Conservation Gap Analysis of Whitebeams, Rowans and Service Trees Threatened in the United Kingdom and Ireland

Rosie Anderson and Dan Crowley

Global Conservation Consortium
Whitebeams, Rowans and Service Trees

the friends of Westonbirt Arboretum
Registered Charity 293190

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BOTANIC GARDENS CONSERVATION INTERNATIONAL

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April 2026

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Sorbus spectans, Avon Gorge (Dan Crowley)

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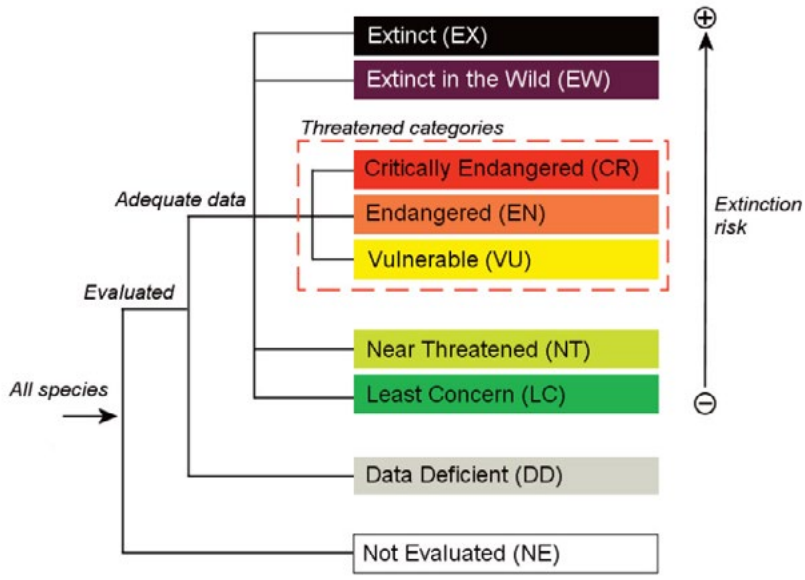

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Sorbus cheddarensis leaves and fruit (Dan Crowley)

Sorbus eminens in Cheddar Gorge (Dan Crowley)

Executive Summary

Sorbus (*sensu lato*) comprises the whitebeams, rowans and service trees and represents one of the most taxonomically complex tree groups in the temperate Northern Hemisphere. While the genus contains at least 250 species globally, the United Kingdom and Ireland constitute a major global centre of diversity. Forty-five native *Sorbus* species occur across these islands, many of which are narrow endemics confined to single gorges, valleys or woodland systems. A significant proportion are the result of hybridisation and polyploid evolution, giving rise to highly localised populations of considerable evolutionary importance. There are eight regional diversity centres across the United Kingdom and Ireland.

Many *Sorbus* species in the United Kingdom and Ireland are at risk of extinction. IUCN Red List of Threatened Species assessments show that 21 species are Critically Endangered (CR), 12 are Endangered (EN), and five are Vulnerable (VU), with many represented by fewer than 50 mature individuals in the wild. Small population sizes, combined with habitat specificity and ongoing environmental pressures, render many species extremely vulnerable to stochastic events and cumulative threats.

Given limited conservation resources, it is essential to identify where the most significant conservation gaps occur – particularly in relation to *ex situ* representation, habitat protection, threat mitigation, and coordination of conservation activities. To address this need, we undertook a comprehensive conservation gap analysis of 39 threatened *Sorbus* species native to the United Kingdom and Ireland. The methodology used was adapted from those previously applied in other tree conservation gap analyses, utilising distribution data, *ex situ* accession-level surveys, a conservation activity questionnaire, literature review, and expert consultation.

Results have been presented by regional diversity centres, with the objective of providing an evidence-based foundation for prioritising conservation actions in these regions and strengthening coordination among stakeholders working to conserve *Sorbus* diversity in the United Kingdom and Ireland.

A group of *Sorbus bristoliensis* at Westonbirt, The National Arboretum (Dan Crowley)

To assess *ex situ* conservation coverage, accession-level data were requested from botanic gardens, arboreta, seed banks and conservation organisations. Thirty-eight organisations across 14 countries provided data, representing 36 of the 39 target species. All 36 species for which data were requested are represented in at least one *ex situ* collection, either as living plants, seedlings or seed bank accessions.

However, representation is highly uneven. Several widespread species (e.g., those occurring across multiple regions) are held by numerous institutions and represented by relatively large numbers of individuals and seed accessions. In contrast, some of the most range-restricted and evolutionarily distinct species are represented by very few individuals, sometimes

in only one or two collections. Many collections lack detailed provenance data, constraining their long-term conservation value.

Species representation is stronger in seed banks than in living collections. However, seed quantity varies substantially between species, and viability concerns have been reported for several.

Prioritisation scoring based on IUCN category and *ex situ* metrics highlights several species of highest conservation concern. These include narrowly endemic species in Cheddar Gorge, Avon Gorge and the Wye Valley.

To provide a clear picture of the threats facing wild populations, current conservation activities, and required conservation actions to protect our target species, threat information was compiled through a Conservation Activity Questionnaire, expert consultation, IUCN Red List assessments and literature review.

Across all regions, the most frequently reported and significant threats include:

- Pests and pathogens
- Invasive species competition
- Grazing pressure
- Disturbance regime modification and woodland succession
- Tourism and recreation impacts
- Development pressures, including infrastructure projects

Many populations persist on cliffs and marginal habitats where grazing and competition are naturally limited. However, changes in disturbance regimes such as reduced traditional woodland management, altered grazing intensity or invasive species expansion, are altering habitat structure in ways that may either suppress regeneration or expose mature trees to new threats. A recurring theme across regions is a lack of regeneration. Even where mature individuals persist, seedling recruitment is often limited by grazing, shading, poor seed viability, or reproductive isolation.

Numerous conservation activities are currently in place for several species. Public awareness and education, occurrence surveys, and conservation horticulture were the most frequently reported activities. Encouragingly, many of the major diversity centres, such as Avon Gorge and Cheddar Gorge, are largely located within protected areas. However, not all populations fall within designated conservation sites, and some occur on land where management practices may not prioritise *Sorbus* conservation.

Across regions, priority actions include:

- Expanding and improving the quality of *ex situ* collections for the highest priority species, with emphasis on genetically representative, well-documented wild provenance material
- Strengthened population monitoring and updated surveys
- Active habitat management (including invasive species control and grazing management)
- Research on seed viability, pathogens, genetics, and climate resilience
- Development of integrated management plans for key diversity centres
- Implementation of habitat protection for populations outside designated protected areas
- Enhanced public awareness

Sorbus diversity in the United Kingdom and Ireland is the product of ongoing hybridisation and polyploid evolution. Many threatened species are apomictic and research has demonstrated that some polyploid species require pollen from other *Sorbus* species to set seed (pseudogamy), meaning that isolated conservation of a single species may fail if broader ecological and evolutionary processes are not maintained.

Accordingly, this report strongly supports a process-based approach to conservation. Rather than focusing exclusively on individual species, management should also aim to conserve dynamic woodland systems that sustain *Sorbus* evolutionary processes. This includes maintaining mixed-species assemblages, restoring appropriate disturbance regimes, managing invasive species, and ensuring landscape-scale connectivity among populations.

Many organisations are already undertaking important and effective conservation actions for threatened *Sorbus* species. However, significant gaps remain in *ex situ* genetic representation, coordinated habitat management, and research into reproductive biology and disease threats. Most importantly, the evolutionary dynamics underpinning *Sorbus* diversity necessitate a coordinated, process-based conservation strategy.

This conservation gap analysis provides a robust evidence base for prioritising actions, guiding resource allocation, and strengthening collaboration among institutions. By integrating *in situ* and *ex situ* conservation with landscape-scale ecological management, it offers a framework to secure the future of one of the United Kingdom and Ireland's most remarkable and evolutionarily significant tree groups.

Introduction and Objectives

The genus *Sorbus* (*sensu lato*) is a taxonomically complex genus, consisting of the whitebeams, rowans, and service trees. Comprising at least 250 species, they are primarily found across the temperate Northern Hemisphere, with many species planted beyond their natural ranges.

Sorbus species often inhabit cliffs and mountainsides, while some occur in lowland pockets of ancient woodlands. There are 45 *Sorbus* species native to the United Kingdom and Ireland, making these islands a global centre of diversity for the genus. According to the IUCN Red List of Threatened Species, and recent, yet to be published assessments for UK species, 21 are Critically Endangered (CR), with 20 of these represented by less than 50 mature individuals in the wild. Twelve species are assessed as Endangered (EN), and five are assessed as Vulnerable (VU) (IUCN, 2023; BGCI, 2025). Many of the most threatened species exist in severely restricted populations, heightening their vulnerability to external threats.

Within the United Kingdom and Ireland are several regional centres of diversity (Figure 1). The most significant of these is the Avon Gorge in Bristol, where 22 *Sorbus* taxa occur, including five species which occur there and nowhere else.

Across the United Kingdom and Ireland, the main ecological pressures on *Sorbus* species are grazing, shade (including succession to tall woodland) and habitat degradation through deforestation and selective forestry. As such, many populations are restricted to rocky cliffs, where they are sheltered from grazing animals and competition for light. Changes in climate are likely to have an increased impact on such marginal habitats and exacerbate threats from pests and diseases. In addition, the challenge of accurate identification, particularly within the polyploid taxa, which results in lack of information may also contribute to inadvertent mismanagement.

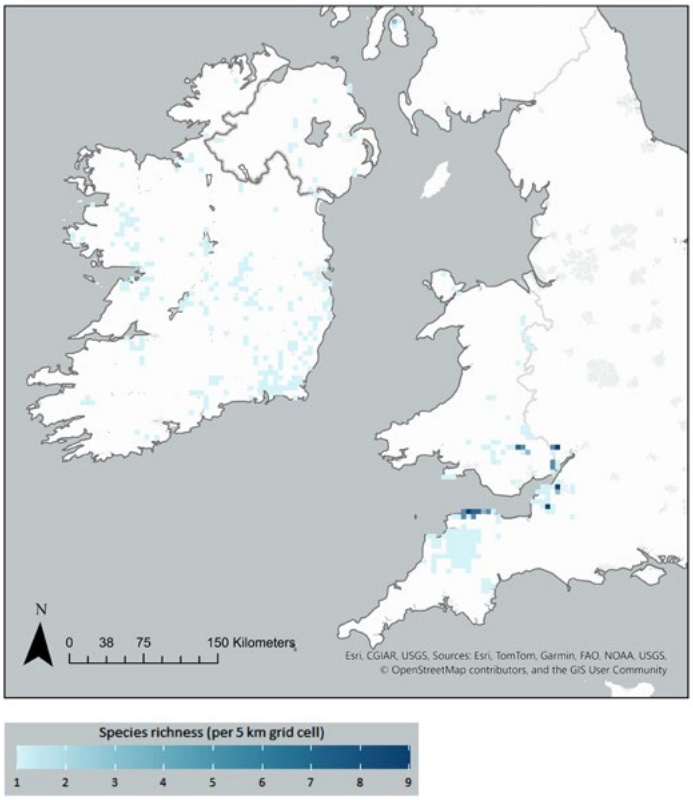


Figure 1. Species richness map of threatened *Sorbus* in the United Kingdom and Ireland.

Several projects targeting conservation of these threatened taxa have been successfully undertaken, though to address the ongoing conservation needs of these trees, a coordinated approach is required. Within the framework of Botanic Gardens Conservation International's (BGCI), Global Conservation Consortia (GCC), the Global Conservation Consortium for Whitebeams, Rowans and Service Trees aims to initiate an integrated approach to conserve these trees both *in situ* and *ex situ*, while raising awareness of their significance, both culturally and evolutionarily (BGCI, 2024).

