



## **Guidelines for the Selection of Biological SSSIs**

### **Part 2: Detailed Guidelines for Habitats and Species Groups**

## **Chapter 11 Vascular Plants**

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## Cover note

This chapter updates and replaces the previous Vascular Plant (VP) SSSI selection guidelines for vascular plants (JNCC 1989). It was drafted initially by Ian Taylor, Simon J. Leach and John P. Martin (NE) and Robert A. Jones (NRW), with the final draft in November 2020 produced by Ian Taylor (NE), Julian Woodman (NRW) and Iain Macdonald (NatureScot). It provides detailed guidance for selecting vascular plant sites throughout Great Britain to recommend for notification as SSSIs. It should be used in conjunction with Part 1 of the SSSI Selection Guidelines (Bainbridge *et al.* 2013), which details the overarching rationale, operational approach and criteria for the selection of SSSIs.

The main changes from the previous vascular plant guidelines are:

- a change of *emphasis* in favour of a species-by-species focus versus an in-combination (or assemblage) focus. Under the 1989 Guidelines *most* VP notified features were Vascular Plant Assemblages (VPAs) – under these revised Guidelines, by far the majority will now be selected on a species-by-species basis. The old VPAs are replaced with ecologically coherent biogeographic assemblages (see “Species Assemblages” section 4.12);
- introduction of new criteria combining rarity with IUCN-compliant Vascular Plant Red List threat status (previous versions of which were based mainly on rarity rather than threat) for taxa that are Threatened;
- fuller treatment of many apomictic species reflecting considerable recent improvements in our knowledge and understanding of genera such as *Alchemilla*, *Hieracium*, *Limonium*, *Sorbus*, and *Taraxacum*;
- use of country-level assessments, where available, reflecting the shift in executive responsibility for conservation within Great Britain, including the selection of SSSIs, which now lies at country level;
- the introduction of criteria for “taxonomically complex groups undergoing active evolution” which encompass all the taxa involved in driving the evolutionary process not just the (usually rare) products resulting from it;
- introduction of weightings for international responsibility and genetic distinctiveness; and
- removal of the Schedule 8 species selection criterion.

This chapter has been subjected to appropriate levels of evidence quality assurance. It is compliant with the JNCC Evidence Quality Assurance Policy 2020 and has been subjected to external peer review by Dr Anita Diaz of Bournemouth University.

The authors would like to thank the Botanical Society of Britain and Ireland for their help in testing these guidelines.

## 1. Introduction and Scope

### 1.1 Introduction

The groups covered here are clubmosses, quillworts, horsetails, ferns, conifers and flowering plants, collectively known as vascular plants. This document replaces Chapter 11 of Guidelines for the Selection of Biological SSSIs (JNCC 1989) and takes its overall approach from that work. It should be used in combination with Bainbridge *et al.* (2013).

### 1.2 Taxonomic scope and nomenclature

As in British and country Red Lists, the words ‘taxon’ and ‘taxa’ are used throughout to indicate that both species and subspecies (and some hybrids – see section 1.5) are eligible for consideration. Intraspecific taxa below subspecies level, however, are not eligible. In these guidelines both scientific and English names follow the most recent edition of the New Flora of the British Isles (Stace 2019).

### 1.3 Native/alien status

For definitions of native/alien status categories, see Preston *et al.* (2002) and (in Scotland in relation to native range) the Code of Practice on Non-Native Species, Scottish Government (2012). All taxa categorised in Great Britain (GB<sup>1</sup>) and/or country Red Lists as ‘**Native**’, ‘**Native or Alien**’, ‘**Archaeophyte**’ and ‘**Archaeophyte or Neophyte**’ are eligible for consideration. Archaeophytes (taxa thought to have been introduced before 1500 CE) are included on account of their long association with human agricultural systems, for example as ‘weeds’ of arable agriculture (see Cheffings and Farrell 2005, p. 5). Site selection is aimed specifically at protecting native taxa, but these ancient introductions are treated in these guidelines in the same way as natives in accordance with the decision taken when compiling the GB Red List.

### 1.4 Apomictic<sup>2</sup> taxa

There have been considerable recent improvements in our knowledge and understanding of apomictic species in genera such as *Alchemilla* (lady’s-mantles), *Hieracium* (hawkweeds), *Limonium* (sea-lavenders), *Sorbus* (whitebeams) and *Taraxacum* (dandelions). Distribution maps for many of these are now available, e.g. dandelions (Dudman and Richards 1997); lady’s-mantles and sea-lavenders (Preston *et al.* 2002); hawkweeds (McCosh and Rich 2011), and whitebeams (Rich *et al.* 2010).

The improved evidence base for many apomictic genera means that they can now usually be treated in much the same way as sexual taxa with respect to SSSI selection. However, site selection thresholds in section 4 (below) have been adjusted to reflect both the poorer levels of recording of some of the larger apomictic groups – essentially the dandelions and hawkweeds – and the lower levels of genetic distinctiveness between taxa in these genera (section 4.6). It should also be noted that some predominantly apomictic genera (as well as some sexual genera) are known to be in a state of active speciation; in such cases the guidance in section 4.13 may apply.

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<sup>1</sup> We refer to ‘GB’, rather than ‘Britain’, throughout because ‘Britain’ is taken to refer solely to the main island of the British archipelago and in many instances within this document would thereby exclude taxa such as *Viola kitaibeliana* (dwarf pansy) which only occur on other islands of the archipelago (in this case the Isles of Scilly). The use of ‘GB’ in this sense is also in line with the widely used and understood text and title of the relevant Red List.

