

Vascular flora of two scrub-cleared slacks at Hightown sand-dunes, Merseyside; 2024 update

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Summary

Following clearance from dense Sea Buckthorn scrub, the vascular flora of two Hightown dune-slacks (total area 0.41 ha) was recorded annually from 2013 to 2024. By the latter year, 200 taxa had been recorded in the two slacks, 26 (13%) of these being non-native and 22 (11%) regionally or nationally notable. A gradual increase in species-richness over time was followed by an apparent decline, though this trend was statistically significant for only one of the slacks. There was a declining trend in the proportion of ruderal plants, these being replaced by typical fixed-dune and dune-slack species. The central areas of both slacks were invaded by birch and other scrub species, while coarse herbaceous vegetation spread over the slack floors. This was attributed to soil enrichment from the original stand of Sea Buckthorn, coupled with insufficient Rabbit-grazing. While the current vegetation represents a marked ‘improvement’ over its previous condition, active management is now required to maintain this interest. This began in 2020, with the partial removal of birch from one slack by *Gems in the Dunes* volunteers. However, the cut birch coppiced and re-grew to heights of up to 3 m, while waist-deep coarse vegetation colonised most of both slack areas, making access difficult.

Introduction

Smith (2021; 2022; 2023) and Smith & Lockwood (2013; 2014; 2015; 2016; 2017; 2018; 2019; 2020) described floristic surveys of two small dune-slacks (slacks no. 2 & 3), with areas of about 3300 m² and 830 m² respectively (total 0.41 ha). Located in the northern part of Hightown sand-dunes (National Grid References: SD 2970 0312; SD 2874 0304), within the Sefton Coast Site of Special Scientific Interest (SSSI), the slacks were restored from dense Sea Buckthorn (*Hippophae rhamnoides*) scrub in January/ February 2013 (Figure 1). The slacks were first studied in the 1980s, when they supported a diverse, open vegetation, including several scarce plants, such as Early Marsh-orchid (*Dactylorhiza incarnata* subsp. *coccinea*), Marsh Helleborine (*Epipactis palustris*),

Variegated Horsetail (*Equisetum variegatum*) and Autumn Gentian (*Gentianella amarella*). However, these and other slack flora had disappeared by 2010 as 4 m-high Sea Buckthorn colonised the slacks and adjacent dune ridges (Figure 2).

Following removal and stump-treatment of the Sea Buckthorn, under the auspices of the Sefton Coast Landscape Partnership Scheme (Figure 3), visits were made in late summer 2013 to record vascular plants in the cleared slacks, the aim being to judge the success of the scrub control programme. A flush of ruderal growth in the extensive bare ground was stimulated by nutrients released from decaying organic matter and from nitrogen fixed by Sea Buckthorn. In total, 99 vascular taxa were recorded in 2013, 76 being found in slack 2 and 74 in slack 3. Thirteen species (13%) were non-native and six (6%) regionally or nationally notable. About 37 plants (37% of the total) were considered to be ‘ruderals’ adapted to growing in open disturbed ground, the rest being typical duneland species.

Further summer recording took place from 2014 to 2023. Overall species-richness gradually increased up to about 2020 and then began to fall, while the proportion of ruderal plants fell from 37% to 23%. The number of non-native plants was relatively low throughout, being 13% of the total in 2023. Overall, 11% of the plants recorded were regionally or nationally notable, including Autumn Gentian (17 spikes in 2014 only), while increasing populations of Pyramidal Orchid (*Anacamptis pyramidalis*) (2015, 2016, 2017, 2018, 2020, 2021, 2022, 2023), together with small numbers of Seaside Centaury (*Centaureum littorale*) (2015), Intermediate Centaury (*C. intermedium*) (2014, 2015), Early Marsh-orchid (2018, 2019, 2020, 2021), Dune Helleborine (*Epipactis dunensis*) (2017), Marsh Helleborine (2015, 2016) and Round-leaved Wintergreen (*Pyrola rotundifolia* subsp. *maritima*) (2018) were found. By the end of the 2023 survey, a grand total of 192 vascular taxa had been recorded in the two slacks, 25 (13%) of these being non-native and 21 (11%) regionally or nationally notable (Table 1).

