

Vascular flora of two scrub-cleared slacks at Hightown sand dunes, Merseyside; 2025 update

Philip H. Smith, January 2026

Summary

Following clearance from dense Sea Buckthorn (*Hippophae rhamnoides*) scrub, the vascular flora of two Hightown dune slacks (slack 2 and slack 3), with a total area of 0.41 ha, was recorded annually from 2013 to 2025. By the latter year, 200 taxa had been recorded in the 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 (*Betula* spp.) and other woody 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- (*Oryctolagus cuniculus*) 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 (*Betula*) from one slack by *Gems in the Dunes* volunteers. However, the coppiced birch re-grew to heights of up to 3 m. The birch was cut again in the 2024/25 winter but was not effectively stump-treated and had vigorously re-grown by the summer of 2025. Since 2023, slack 3 has been invaded by a dense stand of Wood Small-reed (*Calamagrostis epigejos*).

Introduction & surveys to 2024

Smith (2021, 2022, 2023, 2024) 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 scrub in January/February 2013 (Fig. 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 (Fig. 2).

Following removal and stump-treatment of the Sea Buckthorn, under the auspices of the *Sefton Coast Landscape Partnership Scheme* (Fig. 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 the Sea Buckthorn. A total of 99 vascular taxa was 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 recording took place in spring and summer from 2014 to 2024. Species-richness gradually increased up to about 2020 and then began to fall, while the proportion of ruderal plants fell from 37% to 17.5%. The number of non-native taxa was relatively low throughout, being 12% of the total in 2024. In that year, 7% of the plants recorded were regionally or nationally notable. Significant floral finds during the 12 study seasons up to 2024 were: Autumn Gentian (17 spikes in 2014 only), Pyramidal Orchid (*Anacamptis pyramidalis*) (in the years 2015 to 2018 and 2020 to 2024), Seaside Centaury (*Centaureum littorale*) (2015), Intermediate Centaury (*C. intermedium*) (2014 and 2015), Early Marsh-orchid (2018 to 2022), Dune Helleborine (*Epipactis dunensis*) (2017), Marsh Helleborine (2015 and 2016) and Round-leaved Wintergreen (*Pyrola rotundifolia* subsp. *maritima*) (2018). By the end of the 2024 survey, a cumulative total of 199 vascular taxa had been recorded in the two slacks, 26 (13%) of these being non-native and 22 (11%) regionally or nationally notable (Table 1).

2025 survey

Visits were made again during the spring and summer of 2025 to record floristics in the two slacks. Vascular plant species-richness in slack 2 fell slightly from 79 to 71, while 63 taxa (down from 68) were identified in slack 3. The total for both slacks combined was 90, a small fall from 97 the previous year. Only one new plant was found: a single specimen of Southern Marsh-orchid (*Dactylorhiza praetermissa*). This contrasts with four new taxa in 2024. Eleven non-native plants were listed, this being 12% of the total. Only six (6.7%) regionally or nationally notable plants were found. Pyramidal Orchid flower-spikes were recorded as ‘occasional’ in slack 2. As in 2024, 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 a few plants of Common Twayblade (*Neottia ovata*) and one of Dune Helleborine were found where birch had been felled. Sizeable populations of the regionally rare Common Gromwell (*Lithospermum officinale*) (Fig. 4) were again present in both slacks, this habitat being the species’ stronghold on the Sefton Coast.

Fig. 5 shows the change in annual species counts over time for the two slacks. Except in 2019, the larger slack 2 supported more taxa than slack 3. The regression lines suggest a gradual increase in species-richness until about 2018 when totals began to fall. Only in slack 3 is there a statistically significant relationship between number of taxa and time. Fig. 6 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 2025, 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 that created some disturbed ground (see below). The overall trend is statistically significant (Fig. 7). The proportion of non-native plants varied from year to year, within the range of about 9% to 14% (Fig. 8), with a significant increasing trend. The percentage of notable plants over time appeared to increase, but the trend is not significant (Fig. 9). Since recording began in 2013, a cumulative total of 200 vascular taxa has been recorded

