire. For these reasons these measures are not considered to be viable propositions. Intensive, targeted management actions are the only viable option to retain the habitats and rare plant species.

The success of such management is already apparent in the calcareous grassland with orchids, where habitat quality survives due to properly directed appropriate management.

Management of this site requires ongoing regular maintenance, supervision and evaluation.

6.2 GRASSLAND WITH ORCHIDS

The orchid grassland has in recent years been cut annually in September and cuttings are raked and removed.

Rank grasslands fringe this area and are spreading into it. Some areas of these heavy grasslands have been cut in the past, but the cuttings were not removed leading to a consequent build up of thatch.

Trampling by humans has created and maintained a number of tracks through the site. Where trampling is more severe vegetation growth is sparse however on the edges of these tracks shorter grassland vegetation allows the less vigorous species to grow.

Tracks made by tractors accessing the woodland opened up the sward and reached the water table. These tracks created structural diversity giving opportunities for wetland species such as Early Marsh-orchid *Dactylorhiza incarnata* subsp. *incarnata* to grow on the bare mud.

Conservation Objectives

Prevent encroachment of rank grass in order to maintain species diversity within the site

Action

Continue to cut annually and rake and remove cuttings. It is recommended that cutting is left as late as possible in September or early October to allow seed set of late flowering biennial and perennial species.

Create a buffer zone to prevent seed dispersal from adjoining grassland into orchid grasslands.

Year 1 :Mark out a zone of 5 metres around the site.

Cut grass and remove cuttings

Cut as short as possible every three weeks.

Year 2: Cut and remove cuttings in May and September

Year 3: As year 2

Consideration should be given to the evaluation of the conservation status of the orchid populations on an annual basis.

6.3 RARE SPECIES

6.3a Rare species on Rock Outcrops

These outcrops should be regarded as natural rock gardens and maintained as such, by cutting back overhanging plants and removing undesirable plants particularly Gorse and Brambles. The priority habitats lie on rock tips with thin soil cover, and on slopes covered in glacial drift. They also support five of the six rare plant species considered in this report.

Even where cut back, scrub particularly Gorse and Bramble are producing new shoots. Where they have been grubbed out the disturbed ground has given rise to colonization by opportunist vigorous plants, including Nettles. Where cuttings have been left *in situ* a mulch layer has formed.

Conservation Objectives

- Preservation of rare species and habitats
- Enhance potential colonization of rare species
- Prevent loss of habitat to scrub
- Prevent shading of habitat from nearby scrub
- Remove invasive species
- To repair habitat degradation caused by human pressure

Actions

Mark out on the ground areas with the most sensitive habitats and potential habitats.

Mark out a buffer zone of 3 metres around these.

To minimise trampling and disturbance of the rarest habitats work from the rock tips downwards. Rock tips should never be used as collection points for cuttings and debris.

Cut as near to the base of the plant as possible

Cut at least three times a year.

Preferably use a hand loppers, hand saw or mechanical saw (hedge trimmers or strimmers are not suitable as they create a fine mulch which is difficult to rake off.)

Collect up complete cutting, do not break up or mulch *in situ*.

6.3b Rare Species on Track-way

Bird's-foot clover *Trifolium ornithopodioides* grows at the edge of a track-way between the rock outcrops. With just 4 plants within one population this plant is barely surviving. While its preferred habitat is trampled ground severe compaction may be impeding seed germination.

Conservation Objective

To maintain and possibly increase the population of this species

Actions

Cordon off area

In April before seed set, scarify (with a hand fork) an area of 15cm circumference around each plant.

Assess population numbers the following Spring

6.4 Human Pressure on Rock Outcrops

The rock outcrops with the rarest species are the areas under the greatest human pressure. The outcrops offer the best viewing points and areas for sitting, picnicking and camping. Added to this a stepped concrete path runs through the only known population of *Ornithopus perpusillus* Bird's-foot on the Howth Peninsula. Running alongside this path is a track-way used by horse riders. Trampling causes compaction leading to water run-off, thus cutting off water supply for potential seed germination.



Tent on top of Bird's-foot



Thero-Airion vegetation degraded with Bird's-foot outlined in yellow.

Conservation Objectives

To protect this area with a view to restore short grassland habitat
To guide walkers and horse riders away from this area

Actions

Cordon off access to the path and track-way.
Use information boards to advise the public of the presence of rare plants in need of protection.
Strategically place seating facing seaward to encourage the public away from the rock tops.

6.5 Scrub on Rock Outcrops

These outcrops should be regarded as natural rock gardens and maintained as such, by cutting back overhanging plants and removing undesirable plants particularly Gorse and Brambles. The priority habitats lie on rock tips with thin soil cover, and on slopes covered in glacial drift. They also support five of the six rare plant species considered in this report.

Even where cut back, scrub particularly Gorse and Bramble are producing new shoots. Where they have been grubbed out the disturbed ground has given rise to colonization by opportunist vigorous plants, including Nettles. Where cuttings have been left *in situ* a mulch layer has formed. Some cuttings deposited in a former small quarry on the site should be removed.

Conservation Objectives

Preservation of rare species and habitats
Enhance potential colonization of rare species
Prevent loss of habitat to scrub
Prevent shading of habitat from nearby scrub
Remove invasive species
To repair habitat degradation caused by human pressure

Actions

- Mark out on the ground areas with the most sensitive habitats and potential habitats.
- Mark out a buffer zone of 3 metres around these.
- To minimise trampling and disturbance of the rarest habitats work from the rock tips downwards. Rock tips should never be used as collection points for cuttings and debris.
- Cut as near to the base of the plant as possible
- Cut at least three times a year.
- Preferably use a hand loppers, hand saw or mechanical saw (hedge trimmers or strimmers are not suitable as they create a fine mulch which is difficult to rake off.)
- Collect up complete cutting, do not break up or mulch *in situ*.

6.6 Invasive Herbaceous Plant Species

Removal of invasive herbaceous species is a priority. This is an opportunity to eradicate them before they cause irreparable habitat damage.

6.6.1 Alexanders *Smyrnium oluastrum*

Alexanders grows throughout the meadows surrounding the calcareous grasslands. Its invasive abilities represent a serious threat to the whole Redrock area. A prolific seed producer, it germinates in Autumn and Spring. It can flower over winter in sheltered warm positions. It has the capacity to over-run and destroy existing habitats. Attempts have been made to control this plant by cutting but it needs more intensive management. Low growing shoots with flowering heads were noted re-sprouting from root-stocks, within three weeks of having been cut in the course of this survey.

Objective

The objective is to wear out the root-stock (tap-root) to prevent flowering and seed set and halt its spread into the calcareous grassland and throughout the Redrock site. The use of herbicide is not advised within a natural habitat and in such close proximity to the orchid-rich grassland.

Action

Consider Alexanders as an invasive species thus giving it the eradication priority needed. Monthly monitoring with immediate cutting of new plants is required on a year round basis.

6.6.2 Giant-rhubarb *Gunnera tinctoria*

A clump of the noxious weed, Giant-rhubarb *Gunnera tinctoria* marks the south eastern corner of the water course within the site.

Objective

To prevent its further spread

Action

Dig out and remove. Check regularly for new growth and remove.

6.6.3 Bryony *Bryonia dioica*

One large plant is spreading within the the *Scilla verna*/Heathland community.