<sup>2</sup> An apomictic taxon is one which produces seed (or in ferns, a new plant) wholly female in origin, without fertilisation.

## 1.5 Hybrids

Hybrids should not normally be considered for selection unless they appear in the GB or relevant country Red List, or occur as part of an actively evolving metapopulation within a taxonomically complex group, e.g. hybrid taxa within the predominantly sexual genera *Dactylorhiza* (marsh-orchids) and *Euphrasia* (eyebrights), or within the genus *Sorbus* (whitebeams) where evolutionary pathways may involve hybridisation between both sexual and apomictic taxa (section 4.13).

## 1.6 Threat

In GB and country Red Lists, threat status is determined using the most recent version of the IUCN threat categories and criteria (IUCN 2012). These status assessments are used, in combination with estimates of rarity (section 1.7), to determine SSSI selection requirements for particular taxa (sections 4.1-4.4). It should be noted that Red List threat assessments underpin various other GB and country lists of 'priority taxa' – e.g. the S.41 list in England and the S.7 list in Wales. Unsurprisingly, taxa appearing in these lists will (and should) feature prominently as qualifying features when notifying SSSIs using these guidelines, but a taxon's inclusion in these lists does not confer any additional requirement in terms of SSSI selection over and above that determined by its threat status and/or rarity.

GB Red List threat assessments in Cheffings *et al.* (2005), and in the periodic updates to that list (Leach 2007, 2010; Leach and Walker 2011, 2013, 2015), now supersede the old 'Red Data Book' assessments (Perring and Farrell 1977, 1983; Wigginton 1999) used in previous versions of these guidelines. Country-level assessments of threat should also be used, where available [e.g. Dines (2009) for Wales, Stroh *et al.* (2014) for England].

When using multiple published Red Lists, the *highest* level of threat should always be the one used to determine a taxon's SSSI selection requirements, regardless of the geographical scale at which that assessment was made. Thus, a taxon listed as threatened at country level should be treated as such for SSSI selection purposes, even though it may not be threatened in GB (and *vice versa*).

There is a clear presumption in these guidelines that the presence of threatened taxa should be treated as a priority when selecting SSSIs, but it needs to be acknowledged that SSSI designation will not *necessarily* be the preferred (or only) mechanism for conserving such taxa. Some tend to be associated with habitats (e.g. arable fields) which may be better suited to other forms of protection, for example through agri-environment scheme targeting. Equally, taxa mainly threatened by persecution (e.g. collection pressure) will often be more effectively protected through listing on Schedule 8 of the Wildlife and Countryside Act 1981. It should be borne in mind, however, that persecuted taxa may also be threatened in other ways, for example through habitat loss, so SSSI designation will frequently be important in protecting Schedule 8 taxa too.

## 1.7 Rarity

SSSIs have a proven track record of successfully conserving range-restricted taxa (e.g. Walker *et al.* 2017). In these guidelines there remains a presumption, therefore, that SSSIs will be selected for their Rare<sup>3</sup> (section 4.3) and/or Scarce<sup>4</sup> (section 4.4) taxa, even those not listed as threatened on GB or country Red Lists.

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<sup>3</sup> Taxa occurring in 1-15 hectads in GB or the same proportion of the hectads in the individual countries, for example 1-8 hectads in England.

<sup>4</sup> Taxa occurring in 16-100 hectads in GB or the same proportion of hectads in the individual countries, for example 9-52 hectads in England.

If a country has its own list of Rare and Scarce taxa (e.g. in England, Stroh 2013b), this should be used in tandem with the GB list when determining the SSSI selection requirements of a taxon, with the *highest* level of rarity being used regardless of geographical scale. Thus, a taxon listed as Rare or Scarce at **country** level should be treated as such for SSSI selection purposes, even though it may be neither rare nor scarce in GB (and *vice versa*).

Taxa may also qualify for consideration on grounds of **regional** rarity (section 4.11).

## 1.8 Defining native range

Any population of a native taxon being considered for selection should lie within that taxon's native range and be either a 'presumed-native' population or one that has been introduced, re-introduced or augmented for conservation purposes in line with current IUCN re-introduction guidelines, IUCN/SCC (2013). For the most part, native ranges can be taken as those delimited in Preston *et al.* (2002). In Scotland native range is defined in the Wildlife and Countryside Act 1981 (as amended <https://www.legislation.gov.uk/ukpga/1981/69>) as, "...the locality to which the animal or plant of that type is indigenous, and does not refer to any locality to which that type of animal or plant has been imported (whether intentionally or otherwise) by any person." The Scottish Code of Practice on Non-Native Species further defines non-native species as "animals and plants that have been imported into a location outwith their native range by human action, whether intentionally or otherwise".

It should be recognised, however, that ranges – whether native or otherwise – are not static and are apt to vary through time, especially in response to climate change and other pressures. Indeed, the distributions of some taxa are known to be expanding, and in many cases the (formerly clear) distinctions between 'presumed-native' and 'presumed-alien' ranges are becoming increasingly blurred. Where there is uncertainty about the 'nativeness' of a particular population, advice should be sought from the country vascular plant specialists.

## 1.9 Newly Recognised and Recently Discovered Taxa

In applying the selection criteria, it is essential to take into account the significance of a population of interest at various scales, i.e. at local (e.g. Area of Search (AOS)), regional (e.g. English Region), national (country/GB) and international (Europe/world) levels. In the case of newly described or recently discovered taxa this may pose a particular problem: it may be several years before a true picture of their distribution emerges and caution should be exercised whilst this process unfolds. Where taxa are known to be poorly or unevenly recorded, reference should always be made to relevant experts before conclusions are reached as to the significance of a particular population.