2024 survey

Visits were made during the spring and summer of 2024 to record floristics in the two slacks. In slack 2, vascular plant species-richness increased slightly from 70 to 79 taxa, while 68 taxa (up from 59) were identified in slack 3. The total for both slacks combined

was 97, a marked increase from 85 the previous year (Table 1). Four new taxa were found in 2024: Italian Lord's-and-Ladies (*Arum italicum*), Early Forget-me-not (*Myosotis ramosissima*), Annual Meadow-grass (*Poa annua*) and an unidentified shrub in slack 2. This compares with three new taxa in 2023. Twelve non-native plants were listed, this being 12% of the total. Only seven (7%) regionally or nationally notable plants were found. Pyramidal Orchids were occasional in slack 2 but were not counted this year. As in 2023, Round-leaved Wintergreen, Autumn Gentian, Marsh Helleborine, Dune Helleborine, Seaside Centaury and Intermediate Centaury were not re-found but a small population of Early Marsh-orchid persisted in slack 2, while about 36 plants of Twayblade (*Neottia ovata*) were found where birch had been felled in slack 3. Sizeable populations of the regionally rare Common Gromwell (*Lithospermum officinale*) were again present in both slacks, this being the species' stronghold on the Sefton Coast. Figure 4 shows the change in annual species number over time for the two slacks. Except in 2019, the larger slack 2 supported more taxa than slack 3. The trend lines suggest a gradual increase in species-richness until about 2018 when totals began to fall. Only in slack 3 was there a statistically significant relationship between number of taxa and time. Figure 5 shows an apparent increase in vascular plant numbers for both slacks combined, followed by a decline. Although the trend is not statistically significant, it has similarities to the 'hump-back' model of floristic succession described by Isermann (2011) for a dry dune chronosequence in Germany.

In 2024, 17 taxa (17.5% of the total) were classed as 'ruderal', this proportion having markedly declined, followed by a small increase since 2018, perhaps due to birch removal creating some disturbed ground (see below). The overall trend was statistically significant (Figure 6). The proportion of non-native plants varied from year to year, within the range of about 9% to 14% (Figure 7), with a significant increasing trend. The percentage of notable plants over time gradually increased, the overall trend being just significant (Figure 8). Since recording began in 2013, a total of 200 vascular taxa has been recorded in the two slacks, 26 (13%) of these being non-native and 22 (11%) regionally or nationally notable (Table 1).

In recent years, stands of young birch (mainly Silver Birch *Betula pendula*) in the central areas of both slacks have become dominant, reaching heights of about 5 m (Figure

9). However, a start was made in early 2020 to cut down the large birch stand in slack 2, about half of it being removed by *Gems in the Dunes* volunteers before Covid restrictions kicked in. In the 2023/24 winter, some of the birch in slack 3 was also felled (Figure 10). Several ruderal plants colonised the bare ground, previously under dense shade, in slack 2, some of the new species recorded in 2020 falling into this category (Smith & Lockwood, 2020). This probably accounts for the sharp upturn in the proportion of ruderals in 2020 (Figure 6). However, several of these were not found in 2021, 2022, 2023 and 2024. Elsewhere, waist-deep coarse vegetation, including Bramble (*Rubus fruticosus* agg.), Dewberry (*R. caesius*), False Oat-grass (*Arrhenatherum elatius*) and Rosebay Willowherb (*Chamaenerion angustifolium*), continued to spread, with no short, open vegetation surviving. As before, there was re-growth of invasive Sea Buckthorn, some of this being cut when encountered. Although there was no sign of grazing by Rabbits (*Oryctolagus cuniculus*), evidence of willow-browsing by deer (presumably Roe Deer *Capreolus capreolus*) was found (Figure 11). A major concern is the sudden appearance, in 2023, of Wood Small-reed *Calamagrostis epigejos* in slack 3 and its subsequent rapid spread in 2024 (Figure 12).

Away from the woodland/scrub areas, the vegetation showed slight similarities to the UK National Vegetation Classification's SD16: *Salix repens*-*Holcus lanatus* dune-slack community, this being noted in previous annual reports (e.g. Smith & Lockwood, 2018).

Discussion and assessment

The two slacks continue to support a richer community of plants than before restoration, 200 higher plants recorded in an area of only 0.41 ha (equivalent to 488/ha) being impressive. However, vegetation overgrowth, especially by birch, threatens this diversity. The rapid growth of coarse herbaceous and woody vegetation is probably a consequence of soil enrichment caused by nitrogen fixed from the atmosphere by the earlier stand of Sea Buckthorn, coupled with insufficient Rabbit grazing. Aerial deposition of nitrogen from domestic, industrial and agricultural sources may also have contributed. The recent rapid increase of Wood Small-reed in slack 2 is concerning as this species is highly invasive on dunes in the Netherlands. The variety of notable plants has increased a little

over time but the proportion, currently about 7%, is much lower than the 17% for the dune system as a whole (Smith, 2015). The slack basins are so shallow that standing water is present only in exceptionally wet years; therefore, many of the specialist wet-slack rarities are absent. The flora consists mainly of native species, the proportion of introduced taxa has increased over time but remains relatively low (12-13%) compared with the rest of dune system which supports about 40% alien plants (Smith, 2015). As in Smith & Kimpton's (2008) survey of a scrub-cleared slack at Cabin Hill National Nature Reserve, ruderal plants have declined significantly over time, being replaced by characteristic dry-slack and fixed-dune species. However, clearance of birch in early 2020 and 2024 provided more bare ground for an expected, if temporary, increase in ruderals (Figure 6).