Objective

To prevent the rootstock of this perennial plant gaining a foothold in pockets of deep soil from where it scrambles over sensitive habitats thus shading out light from vulnerable species.

Action

Dig out and remove before flowering. Check regularly for new growth and remove.

6.7 Dry Meadows and Grassy Verges: Fossit code GS2

Potential for increased species diversity may lie within the seed bank of some of the uncut, unmanaged areas of grassland.

Where no cutting takes place some grassland areas are being invaded with scrub and bracken. Annual cutting can favour vigorous broad leaved species, at the expense of less vigorous ones thus reducing the variety of plants. Cutting twice a year reduces perennial species vigour and reduces the amount of shade cast over finer and later flowering species. An early spring cut is essential as most dormant seeds are at their most viable in early Spring as soils warm up. The areas with the best potential are those with Downy Oat-grass *Helictotrichon pubescens* and herbs such as Knapweed *Centaurea nigra* and Common Bird's-foot-trefoil *Lotus corniculatus*.

Objective: To increase the floristic diversity within some areas of rank grassland.

Year 1: Record plants in area to be cut using the DAFOR scale of abundance

September: Cut and remove cuttings.

Scarify after cutting using mechanical de-thatching rake with collector.

Aerate with hollow tine aerator

Feb: Cut and remove cuttings

Year 2: Repeat as year 1.

Year 3: Record plants (An increase in species diversity would imply a viable seed bank).

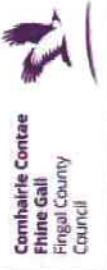
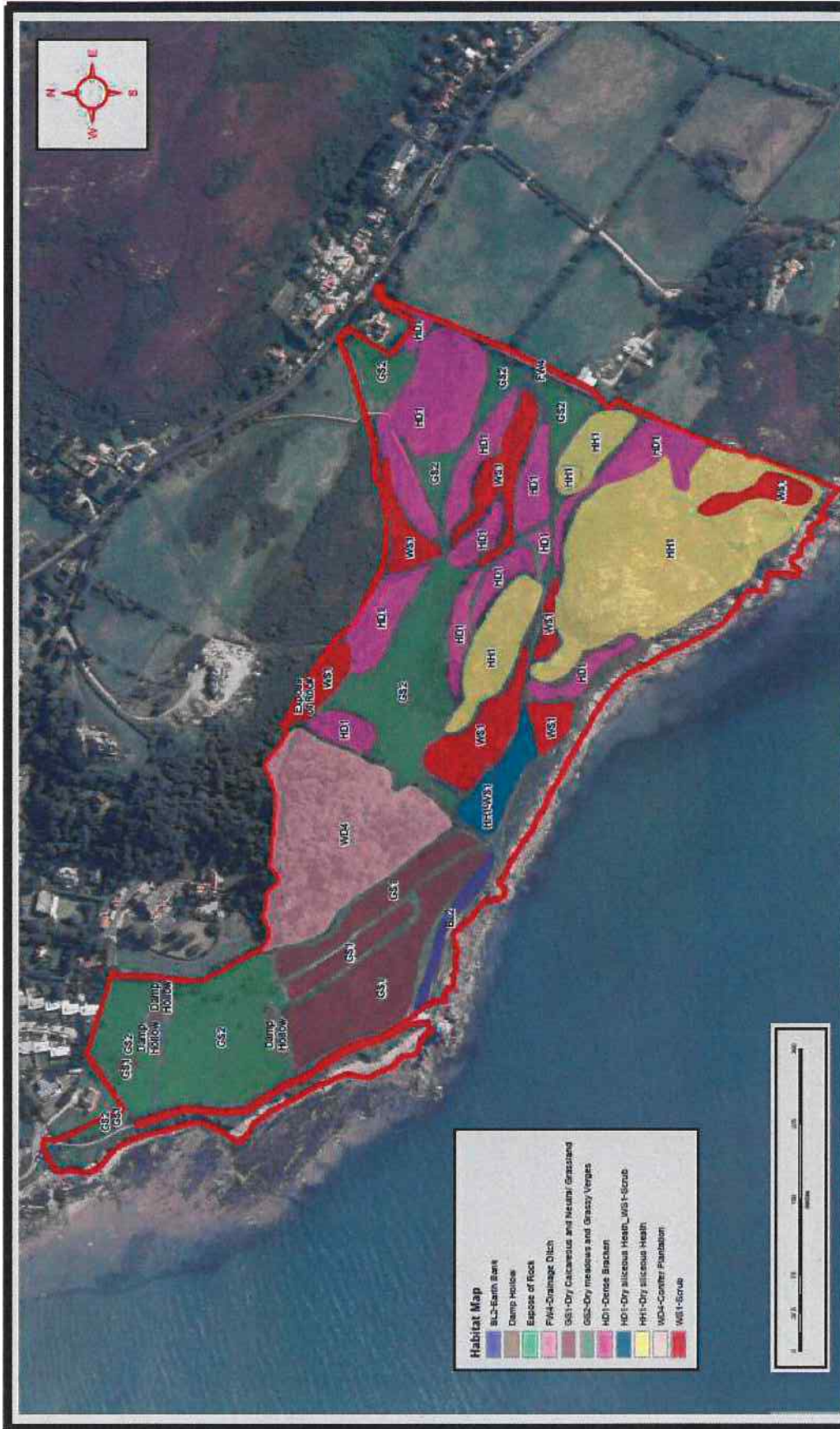
September: Cut and remove cuttings

Scarify after cutting

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APPENDIX 1: Habitat Map



Comhairle Contae
Fhine Gall
Fingal County
Council

Planning & Statigic Infrastructure Department
Parks & Green Infrastructure Division
Senior Parks Superintendent: Kevin J. Halpenny
Index No.: 5741
Scale 1:3500
Date: 12/12/2018
Prepared by: P.C.