To help inform conservation priorities for future work on *Sorbus* threatened in the United Kingdom and Ireland and following methodologies employed by other GCCs, we carried out a comprehensive conservation gap analysis for species assessed as threatened according to the IUCN Red List. Hereon, these are referred to as 'target species' (Table 1). Adapting previous methodologies, including the *Conservation Gap Analysis of* Nothofagus (Steed-Mundin et al., 2024), *Conservation Gap Analysis of Native US Oaks* (Beckman et al., 2019) and the *Global Conservation Gap Analysis of* Magnolia (Linsky et al., 2022), our study included surveys, consultation, and literature reviews to establish the status of each target species both *in situ* and within *ex situ* collections. It also enabled us to identify current and previous conservation activities, along with priorities to help conserve these species both *in situ* and *ex situ*.

There is currently a debate as to how to treat *Sorbus* at a generic level (Rich et al., 2026). No single taxonomic treatment applied to this group has been universally recognised and use of scientific names is inconsistent between botanical institutions and conservation organisations. Due to a lack of consensus on any taxonomic treatment as described by Velebil et al. (2022), here we have chosen to follow the convention followed by Fay and Rich (2022), following scientific names used in the updated W*hitebeams, Rowans and Service Trees of Britain and Ireland* (Rich et al., 2026). *Sorbus* taxa native to United Kingdom and Ireland are listed with their synonyms in Appendix 2.

Sorbus saxicola, Ganarew, England (Rosie Anderson)

Methods

This study focuses on *Sorbus* species native to the United Kingdom and Ireland that have been identified as threatened for the IUCN Red List of Threatened Species (i.e. CR, EN and VU) (IUCN, 2023). In February 2024, *Sorbus anglica* was reassessed from Near Threatened to Vulnerable (Rich and Beech, 2024) and is included here without *ex situ* data and Conservation Activity Questionnaire results. Further taxa were described in 2025 (Rich and Houston, 2025), which have recently been assessed for the IUCN Red List of Threatened Species though are awaiting publication, and have been included in this study without *ex situ* data and Conservation Activity Questionnaire results. *Sorbus devoniensis* was reassessed from VU to Near Threatened (NT) in late 2025 and remains included in the study (BGCI, 2025). This study therefore focuses on 39 target species (Table 1).

The following methodology is adapted from approaches used in the *Conservation Gap Analysis of* Nothofagus (Steed-Mundin et al., 2024), *Conservation Gap Analysis of Native US Oaks* (Beckman et al., 2019) and the *Global Conservation Gap Analysis of* Magnolia (Linsky et al., 2022), utilising a workflow developed by Bruns (2023) and code developed by Bruns et al. (2023), utilising R statistical software (R Core Team, 2024).

Distribution of the target species was gathered from occurrence records from the Botanical Society of Britain and Ireland's Distribution Database (BSBI, 2025). These data were used for producing regional distribution maps. Tables of taxa for each region are included in the results section for each.

Type tree of *Sorbus admonitor*, Watersmeet, England (Rosie Anderson)

Table 1. *Sorbus* target species' distribution, ecology and IUCN Red List Category.

		Ecology (IUCN, 2023; Rix, 2023; Rich et al., 2026)			Conservation Status	
Species	Common name	Diversity centre	Habit	Habitat	IUCN Red List category	Current population trend
Sorbus admonitor M.Proctor	Watersmeet whitebeam; No parking tree	South West England	Tree to 16 m or more.	Old red sandstone and shales, in open woodland between 100 and 250 m asl	EN	Stable
Sorbus anglica Hedl.	English whitebeam	South West England, South Wales and Republic of Ireland	Shrub or tree to 10 m or more	Rock or quarry faces, ledges or open habitat, only occasionally in woodland, between 5 and 480 m asl	VU	Stable
Sorbus arranensis Hedl.	Arran whitebeam	Isle of Arran	Shrub or small tree	Along rocky stream sides and on rock outcrops in open, deciduous woodland on granite substrates, up to 346 m asl	EN	Decreasing
Sorbus arvonicola P.D.Sell	Menai Strait whitebeam, Cerddin Menai	North Wales	Shrub or tree to 10 m or more	Open, rocky woodlands along limestone beds, between 1 and 20 m asl	CR	Stable
Sorbus avonensis T.C.G.Rich	Avon whitebeam	Avon Gorge	Shrub or tree to 7 m or more	Open rocks and open woodlands between 5 and 50 m asl	CR	Stable
Sorbus bristoliensis Wilmott	Bristol whitebeam	Avon Gorge	Tree to 20 m or more	Carboniferous limestone in scrub, quarries and woodland, between 5 and 110 m asl	EN	Increasing
Sorbus cambrensis M.Proctor	Welsh whitebeam	South Wales	Tree to 8 m or more	Rocky open woodland and scrub on carboniferous limestone and old red sandstone, between 250 and 430 m asl	EN	Unknown
Sorbus cheddarensis L.Houston & Ashley Robertson	Cheddar whitebeam	South West England	Shrub or tree to 7 m or more	Limestone slopes and rocks, between 150 and 200 m asl	CR	Unknown
Sorbus cuneifolia T.C.G.Rich	Llangollen whitebeam, Cerddinn Llangollen	North Wales, Shropshire	Shrub or tree to 5 m or more	Carboniferous limestone substrates, between 180 and 420 m asl	EN	Unknown
Sorbus devoniensis E.F.Warb.	Devon whitebeam	South West England, Ireland	Large shrub or tree to 20 m	Hedgerows, rocky woodland and moorland (rarely) on shales, slates and grits, up to 260 m asl	NT	Unknown

		Ecology (IUCN, 2023; Rix, 2023; Rich et al., 2026)			Conservation Status	
Species	Common name	Diversity centre	Habit	Habitat	IUCN Red List category	Current population trend
Sorbus eminens E.F.Warb.	Round-leaved whitebeam	South West England, South Wales	Single or multi-stemmed tree to 20 m or more	Shaded, deciduous woodland and on open rocks, cliff edges and other open areas, largely on carboniferous limestone, but in the Avon Gorge also grows on acidic sandstone substrates. Occurs between 1 and 145 m asl	VU	Stable
Sorbus eminentiformis T.C.G.Rich	Doward whitebeam	Wye Valley	Tree to 20 m or more	Open deciduous woodland on clay soils, carboniferous limestone and on rocks and quarry edges, between 100 and 160 m asl	EN	Unknown
Sorbus eminentoides L.Houston	Two cliffs whitebeam	Cheddar Gorge	Shrub or tree to 9 m or more	Carboniferous limestone rocks and screes	CR	Decreasing
Sorbus evansii T.C.G.Rich	Evan's whitebeam	Wye Valley	Shrub or tree to 6 m or more	Carboniferous limestone cliffs and rocks between 100 and 160 m asl	CR	Unknown
Sorbus fayana L.Houston & T.C.G.Rich	Fay's Whitebeam	Cheddar Gorge and Burrington Combe	Shrub or tree to 8 m or more	Carboniferous Limestone rocks on open cliffs and screes between 12- and 200 m asl	CR	Unknown
Sorbus greenii T.C.G.Rich	Green's whitebeam	Wye Valley	Tree to 18 m or more	In Fraxinus woodland between 100 and 160 m asl	CR	Increasing
Sorbus herefordensis D.Green	Hereford whitebeam	Wye Valley	Single or multi-stemmed tree to 20 m	Closed deciduous woodland on carboniferous limestone between 100 and 160 m asl	EN	Stable
Sorbus hibernica E.F.Warb	Irish whitebeam	Ireland	Tree to 7 m or more	Lowland and upland rock, cliffs, in gorges, on open rocky pastures, in woods and hedges, and as an opportunist in other areas, up to 330 m asl	VU	Stable
Sorbus leighensis T.C.G.Rich	Leigh Woods whitebeam	Avon Gorge	Shrub or tree to 10 m or more	Carboniferous limestone on rocky scrub, cliffs and quarries, between 2 and 110 m asl	EN	Increasing
Sorbus leptophylla E.F.Warb	Thin-leaved whitebeam	South Wales	Shrub or tree to 5 m or more	Scrub and open woodland on carboniferous limestone, between 240 and 270 m asl	EN	Stable
Sorbus leyana Wilmott	Ley's whitebeam	South Wales	Shrub or tree to 10 m or more	Scrub or open woodland on carboniferous limestone, between 340 and 360 m asl	CR	Decreasing

		Ecology (IUCN, 2023; Rix, 2023; Rich et al., 2026)			Conservation Status	
Species	Common name	Diversity centre	Habit	Habitat	IUCN Red List category	Current population trend
Sorbus margaretae M.Proctor	Margaret's whitebeam	South West England	Shrub or small tree to 6 m or more	Open woodlands, on cliffs and old red sandstone moorlands, slates and shales along the coast, between 5 and 300 m asl	EN	Stable
Sorbus minima (Ley) Hedl.	Least whitebeam	South Wales	Shrub or occasionally a small tree to 9 m	Steep, rocky slopes on carboniferous limestone and occasionally millstone grit, between 250 and 450 m asl	VU	Increasing
Sorbus parviloba T.C.G.Rich	Ship Rock whitebeam	Wye Valley	Tree to 8 m	Cliffs in open woodland on carboniferous limestone between 100 and 125 m asl	CR	Unknown
Sorbus porrigentiformis E.F.Warb.	Grey-leaved whitebeam	South West England, South Wales	Shrub or small tree to 10 m	Open woodland and on exposed rock, both inland and on sheltered sea cliffs, mainly on calcareous sandstone and carboniferous limestone but may also grow on acidic substrates, between 2 and 450 m asl	VU	Decreasing
Sorbus pseudofennica E.F.Warb.	Arran service tree	Isle of Arran	Shrub or small tree to 3.5 m or more	Along rocky ravines, on moorland and well-drained areas by streams, between 10 and 350 m asl	CR	Unknown
Sorbus pseudomeinichii Ashley Robertson	Catacol whitebeam	Isle of Arran	Shrub or small tree to 4 m or more	Along rocky riversides, usually on acidic soils, between 150 and 200 m asl	CR	Decreasing
Sorbus richii L.Houston	Rich's whitebeam	South West England	Tree to 15 m or more	Carboniferous limestone substrates in open woodland, scrub and on rocks, up to 30 m asl.	CR	Stable
Sorbus rupicoloides L.Houston & T.G.C.Rich	Gough's Rock whitebeam	Cheddar Gorge	Shrub or tree to 7 m or more.	Carboniferous limestone rocks and slopes	CR	Decreasing
Sorbus saxicola T.C.G.Rich	Symonds Yat whitebeam	Wye Valley	Shrub or tree to around 5 m	Exposed rocks, quarry edges and open, deciduous woodland on carboniferous limestone between 75 and 175 m asl	CR	Stable
Sorbus scannelliana T.C.G.Rich	Scannell's whitebeam	Ireland	Small tree	Deciduous woodland on carboniferous limestone, between 10 and 125 m asl	CR	Stable
Sorbus spectans L.Houston	Observatory whitebeam	Avon Gorge	Tree to 9 m	Carboniferous limestone on rocks and cliffs between 20 and 50 m asl	CR	Stable

		Ecology (IUCN, 2023; Rix, 2023; Rich et al., 2026)			Conservation Status	
Species	Common name	Diversity centre	Habit	Habitat	IUCN Red List category	Current population trend
Sorbus stenophylla M.Proctor	Llanthony Valley whitebeam	South Wales	Shrub or tree to 9 m or more	Rocky, open woodland and scrub on carboniferous limestone, between 330 and 360 m asl	EN	Stable
Sorbus stirtoniana T.C.G.Rich	Stirton's whitebeam	North Wales	Shrub or tree to 5 m or more	Steep, open rock and scree and along woodland edges, between 50 and 365 m asl	CR	Stable
Sorbus subcuneata Wilmott	Somerset whitebeam	South West England	Shrub or tree, occasionally suckering, to 15 m or more	Quercus woodlands and heathland slopes on old red sandstone, shales and lower lias substrates between 1 and 250 m asl	EN	Stable
Sorbus vexans E.F.Warb.	Bloody whitebeam	South West England	Shrub or tree to 10 m or more	Old red sandstone, slates and shales in rocky woodlands, rocks and moorland, rarely inland, up to 210 m asl	CR	Stable
Sorbus whiteana T.C.G.Rich & L.Houston	White's whitebeam	Avon Gorge	Shrub or tree 10 m or more	Rocky scrub, on cliffs and quarries on carboniferous limestone between 20 and 120 m asl	CR	Decreasing
Sorbus wilmottiana E.F.Warb.	Wilmott's whitebeam	Avon Gorge	Shrub or tree 10 m or more	Steep, rocky slopes on carboniferous limestone between 5 and 110 m asl	CR	Stable
Sorbus wyensis (D.Green) T.C.G. Rich	Wynd Cliff whitebeam	Wye Valley	Shrub or tree to 6 m or more	Carboniferous limestone quarry at around 75 m asl	CR	Decreasing

Ex situ collections

Between 2023 and 2024 we distributed a request to institutions with *ex situ* collections to provide accession-level data for these species, including any associated wild provenance details. Data were accepted through to January 2026.