In conclusion, until recently, the condition of the two restored slacks represented a marked 'improvement' in their former condition but the slacks are now in need of active management to maintain this interest and return to 'favourable condition' in this part of the Sefton Coast SSSI. It is hoped that the removal of birch stands that began in 2020 can continue, including stump treatment to prevent coppicing. In the absence of grazing, annual late-summer mowing, with removal of arisings, would be beneficial. Although it would be a major undertaking, the vegetation and top-soil should ideally be scraped off, so that succession can begin again on the underlying calcareous sand.

References

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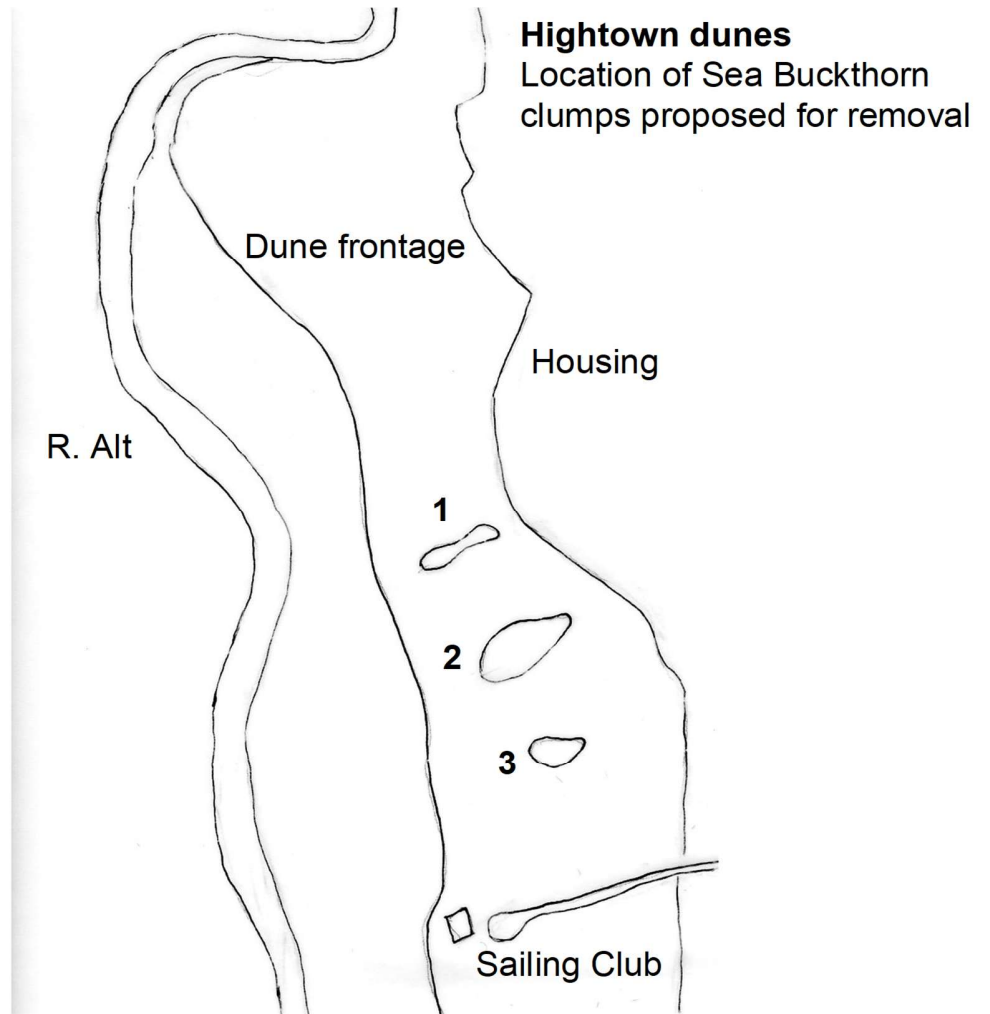


Figure 1. Locations of slacks 2 and 3 at Hightown dunes.



Figure 2. Hightown slack 2 before clearance, May 2009.



Figure 3. Hightown slack 2 after clearance and stump treatment, February 2013.