**Habitat Map,
Redrock Howth.**

APPENDIX 2 PRIORITY HABITATS



REDROCK HOWTH

Comhairle Contae
Fhine Gall
Fingal County
Council

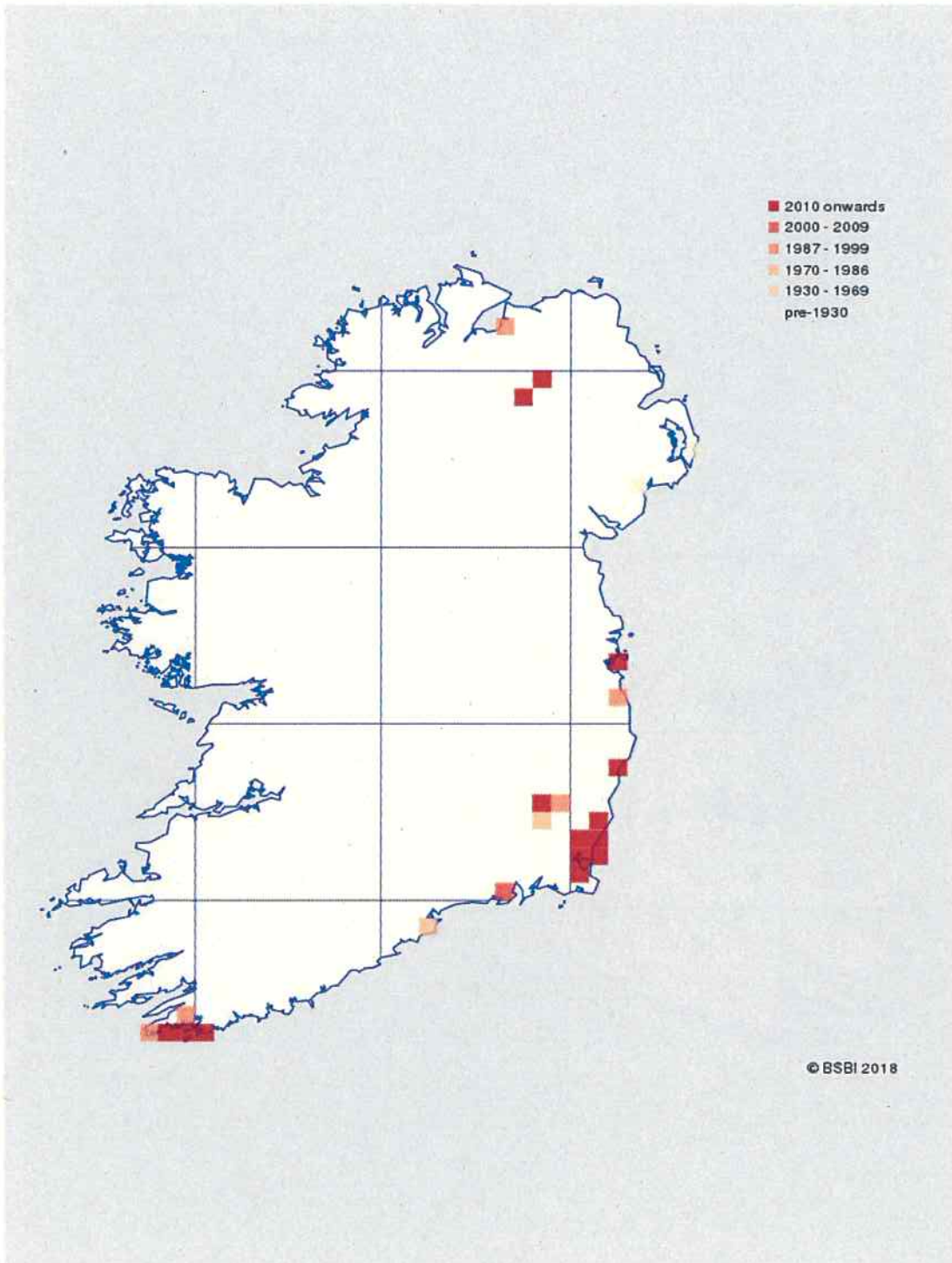
Planning & Strategic Infrastructure Department
Parks & Green Infrastructure Division
Senior Parks Superintendent: Kevin J. Halpenny
Index No.: 5714_01
Prepared by: P.C.