## 2. Dealing with Responsibility

### 2.1 The need to consider 'threat' and 'rarity' at varying geographical scales

Executive responsibility for conservation within GB, including the selection of SSSIs, lies at country level. Increasingly, nature conservation priorities are also being framed and articulated at country level as well as for the whole of GB, for example through country lists of priority taxa (e.g. Section 41 list in England, Section 7 list in Wales and the Scottish Biodiversity List in Scotland) and country-specific biodiversity objectives and targets. It is therefore accepted that country agencies will increasingly make use of country-level Red Lists and Rare/Scarce lists where available, in tandem with the GB lists, in determining SSSI selection requirements with respect to vascular plants.

SSSI selection requirements also need to reflect wider responsibilities for safeguarding taxa that may be of little concern within GB or at individual country level, but which are nevertheless known to be Rare/Scarce or threatened at a larger geographical scale. For example, taxa that are globally threatened or threatened in Europe (e.g. those listed under Annexes II and IV of the Habitats Directive or those which have been assessed as threatened on published Global or European Red Lists) or for which GB is thought to hold a significant proportion of the European population, should be viewed as priorities for SSSI selection, even though they may be regarded as being of lower priority when assessed against the main criteria in sections 4.1-4.4 (see section 4.5).

## **2.2 Endemics**

An endemic taxon is one that is globally restricted to a specific geographical area, in this instance Great Britain (GB). Thus, a GB endemic is one that is restricted to some or all of England, Scotland and Wales, while an English endemic is restricted to England alone. Endemism carries with it the highest level of responsibility (section 4.5), on the grounds that we alone are responsible for an endemic taxon's ultimate survival in the wild. It should be remembered, however, that many endemics are also apomicts (section 4.6), and account should be taken of this when determining selection requirements for endemic taxa (see section 4.7).

## **3. Species Assemblages**

### **3.1 'Vascular Plant Assemblages' (VPA)**

Under previous selection guidelines, sites could qualify for selection if a threshold score was reached or exceeded based on the number of GB Rare and/or Scarce taxa occurring within the site boundary. This criterion was difficult to apply in a robust and ecologically meaningful way, and indeed theoretically almost any site could be 'made' to support an assemblage of this sort if the site boundary were drawn widely enough to contain a sufficient number of scoring species. Frequently, scoring taxa were included based on old records or tiny populations, even though these may have represented ephemeral/transient occurrences or populations with little or no prospect of ever being 'self-sustaining'.

In the present guidelines the former criterion relating to 'Vascular Plant Assemblages' is replaced by a new approach to 'biogeographical' assemblages, outlined below and in section 4.12, along with specific criteria permitting the selection of sites in certain circumstances for single GB or country-level Rare/ Scarce taxa (sections 4.3 and 4.4).

It is essential that early consultation takes place with a country vascular plant specialist whenever an existing SSSI, notified for a VPA under previous guidance, is being considered for amendment, deletion or extension. In such cases, the VPA should be re-assessed to establish whether it may still be eligible under the new guidance relating to species assemblages (sections 3.2 and 4.12 below), but also the constituent taxa should be re-assessed under the new guidance as potential features in their own right. When assessing either individual taxa or 'assemblages', casual occurrences and old (pre-1987) records of taxa now presumed extinct should in most cases be ignored. If in doubt, seek an opinion from the relevant country vascular plant specialists.

### **3.2 'Biogeographical assemblages'**

Sites holding significant ecologically and/or biogeographically coherent assemblages are of great scientific interest (see, for example, Gater 2018) and assemblages of this sort should continue to be recognised as features for which SSSIs can be designated. Within individual habitats, important assemblages of locally or regionally/nationally rare, scarce or threatened

taxa will usually occur in areas already being designated under the relevant habitat selection guidelines (see habitat chapters). In a few instances, however, biogeographically significant assemblages straddling a sometimes-disparate array of spatially adjacent habitats may ‘slip through the net’ on habitat grounds, while still clearly meriting selection as features *in their own right* (section 4.12).

#### 4. Site Selection Requirements

Information on vascular plant taxa qualifying for SSSI selection under criteria in sections 4.1-4.7, 4.9 and 4.11 can be found in a range of sources, which are regularly reviewed (for example Leach and Walker 2015). Additional taxa potentially qualifying under sections 4.8, 4.10, 4.12 or 4.13 cannot be specified other than on a case-by-case basis. Many qualifying taxa have more than one threat/rarity status – a GB Red List taxon, for example, might also be listed as Scarce in England or regionally rare in one or more regions. Site selection requirements for each taxon should be determined by applying the *highest-ranking* selection criterion applicable in each case. The ordering of the criteria in the following sections reflects this ranking. Thus, a GB or country-level Red List taxon (whether GB Rare or not) would be assessed by applying the criteria in section 4.1, whereas a (non-Red List) GB Rare taxon would be assessed using criteria in section 4.3, and so on.

Most threatened vascular plant taxa are assessed as such under IUCN criteria based on declines evidenced by a reduction in Area of Occupancy (AOO) or Extent of Occurrence (EOO), since direct population assessments are only feasible for the very rarest. The recommended numbers of sites eligible for selection under sections 4.1 to 4.4 have therefore been determined in such a way as to most effectively secure the EOO and at the more local AOS scale to mitigate declining AOO. As the criteria also emphasise large and sustainable populations, the relatively small numbers of sites indicated will contain a disproportionately large proportion of the national population. Experience of an essentially similar approach under section 3.2 of the 1989 Guidelines suggests that the numbers chosen will allow the selection of all the best populations of taxa with highly clumped distributions whilst also enabling adequate coverage of those which are more evenly distributed across GB.