As defined in BGCI's *Manual on Planning, Developing and Managing Botanic Gardens* (Gratzfeld, 2016), an accession is:

> *plant material (individual or group) of a single taxon and propagule type with identical or closely similar parentage acquired from one source at the same time. An accession is catalogued and assigned a unique identifier (number or code) associated with additional information.*

The following collections were targeted for the *ex situ* collection survey:

- Institutions who reported target *Sorbus* species to BGCI's PlantSearch database (BGCI, 2023)
- Arboreta/botanic institutions with known *Sorbus* collections

Seventy-three organisations were contacted directly, and the request was further disseminated to additional organisations via collaborators.

Accession data, including associated provenance details, was requested in a standardised format. Once received, these data were cleaned. When distribution coordinates were not provided, where possible they were manually geolocated using locality and source data. When the provenance type was not provided it was assigned as 'unknown'.

Ex situ records were differentiated by living plant collections (individual plants and seedlings on nurseries) and seed collections – these data are reported separately. Organisations were asked to include the number of individuals and/or seeds in each accession. Where the number of individual plants was not given, it was assumed the accession was one individual. Numbers of plants held in *ex situ* collections should therefore be considered as an estimate.

Taxonomic revisions of *S. porrigentiformis* have subdivided the species into an additional 11 endemic taxa (Rich et al., 2022b). Where accessions clearly corresponded to these updated taxa, names were revised to reflect current taxonomy. However, for wild provenance accessions collected within ranges shared by *S. porrigentiformis s.s* and newly described taxa, the name *S. porrigentiformis* was retained. Consequently, analysis results may underrepresent subdivided taxa and overrepresent *S. porrigentiformis* s.s.

Prioritising Target Species

To prioritise target *Sorbus* species for *ex situ* conservation, the following metrics were applied to our target species, adapted from Linsky et al. (2022). Each species was assigned scores based on the level of severity for each metric and a total score was calculated for each species, which is displayed in the Prioritisation matrix (Table 2).

- IUCN Red List category
- Number of organisations with *ex situ* collections (including plants and/or seeds)
- Number of individual plants in *ex situ* living collections
- Number of wild provenance seedlings in nurseries
- Number of seeds in *ex situ* collections

Table 2. Prioritisation scoring matrix identifying *in situ* and *ex situ* metrics measuring conservation of the target *Sorbus* species within the United Kingdom and Ireland.

Criterion	5 points	4 points	3 points	2 points	1 point	0 points
IUCN Red List category	CR	EN	VU	NT	DD	LC
# organisations with *ex situ* collections (inc. plants and/or seeds)			0	1 to 5	6 to 19	>19
# of individual plants in *ex situ* living collections		0-5	6 to 25	26-50	51-100	>100
# wild provenance seedlings in nurseries				0-1,000	1,001 - 10,000	>10,000
# of seeds in *ex situ* collections		0-100	101-1000	1001-3000	3000-30,000	>30,000

Threats to Wild Populations

Threats to wild populations were identified by reviewing The IUCN Red List of Threatened Species, expert consultation, literature review and a Conservation Activity Questionnaire.

Threat categories included in the Conservation Activity Questionnaire were based on those used for the *Conservation Gap Analysis of Native U.S* Oaks (Beckman et al., 2019) and subsequent gap analyses (Linsky et al., 2022; Steed-Mundin et al., 2024). Questionnaires were sent out in 2023 and 2024 to the same institutions and organisations targeted for *ex situ* collections (see section: '*Ex situ* collections reported 2023-2025, p18) plus a further 25 contacts at conservation agencies identified through desktop study and consultation with experts. A total of 98 organisations were contacted directly. The questionnaire was also disseminated further by contributors in centres of diversity. Threats have been categorised under the following 12 threat categories:

- Agriculture and silviculture
- Climate change
- Development, mining, and/or roads
- Disturbance regime modification
- Grazing
- Inbreeding or introgression
- Invasive species competition
- Other
- Pests or pathogens
- Tourism or recreation
- Unknown
- Wild harvesting

The identification of these threats can contribute to developing the most appropriate priority conservation actions for each species and to identify regional trends to inform conservation strategies (Linsky et al., 2022).

Conservation Activities

We investigated on-going and required conservation activities for each target species. Data was gathered from an *ex situ* collections survey, a Conservation Activity Questionnaire, literature review and through consultation with experts.

Current Conservation Activities

Information regarding current conservation activities was gathered through literature review, consultation with experts and via the Conservation Activity Questionnaire. Questionnaires were sent out in 2023 and 2024 to the same institutions and organisations targeted for *ex situ* collections data (see section: '*Ex situ* collections reported 2023-2024, p18). Further contacts at conservation agencies were identified through a desktop study and consultation with experts. A total of 98 organisations were contacted directly and the request was shared further by contacts within regions. The 14 categories for the Conservation Activity Questionnaire follow those used in the *Conservation Gap Analysis of* Magnolia and the *Conservation Gap Analysis of* Nothofagus (Linsky et al., 2022; Steed-Mundin et al., 2024):

- Collect and distribute germplasm
- Conservation horticulture
- Cryopreservation and/or micropropagation
- Habitat restoration
- Implement protection policies or regulations
- Occurrence surveys or population monitoring
- Pollen and/or seed banking
- Population reinforcement or introduction
- Protect and/or manage habitat
- Public awareness or education
- Research: climate change
- Research: genetics
- Research: pests and pathogens
- Research: taxonomy

The results from the Conservation Activity Questionnaire were merged with results from expert consultation and the literature review.

Priority Conservation Actions

Priority conservation actions were identified for each species through the Conservation Activity Questionnaire. Conservation action categories follow those used in the Conservation Gap Analysis of *Magnolia* (Linsky et al., 2022), (see section: 'Current Conservation Activities', p20).

Recommendations

Priority conservation actions, identified through the Conservation Activity Questionnaire, together with findings from the *ex situ* collection survey and threats identified via the questionnaire, literature review, and expert consultation, were synthesised to develop recommendations for each of our target species. These recommendations are discussed by region and categorised as either 'highest priority' or 'recommended' activities. Recommendations for species occurring in multiple regions are tailored to each region, as conservation priorities vary by location.

Results

Results are organised by diversity centre or region within the United Kingdom and Ireland, arranged in ascending order by vice-county. Vice-counties are stable geographical divisions, within the UK and Ireland, used for biological recording purposes (Watson & Newbould, 1847; Praeger, 1901). Within South West England, Avon Gorge, and Cheddar Gorge and Burrington Combe are treated separately from the rest of the region on account of their significance as individual sites (see Figure 2 for a map highlighting the diversity centres or regions within United Kingdom and Ireland).

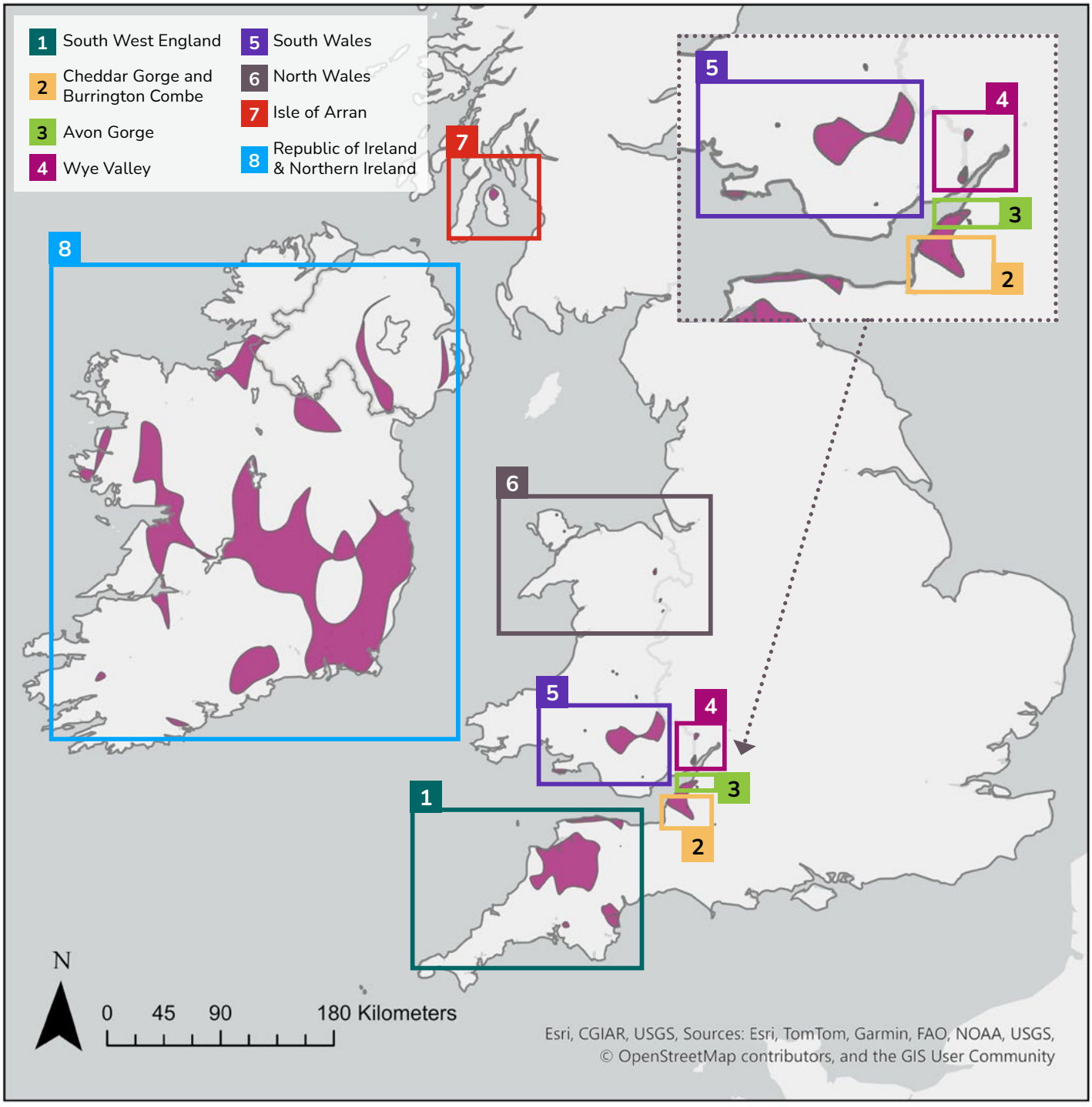


Figure 2. Areas highlighted are diversity centres or regions within the United Kingdom and Ireland.