Scale 1:3500
Date: 28/02/2019

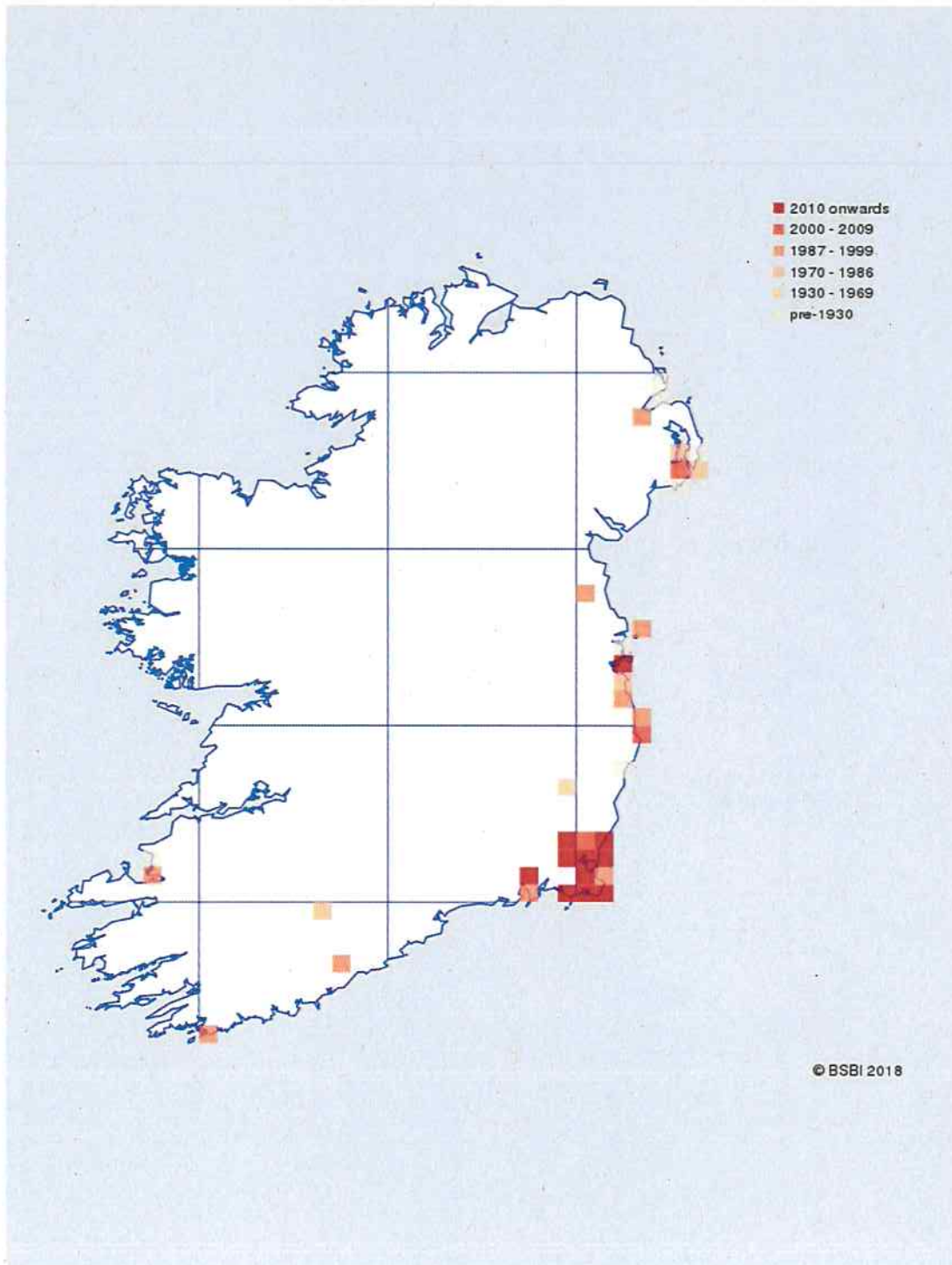
APPENDIX 3 RARE SPECIES DISTRIBUTION MAPS

Botanical Society of Britain and Ireland

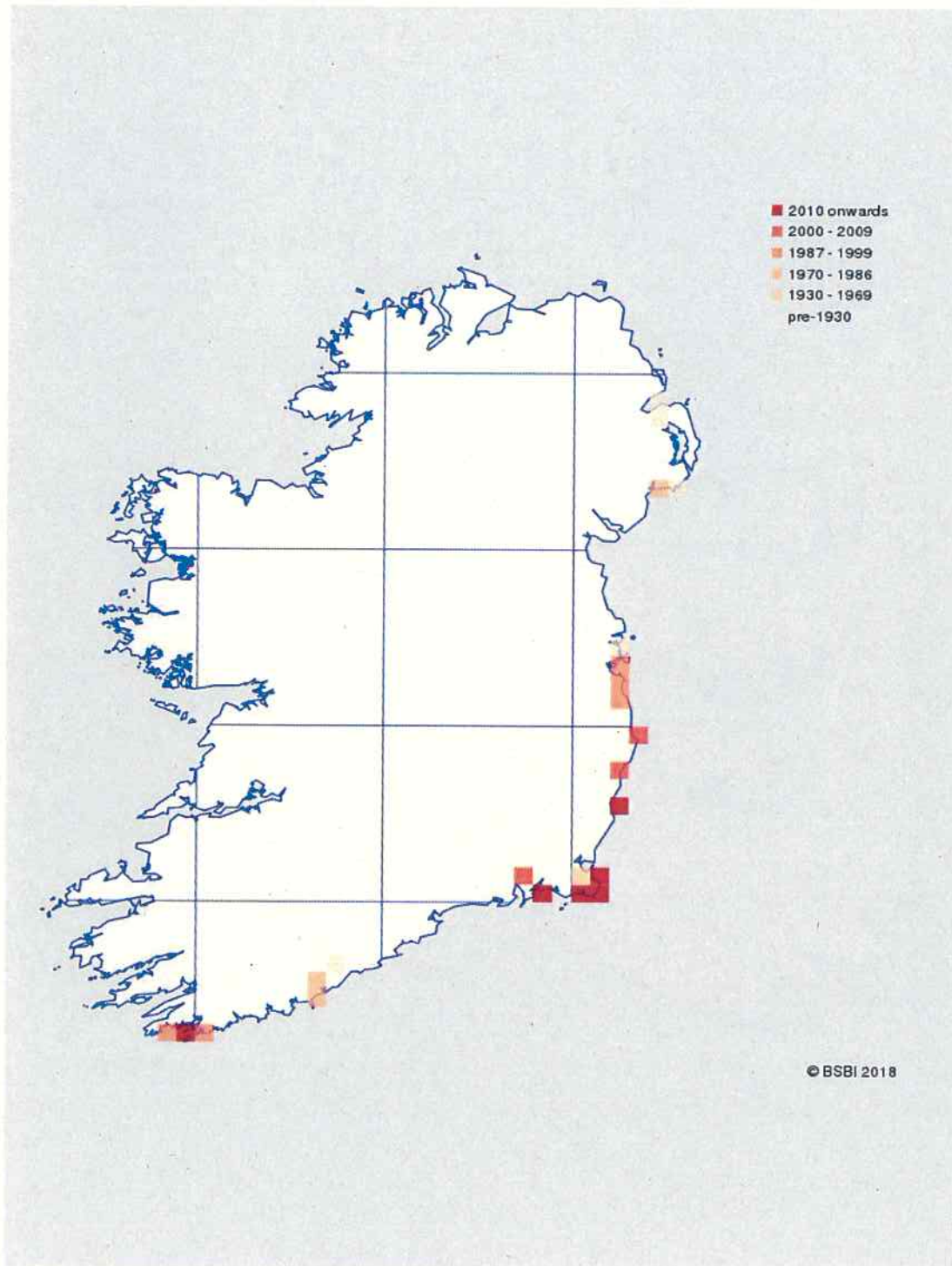
Ornithopus perpusillus Bird's-foot



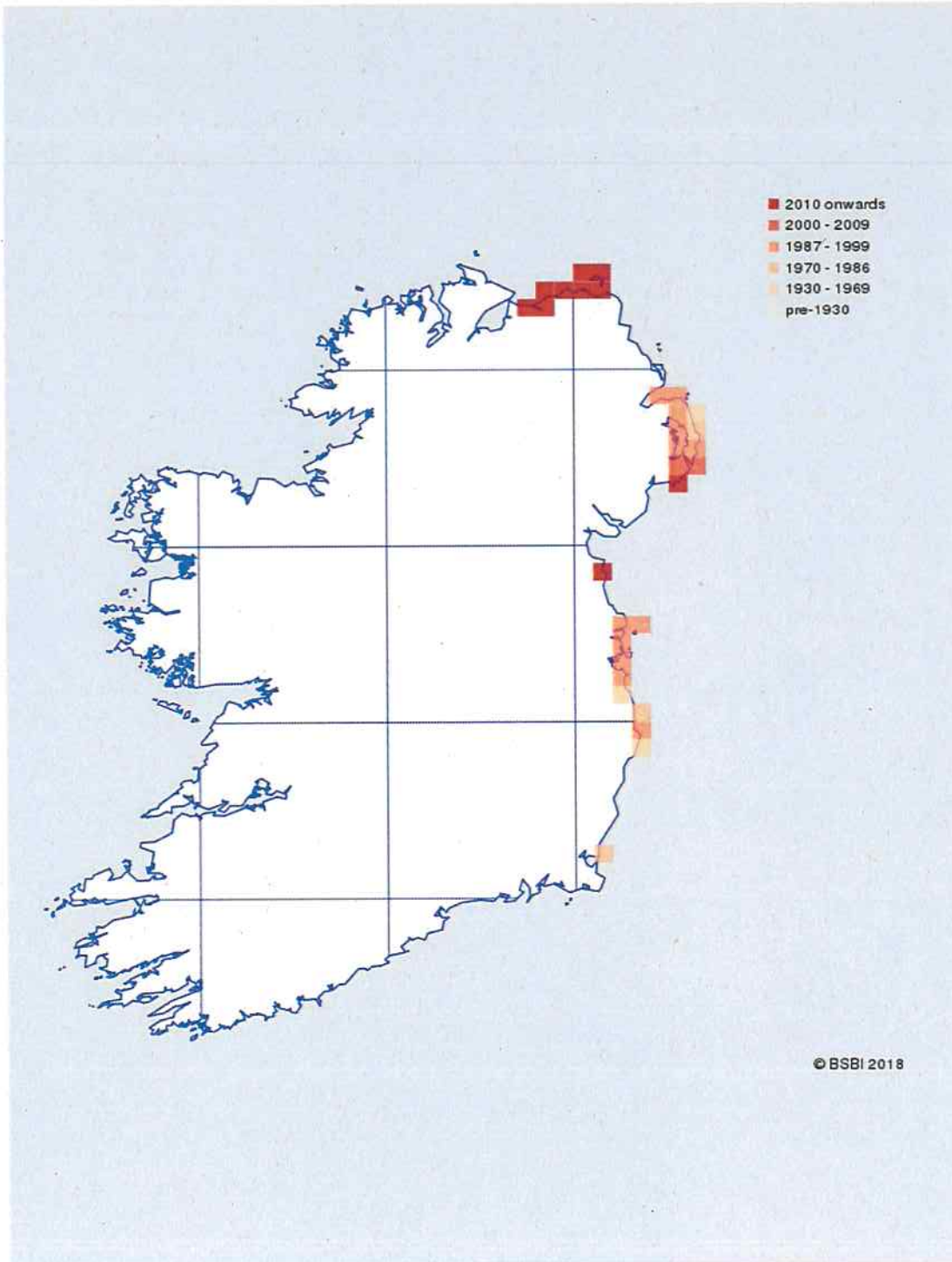
***Trifolium striatum* Rough Clover**



Trifolium ornithopodioides Bird's-foot Trefoil



***Scilla verna* Spring Squill**



APPENDIX 4 VEGETATION QUADRATS



**Quadrats Map,
Redrock Howth.**

**Comhairle Contae
Fhine Gall
Fingal County
Council**

Planning & Strategic Infrastructure Department
Parks & Green Infrastructure Division
Senior Parks Superintendent: Kevin J. Halpenny

