

Colonisation by vascular plants of sand ridges at Hightown sand-dunes, Merseyside; 2024 update

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Summary

A thirteen-year study followed floristic development on artificial sand ridges created in 2011 as part of mitigation for a coast-protection scheme at Hightown sand-dunes, Merseyside. Covering about 0.5 ha, the six parallel ridges (National Grid reference SD297028) are orientated east-west and are situated within the Sefton Coast SSSI and *Natura 2000* site. The number of vascular plant taxa recorded each year ranged from 63 to 87, with no significant trend over time. The grand total identified during the study period was 151, about 12% being non-native and 13% regionally or nationally notable. The proportion of ruderal plants declined over time from about 48% to 18%, reflecting maturation of the vegetation and a reduction of bare sand from about 80% to 2% of the ground surface. A significant positive relationship was found between percentage of ruderal species and percentage bare ground. Supporting observations included a variety of duneland invertebrates.

Introduction

During the restoration of a works compound used for a 2011 coast-protection scheme at Hightown sand-dunes, a series of sandy ridges was created as part of ecological mitigation within the Sefton Coast Site of Special Scientific Interest (SSSI) and *Natura 2000* site. It was hoped that this would produce a more topographically diverse landscape, attracting a wider variety of duneland wildlife than the almost level expanse of heavily vegetated and scrubby fixed-dune that existed here previously. The presence of north and south-facing slopes was intended to add further habitat diversity. There are four parallel east/west ridges up to 2.2 m high and 50 m long, together with two smaller ridges 15 m long and 2 m high, covering an area of about 0.5 ha at National Grid Reference SD297028 (Figures 1a, b).

During the first growing season in 2012, about 20% of the bare sand was colonised by a total of 65 vascular plants, five (8%) being non-native and three (5%) regionally or nationally notable. Nearly half of the species (48%) were classed as ‘ruderals’, typically associated with disturbed ground, the remainder being more characteristic sand-dune plants. Further monitoring took place each summer, the number of vascular plants increasing to 87 in 2013. Numbers

thereafter fluctuated, falling to 71 in 2023. The proportion of ruderal species fell from about 48% in 2012 to 19.7% in 2023. In the latter year, seven (9.9%) of the plants were regionally or nationally notable, while the same number was non-native (Smith 2021, 2022, 2023; Smith & Lockwood, 2012; 2013; 2014; 2015; 2016; 2017; 2018; 2019, 2020).

Monitoring in 2024

Recording visits took place at intervals during the spring and summer of 2024. The number of vascular plants identified increased from 71 to 74 (Table 1). However, there was no overall trend of numbers with time (Figure 2). Six (8.1%) of the plants recorded in 2024 were regionally or nationally notable, there being no significant trend since the beginning of the study (Figure 3). Only six (8.1%) of the taxa found were non-native, this being a particularly low figure compared to the 38% aliens for the dune system as a whole (Smith, 2015). Thirteen (17.6%) of the year total were classed as ruderals, being slightly lower than 19.7% in 2023. The proportion of ruderal plants continued to show a slow decline over time (Figure 4), as did the estimated proportion of bare sand (Figure 5). There was also a highly significant positive relationship between percentage of ruderals and percentage bare sand (Figure 6), reflecting the fact that ruderal plants are often associated with disturbed, open substrates.

Only one new vascular taxon was added during the year: *Prunella vulgaris* (Selfheal). This brought the grand total of vascular plants recorded on the ridges during the thirteen study seasons to 152, 20 (13%) being notable and 18 (12%) non-native (Table 1).

Unfortunately, the ‘nationally scarce’ *Coincya monensis* subsp. *monensis* (Isle of Man Cabbage), a British endemic, was not re-found, having been restricted to south-facing slopes. However, the ‘nationally scarce’ *Centaureum littorale* (Seaside Centaury) and ‘endangered’ *Centaureum intermedium* (Intermediate Centaury) were recorded again.

As before, sporadic observations were made on invertebrates. A few nesting burrows of the Early Colletes solitary bee (*Colletes cunicularius*) were noted in April but these were much reduced in number due to the lack of bare sand. A few common butterflies were observed. No evidence of Rabbit (*Oryctolagus cuniculus*) grazing was seen. Dog-walkers maintained short vegetation along some of the valleys, creating suitable conditions for smaller, less competitive, plants, such as *Centaureum* spp.