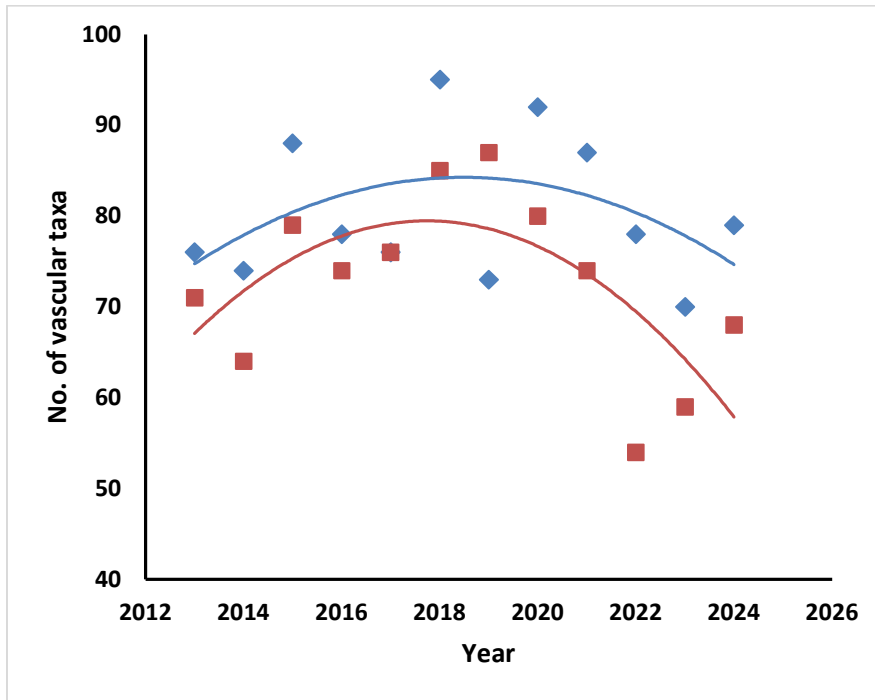


Figure 4. Annual change in species-richness, 2013-2024. Blue = slack 2 ($r = 0.45$; $p = 0.158$); red = slack 3 ($r = 0.677$; $p = 0.016$). Fitted lines polynomial.

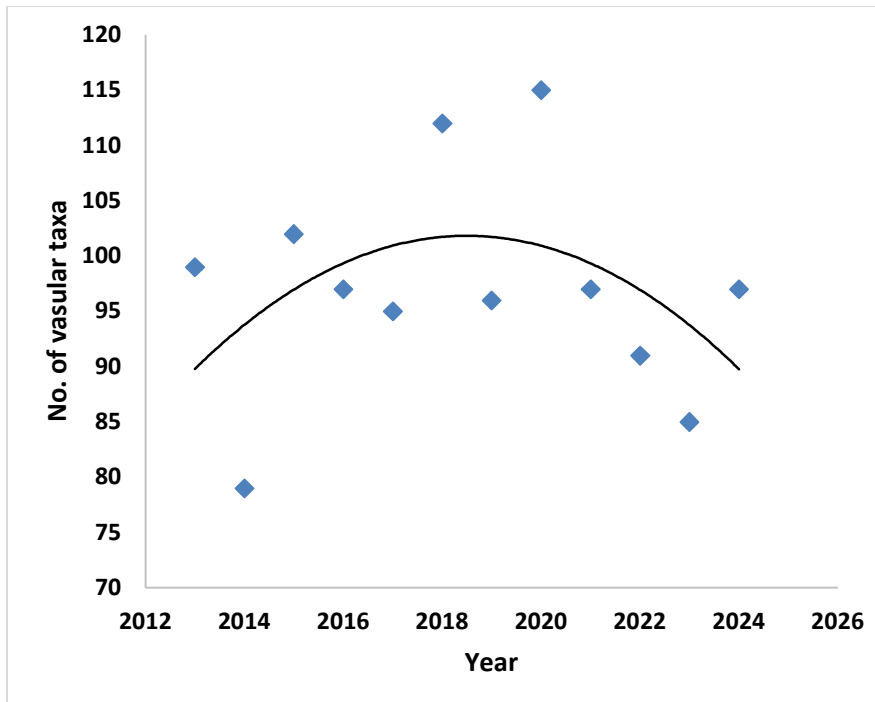


Figure 5. Annual change in species-richness for both slacks combined, 2013-2024 ($r = 0.441$; $p = 0.151$). Fitted line polynomial.