Index No.: 5797 Scale 1:3500
Prepared by: P.C. Date: 01/03/2019

QUADRAT Q001

Thero-Airion vegetation community with *Ornithopus perpusillus* Bird's-foot

Centre point of quadrat ITM 726929.134 737112.732

Quadrat size 60cm x 60cm

Soil Depth: 25cm: 18cm: 9cm:

Date 22nd. May 2018

Notes: Insufficient growth to record plants in April.
Vegetation dried out by mid-June.

Scientific Name	Common Name	Domin
<i>Cerastium semidecandrum</i>	Little Mouse-ear	5
<i>Festuca rubra</i>	Red Fescue	6
Moss		6
<i>Ornithopus perpusillus</i>	Bird's-foot	1
<i>Rumex acetosella</i>	Sheep's Sorrel	4
<i>Sedum anglicum</i>	English Stonecrop	1
<i>Trifolium dubium</i>	Lesser Trefoil	5

Quadrat Q002

Thero-Airion vegetation community with *Ornithopus perpusillus* Bird's-foot

Centre point of quadrat. ITM 726926.543 737127.471

Quadrat size 60cm x 60cm

Soil depth: 22cm: 11cm: 22cm:

Date 22nd. May 2018

Notes: Insufficient growth to record plants in April.
Vegetation dried out by mid-June.

Scientific Name	Common Name	Domin
<i>Anthoxanthum odoratum</i>	Sweet Vernal-grass	4
<i>Aphanes</i> sp.		1
<i>Cerastium semidecandrum</i>	Little Mouse-ear	1
<i>Festuca rubra</i>	Red Fescue	7
<i>Hypochaeris radicata</i>	Cat's-ear	2
<i>Ornithopus perpusillus</i>	Bird's-foot-trefoil	7
<i>Rumex acetosella</i>	Sheep's Sorrel	4
<i>Veronica arvensis</i>	Wall Speedwell	1
<i>Vulpia bromoides</i>	Squirreltail Fescue	1
Moss		4
Bare ground		1
Rock		1

Quadrat Q003

Thero-Airion vegetation community with *Ornithopus perpusillus* Bird's-foot

Centre point of quadrat: ITM 726933.295 737123.977

Quadrat size 60cm x 60cm

Soil depth: 11cm: 7cm: 2cm:

Date 22nd. May 2018

Notes: Insufficient growth to record plants in April.
Vegetation dried out by mid-June.

Scientific Name	Common Name	Domin
<i>Anthoxanthum odoratum</i>	Sweet Vernal-grass	3
<i>Cerastium semidecandrum</i>	Red Fescue	4
<i>Festuca rubra</i>	Sheep's Sorrel	4
<i>Ornithopus perpusillus</i>	Bird's-foot	6
<i>Rumex acetosella</i>	Lesser Trefoil	4
<i>Trifolium dubium</i>	Little Mouse-ear	2
Bare ground		6
Rock		4

Quadrat Q004

Thero-Airion vegetation community with trampling damage

Centre point of quadrat. ITM 726925.801 737112.866

Quadrat size 60cm x 60cm

Soil depth: 11cm: 7cm: 2cm:

Date 22nd. May 2018

Notes: Insufficient growth to record plants in April.
Vegetation dried out by mid-June.

Scientific Name	Common Name	Domin
<i>Aira praecox</i>	Early Hair-grass	1
<i>Cerastium semidecandrum</i>	Little Mouse-ear	2
<i>Festuca rubra</i>	Red Fescue	4
<i>Holcus lanatus</i>	Yorkshire-fog	2
<i>Montia fontana subsp. chondrosperma</i>		4
<i>Myosotis discolor</i>	Changing-forget-me-not	4
<i>Poa annua</i>	Annual Meadow-grass	1
<i>Rubus fruticosus agg.</i>	Bramble	5
<i>Sonchus oleraceus</i>	Smooth Sow-thistle	1
<i>Ulex europaeus</i>	Gorse	5
<i>Veronica arvensis</i>	Wall Speedwell	4

Notes: The *Montia fontana subsp. chondrosperma* grows where sufficient water accumulates to provide it with a suitable niche.

QUADRAT Q005

Calcareous Grassland and Heathland Mosaic

Centre point of quadrat. ITM 726961.452 737094.447

Quadrat size 60cm x 60cm

Soil depth: 8cm: 9cm: 4.5cm:

Date 22nd. May 2018

Notes: Vegetation dried out by mid-June.

Scientific Name	Common Name	Domin
	<i>Moss</i>	6
<i>Anthoxanthum odoratum</i>	Sweet Vernal-grass	5
<i>Aphanes sp.</i>		1
<i>Centaureum erythraea</i>	Common Centaury	4
<i>Festuca bovine</i>	Sheep's-fescue	5
<i>Lathyrus pratensis</i>	Meadow Vetchling	4
<i>Luzula campestris</i>	Field Wood-rush	6
<i>Myosotis discolor</i>	Changing-forget-me-not	1
<i>Rumex acetosella</i>	Sheep's Sorrel	4
<i>Rumex obtusifolius</i>	Broad-leaved Dock	1
<i>Sedum anglicum</i>	English Stonecrop	1
<i>Senecio jacobaea</i>	Common Ragwort	1
<i>Teucrium scorodonia</i>	Wood Sage	1
<i>Trifolium dubium</i>	Lesser Trefoil	2
<i>Vicia sativa</i>		1

Quadrat Q006

Calcareous Grassland and Heathland Mosaic

Centre point of quadrat. ITM 726961.441 737102.351

Quadrat size 60cm x 60cm

Soil depth: 13cm: 8cm: 4.5cm:

Date 22nd. May 2018

Notes: Vegetation dried out by mid-June.

Scientific Name	Common Name	Domin
	Moss	1
<i>Aira praecox</i>	Early Hair-grass	4
<i>Anthoxanthum odoratum</i>	Sweet Vernal-grass	4
<i>Armeria maritima subsp. maritima</i>	Thrift	4
<i>Dactylis glomerata</i>	Cock's-foot	5
<i>Festuca ovina</i>	Sheep's-fescue	5
<i>Hypochaeris radicata</i>	Cat's-ear	1
<i>Lathyrus pratensis</i>	Meadow Vetchling	4
<i>Luzula campestris</i>	Field Wood-rush	3
<i>Myosotis discolor</i>	Changing-forget-me-not	1
<i>Pilosella officinarum</i>	Mouse-ear-hawkweed	1
<i>Rumex acetosella</i>	Sheep's Sorrel	1
<i>Sedum anglicum</i>	English Stonecrop	1
Taraxacum agg. Erythrosperma group	Dandelion	1
<i>Trifolium dubium</i>	Lesser Trefoil	3
<i>Veronica chamaedrys</i>	Germander Speedwell	4
<i>Vicia sativa</i>		1
<i>Vulpia bromoides</i>	Squirreltail Fescue	3

QUADRAT Q007

Thero-Airion vegetation community with *Trifolium striatum* Knotted Clover

Centre point of quadrat. ITM 727009.218 737138.476

Quadrat size 60cm x 60cm

Soil depth: 1cm: 7cm: 3.5 cm:

Date 22nd. May 2018

Notes: Insufficient growth in April to record plants due to late growing season.