Ex situ collections reported

A total of 38 organisations from 14 countries provided accession-level data for 36 of the target species in response to the *ex situ* collections survey of *Sorbus* threatened in the United Kingdom and Ireland (see Figure 3 for location of *ex situ* planting sites held by the 38 organisations that provided accession-level data). Organisations included botanic gardens, arboreta, seed banks, and forestry institutes in 12 European countries and the United States and Canada. Most organisations reporting collections of target species are in the UK (42.5%), followed by Ireland and the United States (both 7.5%).

Of the 36 *Sorbus* target species that we requested data for, all 36 are held in at least one *ex situ* collection (Table 3).

a) Living collections: plants

The species with the highest number of reported plant accessions in *ex situ* living collections is *Sorbus bristoliensis* (54), followed by *S. leighensis* (42). Eight species are only found in living collections within the United Kingdom *S. bristoliensis* has the highest number of individual plants in *ex situ* living collections (138), followed by *S. pseudofennica* (102), and all other species each have less than 100 (Table 3). *S. cheddarensis*, and *S. scannelliana*, are both represented by just two plants in *ex situ* living collections, while there were no plants of *S. avonensis*, *S. greenii*, *S. herefordensis* and *S. spectans* reported in *ex situ* living collections (Table 3).

Provenance information is included in regional results below.

b) Living collections: seedlings

Fourteen of the target species are represented by seedlings in living collections, with each species having no more than two seedling accessions. *S. avonensis*, *S. greenii* and *S. herefordensis* are represented by seedlings and banked seed in *ex situ* collections, with no individual plants currently held.

c) Seed banks

Of the 36 target species for which we requested data, 35 are held in seed banks. *S. scannelliana* is the only species absent from seed banks. *S. pseudofennica* has the largest number of banked seed accessions (12), followed by *S. devoniensis*, *S. arranensis* and *S. porrigentiformis* (each with 9 accessions) (see regional results). The number of individual seeds banked for each species varies considerably. *S. bristoliensis* has 9895 seeds, although the majority of species have less than 2000 seeds (Table 3).

Provenance information is included in regional results below.

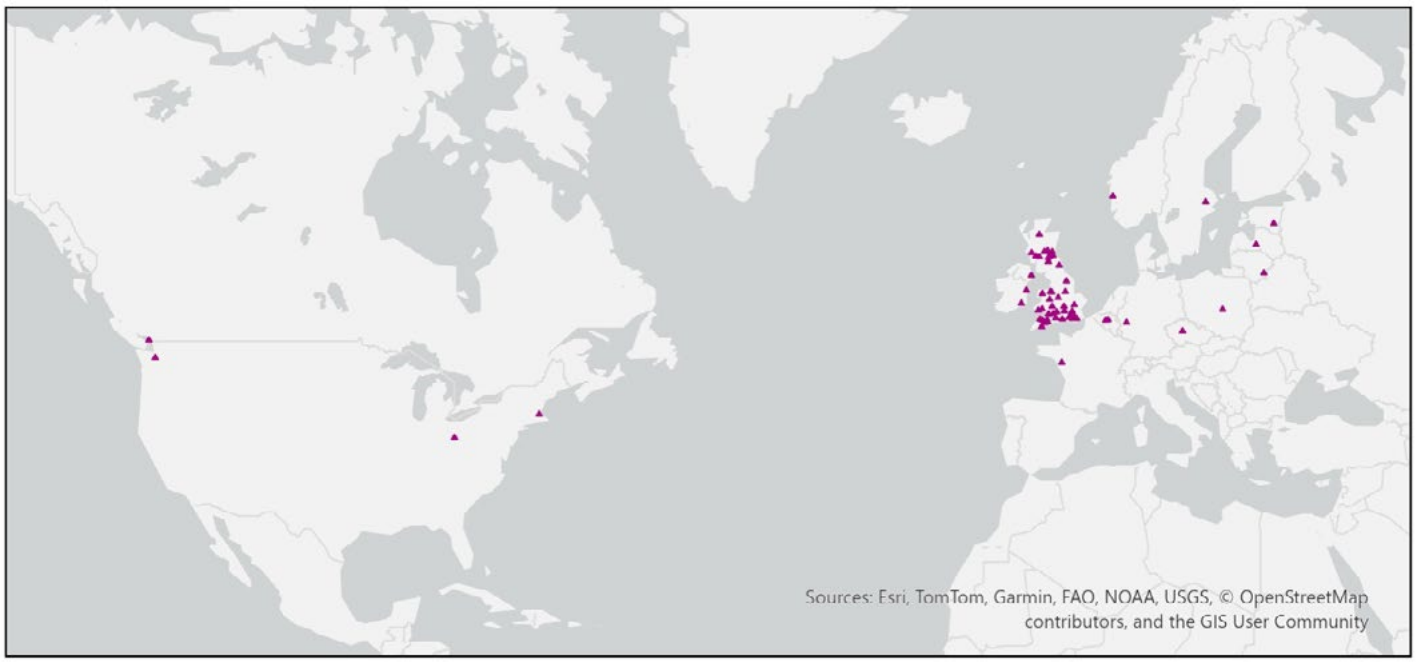


Figure 3. Location of *ex situ* planting sites held by the 38 organisations that provided accession-level data.

Prioritisation Matrix

Results from the *ex situ* collections survey and existing conservation assessments have been combined to produce prioritisation matrices for all target species and for each region (Table 3 and regional results). Each species was assigned scores based on the level of severity for each metric and a total score was calculated for each species.

Table 3. *Ex situ* prioritisation matrix identifying conservation concern score for *Sorbus* target species. IUCN Red List categories of United Kingdom species are taken from recent unpublished reassessment workshop (BGCI, 2025) While endemic Irish and Northern Irish taxa are taken from published assessments (IUCN, 2023). *Ex situ* data for *S. fayana* and *S. wyensis* are taken from Rich et al., 2026).

Species	IUCN Red List category	# organisations with *ex situ* collections (plants and/or seeds)	# of individual plants in *ex situ* living collections	# wild provenance seedlings in nurseries	# of seeds in *ex situ* collections	Concern Score (max score = 18)
Sorbus admonitor	EN	5	8	0	125	14
Sorbus arranensis	EN	18	88	20	1350	10
Sorbus arvonicola	CR	8	68	0	2839	11
Sorbus avonensis	CR	2	0	21	381	16
Sorbus bristoliensis	EN	22	138	14	9895	7
Sorbus cambrensis	EN	4	9	0	1189	13
Sorbus cheddarensis	CR	2	2	0	662	16
Sorbus cuneifolia	EN	7	46	0	4370	10
Sorbus devoniensis	NT	18	215	0	2585	7
Sorbus eminens	VU	9	41	50	669	11
Sorbus eminentiformis	EN	5	10	5	1599	13
Sorbus eminentoides	CR	3	15	0	750	14
Sorbus evansii	CR	5	7	5	1259	14
Sorbus fayana	CR	0	0	0	0	18
Sorbus greenii	CR	2	0	25	527	16
Sorbus herefordensis	EN	1	0	0	3462	13
Sorbus hibernica	VU	11	27	0	202	11
Sorbus leighensis	EN	4	43	27	592	13
Sorbus leptophylla	EN	15	33	0	910	12
Sorbus leyana	CR	12	58	0	292	12
Sorbus margaretae	EN	3	6	0	3093	12

5 points	4 points	3 points	2 points	1 point	0 points

Species	IUCN Red List category	# organisations with *ex situ* collections (plants and/or seeds)	# of individual plants in *ex situ* living collections	# wild provenance seedlings in nurseries	# of seeds in *ex situ* collections	Concern Score (max score = 18)
Sorbus minima	VU	17	53	0	1184	9
Sorbus parviloba	CR	6	8	15	215	14
Sorbus porrigentiformis	VU	16	49	68	1401	10
Sorbus pseudofennica	CR	16	102	27	1997	10
Sorbus pseudomeinichii	CR	4	21	67	196	15
Sorbus richii	CR	3	6	0	771	15
Sorbus rupicoloides	CR	4	18	0	1204	14
Sorbus saxicola	CR	4	7	14	1209	14
Sorbus scannelliana	CR	1	2	0	0	17
Sorbus spectans	CR	1	0	0	1447	15
Sorbus stenophylla	EN	3	7	0	1908	13
Sorbus stirtoniana	CR	3	9	0	1045	14
Sorbus subcuneata	EN	10	20	0	860	13
Sorbus vexans	CR	12	25	0	407	14
Sorbus whiteana	CR	4	21	49	2086	14
Sorbus wilmottiana	CR	21	73	79	1138	10
Sorbus wyensis	CR	0	0	0	0	18

5 points	4 points	3 points	2 points	1 point	0 points

Threats to wild populations

A total of 34 respondents from 31 organisations and two private individuals (see Appendix 1 for list of contributors) provided threat information for 36 target species via the Conservation Activity Questionnaire (Figure 4). Threat information was also gathered from IUCN Red List of Threatened Species assessments, expert consultation and literature review.

Across all 36 target species that we requested threat data for in the Conservation Activity Questionnaire, pests and pathogens, invasive species competition and grazing were identified by respondents as the three most significant threats to wild populations (Figure 5).

Conservation Activities

Current conservation activities

Information regarding current conservation activities was gathered through literature review, consultation with experts and via the Conservation Activity Questionnaire.

Across all 36 target species that we requested data for in the Conservation Activity Questionnaire, public awareness or education, occurrence surveys or population monitoring and conservation horticulture were the three most identified conservation activities by respondents (Figure 6).

More detailed results from this research are presented at a regional level in regional results.

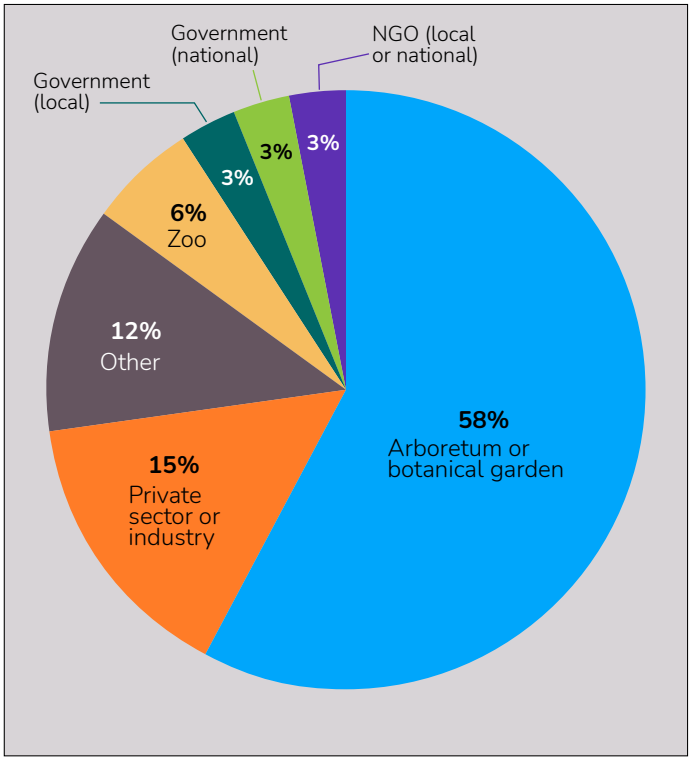


Figure 4. The proportion of respondents to the Conservation Activity Questionnaire by organisation type that provided information about current conservation activities.

Sorbus porrigentiformis, Avon Gorge, Bristol (Rosie Anderson)

Priority Conservation Actions

Priority conservation actions were identified for each species through the Conservation Activity Questionnaire. Across all 36 target species that we requested data for in the Conservation Activity Questionnaire, occurrence surveys or population monitoring, protect and/or manage habitat and public awareness or education were the three most frequently identified priority conservation activities by respondents (Figure 7).