Conclusions & assessment

Development of coarse vegetation on the ridge crests continued during 2024, these being dominated by Marram (*Ammophila arenaria*) and False Oat-grass (*Arrhenatherum elatius*) with occasional tall herbs, such as Wild Parsnip (*Pastinaca sativa*) (Figures 7, 8). Overall species-richness has begun to show signs of a decline (Figure 2), although the trend is not statistically significant. Such a change would be expected, reflecting rapid ecological succession and a closed vegetation type with fewer opportunities for colonisation, especially by ruderal species. The proportion of the latter has shown a significant decline during the study (Figure 4). Plant species-richness seems to be higher on the ridges than the overgrown, scrub-invaded fixed-dunes that still prevail in the surrounding area. Several notable vascular taxa were present, especially on the south-facing slopes and in the troughs, though the proportion is lower than might be expected, probably due to the absence of wet-slack habitat which supports many of the dune system's rarer species (Smith, 2015). A high proportion of the plants recorded were native species. The expected benefits from varied topography and open conditions on the ridges are being gradually lost, due to vegetation overgrowth and, unless Rabbit activity or disturbance increase, this trend is likely to continue.

Acknowledgements

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References

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Figure 1a. Aerial photograph of Hightown sand ridges in 2015 (Google Earth).



Figure 1b. Same view as above in 2024.

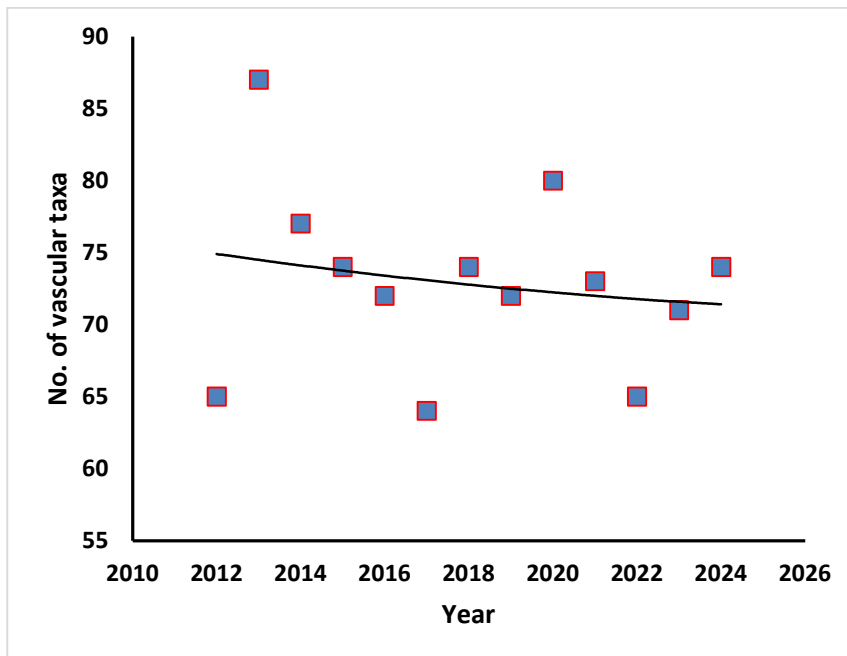


Figure 2. Number of vascular plants recorded each year from 2012 to 2024). Fitted line polynomial ($r = -0.181$; $p = 0.554$).