for 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 became increasingly dominant, reaching heights of about 5 m. 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, the remainder in both slacks being cleared by *Green Sefton* volunteers in the winter of 2024/25 (Fig. 10). Unfortunately, rapid coppice regrowth of the coppiced birch occurred during summer 2025 (Fig. 11). Several ruderal plants colonised the bare ground, previously under dense shade. In slack 2, some of the new species recorded in 2020 fell into this category (Smith & Lockwood, 2020), probably accounting for the sharp upturn in the proportion of ruderals that year (Fig. 7). However, several of these plants did not persist into 2021-2025. 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 (Figs. 12, 13). As before, there was regrowth of invasive Sea Buckthorn, some of this being cut when encountered. A few Rabbit droppings were seen around the edge of slack 3 but there was no evidence of Roe Deer (*Capreolus capreolus*) activity. A major concern was the sudden appearance, in 2023, of Wood Small-reed in slack 3 and its subsequent invasive spread in the following two years (Fig. 14).

Away from the woodland/scrub areas, some of the vegetation showed 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 and Wood Small-reed, 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 3 is concerning as this species is highly invasive and ecologically damaging on dunes in the Netherlands and Belgium, being linked to reduced grazing and eutrophication (Provoost *et al.*, 2011). 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 38% alien plants (Smith, 2020). 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 from 2020 onwards provided more bare ground for a temporary, increase in ruderals (Fig. 7).

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 more diligent stump treatment. 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.

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References

- Isermann, M. 2011. Patterns in species diversity during succession of coastal dunes. *Journal of Coastal Research* 27: 661-671.
- Provoost, S., Jones, L.M. & Edmondson, S.E. 2011. Changes in landscape and vegetation of coastal dunes in northwest Europe: a review. *Journal of Coastal Conservation* 15: 207-226.
- Smith, P.H. 2015. A revision of the inventory of vascular plants for the Sefton Coast, north Merseyside (v.c.59, South Lancashire), with particular reference to the 2014 Red List for England. *BSBI News* 129: 36-40.
- Smith, P.H. 2020. Increasing status of non-native vascular plants in the Sefton Coast sand-dune system, north Merseyside, UK. *British & Irish Botany* 2: 102-126.
- Smith, P.H. 2021. *Vascular flora of two scrub-cleared slacks at Hightown Sand-dunes, Merseyside, 2021 update*. Unpublished report.
- Smith, P.H. 2022. *Vascular flora of two scrub-cleared slacks at Hightown Sand-dunes, Merseyside, 2022 update*. Unpublished report.
- Smith, P.H. 2023. *Vascular flora of two scrub-cleared slacks at Hightown Sand-dunes, Merseyside, 2023 update*. Unpublished report.
- Smith, P.H. 2024. *Vascular flora of two scrub-cleared slacks at Hightown Sand-dunes, Merseyside, 2023 update*. Unpublished report.
- Smith, P.H. & Kimpton, A. 2008. Effects of grey willow *Salix cinerea* removal on the floristic diversity of a wet dune-slack at Cabin Hill National Nature Reserve on the Sefton Coast, England. *Conservation Evidence* 5: 6-11.
- Smith, P.H. & Lockwood, P.A. 2013. *Vascular flora of two scrub-cleared slacks at Hightown Sand-dunes, Merseyside*. Unpublished report.
- Smith, P.H. & Lockwood, P.A. 2014. *Vascular flora of two scrub-cleared slacks at Hightown Sand-dunes, Merseyside, 2014 update*. Unpublished report.
- Smith, P.H. & Lockwood, P.A. 2015. *Vascular flora of two scrub-cleared slacks at Hightown Sand-dunes, Merseyside, 2015 update*. Unpublished report.
- Smith, P.H. & Lockwood, P.A. 2016. *Vascular flora of two scrub-cleared slacks at Hightown Sand-dunes, Merseyside, 2016 update*. Unpublished report.
- Smith, P.H. & Lockwood, P.A. 2017. *Vascular flora of two scrub-cleared slacks at Hightown Sand-dunes, Merseyside, 2017 update*. Unpublished report.

Smith, P.H. & Lockwood, P.A. 2018. *Vascular flora of two scrub-cleared slacks at Hightown Sand-dunes, Merseyside, 2018 update*. Unpublished report.

Smith, P.H. & Lockwood, P.A. 2019. *Vascular flora of two scrub-cleared slacks at Hightown Sand-dunes, Merseyside, 2019 update*. Unpublished report.