More detailed results from this research are presented at a regional level in regional results.

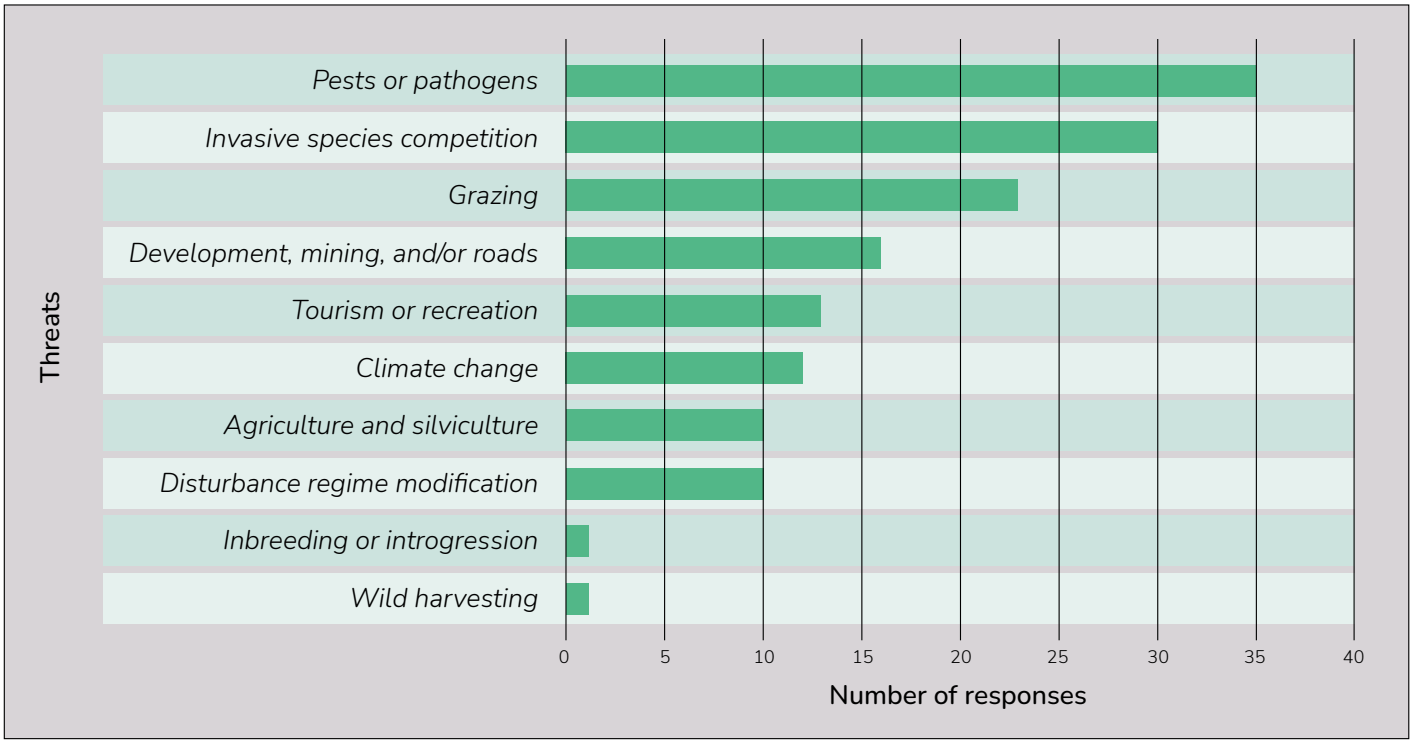


Figure 5. The most significant threat to wild populations as identified by respondents to the Conservation Activity Questionnaire. In addition to results presented, 31 responses stated that the most significant threat was unknown.

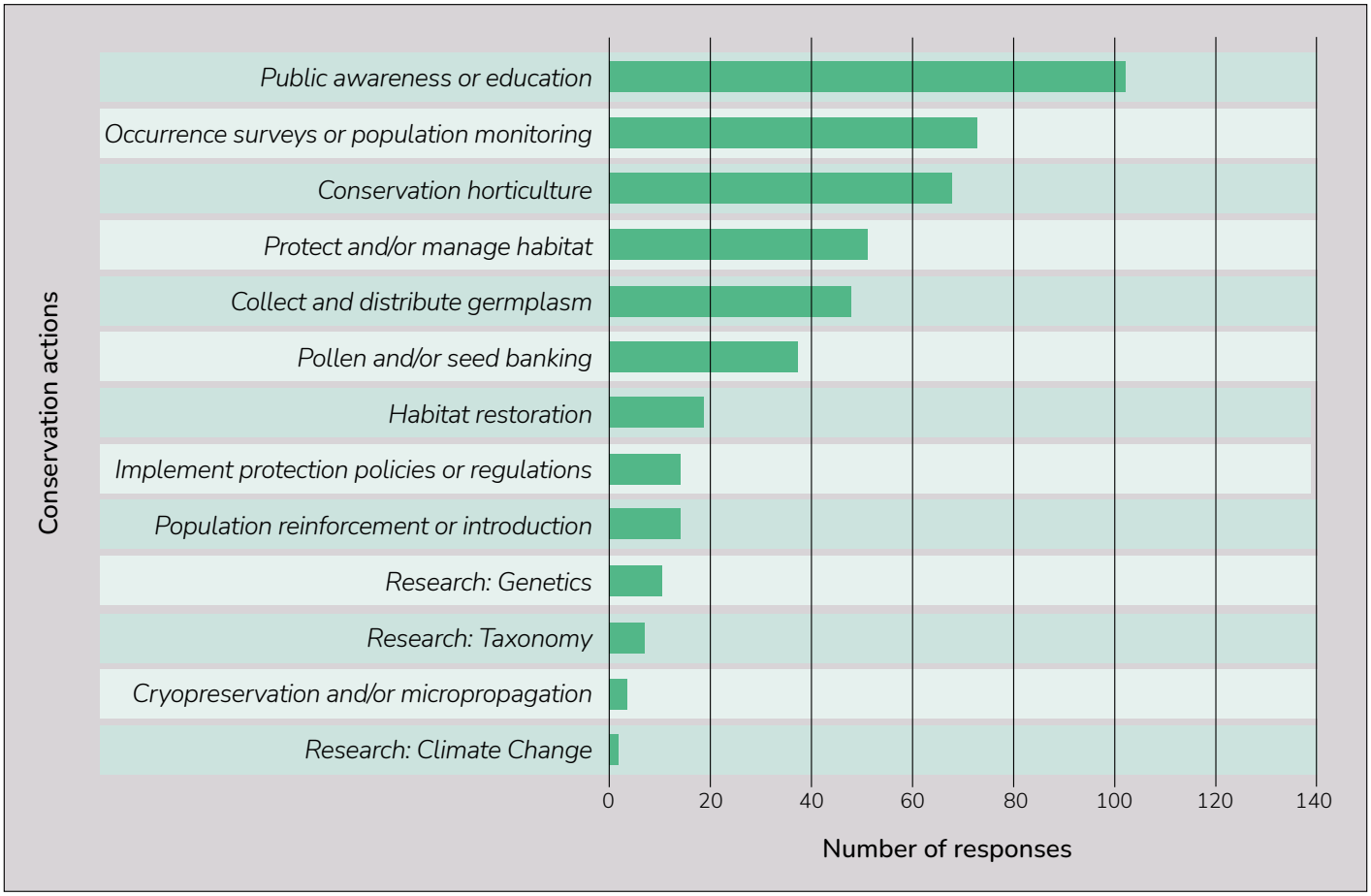


Figure 6. Conservation activities reported by respondents to the Conservation Activity Questionnaire.

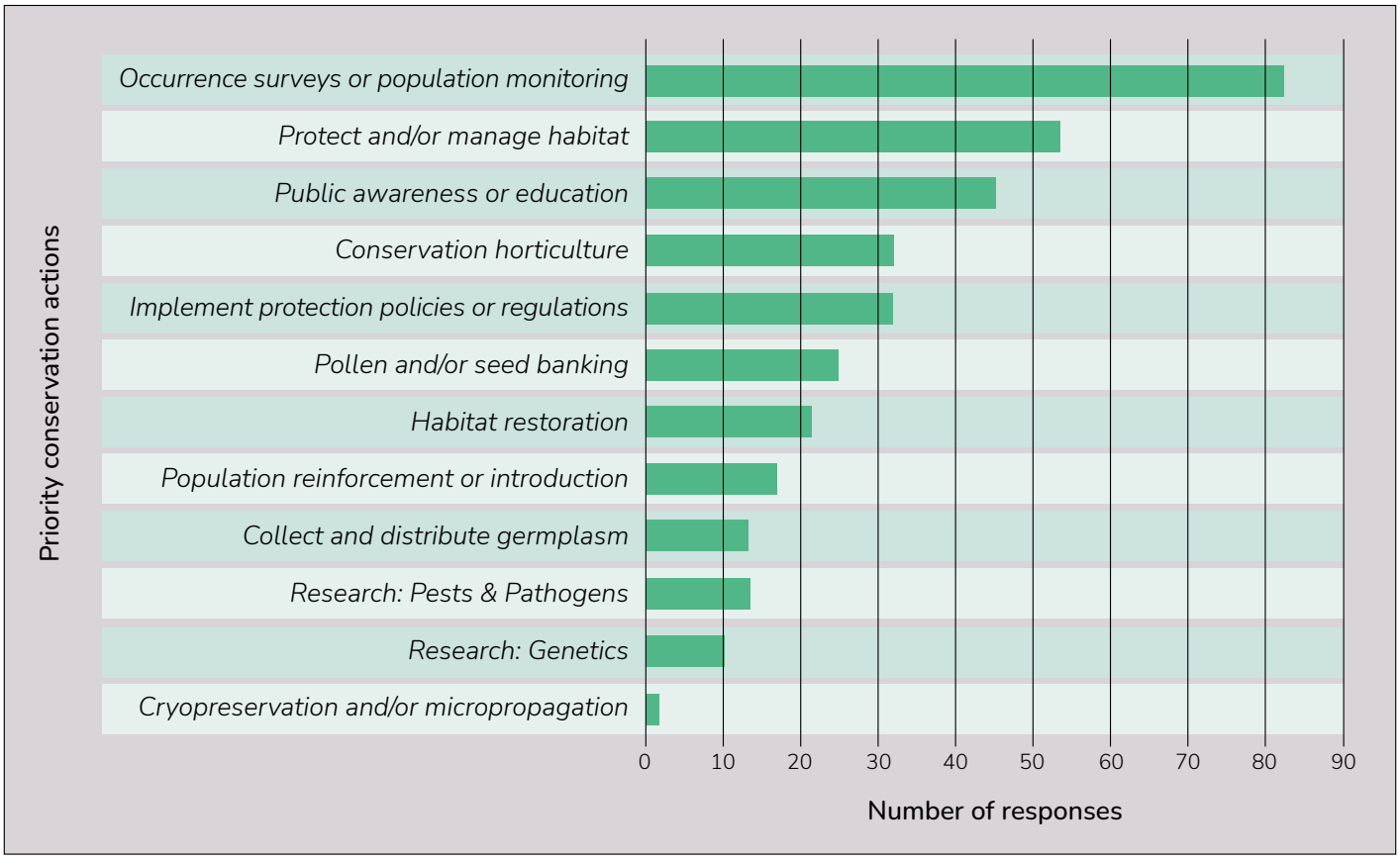


Figure 7. Priority conservation actions identified by respondents to the Conservation Activity Questionnaire.

Results for Centres of Diversity for *Sorbus* threatened in United Kingdom and Ireland

South West England

There are 17 *Sorbus* taxa that occur in South West England (as delimited here, which excludes the Avon Gorge and Cheddar Gorge and Burrington Combe Table 4). Five species occur here and nowhere else. See Appendix 3 for protected areas in which *Sorbus* occur. In February 2024, *S. anglica* was reassessed from Near Threatened to Vulnerable (Rich and Beech, 2024) and is included here without *ex situ* data and Conservation Activity Questionnaire results.