For any potentially qualifying taxon, the ‘main criteria’ in sections 4.1-4.4 should be applied first, with the resulting assessment then being weighted as necessary according to whether it is one for which GB has ‘international responsibility’ (section 4.5) or belongs to one of the larger apomictic genera (section 4.6). These main criteria are then followed by several ‘supplementary criteria’ (sections 4.8-4.12).

As in previous versions of these guidelines, much emphasis is placed here on assessments of population size and a population’s likely ‘sustainability’. Sustainability is hard to define, and in many cases population size will have to serve as a ‘proxy’ measure of its sustainability – the assumption being that a large population is likely to be more ‘sustainable’ than a small one. Evidence of a population being long-established, whether through its long-recorded history or (in the case of long-lived perennial taxa) the presence of old plants along with cohorts of younger plants of different ages, will also be helpful in ascertaining its likely sustainability. Further supporting evidence could include observations of plants flowering and setting seed, the presence of seedlings and an understanding of seed bank viability. Evidence of *long continuity* of suitable habitat, and appropriate habitat *management*, may also be important.

It is accepted, however, that for some taxa/sites and some Areas of Search (AOSs) assessments of a qualifying taxon’s sustainability will be hard to make. It is advisable to trawl through all available data sources including site files, NBN, Local Records Centres, Vice-county Rare Plant Registers and the BSBI Distribution Database, and to consult local botanical recorders and recording groups, and relevant country botanical specialist/s as

necessary. In many cases a final decision on a population's 'sustainability' will be based principally on a mixture of local intelligence and expert opinion.

#### 4.1 GB or country-level Red List (threatened) taxa

- 4.1.1 Restricted Range (GB or country-level Rare/Scarce) threatened taxa qualifying as CR, EN or VU under IUCN criteria A, B, C and/or D, IUCN (2012a). **All** localities with sustainable populations should be considered for selection<sup>5</sup>.
- 4.1.2 Widespread taxa (not Rare or Scarce) that are declining (i.e. qualifying as threatened under IUCN criterion A only). Conservation mechanisms other than SSSI designation should be deployed wherever possible. Where such alternative conservation mechanisms are judged to be unavailable, impractical or potentially ineffective the locality within the AOS with the largest population may be selected.

On SSSIs selected for other reasons, threatened taxa not qualifying as features in their own right should nevertheless be highlighted, wherever possible, in site descriptions (citations) and as supporting indicators of the value of a qualifying habitat. An example is when listing 'indicators of local distinctiveness' in Favourable Condition Tables for SSSIs in England and Wales or in Site Management Statements in Scotland.

#### 4.2 GB or country-level Near Threatened or Data Deficient<sup>6</sup> taxa

Although not considered qualifying features in their own right, Near Threatened or Data Deficient taxa should be included, wherever possible, in site descriptions (citations) on SSSIs selected for other reasons as indicators of the value of a qualifying habitat. For example, when listing 'indicators of local distinctiveness' in Favourable Condition Tables for SSSIs in England and Wales or in Site Management Statements in Scotland.

#### 4.3 GB or country-level Rare non-threatened taxa

A locality with a sustainable population of **one** GB or country-level Rare taxon qualifies for consideration if any of the following apply:

- 4.3.1 In the case of a **GB** Rare taxon, it is one of the five largest populations in GB.
- 4.3.2 In the case of a **country**-level Rare taxon, it is one of the **three** largest populations in that country.
- 4.3.3 In the case of either a **GB** or **country**-level Rare taxon, it is the largest (or only) sustainable population within an AOS.

On SSSIs selected for other reasons, Rare taxa not qualifying as features in their own right should nevertheless be highlighted, wherever possible, in site descriptions (citations) and as supporting indicators of the value of a qualifying habitat, for example when listing 'indicators of local distinctiveness' in Favourable Condition Tables for SSSIs in England and Wales or in Site Management Statements in Scotland.

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<sup>5</sup> For definitions of Red List categories and IUCN criteria as used in the GB Red List, refer to Cheffings and Farrell (2005).

<sup>6</sup> A **Data Deficient** taxon is one for which there is currently insufficient information for a Red List assessment to be undertaken.



#### 4.4 GB or country-level Scarce non-threatened taxa

A locality with a sustainable population of **one** GB or country-level Scarce taxon should be considered for selection if any of the following applies:

- 4.4.1 In the case of a **GB** Scarce taxon, it is one of the **three** largest populations in GB.
- 4.4.2 In the case of either a **GB** or **country**-level Scarce taxon, it is the largest (or only) sustainable population within an AOS.

On SSSIs selected for other reasons, Scarce taxa not qualifying as features in their own right should nevertheless be highlighted, wherever possible, in site descriptions (citations) and as supporting indicators of the value of a qualifying habitat, for example when listing 'indicators of local distinctiveness' in Favourable Condition Tables for SSSIs in England and Wales or in Site Management Statements in Scotland.