Smith, P.H. & Lockwood, P.A. 2020. *Vascular flora of two scrub-cleared slacks at Hightown Sand-dunes, Merseyside, 2020 update*. Unpublished report.

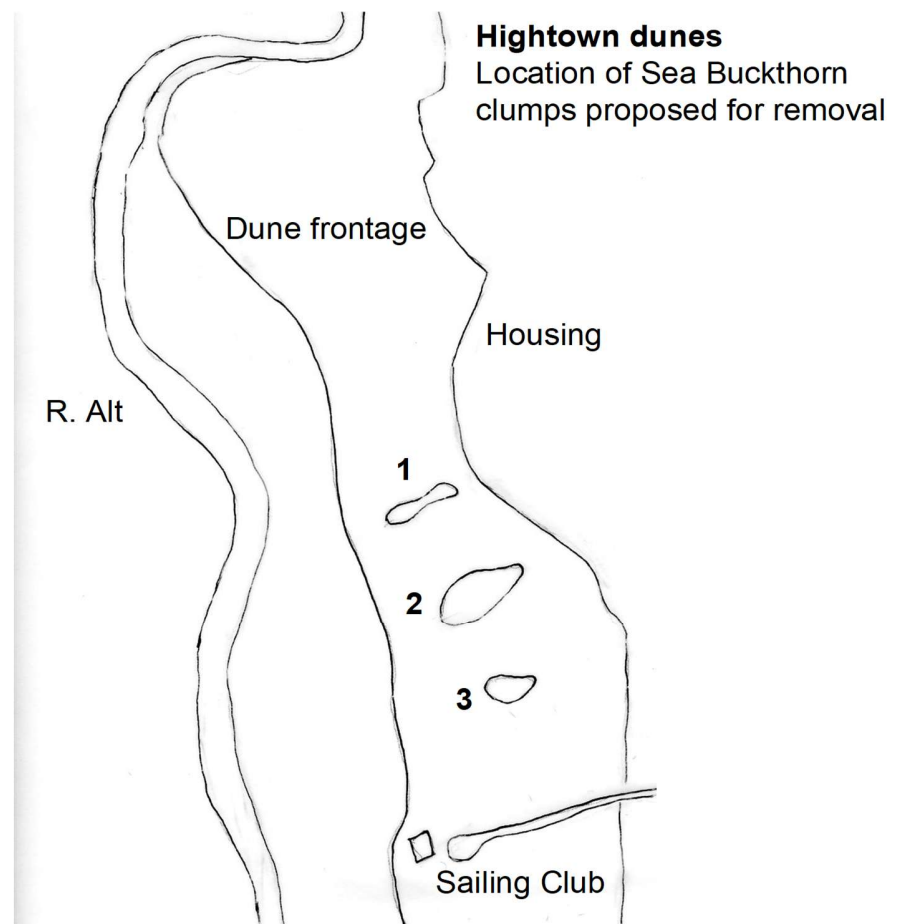


Figure 1. Locations of slacks 2 and 3 at Hightown dunes



Figure 2. Hightown slack 2 before clearance, May 2009



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



Figure 4. Common Gromwell in Hightown slack 2, April 2025