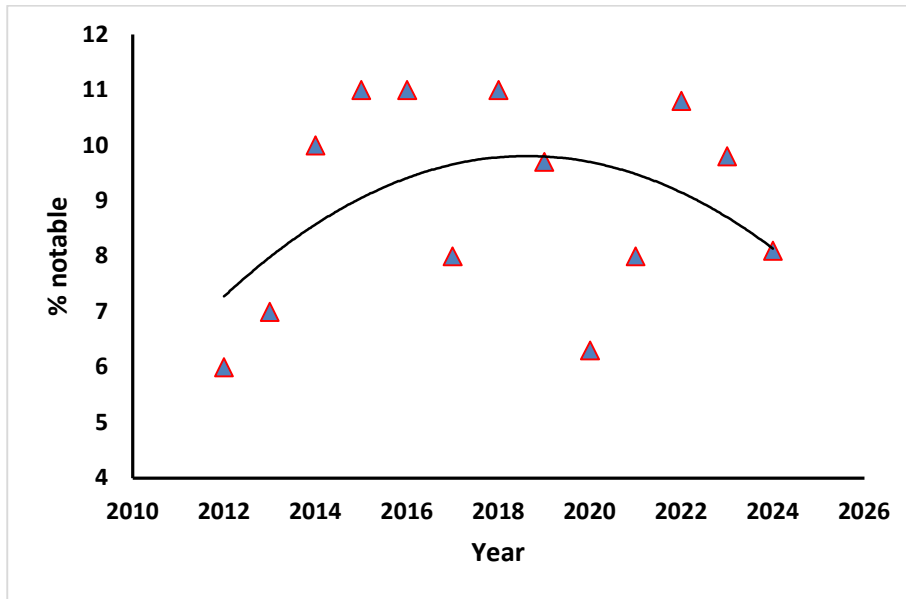


Figure 3. Proportion of notable plants, 2012-2024. Fitted line polynomial ($r = 0.434$; $p = 0.138$).

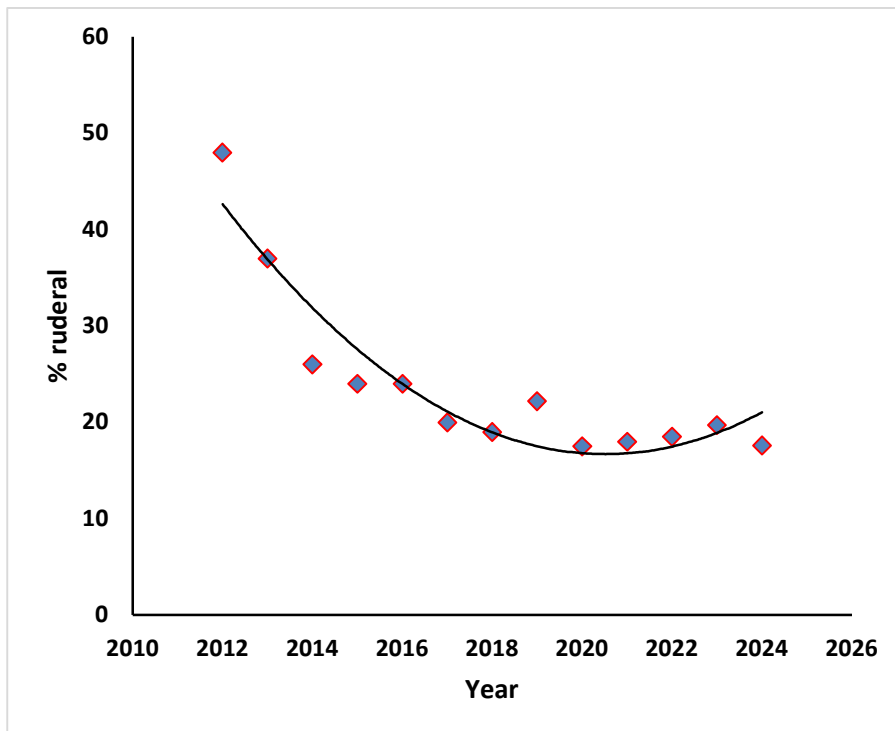


Figure 4. Proportion of ruderal plants recorded each year, 2012 to 2024. Fitted line polynomial ($r = -0.949$; $p \leq 0.00001$).

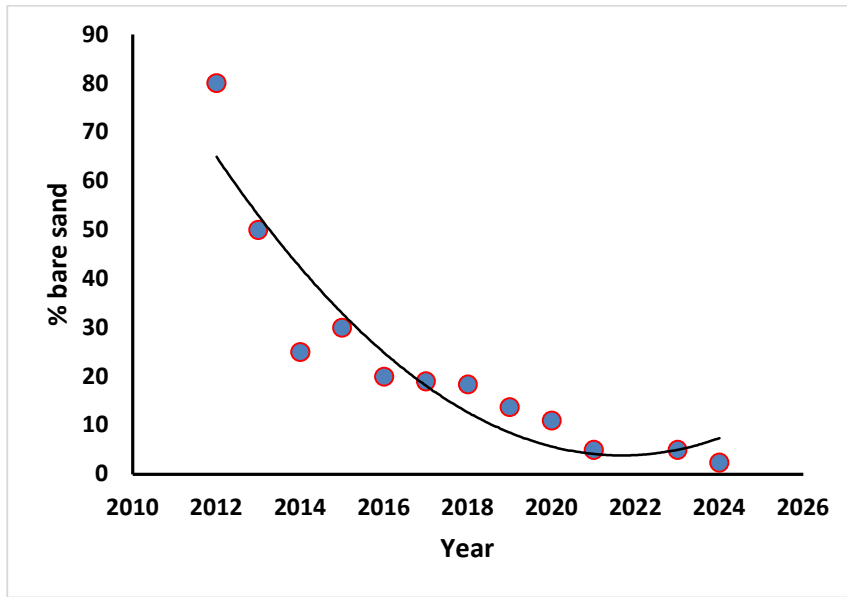


Figure 5. Proportion of bare sand estimated each year, 2012-2024 (Not recorded in 2022). Fitted line polynomial ($r = -0.935$; $p \leq 0.00001$).