#### 4.5 Weightings to apply when assessing taxa for which GB and/or England, Scotland or Wales have a clear international responsibility<sup>7</sup>

Sexual taxa for which GB has a clear international responsibility comprise: country-level, GB and British Isles endemics; taxa for which GB is likely or certain to hold a significant proportion (>25%) of the European population and taxa considered to be threatened or a priority for conservation measures within Europe or globally, even if not so within our own area. For such taxa there is an additional imperative to extend the contribution SSSI selection can make towards countering threat (or avoiding it in the case of non-threatened, range-restricted taxa). The rationale underpinning the number and distribution of eligible sites as set out above and expressed in sections 4.1 to 4.4 can be extended to enhance the number of sites afforded by SSSI selection. For any taxa for which GB has clear international responsibility, selection requirements in sections 4.1-4.4 should be weighted as follows:

4.5.1 Taxa qualifying under 4.1 should be assessed as normal.

4.5.2 Taxa qualifying under 4.3 should have the thresholds modified to:

- One of the **ten** largest populations in GB.
- One of the **five** largest populations in England, Scotland or Wales.

4.5.3 Taxa qualifying under 4.4 should have the thresholds modified to:

- One of the **five** largest populations in GB.
- One of the **two** largest populations in an AOS.

4.5.4 In addition Annex II of the Habitats and Species Directive lists species for which a network of sites should be notified to protect viable populations of international importance. Section 6.3 of Guidelines for the Selection of Biological SSSIs Part 1 (Bainbridge *et al.* 2013) recommends that it may be necessary not to rely on choosing only a minimum number of exemplary areas, but to select more or all sites above a critical international standard, in order to meet international conservation obligations. In the light of this we recommend that all sites supporting sustainable populations of Annex II species should be considered for notification as SSSI. The Annex II species recorded in Britain are:

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<sup>7</sup> But see also sections 4.6 and 4.7 if the taxon belongs to one of the larger apomictic genera (*Hieracium* (hawkweeds), *Limonium* (sea-lavenders), *Sorbus* (whitebeams), *Taraxacum* (dandelions)), or section 4.8 if it belongs to genus *Rubus* subgenus *Rubus* (brambles).

*Trichomanes speciosum* (*Vandenboschia speciosa*) (Killarney fern), *Rumex rupestris* (shore dock), *Saxifraga hirculus* (marsh saxifrage), *Helosciadium* (*Apium*) *repens* (creeping marshwort), *Gentianella amarella* ssp. *anglica* (*Gentianella anglica*) (early gentian), *Luronium natans* (floating water-plantain), *Najas flexilis* (slender naiad), *Cypripedium calceolus* (lady's-slipper) and *Liparis loeselii* (fen orchid).

It should be borne in mind that there are also taxa for which GB has 'international responsibility', but which are neither threatened nor Rare/Scarce at either GB or country level. Such taxa are generally too widespread and/or common to be regarded as being of 'conservation concern', e.g. *Asplenium marinum* (sea spleenwort), *Cochlearia anglica* (English scurvygrass), and *Lepidium heterophyllum* (Smith's pepperwort). While there is no selection requirement for these taxa, every effort should be made to ensure that they are well represented within sites selected for other reasons; when appropriate, they should also be mentioned in site descriptions (citations) and as supporting indicators of the value of a qualifying habitat, for example when listing 'indicators of local distinctiveness' in Favourable Condition Tables for SSSIs in England.

#### 4.6 Weightings to apply when assessing apomictic taxa within the genera *Hieracium*, *Limonium*, *Sorbus* and *Taraxacum*<sup>8</sup>

The following selection requirements for apomictic taxa relate **only** to those taxa that are also Threatened and/or Rare or Scarce at either GB or country level. There is no requirement to select SSSIs specifically for apomictic taxa that are neither Rare/Scarce nor Threatened.

The genetic distinctiveness between related apomictic taxa tends to be substantially less than between sexual taxa of equivalent taxonomic rank. Consequently, lower levels of representation within the SSSI series are considered sufficient to adequately conserve the genome, and selection requirements in sections 4.1-4.4 are therefore weighted as follows:

4.6.1 Taxa qualifying under 4.1 should be assessed as normal.

4.6.2 Taxa qualifying under 4.3 should have the thresholds modified to:

- One of the **three** largest populations in GB.
- The largest population in the country in question.

4.6.3 Taxa qualifying under 4.4 should have the thresholds modified to:

- The largest population in GB or the country in question.

#### 4.7 Endemic/near-endemic apomicts

In the case of endemic or near-endemic apomicts – of which there are many in the genera *Hieracium*, *Limonium*, *Sorbus* and *Taraxacum* – the weightings to reflect their 'endemicity' (section 4.5) and their apomixis (section 4.6) effectively cancel each other out. Selection requirements for qualifying endemic or near-endemic apomictic taxa should therefore use the thresholds given in the main criteria in (sections 4.1 to 4.4), without applying any weightings. Selection requirements for endemic/near-endemic taxa within the genus *Rubus* subgenus *Rubus* are considered in the next section.

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<sup>8</sup> See section 4.7 if the taxon is also an endemic or near endemic. Apomicts within the genus *Rubus* subgenus *Rubus* (brambles) are dealt with in section 4.8.

#### 4.8 *Rubus* subgenus *Rubus*

Site selection for taxa within the predominantly apomictic sections of *Rubus* subgenus *Rubus* presents problems because far more taxa are known to occur in GB than have been named. Even so, about 340 named species are currently recognised (Newton and Randall 2004), with slightly more than half of these being endemic to Britain and Ireland. This high rate of endemism, the coherent geographical distributions and ecological preferences shown by so many of the taxa, and their complex reproductive biology – including low out-crossing rates and frequent hybridisation – all contribute to the group’s considerable scientific interest. The large number of recognised but un-named entities has arisen because a taxon is now not formally named until it has been found to occur at several localities (usually >5) with a distance between the furthest-apart localities of usually at least 20 kilometres. It follows from this that the very rarest (and possibly most threatened) taxa are, by definition, un-named – and so are missing from any lists of GB species.