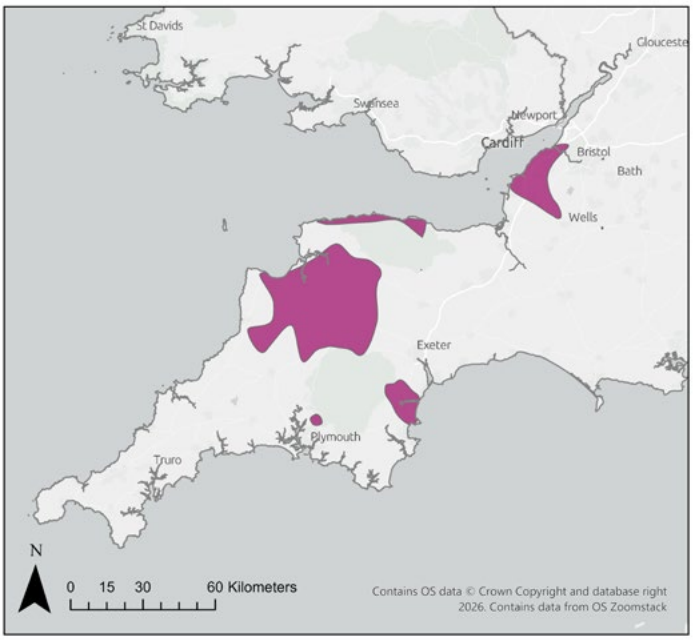


Figure 8. Regional map of South West England, showing the distribution of target species.

Table 4. *Sorbus* taxa occurring in South West England with target species shown in bold (IUCN Red List categories of non-native species excluded) Hybrids are not assessed.

Species	IUCN Red List category	Status
Sorbus admonitor	EN	**Native (regional endemic)**
Sorbus anglica	VU	**Native**
Sorbus aria	LC	Native
Sorbus aucuparia	LC	Native
Sorbus croceocarpa	-	Naturalised
Sorbus devoniensis	NT	**Native**
Sorbus domestica	LC	Native
Sorbus eminens	VU	**Native**
Sorbus latifolia	-	Naturalised
Sorbus margaretae	EN	**Native (regional endemic)**
Sorbus margaretae × *S. vexans*	-	Native
Sorbus porrigentiformis	VU	**Native**
Sorbus × *pseudoporrigentiformis*	-	Native
Sorbus richii	CR	**Native (regional endemic)**
Sorbus rupicola	LC	Native
Sorbus subcuneata	EN	**Native (regional endemic)**
Sorbus torminalis	LC	Native
Sorbus vexans	CR	**Native (regional endemic)**

Threats to wild populations

A total of 34 respondents from 31 organisations and two private individuals (see Appendix 1 for list of contributors) provided threat information for 36 target species via the Conservation Activity Questionnaire (Figure 9). Threat information was also gathered from IUCN Red List assessments, expert consultation and literature review.

Invasive species: Of the nine target species in South West England, invasive species competition was most frequently selected as the most significant threat to wild populations and was stated as a threat to all species (Figure 9). The invasive shrub *Rhododendron ponticum* has been identified as a threat to populations of *S. margaretae*, *S. subcuneata*, *S. vexans* and *S. porrigentiformis* through its potential to outcompete and shade out species (Rivers et al. 2017b; Beech et al., 2017c; Beech et al., 2017k; Beech and Rivers, 2017n). *Quercus ilex* and *Acer pseudoplatanus* are also identified as species with the potential to outcompete *S. subcuneata* (Rivers et al., 2017b).

Sorbus anglica (Dan Crowley)

Pests or pathogens: This was identified as the second most significant threat to wild populations in South West England, as stated for *S. porrigentiformis*, *S. eminens* and *S. richii*. However, responses for *S. porrigentiformis* and *S. eminens* may refer to trees in the Avon Gorge and the Wye Valley where pests and pathogens have more frequently been reported as threats to these species (see Avon Gorge and Wye Valley regional summaries).

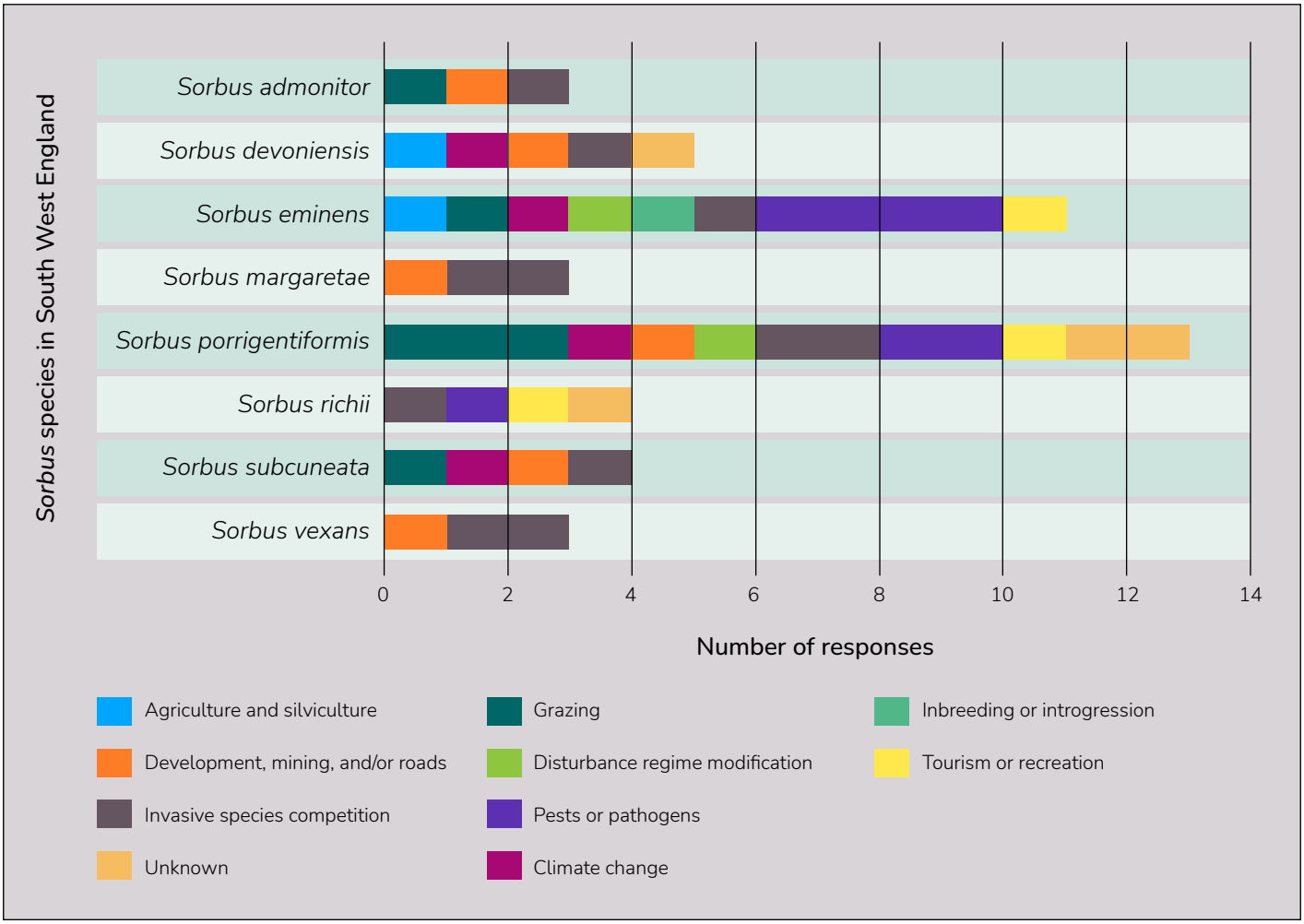


Figure 9. Threat categories reported by respondents to the Conservation Activity Questionnaire for target species occurring in South West England.

Grazing: This was identified by six respondents as a threat to wild populations. Deer grazing has been identified as a threat to populations of *S. admonitor*, *S. subcuneata*, and *S. vexans* (Beech and Rivers, 2017a; Rivers et al., 2017b; Beech et al., 2017k). One respondent identified a lack of regeneration as an additional threat to *S. richii*.

Agriculture and silviculture: *S. devoniensis* is affected by annual hedgerow cutting, which can reduce or prevent fruiting. Alternative management approaches, such as trimming hedges on a rotational basis or on alternate sides in different years, or managing trees as standards may help to mitigate this impact (Rich et al., 2026).

Development, mining, and/or roads: This was also identified by six respondents. *S. anglica* at Stoneycombe Quarry, Devon is potentially threatened by expansion of the quarry (T. Rich, pers. comm., 2026).

Climate change: Beech et al. (2017) reported sea level rises and subsequent erosion of the shoreline as a threat to *S. richii*. *S. subcuneata* is also threatened by cliff erosion at Greenaleigh point (Rich et al., 2026).

Unknown: An outlying population of *S. anglica* in Kingerswell, South Devon, which may represent a distinct local genotype has seen a dramatic decline from between 9-16 shrubs, down to 2, with the cause unclear (Rich et al., 2026).

Sorbus admonitor, Watersmeet, Devon (Rosie Anderson)

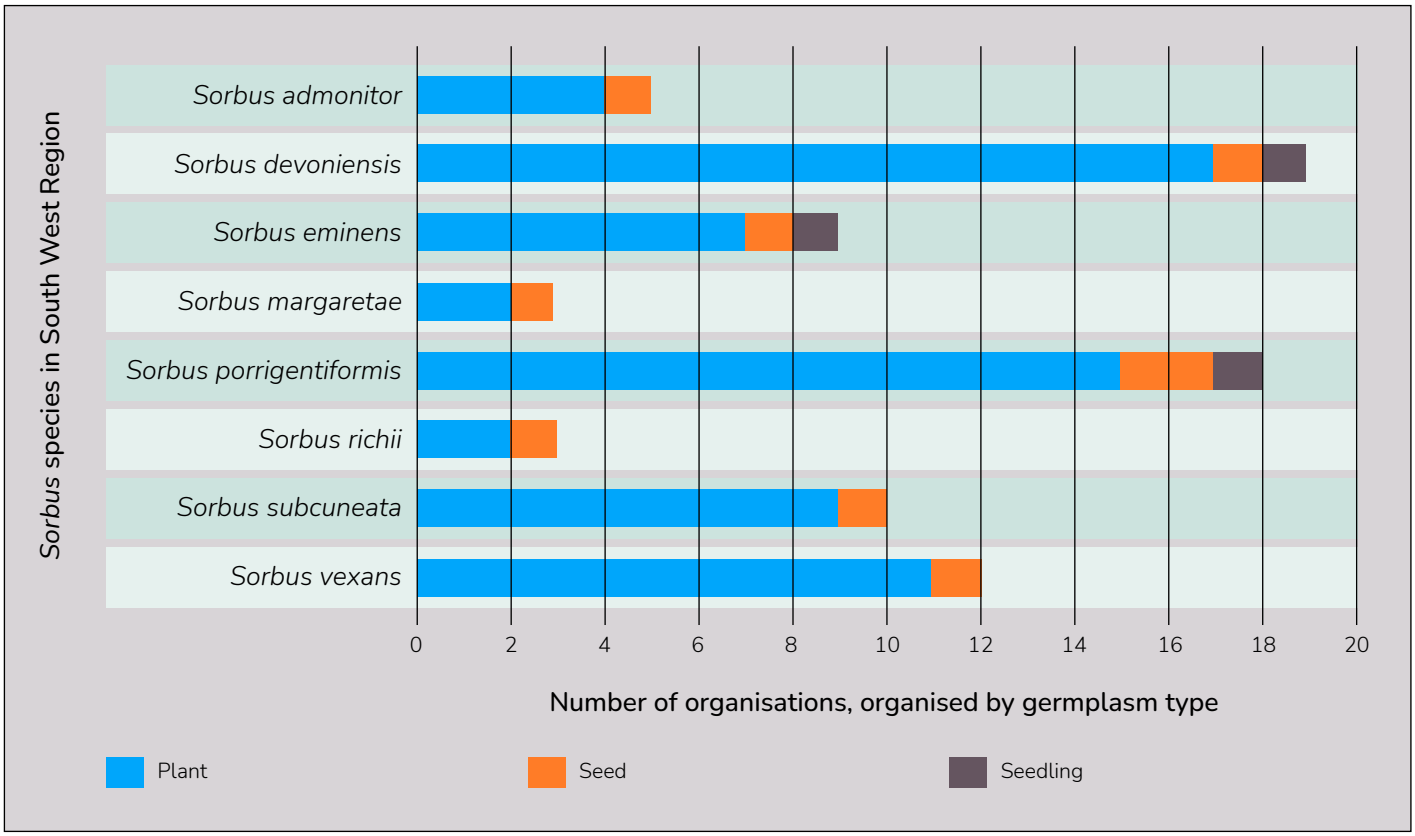


Figure 10. Number of organisations that reported *ex situ* collections of target species in South West England, categorised by germplasm type.