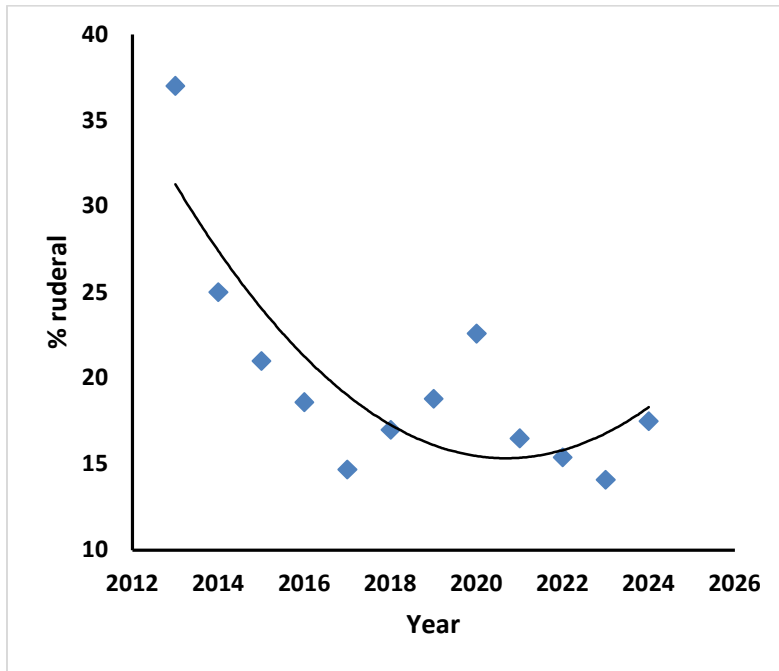


Figure 6. Changes in the proportion of ruderal plants in both slacks, 2013-2024 ($r = -0.823$; $p = 0.001$). Fitted line polynomial.

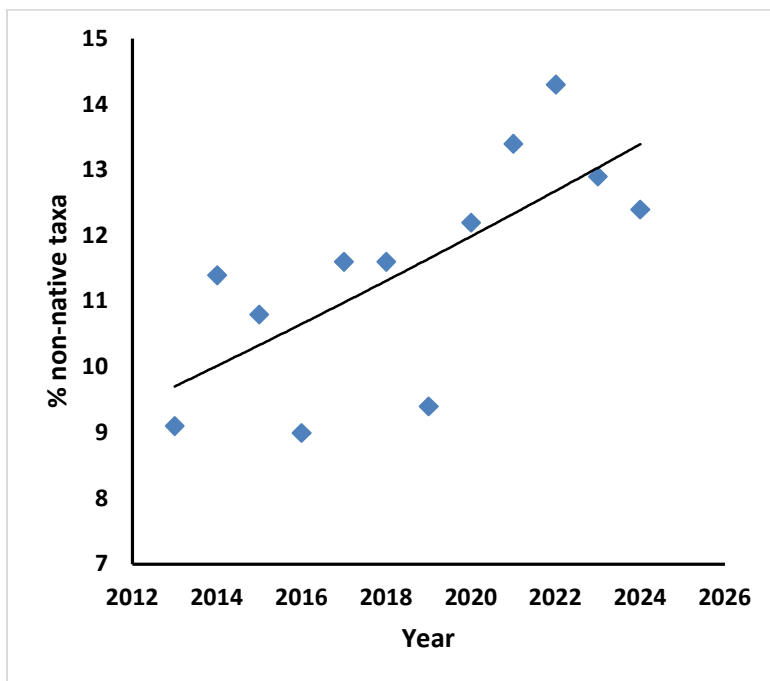


Figure 7. Changes in the proportion of non-native taxa, 2013-2024 ($r = 0.713$; $p = 0.0098$). Fitted line polynomial.

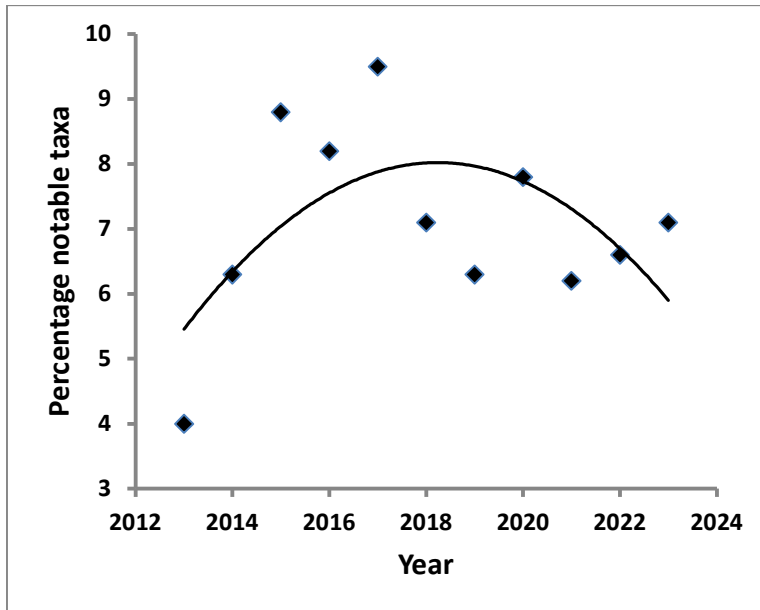


Figure 8. Changes in the proportion of notable vascular plants 2013-2024 ($r = 0.589$; $p = 0.044$). Fitted line polynomial.



Figure 9. Slack 2 showing birch invasion, September 2024.



Figure 10. Birch removal slack 3, May 2024.