Scientific Name	Common Name	Domin
	Rock	5
	Bare ground	4
	Moss	4
<i>Aira praecox</i>	Early Hair-grass	4
<i>Cerastium fontanum</i>	Common Mouse-ear	1
<i>Festuca rubra</i>	Red Fescue	7
<i>Myosotis discolor</i>	Changing-forget-me-not	1
<i>Sedum anglicum</i>	English Stonecrop	4
<i>Trifolium dubium</i>	Lesser Trefoil	1
<i>Trifolium striatum</i>	Knotted Clover	5
<i>Veronica arvensis</i>	Wall speedwell	4
<i>Vicia sativa</i>		4

Date: 19th June 2018

Notes: Some *Sedum anglicum* and just one plant of *Lepidium heterophyllum* survived the summer drought. The remainder of the vegetation dried up.

Scientific Name	Common Name	
	Dried up vegetation	10
<i>Lepidium heterophyllum</i>	Smith's Pepperwort	1
<i>Sedum anglicum</i>	English Stonecrop	4

Quadrat Q008

Calcareous Grassland and Heathland Mosaic

Centre point of quadrat. ITM 727007.533 737139.211

Quadrat size 60cm x 60cm

Soil depth: 13cm: 8cm: 4.5cm:

Date 29th. May 2018

Notes: *Sedum anglicum* and *Rumex acetosella* survived the Summer drought. By mid-June the rest of the vegetation had dried out.

Scientific Name	Common Name	Domin
	Rock	7
	Moss	5
<i>Dactylis glomerata</i>	Cock's-foot	4
<i>Festuca rubra</i>	Red Fescue	5
<i>Luzula campestris</i>	Field Wood-rush	3
<i>Rumex acetosella</i>	Sheep's Sorrel	4
<i>Sedum anglicum</i>	English Stonecrop	5
<i>Veronica arvensis</i>	Wall Speedwell	1
<i>Vicia sativa</i>		1

Quadrat Q009

***Scilla verna* Spring Squill Grassland and Calcareous Grassland Mosaic with *Ornithopus perpusillus* Bird's-foot**

Centre point of quadrat. ITM 726990.54 737082.421

Quadrat size 60cm x 60cm

Soil depth 13cm: 7.4cm: 7.9cm:

Date 22nd. May 2018

Notes: Insufficient growth in April to record plants.

By the end of May *Scilla verna* had gone to seed and the leaves had turned yellow.
Festuca ovina was flowering and the leaves were brown and shrivelled.

Scientific Name	Common Name	Domin
	Moss	4
<i>Aira praecox</i>	Early Hair-grass	4
<i>Festuca ovina</i>	Sheep's-fescue	4
<i>Hypochaeris radicata</i>	Cat's-ear	2
<i>Luzula campestris</i>	Field Wood-rush	5
<i>Ornithopus perpusillus</i>	Bird's-foot	2
<i>Scilla verna</i>	Spring squill	8
<i>Sedum anglicum</i>	English Stonecrop	4

Quadrat 009

Date 29/05/18

Note: Recorded one week later. By mid-June the vegetation had dried up.

Scientific name	Common Name	Domin.
	Moss	4
<i>Aira praecox</i>	Early Hair-grass	4
<i>Dactylis glomerata</i>	Cock's-foot	4
<i>Festuca ovina</i>	Sheep's-fescue	6
<i>Hyacinthoides non-scripta</i>	Bluebell	4
<i>Hypochaeris radicata</i>	Cat's-ear	2
<i>Luzula campestris</i>	Field Wood-rush	5
<i>Ornithopus perpusillus</i>	Bird's-foot	2
<i>Pilosella officinarum</i>	Mouse-ear-hawkweed	1
<i>Rumex acetosella</i>	Sheep's Sorrel	4
<i>Scilla verna</i>	Spring Squill	6
<i>Sedum anglicum</i>	English Stonecrop	4
<i>Veronica arvensis</i>	Wall Speedwell	1

Quadrat Q013

Trifolium ornithopodioides Bird's-foot Clover and *Trifolium striatum* Knotted Clover

Centre point of quadrat. ITM 727162.986 737132.905

Quadrat size 60cm x 60cm

Soil Depth: 1.1cm: 1.7cm: 1.0cm:

30/05/18

Scientific Name	Common Name	Domin
	Rock	4
	Moss	4
	Bare ground	4
<i>Aphanes</i> sp.		1
<i>Hypochaeris radicata</i>	Cat's-ear	4
<i>Lolium perenne</i>	Perennial Rye-grass	7
<i>Plantago lanceolata</i>	Ribwort Plantain	2
<i>Poa annua</i>	Annual Meadow-grass	5
<i>Rumex acetosella</i>	Sheep's Sorrel	4
<i>Trifolium ornithopodioides</i>	Bird's-foot Clover	4
<i>Trifolium striatum</i>	Knotted Clover	2

Notes: 19/06/19. *Trifolium ornithopodioides* had finished flowering with the green seeds still in their capsules. *Trifolium striatum* had completely died down along with most of the vegetation.

07/08/18

Scientific Name	Common Name	Domin
<i>Poa annua</i>	Annual Meadow-grass (seedlings)	4
	Bare ground	8
<i>Plantago lanceolata</i>	Ribwort Plantain (seedlings)	4
	Rock	5
<i>Rumex acetosella</i>	Sheep's Sorrel	5
<i>Daucus carota</i> subsp. <i>carota</i>	Wild Carrot (seedlings)	4

QUADRAT Q014

Trifolium striatum Knotted Clover

Centre point of quadrat. ITM 727164.012 737134.379

Quadrat size 60cm x 60cm

Soil depth: 4.5cm: 4.5cm: 2.5cm:

Date: 30/05/18

Scientific Name	Common Name	Domin
	Moss	5
<i>Aphanes</i> sp.		2
<i>Festuca rubra</i>	Red Fescue	5
<i>Lolium perenne</i>	Perennial Rye-grass	5
<i>Poa annua</i>	Annual Meadow-grass	4
<i>Rumex acetosella</i>	Sheep's Sorrel	5
<i>Trifolium dubium</i>	Lesser Trefoil	2
<i>Trifolium repens</i>	White Clover	4
<i>Trifolium striatum</i>	Knotted Clover	5

Notes 19/06/18: Vegetation dried up only plant showing signs of growth, is *Rumex acetosella* Sheep's Sorrel.