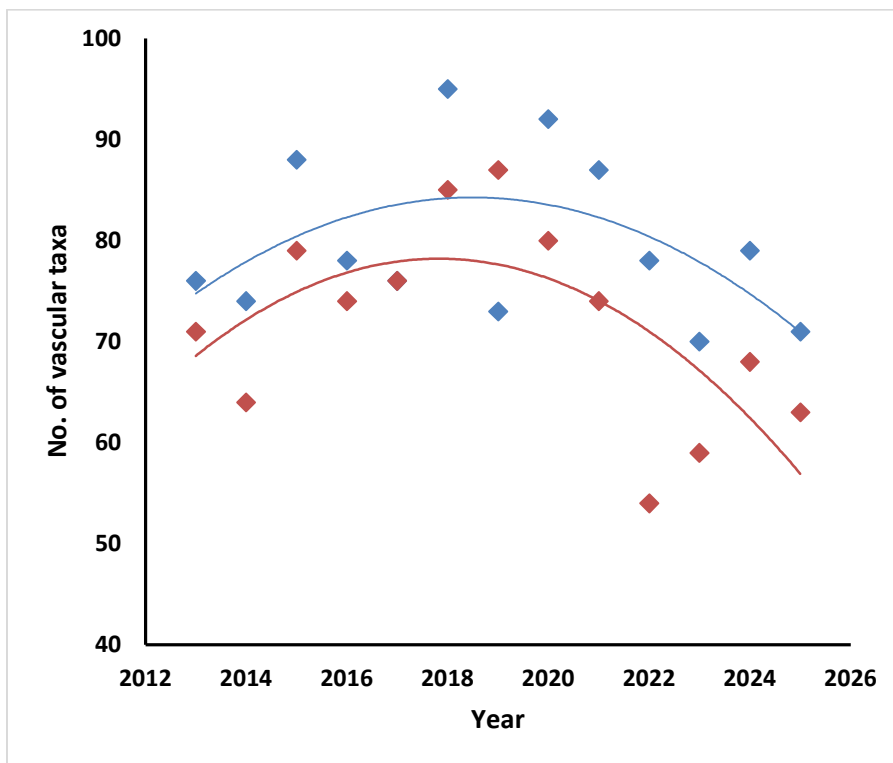


Figure 5. Annual change in vascular species-richness, 2013-2025. Blue = slack 2 ($r = 0.524$; $p = 0.066$); red = slack 3 ($r = 0.658$; $p = 0.014$). Fitted lines polynomial

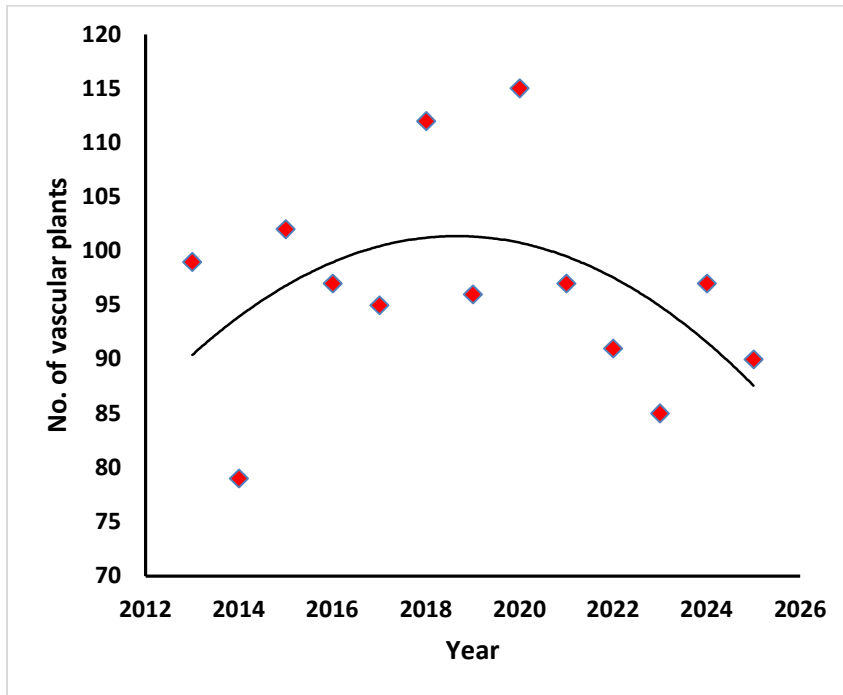


Figure 6. Annual change in species-richness for both slacks combined, 2013-2025 ($r = 0.466$; $p = 0.108$). Fitted line polynomial