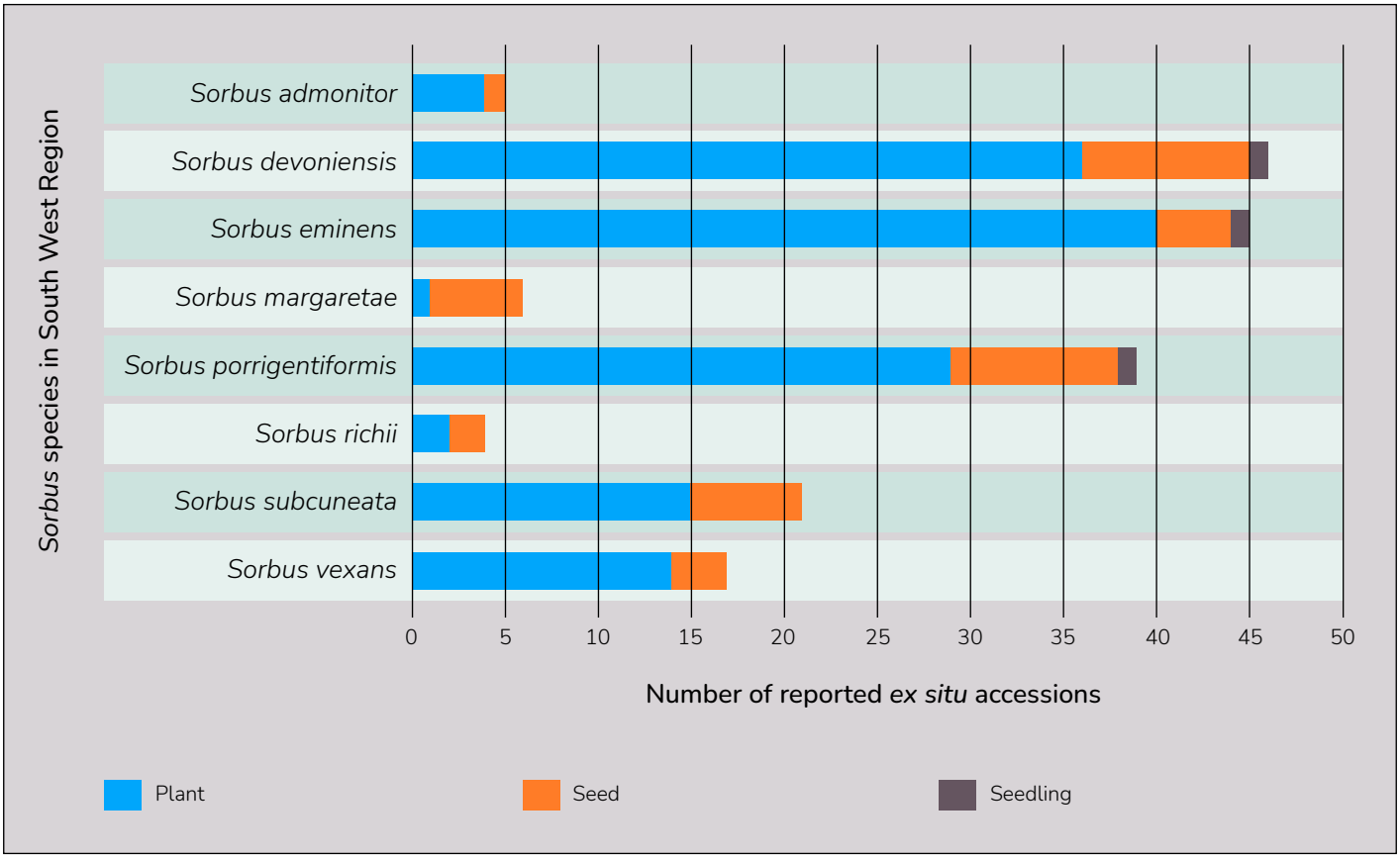


Figure 11. Number of reported *ex situ* accessions of target species in South West England, categorised by germplasm type.

Conservation Activities

Ex situ collections reported

Based on data from 38 *ex situ* collections that submitted accessions data, *S. devoniensis* and *S. porrigentiformis* have the highest number of organisations reporting *ex situ* collections including living plants and seeds (18 and 16 organisations respectively) (Figure 10). *Ex situ* collections of *S. richii* and *S. margaretae* are reported by the lowest number of organisations (3 each).

The number of *ex situ* accessions (including living collections and seed bank material) recorded for South West target species varies considerably. The more widespread taxa, *S. devoniensis*, *S. eminens* and *S. porrigentiformis*, are represented by the highest numbers of accessions (46, 45 and 39 respectively), whereas the regional endemics *S. richii*, *S. admonitor* and *S. margaretae* are represented by comparatively few accessions (4, 5 and 6 respectively) (Figure 11).

Sorbus richii at Portishead, Somerset (Dan Crowley)

Figure 12. A: Number of individual plants reported in *ex situ* collections belonging to target species occurring in South West England, categorised by provenance type. **B:** Number of reported *ex situ* seeds banked of target species in South West England, categorised by provenance type. **C:** Number of reported *ex situ* seedlings of target species in South West England, categorised by provenance type.

a) Living collections: plants

S. devoniensis is represented by the most *ex situ* individuals (59) but over half of individuals are of unknown, garden or indirect wild provenance (Figure 12). *S. porrigentiformis* has the second highest number of individuals (49). *S. richii* and *S. margaretae* have the lowest number of reported individuals (6 each), with 50% of *S. richii* individuals having the spatial data necessary for mapping wild *ex situ* source locality, compared to 83% of *S. margaretae*.

b) Living collections: seedlings

S. devoniensis is represented by the most *ex situ* seedlings in nurseries (156) but all are of indirect wild provenance (Figure 12). Seedlings of *S. eminens* and *S. porrigentiformis* were also reported but these originate from collections made in the Avon Gorge. Although seedling data should be interpreted with caution, as not all individuals will survive to be established in *ex situ* collections, these records nonetheless provide a useful indication of the species currently subject to active propagation and conservation effort.

Sorbus richii at Portishead, Somerset (Dan Crowley)

c) Seed banks: seeds

S. margaretae is represented by the most banked *ex situ* seeds (3093), of which all are of wild provenance (Figure 12). *S. admonitor* has the lowest number of *ex situ* banked seeds (125).

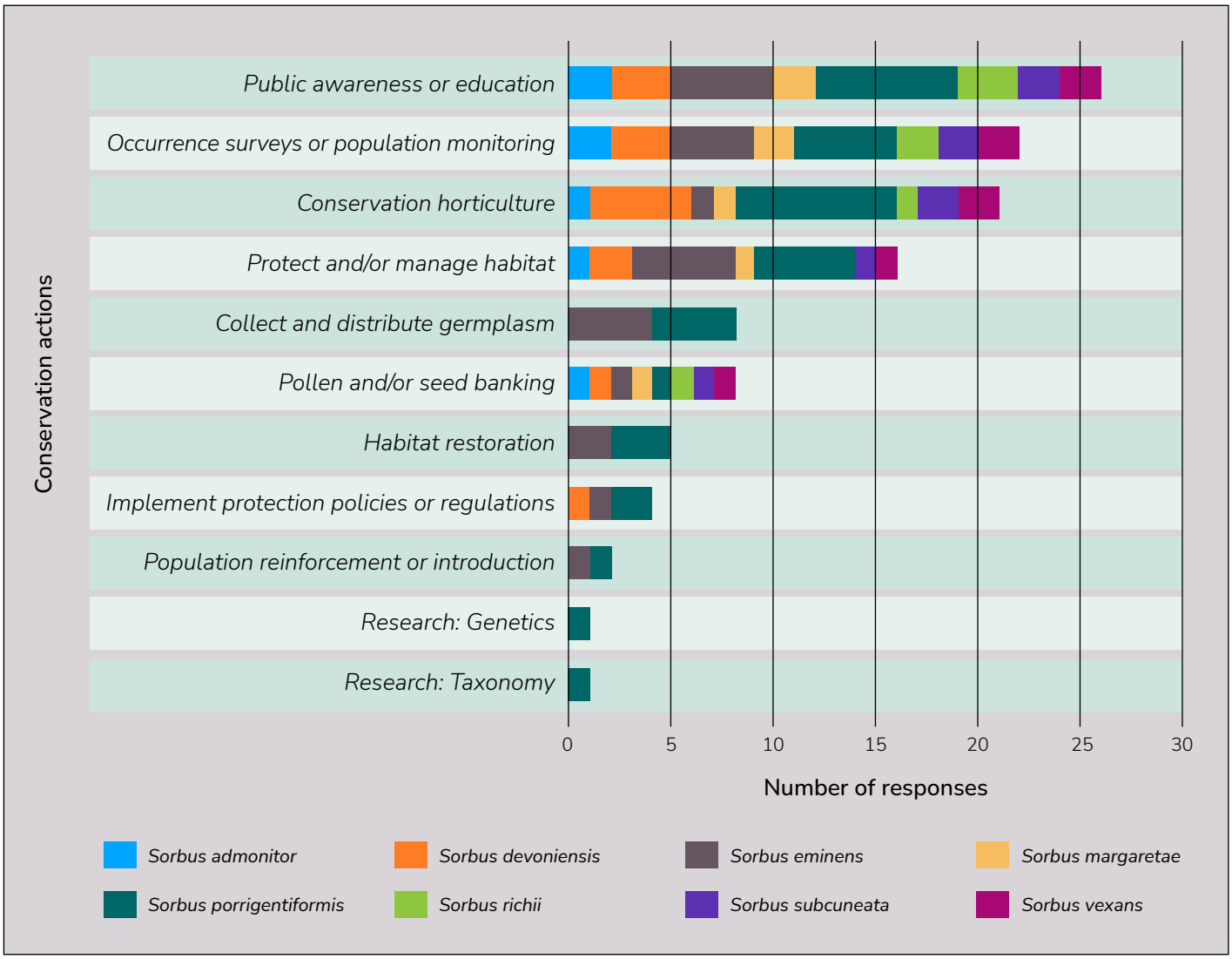


Figure 13. Number of responses for each conservation activity in the Conservation Activity Questionnaire by target species occurring in South West England.

Current conservation activities

A total of 34 respondents from 31 organisations and two private individuals (see Appendix 1 for list of contributors) provided information on current conservation activities for 36 target species via the Conservation Activity Questionnaire (Figure 13). Additional information was also gathered through expert consultation and a review of the literature.