Scientific Name	Common Name	DOMIN
	Rock	5
	Bare ground	8
<i>Daucus carota</i> subsp. <i>carota</i> (seedlings)	Wild Carrot	4
<i>Plantago lanceolata</i>	Ribwort Plantain	4
<i>Poa annua</i> (seedlings)	Annual Meadow-grass	4
<i>Rumex acetosella</i>	Sheep's Sorrel	5

QUADRAT Q015

Calcareous Grassland with *Primula veris* Cowslip

Centre point of quadrat. ITM 726664.322 737456.924

Quadrat size 1m x 1m

Soil depth: 5cm: 5.5cm: 5.5cm:

Date: 06/06/18

Note: Insufficient growth to record plants at the beginning of May.
Primula veris flowered and set seed by the first week of June.

Scientific Name	Common Name	Domin
<i>Anthoxanthum odoratum</i>	Sweet Vernal-grass	4
<i>Avenula pubescens</i>	Oat-grass	4
<i>Centaurea nigra</i>	Common Knapweed	5
<i>Dactylis glomerata</i>	Cock's-foot	3
<i>Festuca rubra</i>	Red Fescue	4
<i>Lathyrus pratensis</i>	Meadow Vetchling	5
<i>Plantago lanceolata</i>	Ribwort Plantain	4
<i>Primula veris</i>	Cow slip	5
<i>Rhinanthus minor</i>	Yellow-rattle	3
<i>Senecio jacobaea</i>	Common Ragwort	2

07/08/18 **QUADRAT Q015**

Scientific Name	Common Name	Domin.
<i>Anthoxanthum odoratum</i>	Sweet Vernal-grass	4
<i>Avenula pubescens</i>	Oat-grass	4
<i>Carex flacca</i>	Glaucous Sedge	4
<i>Centaurea nigra</i>	Common Knapweed	5
<i>Dactylis glomerata</i>	Cock's-foot	3
<i>Festuca rubra</i>	Red Fescue	4
<i>Lathyrus pratensis</i>	Meadow Vetchling	5
<i>Plantago lanceolata</i>	Ribwort Plantain	4
<i>Potentilla reptans</i>	Creeping Cinquefoil	2
<i>Primula veris</i>	Cowslip	3
<i>Rhinanthus minor</i>	Yellow-rattle	4
<i>Senecio jacobaea</i>	Common Ragwort	2
<i>Taraxacum officinale</i> agg.	Dandelion	2
<i>Trifolium pratense</i>	Red Clover	4

QUADRAT Q016

Calcareous Grassland with Orchids

Centre point of quadrat. ITM: 726767.123 737257.483

Quadrat size 1m x 1m

19/06/18

Scientific Name	Common Name	DOMIN
<i>Anacamptis pyramidalis</i>	Pyramidal Orchid	4
<i>Carex flacca</i>	Glaucous Sedge	4
<i>Centaurea nigra</i>	Common Knapweed	4
<i>Cerastium fontanum</i>	Common Mouse-ear	4
<i>Cynosurus cristatus</i>	Crested Dog's-tail	4
<i>Dactylis glomerata</i>	Cock's-foot	4
<i>Dactylorhiza</i> sp.		4
<i>Festuca rubra</i>	Red Fescue	5
<i>Hypochaeris radicata</i>	Cat's-ear	4
<i>Linum catharticum</i>	Fairy Flax	1
<i>Lotus corniculatus</i>	Common Bird's-foot-trefoil	5
<i>Luzula campestris</i>	Field Wood-rush	4
<i>Ranunculus bulbosus</i>	Bulbous Buttercup	3
<i>Rhinanthus minor</i>	Yellow-rattle	4
<i>Taraxacum officinale</i> agg.	Dandelion	3
<i>Trifolium repens</i>	White Clover	5

Note: 07/08/18. *Luzula campestris* died back. Additional species: Sea Plantain *Plantago maritima*, Black Medick *Medicago lupulina*, Wild Carrot *Daucus carota* subsp. *carota* and Mosses.

QUADRAT Q017

Calcareous Grassland with *Euphrasia* sp.

Centre point of quadrat. ITM 726762.271 737279.62

Quadrat size 1m x 1m

Date 07/08/18

Soil depth: 5cm: 2.5cm: 2.5cm:

Scientific Name	Common Name	DOMIN
	Moss	2
<i>Agrostis stolonifera</i>	Creeping Bent	4
<i>Anthoxanthum odoratum</i>	Sweet Vernal-grass	4
<i>Carex flacca</i>	Glaucous Sedge	5
<i>Dactylorhiza</i> sp.	Orchid	1
<i>Euphrasia</i> sp.		2
<i>Festuca rubra</i>	Red Fescue	5
<i>Hypochaeris radicata</i>	Cat's-ear	5
<i>Linum catharticum</i>	Fairy Flax	1
<i>Lotus corniculatus</i>	Common Bird's-foot-trefoil	6
<i>Luzula campestris</i>	Field Wood-rush	3
<i>Plantago lanceolata</i>	Ribwort Plantain	5
<i>Rhinanthus minor</i>	Yellow-rattle	1
<i>Trifolium pratense</i>	Red Clover	4
<i>Trifolium repens</i>	White Clover	4

APPENDIX 5 Plant List Calcareous Grassland with Orchids

Scientific Name	Common Name
<i>Agrostis stolonifera</i>	Creeping Bent
<i>Anacamptis pyramidalis</i>	Pyramidal Orchid
<i>Anthoxanthum odoratum</i>	Sweet Vernal-grass
<i>Anthyllis vulneraria</i>	Kidney Vetch
<i>Armeria maritima subsp. maritima</i>	Thrift
<i>Arrhenatherum elatius</i>	False Oat-grass
<i>Avenula pubescens</i>	Oat-grass
<i>Bellis perennis</i>	Daisy
<i>Carex flacca</i>	Glaucous Sedge
<i>Centaurea nigra</i>	Common Knapweed
<i>Cerastium fontanum</i>	Common Mouse-ear
<i>Cynosurus cristatus</i>	Crested Dog's-tail
<i>Dactylis glomerata</i>	Cock's-foot
<i>Dactylorhiza incarnata subsp. incarnata</i>	
<i>Dactylorhiza sp.</i>	
<i>Daucus carota subsp. carota</i>	Wild Carrot
<i>Festuca rubra</i>	Red Fescue
<i>Hypochaeris radicata</i>	Cat's-ear
<i>Lathyrus pratensis</i>	Meadow Vetchling
<i>Linum catharticum</i>	Fairy Flax
<i>Lotus corniculatus</i>	Common Bird's-foot-trefoil
<i>Luzula campestris</i>	Field Wood-rush
<i>Medicago lupulina</i>	Black Medick
<i>Ophrys apifera</i>	Bee Orchid
<i>Plantago lanceolata</i>	Ribwort Plantain
<i>Plantago maritima</i>	Sea Plantain
<i>Primula veris</i>	Cowslip
<i>Ranunculus bulbosus</i>	Bulbous Buttercup
<i>Rhinanthus minor</i>	Yellow-rattle
<i>Taraxacum officinale agg.</i>	Dandelion
<i>Trifolium pratense</i>	Red Clover
<i>Trifolium repens</i>	White Clover