Ideally the genus would be treated as a ‘taxonomically complex group’ undergoing contemporary evolution (section 4.13) but there is some evidence to suggest that bramble diversity is generated in a sporadic or diffuse way across the landscape rendering the approach suggested in 4.13 difficult to apply. There seems little alternative than to select sites on the basis of their taxonomic diversity, and within AOSs known to have a high *Rubus* diversity attempts should be made to identify the richest sites – bramble ‘hot-spots’ – for selection, within a more general and overarching aim of ensuring that each recognised entity (named or otherwise) is included on at least one SSSI in GB.

The identification of *Rubus* species is highly specialised and there are currently very few bramble experts active in GB with the requisite skills. Delimitation of candidate sites and assessments of their contribution to bramble conservation nationally should always be based on the recommendations of an expert ‘batologist’ (the name given to a botanist engaged in the study of brambles), in consultation with relevant country vascular plant specialists.

On many SSSIs brambles are viewed as ‘problem’ species needing to be controlled or eliminated, but it is important to be alert to the possibility that the *Rubus* flora of a site could include several range-restricted and/or endemic taxa. Where such taxa are known to occur on SSSIs selected for other reasons, they should be highlighted in site descriptions (citations) and as supporting indicators of the value of a qualifying habitat, e.g. when listing ‘indicators of local distinctiveness’ in Favourable Condition Tables for SSSIs in England and Wales or in Site Management Statements in Scotland.

#### 4.9 Historic decliners

Declining taxa that suffered the bulk of their declines prior to 1930 (the ‘start date’ for vascular plant Red List assessments) may be assessed as ‘Least Concern’ in GB or country Red Lists, despite the fact that they may have been reduced to a meagre scatter of sites, particularly across AOSs in central and southern Britain. Examples of ‘historic decliners’ include *Helosciadium inundatum* (lesser marshwort), *Carex dioica* (dioecious sedge) and *Eriophorum latifolium* (broad-leaved cottongrass) – all taxa that are now scarce across much of lowland England, even though still plentiful in AOSs in the north and west. Lists of such taxa are not currently available at GB level or for Scotland or Wales; however, ‘Least Concern’ taxa qualifying as ‘historic decliners’ in England are listed in the England Red List (Stroh *et al.* 2014).

It is likely that many ‘historic decliners’ will already be well represented in the SSSI series, often occurring on sites selected principally for their *habitat* interest. Many others will doubtless qualify for selection as regional rarities (section 4.11). However, in consultation with country botanical specialists, within each country up to **five** particularly large

populations of any GB or country-level ‘historic decliner’ may be **considered** for selection, with the emphasis being on selecting surviving populations lying within parts of the range of a taxon where losses have been particularly severe.

#### 4.10 Disjunctions

Disjunct occurrences are of considerable interest to botanists and generally indicate unusual local ecological conditions in the outlying localities, or the historic or ongoing occurrence of significant biogeographical events. Important disjunctions are hard to define or quantify, but in general there must be a significant barrier to the exchange of genes between the disjunct population and the main population. Examples include outlying populations of northern-montane species in south-west England (e.g. *Saxifraga hypnoides* (mossy saxifrage) at Cheddar Gorge and *Empetrum nigrum* (crowberry) on Dartmoor, or predominantly western-oceanic taxa occurring in isolated, sufficiently ‘humid’ niches in south-east England (e.g. *Hymenophyllum tunbrigense* (Tunbridge filmy-fern) and *Dryopteris aemula* (hay-scented buckler-fern) in Kent).

Where disjunct populations of a taxon occur, the **three** largest populations within an AOS may be **considered** for selection. Help should be sought from country vascular plant specialists when deciding if the disjunction displayed by a particular taxon is significant enough to merit SSSI designation.

#### 4.11 Regional Rarities

Many taxa are intrinsically rarer in some parts of GB than in others. It is therefore accepted that there will be some taxa which are of considerable *regional* interest, even though at GB or country level they may be of limited conservation concern. With respect to ‘regional rarity’ in England, for any taxon occurring in five or fewer 10 km squares in a region the largest population in each occupied AOS within that region may be **considered** for selection.

On SSSIs selected for other reasons, regionally rare taxa not qualifying as features in their own right should nevertheless be highlighted, wherever possible, in site descriptions (citations) and as supporting indicators of the value of a qualifying habitat, for example when listing ‘indicators of local distinctiveness’ in Favourable Condition Tables for SSSIs in England.

#### 4.12 Species assemblages

There are some instances where biogeographically significant assemblages occur in which the constituent taxa are either confined to a single well-defined habitat or otherwise clearly linked by some other factor, e.g. climate, soil or historic land-use. Upper Teesdale, for example, is renowned for its diverse botanical assemblage straddling a wide range of component habitats, including flushes, pastures, hay-meadows, limestone outcrops and open moorland. Where such biogeographic assemblages occur, they can be selected as features in their own right.

It is important to recognise that widespread taxa of relatively low conservation concern may be important constituents in assemblages of this sort; for example, the biogeographic assemblage of the Lizard peninsula includes *Serratula tinctoria* (saw-wort) and *Sanguisorba officinalis* (great burnet), both of which occur there as south-western outliers within a highly distinctive suite of Threatened, Near Threatened and Rare/Scarce taxa. In most cases potentially qualifying species assemblages will already be covered through the recognition of individually qualifying taxa and/or qualifying habitats, meaning that the use of this criterion is likely to be very limited. Advice on sites possibly qualifying on account of their species

assemblages should be sought from the relevant country vascular plant specialist/s, in consultation with relevant habitat specialists.