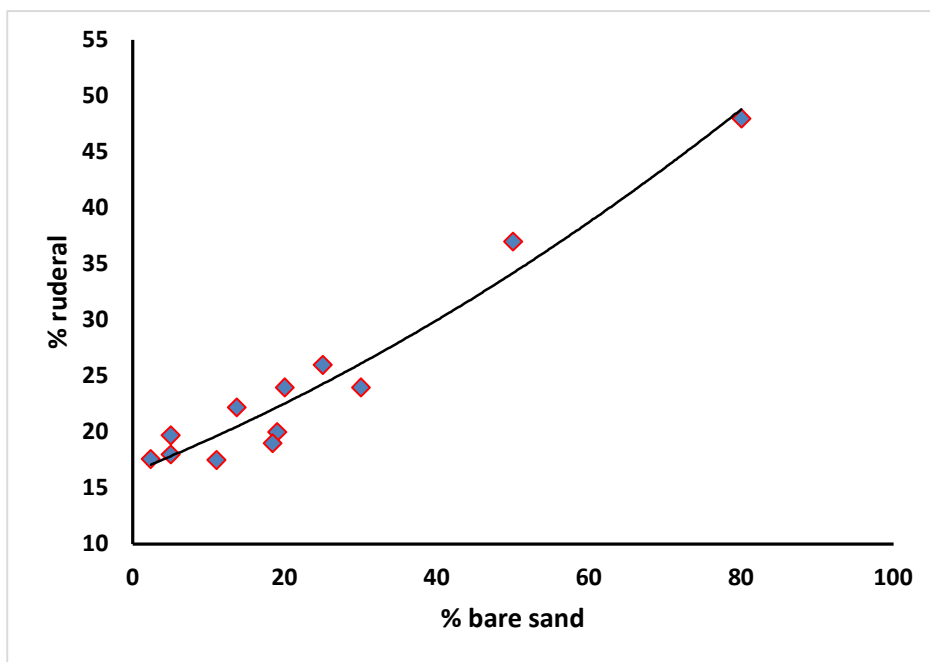


Figure 6. The relationship between the percentage of ruderal plants each year and percentage bare sand. Not recorded in 2022. Fitted line polynomial ($r = 0.976$ $p \leq 0.00001$).



Figure 7. Hightown ridges in September 2012, after one growing season (similar view to Figure 8).



Figure 8. General view of Hightown ridges, August 2024, showing dense ridge crest vegetation.

Table 1. Vascular plants recorded annually on the Hightown sand ridges, 2016 - 2024 (2012-15 excluded).

*non-native neophyte or introduced native; R = ruderal; r = rare; o = occasional; f = frequent; a = abundant; d = dominant; l = locally; v = very; Stat. = conservation status; NR = Nationally Rare; NS = Nationally Scarce; NT = Near Threatened; VU = Vulnerable; EN = Endangered (*italics* = England Red List); SCI = Species of Conservation Importance in North West England. Nomenclature follows C.A. Stace's *New Flora 4th edition* (2019) and subsequent amendments.

[illegible]