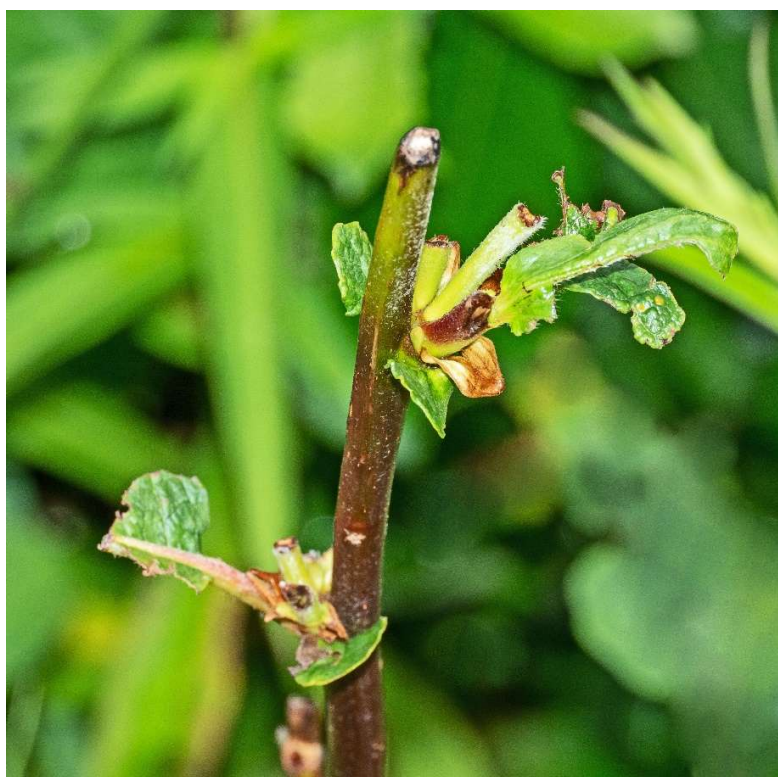


Figure 11. Grey Willow *Salix cinerea* browsed by deer, slack 3, July 2024

Table 1. Vascular plants recorded annually in slacks 2 and 3 during 2016-2024 (2013 - 2018 excluded). Nomenclature follows C.A. Stace's *New Flora* 4th edition (2019) and subsequent updates.

[illegible]

<i>Alliaria petiolata</i>	Garlic Mustard		o	lf									
<i>Amelanchier lamarckii</i> *	Juneberry			r			r			r	r	o	r
<i>Ammophila arenaria</i>	Marram	o	o	lf	lf	lf	o	o	o	o	o	lf	lf
<i>Anacamptis pyramidalis</i> SCI	Pyramidal Orchid		o	o	lo	o	o		r				
<i>Angelica sylvestris</i>	Wild Angelica	o	o	r				r					
<i>Anthoxanthum odoratum</i>	Sweet Vernal-grass	lf	lf	lf	lo	lo	lf	lf	lf	lf	lf	lf	o
<i>Anthyllis vulneraria</i>	Kidney Vetch		lo	r				r		r			
<i>Antirrhinum majus</i> * R	Snapdragon												
<i>Aquilegia vulgaris</i> *	Columbine							r	r	r			
<i>Arabidopsis thaliana</i>	Thale-cress		r										
<i>Arctium minus</i>	Lesser Burdock		r										
<i>Arrhenatherum elatius</i>	False Oat-grass	la	la	la	la	la	la	lf	lf	lf	lf	lf	lf
<i>Artemisia vulgaris</i> R	Mugwort	r	r	r	r		r						
<i>Arum italicum</i> *													r
<i>Asparagus officinalis</i> *	Garden Asparagus		r	r	r		r	r	r	r	r		r
<i>Aster</i> sp.* R	Michaelmas-daisy		r					lo		vlf	vla	vla	vla
<i>Avenula pubescens</i>	Downy Oat-grass							lf		r	lo	lf	lo
<i>Ballota nigra</i> R	Black Horehound												
<i>Betula pubescens</i> R	Downy Birch	o	o	o	o		r						r
<i>Betula pendula</i> R	Silver Birch	ld	ld	ld	ld	ld	ld	ld	ld	ld	ld	ld	ld
<i>Blackstonia perfoliata</i>	Yellow-wort	r											
<i>Bromus hordeaceus</i> R	Soft Brome							lf	vlo				
<i>Calamagrostis epigejos</i>	Wood Small-reed											vlo	la
<i>Calystegia</i> sp.	Bindweed		lo	lo	r		r						
<i>Campanula persicifolia</i> *	Peach-leaved Bellflower				r								
<i>Campanula rotundifolia</i> NT	Harebell	o	o	r	r			o	o	o	o		
<i>Capsella bursa-pastoris</i> R	Shepherd's-purse												
<i>Cardamine pratensis</i>	Cuckooflower	r	r	vlf	vlf	o							
<i>Carex arenaria</i>	Sand Sedge	lo	o	o	r	r	o	lo	lo	lo	lo	lo	lo