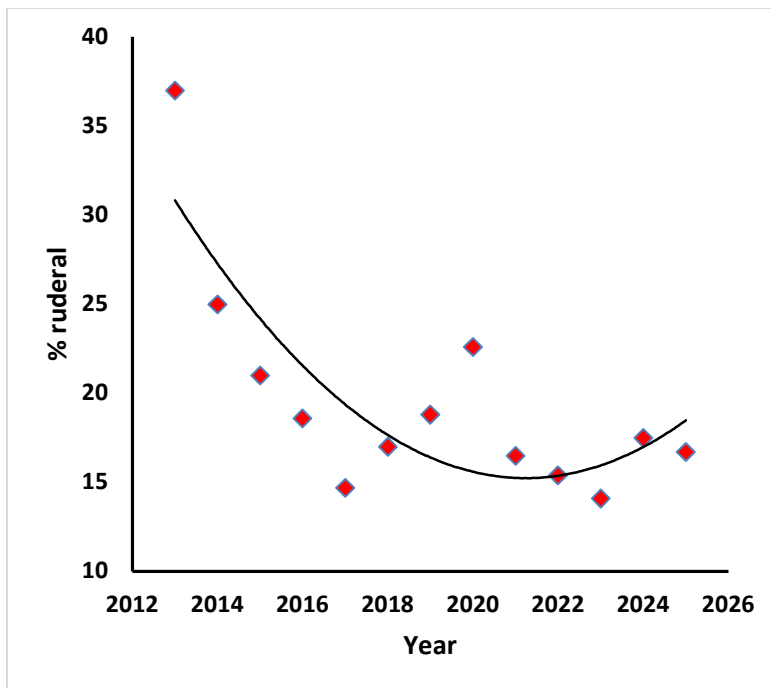


Figure 7. Changes in the proportion of ruderal plants in both slacks combined, 2013-2025 ($r = -0.818$; $p = 0.0006$). Fitted line polynomial

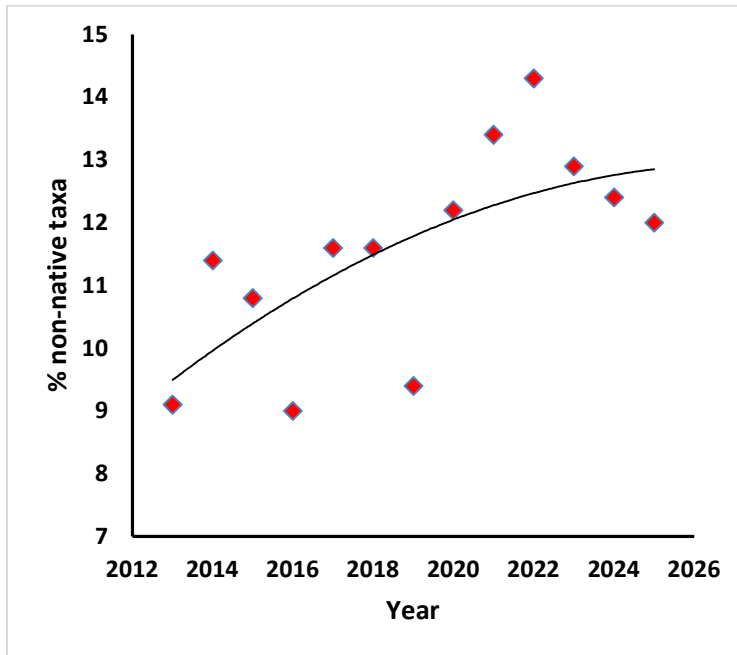


Figure 8. Changes in the proportion of non-native taxa in both slacks combined, 2013-2025 ($r = 0.682$; $p = 0.010$). Fitted line polynomial

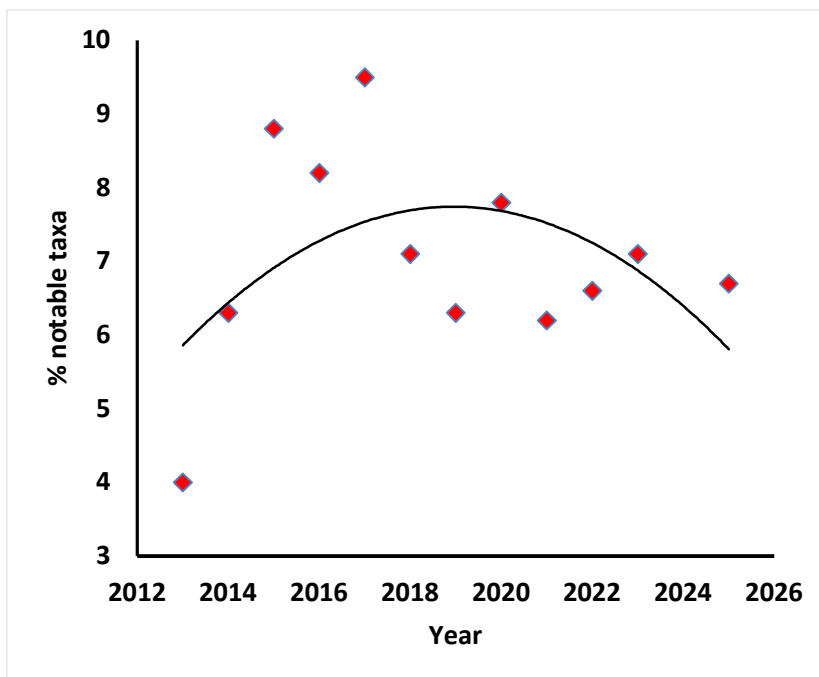


Figure 9. Changes in the proportion of nationally and regionally notable vascular plants in both slacks combined, 2013-2025 ($r = 0.483$; $p = 0.095$). Fitted line polynomial