#### 4.13 Taxonomically Complex Groups undergoing contemporary evolution

There is good evidence to suggest that several taxonomically complex groups - usually genera or subsets of taxa within genera – are in a state of contemporary evolution which results in many closely related species and hybrids occurring within discrete geographical areas (e.g. the concentrations of *Sorbus* (whitebeam) taxa in the Avon Gorge, Cheddar Gorge, on Arran or in the Wye Valley). Usually some of the component taxa within such evolving complexes will have recognised threat or rarity status, and so may already be recognised as potential features in their own right through application of the main criteria above (see sections 4.1-4.7). But there are frequently other important components that may, in other instances, be presumed to be of low conservation concern (e.g. *Sorbus aria* (common whitebeam) in the example given above); or there may be varieties, hybrids, or perhaps swarms of introgressed individuals, which would not normally be considered eligible for selection. In the case of actively evolving assemblages within taxonomically complex groups, however, **all** taxa involved in the evolutionary process are significant, and so SSSI designation should aim to encompass sufficient habitat and populations of such taxa to allow the evolutionary process to continue. As far as possible, the identification of relevant situations and assessment of the nature and extent of habitat (and taxa) required should be based on published research on the genera concerned.

Based on current understanding, pertinent genera under this criterion include *Sorbus* (whitebeams) (Ennos *et al.* 2011), *Euphrasia* (eyebrights) (French *et al.* 2008), *Epipactis* (helleborines) (Hollingsworth *et al.* 2006), and *Dactylorhiza* (marsh-orchids) (Pillon *et al.* 2007). In some other genera such as *Hieracium* (hawkweeds) and *Limonium* (sea-lavenders), it is now known that current taxonomic diversity in GB is the result of historic rather than contemporary evolution; in these cases, conventional approaches to site selection will usually be more suitable. Selection requirements for taxa within the complex and 'difficult' *Rubus* subgenus *Rubus* (brambles) are dealt with in section 4.8 above.

### 5. Setting SSSI boundaries for vascular plants

In general terms the recommendations given on boundary setting in section 8 of Part 1 of these Guidelines should be followed but there are a number of issues where additional attention needs to be given when considering sites for their vascular plant interest:

#### 5.1 Extent

The SSSI boundary should include a sufficient area of suitable habitat to enable the long-term maintenance of populations of taxa qualifying either as notified features in their own right or as parts of a species assemblage or Taxonomically Complex Group (sections 4.12 and 4.13). Populations are frequently dynamic, with individuals colonising new patches of suitable habitat whilst others may be lost due to natural change in habitat condition, etc. Therefore, patches of suitable (or potentially suitable) habitat within the same management unit that do not currently support the qualifying taxon should still be included within the SSSI boundary. Areas of suitable habitat nearby should also be considered for inclusion, especially if the habitat is particularly rare or unusual (such as heavy metal contaminated ground and mine spoil), or if the taxon in question is known to be opportunistic or highly mobile, thus allowing appropriate management to be applied across a wider area to provide additional opportunities for the spread of rare or threatened taxa. For some taxa in certain habitats the SSSI boundary may have to include quite large areas which lack the taxon but which are ecologically and functionally part of the same site; in the case of an aquatic taxon for example, one would ideally notify a whole lake rather than just that portion of the lake

currently supporting the taxon in question, although in very large water-bodies this may be disproportionate and judgement will need to be applied based on the nature of threats and the potential for them to affect the entire ecosystem.

Attention should be paid to ensuring that supporting habitat is available if any ecological relationships are essential in the life strategy of a qualifying taxon, and in particular the needs of critical pollinating animals (e.g. insect breeding sites, flight paths and the provision of year-round food supplies) and of mycorrhizal fungi.

Where taxa are dependent on water supply and/or water quality it is essential that sufficient land is included within the boundary to ensure sustainability of the habitat. This is most obviously important for aquatic taxa inhabiting oligotrophic systems but should also be borne in mind for species of other wet habitats (wet woodland, mires, marshy grassland, flushes, wet heath etc.).

## 5.2 Buffering

It is important to consider whether the quality of a particular habitat might be negatively influenced by adjacent management practices. For example, a flush, marsh, fen or pond could be negatively affected by nutrient-enrichment due to the application of fertilizer on adjacent land within the hydrological catchment. Nutrient-sensitive taxa growing close to the boundary of a site may also be negatively affected by fertilizer application, particularly artificial NPK fertilizers. In such cases, where inclusion of a 'buffer' zone within the site boundary is under consideration, sections 8.5 and 8.6 of Bainbridge *et al.* (2013) should be consulted.

## 5.3 Population characteristics

In general, large populations of qualifying taxa with long histories and covering extensive tracts of suitably managed land are the ideal candidates when it comes to selecting SSSIs. However, in an increasingly fragmented landscape and when dealing with small remnant populations of rapidly declining or range-restricted taxa, such opportunities rarely present themselves; thus, to achieve appropriate representation of a taxon across its range, it will often be necessary to select sites – and draw boundaries – which do not meet this 'ideal state'. In fact evidence suggests that large population size may not always be an indicator of importance, particularly where taxa have undergone rapid decline; in such cases, small remnant populations within formerly extensive and continuous distributions may retain greater genetic diversity than that found in larger isolated ones – particularly if the latter is the result of a recent colonisation. Nonetheless, the principles underlying the description of the ideal situation above should be borne in mind, and site boundaries should aim to include the entire population wherever possible – encompassing all individuals which can interbreed (for out-crossing species) and sufficient habitat [including areas with 'potential value' – section 5.12.1 of Bainbridge *et al.* (2013) for recruitment.