<i>Betula pendula</i>	Silver Birch								r	r	
<i>Blackstonia perfoliata</i>	Yellow-wort	r	o	r	lo		lo	lo			
<i>Bromus hordeaceus</i> R	Soft Brome				vlo						
<i>Cakile maritima</i>	Sea Rocket										
<i>Campanula rotundifolia</i>	Harebell		r	r	lo	lo	vlo				NT
<i>Capsella bursa-pastoris</i> R	Shepherd's-purse										
<i>Cardamine hirsuta</i>	Hairy Bitter-cress	o	o			o		o	o	r	
<i>Carex arenaria</i>	Sand Sedge	la	lf	lf	lf	lf	lf	lf	lf	lf	
<i>Carex flacca</i>	Glaucous Sedge	o		r	r	r	la	la	lf	lf	
<i>Carlina vulgaris</i>	Carlina Thistle				r	r			r		SCI
<i>Catapodium marinum</i>	Sea Hard-grass	r									
<i>Centaurea nigra</i>	Common Knapweed										
<i>Centaureum erythraea</i>	Common Centaury		o	o	o	r	o		r	o	
<i>Centaureum intermedium</i>	Intermediate Centaury		o	lf	lf	r	o		r	lo	EN
<i>Centaureum littorale</i>	Seaside Centaury	r	r	o	lo	o	lf		r		NS SCI
<i>Cerastium diffusum</i>	Sea Mouse-ear	o	o	o	o	lf	o	o	o	r	
<i>Cerastium fontanum</i>	Common Mouse-ear	o	o	f	o	o	o	o	o	o	
<i>Cerastium glomeratum</i> R	Sticky Mouse-ear										
<i>Cerastium semidecandrum</i>	Little Mouse-ear					r					
<i>Chamaenerion angustifolium</i> R	Rosebay Willowherb	o	o	o	lo	vlo	vlo	vlo	r	vlf	
<i>Chenopodium album</i> R	Fat-hen										
<i>Cirsium arvense</i> R	Creeping Thistle				r						
<i>Cirsium vulgare</i> R	Spear Thistle		r	r				r			
<i>Coincya monensis</i> subsp. <i>monensis</i>	Isle of Man Cabbage	o	o	r	o	r	o	r	r		NS SCI
<i>Consolida ajacis</i> *	Larkspur										
<i>Crataegus monogyna</i>	Hawthorn	o	o	o	o	o	o	lo	o	o	

<i>Crepis capillaris</i>	Smooth Hawk's-beard		r	o	o	o	r		r	o	
<i>Dactylis glomerata</i>	Cock's-foot	lf	lf	la	lf	lf	lf	lf	lf	lf	
<i>Dactylorhiza incarnata</i> subsp. <i>coccinea</i>	Early Marsh-orchid							r			NS NT SCI
<i>Elymus junceiformis</i>	Sand Couch			r							
<i>Elymus repens</i> R	Common Couch		o								
<i>Epilobium montanum</i> R	Broad-leaved Willowherb										
<i>Equisetum arvense</i> R	Field Horsetail	la	o	o	o	o	o	o	o	o	
<i>Erigeron acris</i>	Blue Fleabane				r						
<i>Erodium aethiopicum</i>	Sticky Stork's-bill			r	r						NS SCI
<i>Erodium cicutarium</i> R	Common Stork's-bill	o	o	r	r		o				
<i>Erophila verna</i> R	Common Whitlow-grass					o				r	
<i>Ervilia hirta</i> R	Hairy Tare								vlo		
<i>Eryngium maritimum</i>	Sea Holly	r		r							SCI NT
<i>Euphorbia paralias</i>	Sea Spurge	r	r	r							SCI
<i>Euphrasia nemorosa</i>	Common Eyebright						r	r		vlo	NT
<i>Fallopia convolvulus</i> R	Black Bindweed										
<i>Festuca ovina</i>	Sheep's-fescue					r					
<i>Festuca rubra</i> agg.	Red Fescue	o	o	lf	la	la	la	la	a	a	
<i>Filipendula ulmaria</i>	Meadowsweet	r									
<i>Galium aparine</i> R	Cleavers							la			
<i>Galium verum</i>	Lady's Bedstraw		vlf		lf	r				vlo	
<i>Geranium molle</i>	Dove's-foot Crane's-bill	r									
<i>Hieracium umbellatum</i>	Umbellate Hawkweed		o	o	lo	o	o	o	o	r	
<i>Hippophae rhamnoides</i> *	Sea Buckthorn	r	r	r	r	r	r		lo	r	
<i>Holcus lanatus</i>	Yorkshire-fog	la	la	la	la	lf	o	o	o	f	
<i>Hordeum murinum</i> R	Wall Barley				vlo						