Figure 10. Slack 2 showing birch removal, April 2025



Figure 11. Regrowth of coppiced birch in slack 2, June 2025



Figure 12. General view of vegetation, slack 2 June 2025



Figure 13. General view of slack 3, June 2025



Figure 14. Wood Small-reed invading slack 3, June 2025

Table 1. Vascular plants recorded annually in slacks 2 and 3 during 2020-2025 (2013-2019 excluded). Nomenclature follows C.A. Stace's *New Flora* 4th edition (2019) and subsequent updates.

* = non-native (neophyte or introduced native taxon); R = ruderal; r = rare, o = occasional, f = frequent, a = abundant, l = locally, v = very; no frequency = recorded before 2020; NR = Nationally Rare; NS = Nationally Scarce; EN = Endangered; VU = Vulnerable; NT = Near Threatened; SCI = Species of Conservation Importance in Northwest England. Italics = threat status in 2014 Red List for England.

Taxon	English name	Slack 2						Slack 3					
		20	21	22	23	24	25	20	21	22	23	24	25
<i>Achillea millefolium</i>	Yarrow												
<i>Agrimonia eupatoria</i>	Agrimony	o	o	o	o	o	o	o	o			r	r
<i>Agrostis capillaris</i>	Common Bent						lf	o	o			lf	
<i>Agrostis stolonifera</i>	Creeping Bent	la				o	lf	lf		vla		vla	la
<i>Aira caryophyllea</i>	Silver Hair-grass												
<i>Alliaria petiolata</i>	Garlic Mustard	o	lf				vlo						
<i>Amelanchier lamarckii</i> *	Juneberry		r			r			r	r	o	r	r
<i>Ammophila arenaria</i>	Marram	o	lf	lf	lf	o	lo	o	o	o	lf	lf	lo
<i>Anacamptis pyramidalis</i> SCI	Pyramidal Orchid	o	o	lo	o	o	o	r					
<i>Angelica sylvestris</i>	Wild Angelica	o	r										
<i>Anthoxanthum odoratum</i>	Sweet Vernal-grass	lf	lf	lo	lo	lf	lf	lf	lf	lf	lf	o	o

<i>Anthyllis vulneraria</i>	Kidney Vetch	lo	r						r				
<i>Antirrhinum majus</i> * R	Snapdragon												
<i>Aquilegia vulgaris</i> *	Columbine							r	r				
<i>Arabidopsis thaliana</i>	Thale-cress	r											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						r
<i>Arum italicum</i> *	Italian Lords-and-Ladies											r	
<i>Asparagus officinalis</i> *	Garden Asparagus	r	r	r		r	r	r	r	r		r	
<i>Avenula pubescens</i>	Downy Oat-grass								r	lo	lf	lo	lo
<i>Ballota nigra</i> R	Black Horehound												
<i>Betula pubescens</i> R	Downy Birch	o	o	o		r	lf					r	r
<i>Betula pendula</i> R	Birch	ld	ld	ld	ld	ld	lf	ld	ld	ld	ld	ld	o
<i>Blackstonia perfoliata</i>	Yellow-wort												
<i>Bromus hordeaceus</i> R	Soft Brome						r	vlo					
<i>Calamagrostis epigejos</i>	Wood Small-reed										vlo	la	ld
<i>Calystegia</i> sp.	Bindweed	lo	lo	r		r	r						
<i>Campanula persicifolia</i> *	Peach-leaved Bellflower			r									
<i>Campanula rotundifolia</i> NT	Harebell	o	r	r				o	o	o			o
<i>Capsella bursa-pastoris</i> R	Shepherd's-purse												
<i>Cardamine pratensis</i>	Cuckooflower	r	vlf	vlf	o								
<i>Carex arenaria</i>	Sand Sedge	o	o	r	r	o		lo	lo	lo	lo	lo	r
<i>Carex flacca</i>	Glaucous Sedge		r										
<i>Carex otrubae</i>	False Fox-sedge												
<i>Carlina vulgaris</i> SCI	Carlina Thistle							vlf	vlf	r	r		
<i>Centaurea nigra</i>	Common Knapweed	lf	lf	lf	lf	lf	lf						
<i>Centaurium intermedium</i> NR EN	Intermediate Centaury												
<i>Centaurium erythraea</i>	Common Centaury												r
<i>Centaurium littorale</i> NS, SCI	Seaside Centaury												
<i>Cerastium diffusum</i>	Sea Mouse-ear												
<i>Cerastium fontanum</i>	Common Mouse-ear	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	Springbeauty												
<i>Claytonia sibirica</i> *	Pink Purslane							lf	r				