<i>Carex flacca</i>	Glaucous Sedge			r									
<i>Carex otrubae</i>	False Fox-sedge												
<i>Carlina vulgaris</i> SCI	Carlina Thistle							vlf	vlf	vlf	r	r	
<i>Centaurea nigra</i>	Common Knapweed	la	lf	lf	lf	lf	lf						
<i>Centaureum intermedium</i> NR EN	Intermediate Centaury												
<i>Centaureum erythraea</i>	Common Centaury							r					
<i>Centaureum littorale</i> NS, SCI	Seaside Centaury												
<i>Cerastium diffusum</i>	Sea Mouse-ear												
<i>Cerastium fontanum</i>	Common Mouse-ear	lo	o	o			o	o	o	o			o
<i>Chamaenerion angustifolium</i> R	Rosebay Willowherb	la	la	la	la	la	la	la	la	la	la	la	la
<i>Chenopodium album</i> R	Fat-hen		r										
<i>Cirsium arvense</i> R	Creeping Thistle	o	o	o	o	o	o	o	o	o	o	o	o
<i>Cirsium vulgare</i> R	Spear Thistle			o	r			r					r
<i>Claytonia perfoliata</i> * R	Spring-beauty												
<i>Claytonia sibirica</i> *	Pink Purslane							o	lf	r			
<i>Conyza canadensis</i> * R	Canadian Fleabane		r										
<i>Conyza sumatrensis</i> * R	Guernsey Fleabane												
<i>Cotoneaster</i> sp.*	Cotoneaster		r	r	r	r	r						
<i>Crataegus monogyna</i>	Hawthorn	o	o	o	o	o	o	o	o	o	o	o	o
<i>Crepis capillaris</i>	Smooth Hawk's-beard	r	r	r			r						
<i>Dactylis glomerata</i>	Cock's-foot	o	o	o	o	o	o	o	o	o	o	r	o
<i>Dactylorhiza incarnata</i> subsp. <i>coccinea</i> NS NT SCI	Early Marsh-orchid			vlo	vlo		vlo	lo	lo	lo	vlo		
<i>Dactylorhiza</i> × <i>grandis</i>	Hybrid Marsh-orchid				r								
<i>Elaeagnus</i> × <i>submacrophylla</i> *	Hybrid Oleander				r	r							
<i>Epilobium ciliatum</i> *	American Willowherb		o	r	o			r	r	o	o		
<i>Epilobium hirsutum</i>	Great Willowherb	lf	lf	lf	lf	lf	o	o	o	o			o
<i>Epilobium montanum</i> R	Broad-leaved Willowherb							r					

<i>Epilobium obscurum</i>	Short-fruited Willowherb							r					
<i>Epilobium parviflorum</i>	Hoary Willowherb			o	o				r	o			
<i>Epipactis dunensis</i> NR SCI	Dune Helleborine												
<i>Epipactis palustris</i> NT SCI	Marsh Helleborine												
<i>Equisetum arvense</i> R	Field Horsetail	o	o	o	o	o	o	o	o	lf	lf	o	o
<i>Equisetum variegatum</i> SCI	Variegated Horsetail												
<i>Equisetum ×litorale</i>	Shore Horsetail					lf							
<i>Erigeron acris</i>	Blue Fleabane												
<i>Euonymus europaeus</i>	Spindle		r	r	r	r	r	r	r	r		r	
<i>Eupatorium cannabinum</i>	Hemp-agrimony							r	r				r
<i>Euphorbia portlandica</i> SCI	Portland Spurge		r										
<i>Euphrasia confusa</i> VU VU	Confused Eyebright	r	vlf										
<i>Euphrasia nemorosa</i> NT NT	Common Eyebright												
<i>Fallopia convolvulus</i> R	Black Bindweed												
<i>Festuca rubra</i>	Red Fescue	lf	lf	lf	lf	lf	lf	lf	lf	lf	lf	lf	lf
<i>Filipendula ulmaria</i>	Meadowsweet	lf	lf	lf	lf	lf	lf	o		vlf		vlf	o
<i>Fragaria ananassa</i> *	Garden Strawberry			r	r								
<i>Galium aparine</i> R	Cleavers	o	o	o	r	lo	o	o	o	o	o	o	o
<i>Gentianella amarella</i> NT	Autumn Gentian												
<i>Geranium molle</i>	Dove's-foot Crane's-bill			r									
<i>Geranium robertianum</i>	Herb-Robert	o	o	o	o	o	o	o	o	o		o	r
<i>Geum urbanum</i>	Wood Avens	o	o	o	o	lf	o	o	o	o	o		o
<i>Hedera hibernica</i>	Atlantic Ivy			r			vlf						
<i>Helianthus annuus</i> * R	Sunflower												
<i>Hieracium</i> sp.	Hawkweed	o						o	r				
<i>Hieracium umbellatum</i>	Umbellate Hawkweed	o	o	o	o	o	o	o	o	o	o		o
<i>Hippophae rhamnoides</i> *	Sea Buckthorn	o	o	o	o	o	o	o	o	o	o	ld	o
<i>Holcus lanatus</i>	Yorkshire-fog	o	o	la	lf	la	la	la	la	la	la		o
<i>Hyacinthoides × massartiana</i> *	Hybrid Bluebell		r	r	lo	lo	vlf			r		r	
<i>Hypericum androsaemum</i>	Tutsan					r	r						