<i>Hyacinthoides</i> × <i>massartiana</i> *	Hybrid Bluebell		r				r	r			
<i>Hypochaeris radicata</i>	Cat's-ear	o	lf	lf	f	lf	f	f	f	o	
<i>Jacobaea vulgaris</i> R	Common Ragwort	f	o	o	o	o	o	o	o	o	
<i>Juncus articulatus</i>	Jointed Rush					r	r			r	
<i>Juncus bufonius</i> R	Toad Rush						vlf			lo	
<i>Lathyrus pratensis</i>	Meadow Vetchling	lf	lf	lf	lf	lf	lf	lf	lf	lf	
<i>Leontodon saxatilis</i>	Lesser Hawkbit		o	o	o	o	o	o	o	o	
<i>Lepidium didymum</i> * R	Lesser Swine-cress										
<i>Leymus arenarius</i>	Lyme-grass			r		r		r			
<i>Lolium perenne</i>	Perennial Rye-grass	r		r	vlo	vlo	o	o		lo	
<i>Lotus corniculatus</i>	Common Bird's-foot-trefoil	f	lf	lf	lf	lf	lf	lf	lf	lf	
<i>Lupinus arboreus</i> * R	Tree Lupin										
<i>Luzula campestris</i>	Field Wood-rush		o	r		o	o	lf	o	o	
<i>Malus</i> sp.*	Apple					r	r		r	r	
<i>Medicago lupulina</i> R	Black Medick			vla	vla	vla			r	vla	
<i>Melilotus officinalis</i> * R	Ribbed Melilot										
<i>Myosotis ramosissima</i>	Early Forget-me-not	r									SCI
<i>Oenothera</i> × <i>britannica</i> *R	Hybrid Evening-primrose						r				NS
<i>Oenothera biennis</i> * R	Common Evening-primrose						r				
<i>Oenothera glazioviana</i> × <i>biennis</i> × <i>cambrica</i> * R	Triple Hybrid Evening-primrose			lo		r			vlo	r	NS
<i>Oenothera glazioviana</i> * R	Large-flowered Evening-primrose		o	o	o	o	o	r	o	lf	

<i>Oenothera</i> × <i>fallax</i> * R	Intermediate Evening- primrose		lf	o	o	r	o		lf	o	
<i>Ononis repens</i>	Common Restharrow	o	lf	lf	lf	o	o	o	lf	lf	
<i>Papaver dubium</i>	Long-headed Poppy			r							
<i>Pastinaca sativa</i> subsp. <i>sylvestris</i>	Wild Parsnip	o	lf	la	o	o	o	o	o	o	
<i>Phleum arenarium</i>	Sand Cat's-tail			vlf		r					SC NT
<i>Pilosella officinarum</i>	Mouse-ear Hawkweed							r			
<i>Plantago coronopus</i>	Buck's-horn Plantain		o		o			r			
<i>Plantago lanceolata</i>	Ribwort Plantain	lf	lf	lf		o	o	o	o	o	
<i>Plantago major</i> R	Greater Plantain					r	r	r		r	
<i>Poa annua</i> R	Annual Meadow-grass	r		vlf		r	vla	vla	o	lo	
<i>Poa humilis</i>	Spreading Meadow-grass					o	o	o	r		
<i>Poa pratensis</i>	Smooth Meadow-grass					o	o	o	o	o	
<i>Polygala vulgaris</i>	Common Milkwort	lf	lf	lf	o	o	o	o	o	o	
<i>Polygonum depressum</i> R	Equal-leaved Knotgrass										
<i>Polygonum aviculare</i> R	Knotgrass										
<i>Potentilla reptans</i>	Creeping Cinquefoil	r		r		r	lo		r		
<i>Prunella vulgaris</i>	Selfheal									r	
<i>Prunus</i> sp.	Cherry				r	r	r	r	r	r	
<i>Pyrola rotundifolia</i>	Round-leaved Wintergreen							r			NS SCI
<i>Ranunculus acris</i>	Meadow Buttercup	r		r	r	r	vlf	o	r	lo	
<i>Ranunculus bulbosus</i>	Bulbous Buttercup	o	r	o	o	o	o		o	o	
<i>Ranunculus repens</i>	Creeping Buttercup										
<i>Raphanus raphanistrum</i> subsp. <i>maritimus</i>	Sea Radish	r	r	o	o	o	r	r	r	r	SCI

[illegible]

<i>Triticum aestivum</i> R	Bread Wheat										
<i>Urtica dioica</i>	Common Nettle	la	lf	la	lf	lf	vlf	lf		lf	
<i>Vicia cracca</i>	Tufted Vetch		o		o	vlf	vlf		r	o	
<i>Vicia lathyroides</i>	Spring Vetch	r									SCI
<i>Vicia sativa</i> subsp. <i>nigra</i>	Common Vetch	o	o	o	o	o	o		r	r	
<i>Vicia sativa</i> subsp. <i>sativa</i>	Common Vetch	o				r			r		
<i>Viola arvensis</i> R	Field Pansy										
<i>Viola canina</i>	Heath Dog-violet	r	o	o							NT SCI <i>VU</i>
Total:152 (16 alien) (43 ruderal)		72	64	74	72	80	73	65	71	74	20 notable