Redrock Plant List

Scientific Name	Common Name
<i>Alnus glutinosa</i>	Alder
<i>Lathyrus pratensis</i>	Meadow Vetchling
<i>Acer pseudoplatanus</i>	Sycamore
<i>Achillea millefolium</i>	Yarrow
<i>Agrostis stolonifera</i>	Creeping Bent
<i>Aira praecox</i>	Early Hair-grass
<i>Alopecurus pratensis</i>	Meadow Foxtail
<i>Anacamptis pyramidalis</i>	Pyramidal Orchid
<i>Anagallis arvensis</i>	Scarlet Pimpernel
<i>Angelica sylvestris</i>	Wild Angelica
<i>Anthoxanthum odoratum</i>	Sweet Vernal-grass
<i>Anthriscus sylvestris</i>	Cow Parsley
<i>Anthyllis vulneraria</i>	Kidney Vetch
<i>Aphanes</i> sp.	
<i>Armeria maritima</i> subsp. <i>maritima</i>	Thrift
<i>Arrhenatherum elatius</i>	False Oat-grass
<i>Arum maculatum</i>	Lords-and-Ladies
<i>Avenula pubescens</i>	Oat-grass
<i>Bellis perennis</i>	Daisy
<i>Betula pubescens</i>	Downy Birch
<i>Brachypodium sylvaticum</i>	False-brome
<i>Brassica rapa</i>	Turnip
<i>Callun vulgaris</i>	Heather
<i>Calystegia silvatica</i>	Large Bindweed
<i>Cardamine hirsuta</i>	Hairy Bitter-cress
<i>Carduus tenuiflorus</i>	Slender Thistle
<i>Carex flacca</i>	Glaucous Sedge
<i>Carex hirta</i>	Hairy sedge
<i>Carex pendula</i>	Pendulous Sedge
<i>Carex remota</i>	Remote Sedge
<i>Centaurea nigra</i>	Common Knapweed
<i>Centaureum erythraea</i>	Common Centaury

<i>Cerastium fontanum</i>	Common Mouse-ear
<i>Cerastium glomeratum</i>	Sticky Mouse-ear
<i>Cerastium semidecandrum</i>	Little Mouse-ear
<i>Chamerion angustifolium</i>	Rosebay Willowherb
<i>Cirsium arvense</i>	Creeping Thistle
<i>Cirsium vulgare</i>	Spear Thistle
<i>Coryza</i> sp.	
<i>Crataegus monogyna</i>	Hawthorn
<i>Cynosurus cristatus</i>	Crested Dog's-tail
<i>Dactylis glomerata</i>	Cock's-foot
<i>Dactylorhiza incarnata</i> subsp. <i>incarnata</i>	
<i>Dactylorhiza</i> sp.	
<i>Daucus carota</i> subsp. <i>carota</i>	Wild Carrot
<i>Deschampsia flexuosa</i>	Wavy Hair-grass
<i>Digitalis purpurea</i>	Foxglove
<i>Dryopteris dilatata</i>	Broad Buckler-fern
<i>Elytrigia repens</i>	Common Couch
<i>Epilobium montanum</i>	Broad-leaved Willowherb
<i>Equisetum arvense</i>	Field Horsetail
<i>Erodium moschatum</i>	Musk Stork's-bill
<i>Festuca ovina</i>	Sheep's-fescue
<i>Festuca rubra</i>	Red Fescue
<i>Galium aparine</i>	Cleavers
<i>Geranium molle</i>	Dove's-foot Crane's-bill
<i>Gunnera tinctoria</i>	Giant-rhubarb
<i>Hedera helix</i>	Common Ivy
<i>Heracleum sphondylium</i>	Hogweed
<i>Holcus lanatus</i>	Yorkshire-fog
<i>Hyacinthoides non-scripta</i>	Bluebell
<i>Hypochaeris radicata</i>	Cat's-ear
<i>Juncus bulbosus</i>	Bulbous Rush
<i>Lepidium heterophyllum</i>	Smith's Pepperwort
<i>Linum catharticum</i>	Fairy Flax
<i>Lolium perenne</i>	Perennial Rye-grass
<i>Lonicera periclymenum</i>	Honeysuckle
<i>Lotus corniculatus</i>	Common Bird's-foot-trefoil
<i>Matricaria discoidea</i>	Pineapple weed

<i>Montia fontana subsp. chondrosperma</i>	
<i>Myosotis discolor</i>	Changing-forget-me-not
<i>Odontites vernus</i>	Red Bartsia
<i>Ophrys apifera</i>	Bee Orchid
<i>Ornithopus perpusillus</i>	Bird's-foot
<i>Persicaria amphibia</i>	Amphibious Bistort
<i>Phyllitis scolopendrium</i>	Hart's-tongue
<i>Pilosella officinarum</i>	Mouse-ear-hawkweed
<i>Plantago lanceolata</i>	Ribwort Plantain
<i>Plantago maritima</i>	Sea Plantain
<i>Poa annua</i>	Annual Meadow-grass
<i>Poa trivialis</i>	Rough Meadow-grass
<i>Polypodium vulgare</i>	Polypody
<i>Potentilla reptans</i>	Creeping Cinquefoil
<i>Primula veris</i>	Cowslip
<i>Prunus spinosa</i>	Blackthorn
<i>Pteridium aquilinum</i>	Bracken
<i>Ranunculus bulbosus</i>	Bulbous Buttercup
<i>Ranunculus repens</i>	Creeping Buttercup
<i>Rhinanthus minor</i>	Yellow-rattle
<i>Nasturtium officinale</i>	Water-cress
<i>Rubus fruticosus agg.</i>	Bramble
<i>Rumex acetosella</i>	Sheep's Sorrel
<i>Rumex obtusifolius</i>	Broad-leaved Dock
<i>Salix cinerea subsp. oleifolia</i>	Rusty Willow
<i>Salix viminalis</i>	Osier
<i>Sambucus nigra</i>	Elder
<i>Scilla verna</i>	Spring Squill
<i>Sedum anglicum</i>	English Stonecrop
<i>Senecio jacobaea</i>	Common Ragwort
<i>Senecio sylvaticus</i>	Heath Groundsel
<i>Silene uniflora</i>	Sea Campion
<i>Sisymbrium officinale</i>	Hedge Mustard
<i>Smyrnium oluastrum</i>	Alexanders
<i>Sonchus oleraceus</i>	Smooth Sow-thistle
<i>Sorbus aucuparia</i>	Rowan
<i>Stellaria holostea</i>	Greater Stichwort

<i>Stellaria media</i>	Common Chickweed
<i>Taraxacum officinale</i> agg.	Dandelion
<i>Teucrium scorodonia</i>	Wood Sage
<i>Trifolium dubium</i>	Lesser Trefoil
<i>Trifolium hybridum</i>	Alsike Clover
<i>Trifolium ornithopodiodes</i>	Bird's-foot Clover
<i>Trifolium pratense</i>	Red Clover
<i>Trifolium repens</i>	White Clover
<i>Trifolium striatum</i>	Knotted Clover
<i>Ulex europaeus</i>	Gorse
<i>Ulex gallii</i>	Western Gorse
<i>Urtica dioica</i>	Nettle
<i>Veronica anagallis-aquatica</i>	Blue Water-Speedwell
<i>Veronica arvensis</i>	Wall Speedwell
<i>Veronica chamaedrys</i>	Germander Speedwell
<i>Vicia hirsuta</i>	Hairy Tare
<i>Vicia sativa</i>	
<i>Vulpia bromoides</i>	Squirreltail Fescue