<i>Hypochaeris radicata</i>	Cat's-ear	lo	lo	lo	lo		lo	r	lo	lo	lo		
<i>Ilex aquifolium</i>	Holly	r	r	r	r	r	r		r	r	r	r	r
<i>Juncus conglomeratus</i>	Compact Rush									r			
<i>Juncus effusus</i>	Soft Rush									r			r
<i>Juncus bufonius</i> R	Toad Rush		lo										
<i>Juncus inflexus</i>	Hard Rush	lo	lo	o	o	o	r			r			
<i>Juncus ranarius</i> SCI	Frog Rush												
<i>Lamium album</i>	White Deadnettle								r				
<i>Lathyrus pratensis</i>	Meadow Vetchling	lo	lo	lo	lo	lo	lf						
<i>Leontodon saxatilis</i>	Lesser Hawkbit									r			
<i>Leucanthemum vulgare</i>	Oxeye Daisy							r	r		r	r	vlf
<i>Linaria purpurea</i> *	Purple Toadflax							r	r				
<i>Linum bienne</i> SCI	Pale Flax		r										
<i>Linum catharticum</i>	Fairy Flax	lf	lf	vlf					r				
<i>Lithospermum officinale</i> SCI	Common Gromwell	o	o	o	o	o	o	o	o	o	o	o	o
<i>Lonicera periclymenum</i>	Honeysuckle	la	la	la	la	la	la	la	la	la	la	la	la
<i>Lotus corniculatus</i>	Common Bird's-foot-trefoil	lf	lf	lf	o	o	o	lf	lf	o	o	o	o
<i>Luzula campestris</i>	Field Wood-rush	lo	lf		r				r	r			
<i>Lycopus europaeus</i>	Gypsywort		lf	la	la		r	lf	lf	lf	vlf		r
<i>Malus pumila</i> *	Apple				r		r						
<i>Myosotis arvensis</i> R	Field Forget-me-not			r					r				
<i>Myosotis ramosissima</i> SCI	Early Forget-me-not						r						
<i>Myosotis sylvatica</i> *	Wood Forget-me-not								r				
<i>Neottia ovata</i>	Twayblade								r				lo
<i>Oenanthe crocata</i>	Hemlock Water-dropwort	o	o	o	o	o	lf	r					
<i>Oenothera glazioviana</i> * R	Large-flowered Evening-primrose		o	lf				r	r	r			r
<i>Oenothera</i> × <i>fallax</i> * R	Intermediate Evening-primrose			r						r			r
<i>Ononis repens</i>	Common Restharrow	o		r	r			lf	o	lf			

[illegible]

[illegible]

<i>Stellaria media</i>	Common Chickweed		r										
<i>Symphoricarpos</i> sp.*	Snowberry												
<i>Taraxacum</i> agg. R	Dandelion	o	o	o	o	o	o	o	o	o	o	o	o
<i>Teucrium scorodonia</i>	Wood Sage								r				
<i>Tragopogon pratense</i>	Goat's-beard	r	r	r			r	r					
<i>Trifolium arvense</i>	Hare's-foot Clover												
<i>Trifolium dubium</i>	Lesser Trefoil	la	r				vla						
<i>Trifolium pratense</i>	Red Clover	r	o	r	r		r						
<i>Trifolium repens</i>	White Clover	lf	lf	lf	lo		lf				r		r
<i>Tripleurospermum inodorum</i> R	Scentless Mayweed												
<i>Tripleurospermum maritimum</i>	Sea Mayweed		r										
<i>Urtica dioica</i> R	Common Nettle	lf	lf	o	o	o	o	o	lf	o	o	lf	o
<i>Veronica chamaedrys</i>	Germander Speedwell	lf	lf	lf	o	r	lf	r	r	r			
<i>Veronica hederifolia</i>	Ivy-leaved Speedwell		o										
<i>Viburnum opulus</i>	Guelder Rose											r	r
<i>Vicia cracca</i>	Tufted Vetch			r									
<i>Vicia sativa</i> subsp. <i>nigra</i>	Common Vetch		r		lo	lo	r		r		lo	r	
<i>Vicia sativa</i> subsp. <i>sativa</i>	Common Vetch	lf	o	r		r	r	o	o	r			
<i>Viola arvensis</i> R	Field Pansy												
<i>Viola canina</i> NT VU SCI	Heath Dog-violet												
Unknown shrub*							r						
Total 200 taxa (26 non-native; 44 ruderal, 22 notable)		73	92	87	78	70	79	87	80	74	54	59	68