[illegible]

<i>Geranium robertianum</i>	Herb-Robert	o	o	o	o	o	r	o	o		o	r	r
<i>Geum urbanum</i>	Wood Avens	o	o	o	lf	o	o	o	o	o		o	
<i>Hedera hibernica</i>	Atlantic Ivy		r			vlf	vlf						
<i>Helianthus annuus</i> * R	Sunflower												
<i>Hieracium</i> sp.	Hawkweed							r					
<i>Hieracium umbellatum</i>	Umbellate Hawkweed	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	ld	o	o
<i>Holcus lanatus</i>	Yorkshire-fog	o	la	lf	la	la	la	la	la	la		o	lf
<i>Hyacinthoides</i> × <i>massartiana</i> *	Hybrid Bluebell	r	r	lo	lo	vlf	o		r		r		r
<i>Hypericum androsaemum</i>	Tutsan				r	r							
<i>Hypochaeris radicata</i>	Cat's-ear	lo	lo	lo		lo	r	lo	lo	lo			
<i>Ilex aquifolium</i>	Holly	r	r	r	r	r	r	r	r	r	r	r	r
<i>Jacobaea vulgaris</i>	Common Ragwort	o	o	r	o	o		o	o	o	o	o	o
<i>Juncus conglomeratus</i>	Compact Rush								r				r
<i>Juncus effusus</i>	Soft Rush								r			r	
<i>Juncus bufonius</i> R	Toad Rush	lo											
<i>Juncus inflexus</i>	Hard Rush	lo	o	o	o	r	lo		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	lf	lo						r
<i>Leontodon saxatilis</i>	Lesser Hawkbit								r				
<i>Leucanthemum vulgare</i>	Oxeye Daisy							r		r	r	vlf	vlf
<i>Linaria purpurea</i> *	Purple Toadflax							r					
<i>Linum bienne</i> SCI	Pale Flax	r											
<i>Linum catharticum</i>	Fairy Flax	lf	vlf					r					
<i>Lithospermum officinale</i> SCI	Common Gromwell	o	o	o	o	o	lo	o	o	o	o	o	r
<i>Lonicera periclymenum</i>	Honeysuckle	la	la	la	la	la	la	la	la	la	la	la	lo
<i>Lotus corniculatus</i>	Common Bird's-foot-trefoil	lf	lf	o	o	o	o	lf	o	o	o	o	o
<i>Luzula campestris</i>	Field Wood-rush	lf		r				r	r				
<i>Lycopus europaeus</i>	Gypsywort	lf	la	la		r	lf	lf	lf	vlf		r	
<i>Malus domestica</i> *	Apple			r		r	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	r				lo	lo
<i>Oenanthe crocata</i>	Hemlock Water-dropwort	o	o	o	o	lf	lf						
<i>Oenothera glazioviana</i> * R	Large-flowered	o	lf					r	r			r	r

[illegible]

[illegible]

<i>Tripleurospermum maritimum</i>	Sea Mayweed	r											
<i>Urtica dioica</i> R	Common Nettle	lf	o	o	o	o	la	lf	o	o	lf	o	o
<i>Veronica chamaedrys</i>	Germander Speedwell	lf	lf	o	r	lf	lo	r	r				
<i>Veronica hederifolia</i>	Ivy-leaved Speedwell	o											
<i>Viburnum opulus</i>	Guelder Rose										r	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	o	r		r	r		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		92	87	78		79	71	80	74	54		68	63