## 5.4 Actively evolving genera

In certain genera where active evolution is believed to be occurring it will be important to include areas of land encompassing populations of the usually more widespread out-crossing species (which frequently 'drive' the evolutionary process) alongside the qualifying, often recently derived taxa which typically represent narrowly endemic and sometimes selfing lines (see section 4.13 and Ennos, *et al.* 2005). In such cases there are also likely to be many individuals present which are clearly of hybrid origin or which are thought to represent potential new species; it is clearly important that these (otherwise ineligible) entities are included within the boundary. Examples of genera for which such 'evolutionary process' sites may be appropriate include *Sorbus* (whitebeams), *Rubus* (brambles),

*Euphrasia* (eyebrights) and *Dactylorhiza* (marsh-orchids). These sites will also need to encompass adequate habitat to allow recruitment of new individuals so that the process may continue to be expressed.

## 5.5 Metapopulations

In some instances, disjunct habitat patches may support apparently isolated and disconnected populations that in fact function as a single metapopulation. In such cases the loss of any one of the component populations could have an unanticipated knock-on effect across the rest of the metapopulation. Some coastal taxa [e.g. *Rumex rupestris* (shore dock)], for example, may occur as widely scattered – and apparently unconnected – small populations where local extinctions are followed by re-colonisation by sea-borne seed originating from populations further along the coast. In these circumstances it may be important to consider notifying several small areas as a compound SSSI. Additionally, patches of suitable but currently unoccupied habitat may need to be included within the SSSI. These could provide important ‘stepping-stones’ for a plant, enabling it to more easily move between other components of the site or they might be critical for its pollinators or seed dispersal agents. In principle, this is analogous to designating compound sites for metapopulations of animals which has already been tried and tested in several SSSIs in England and Wales. Under this approach the multiple discrete patches of habitat are treated as a single SSSI supporting the current locations of the species and land required to ensure long-term population viability. See section 4.9 of Bainbridge *et al.* (2013) for further elaboration of the principles underlying the relevance of site selection to the conservation of metapopulations.

## 6. Survey requirements: the importance of basing site/species assessments on the most robust and up-to-date survey data available

Vascular plant taxa vary enormously in their life strategies, ranging from annuals to perennials which may live for centuries. Some are evident above ground – or in the water column in the case of aquatics – throughout the year, whilst others may spend part of the year (usually but not always the winter months in Britain) dormant underground either as seed (the ‘seed bank’) or as a variety of ‘perennating’ organs (bulbs, corms, tubers, etc.). Many taxa are notoriously erratic in their appearance above ground, sometimes remaining ‘invisible’ for several years in a row: *Epipogium aphyllum* (ghost orchid) is a particularly well-known example.

It is essential that surveys are undertaken at the correct time of year if the significance of a site for a given taxon is to be properly determined. Additionally, whilst a thorough single survey may be perfectly adequate for certain taxa [many trees for example, e.g. *Sorbus* species (whitebeams)], others will require multiple assessments – referenced against performance of the taxon at GB and country level wherever possible – before the significance of a particular site can be properly appreciated. Examples of such species include:

- Many annuals, e.g. *Gentianella amarella* ssp. *anglica* (early gentian) or *Lotus angustissimus* (slender bird’s-foot-trefoil), which respond in sometimes unpredictable ways to interactions between land management and the weather.
- Some woodland herbs which have long-lived seeds and are adapted to exploit periodic gaps in the tree canopy, e.g. *Stachys alpina* (limestone woundwort).

- Orchids which are notorious for spending periods (sometimes years) either as protocorms or as rather hard-to-detect small vegetative plants before commencing (or resuming) full flowering.
- Some aquatics which can increase or decrease rapidly in response to periodic/cyclic management, e.g. ditch clearance.
- Many small perennials which may persist as inconspicuous individuals under adverse management (e.g. heavy grazing pressure) such as *Carex vaginata* (sheathed sedge), a species which persisted for decades undetected in the Northern Pennines before a reduction in grazing allowed the more distinctive flowers and fruits to appear.

For some so-called 'critical taxa', it is also important that surveyors have a proven track record in recording such taxa in the field. Inexperience can lead to *under-recording* (where individuals of the target taxon are dismissed as members of a more widespread and morphologically similar relative), *over-recording* (where the reverse applies), or *inconsistent recording* – particularly as the season progresses and a taxon which may be readily distinguishable in flower becomes easily overlooked (or more readily misidentified) when in fruit. 'Critical taxa' include the majority of species within the larger apomictic genera such as *Hieracium* (hawkweeds), *Taraxacum* (dandelions), *Rubus* (brambles), *Alchemilla* (lady's-mantles), *Sorbus* (whitebeams) and *Limonium* (sea-lavenders), but also those within genera prone to hybridisation such as *Rosa* (roses), *Dactylorhiza* (marsh-orchids) and *Euphrasia* (eyebrights). Some other genera contain many similar-looking taxa which can be hard to distinguish from one other without considerable experience and expertise, e.g. many *Carex* (sedges), *Salicornia* (glassworts) and *Potamogeton* (pondweed) species.

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