Public awareness or education: Of the nine target species native to the South West region, public awareness or education was the most common activity reported, which were reported for all species.

Occurrence surveys or population monitoring: Occurrence surveys or population monitoring were reported for all species.

Conservation horticulture: Conservation horticulture was reported for all species. In 2013, Exmoor National Park Authority worked with Exmoor Trees nursery to propagate *S. margaretae* at Culbone Wood and *S. devoniensis* trees at Timberscombe Woods (Exmoor4all, 2013). Paignton Zoo have been propagating South West species from seed and cuttings, although a recent change of management has resulted in the closure of their nursery (Wild Planet Trust, 2020; T. Rich pers. comm., 2026)

Protect and/or manage habitat: Protecting and/or managing habitat was reported for all species except *S. richii*. *S. torminalis*, a parent to species of subgenus Tormaria, which includes *S. admonitor*, *S. devoniensis* and *S. subcuneata*, was planted at sites on National Trust land (V. Stanfield pers. comm., 2025). Light haloing has been undertaken around trees at Watersmeet in Devon (V. Stanfield pers. comm., 2025).

Land protection: Overall, the distributions of the target species occurring in South West England lie predominantly within protected areas. Exceptions include populations of *S. margaretae*, *S. subcuneata* and *S. vexans* at Culbone, *S. vexans* at Yenworthy, and *S. subcuneata* at Culver Cliff Wood. *S. devoniensis* occurs as numerous small, scattered populations and is locally frequent in hedgerows and woodland habitats (Rich et al., 2026). Consequently, while many wild *S. devoniensis* individuals are present within protected areas, the majority of the population lies outside formally designated conservation sites. See Appendix 3 for a list of protected areas in which target species occur.

Table 5. *Ex situ* prioritisation matrix identifying conservation concern score for South West target species. IUCN Red List categories of UK species are taken from recent unpublished reassessment workshop (BGCI, 2025).

Species	IUCN Red List category	# organisations with *ex situ* collections (plants and/or seeds)	# of individual plants in *ex situ* living collections	# wild provenance seedlings in nurseries	# of seeds in *ex situ* collections	Concern Score (max score= 18)
Sorbus richii	CR	3	6	0	771	15
Sorbus admonitor	EN	5	8	0	125	14
Sorbus vexans	CR	12	25	0	407	14
Sorbus subcuneata	EN	10	20	0	860	13
Sorbus margaretae	EN	3	6	0	3093	12
Sorbus eminens	VU	9	41	50	669	11
Sorbus porrigentiformis	VU	16	49	68	1401	10
Sorbus devoniensis	NT	18	215	0	2585	7

5 points	4 points	3 points	2 points	1 point	0 points

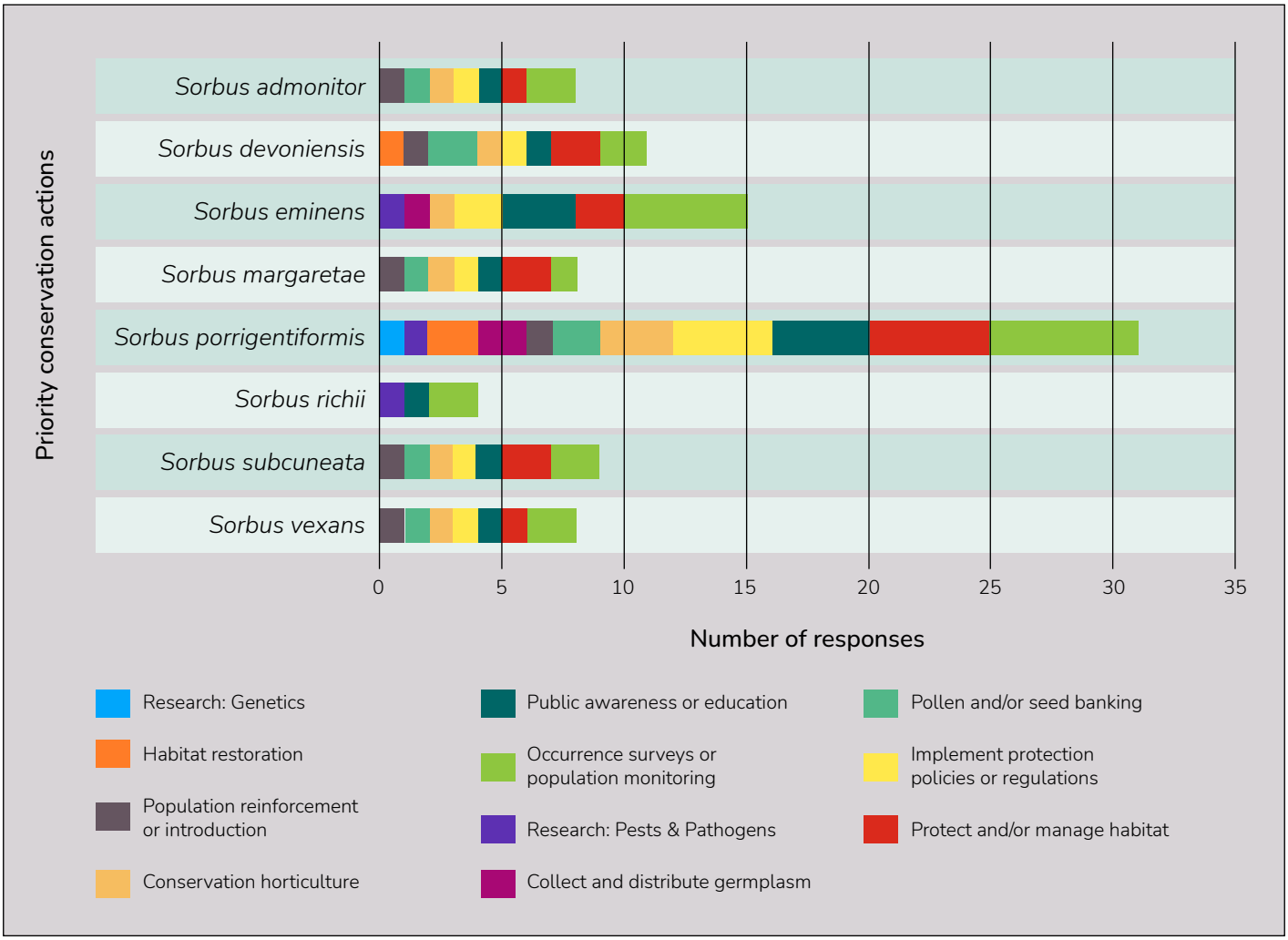


Figure 14. Priority conservation actions identified in the Conservation Activity Questionnaire reported as a proportion of responses by target species occurring in South West England.

Overall summary and recommendations

Priority conservation actions were identified for each species through the Conservation Activity Questionnaire (Figure 14).

Priority conservation actions, identified through the Conservation Activity Questionnaire, together with findings from the *ex situ* collection survey and threats identified via the questionnaire, literature review, and expert consultation, were synthesised to develop recommendations for each of our target species.

The highest priority and recommended conservation activities for each species can be found in Table 6.

Expand and improve quality of *ex situ* collections: *S. richii* has the highest conservation concern score of all target species native to the South West region (15), followed by *S. admonitor* and *S. vexans* (both 14). Although all South West target species are represented in *ex situ* collections, these individuals often lack clear records of source location. As a result, further high-quality seed collections, with accurate provenance data are recommended for all species, and are considered a particular priority for *S. admonitor*, *S. margaretae*, *S. richii*, *S. subcuneata* and *S. vexans*. Urgent collection and distribution of germplasm, conservation horticulture, and seed banking, are identified as high-priority conservation actions for the outlying population of *S. anglica* at Kingskerswell, south Devon.

Protect and manage habitat: It is important that target species are not considered in isolation. Hamston (2016) demonstrated that the triploid *S. subcuneata* is unable to self-fertilise and requires pollen from nearby tetraploid *Sorbus* species (e.g. *S. admonitor*) to produce viable seed. Consequently, reproductive success is likely to be severely constrained where populations occur in isolation or at a distance from compatible species. Work by Hamson et al. (2018), focusing on *Sorbus* species native to Devon and along the north Somerset coast, supports the use of a process-based approach to conservation, as described by Ennos et al. (2012).

In line with this, Rich et al. (2026) recommend that management of *S. admonitor*, *S. subcuneata*, *S. vexans* and *S. margaretae* should involve broader-scale woodland management across the coastal woodlands of North Devon and Somerset. Recommended measures include the removal of *Rhododendron*, reduction of deer grazing pressure, and the reintroduction of appropriate coppicing regimes. Such interventions would benefit not only these target species but also other *Sorbus* species native to the region, supporting the recommendation that 'protect and/or manage habitat' is a priority conservation action for all South West target species. Caution is advised when clearing around mature trees, as in some cases this may leave trees vulnerable to be blown over, as has been seen at Watersmeet (V. Stanfield pers. comm., 2025).

S. devoniensis is affected by annual hedgerow cutting, which can reduce or prevent fruiting. Alternative management approaches, such as trimming hedges on a rotational basis or on alternate sides in different years or managing trees as standards may help to mitigate this impact (Rich et al., 2026).

Research: Further genetic research for the outlying population of *S. anglica* at Kingskerswell, South Devon is a high-priority conservation action.

Implement protection polices: Implementation of protective policies or regulations is recommended for several populations currently outside designated areas, including populations of *S. margaretae*, *S. subcuneata* and *S. vexans* at Culbone, *S. vexans* at Yenworthy, and *S. subcuneata* at Culver Cliff Wood.

Population reinforcement or introduction: *S. richii* populations are vulnerable to projected sea-level rise associated with climate change. The development and implementation of a managed conservation translocation programme, identifying and establishing populations at climatically and ecologically suitable sites along the Bristol Channel, is therefore recommended.

Table 6. Recommended conservation activities for South West England target species, red is highest priority conservation actions and orange is recommended activities.

Species	Collect and distribute germplasm	Conservation horticulture	Habitat restoration	Implement protection policies or regulations	Occurrence surveys or population monitoring	Pollen and/or seed banking	Population reinforcement or introduction	Protect and/or manage habitat	Public awareness or education	Research: Climate Change, Genetics, Pests & Pathogens
Sorbus admonitor										
Sorbus anglica										
Sorbus devoniensis										
Sorbus eminens										
Sorbus margaretae										
Sorbus porrigentiformis										
Sorbus richii										
Sorbus subcuneata										
Sorbus vexans										

Highest priority conservation actions

Recommended activities

Cheddar Gorge and Burrington Combe

Cheddar Gorge is a limestone gorge located on the southern end of the Mendip Hills, Somerset (Figure 15). It is one of the most important sites for *Sorbus* in England (Rich et al., 2026).

There are nine taxa that occur in Cheddar Gorge, including three species that occur here and nowhere else (Rich et al., 2026). A new species, *Sorbus fayana*, has recently been described at neighbouring Burrington Combe but occurrence in Cheddar still requires DNA confirmation (Rich and Houston, 2025; Rich et al., 2026). In February 2024, *Sorbus anglica* was reassessed from Near Threatened to Vulnerable (Rich and Beech, 2024) and is included here without *ex situ* data and Conservation Activity Questionnaire results.

Table 7. *Sorbus* taxa occurring in Cheddar Gorge and Burrington Combe with target species shown in bold (IUCN Red List categories of non-native species excluded and hybrids are not assessed).

Species	IUCN Red List category	Status
Sorbus anglica	**VU**	**Native**
Sorbus aria	LC	Native
Sorbus intermedia	-	Naturalized
Sorbus cheddarensis	**CR**	**Native (regional endemic)**
Sorbus eminentoides	**CR**	**Native (regional endemic)**
Sorbus eminens	**VU**	**Native**
Sorbus fayana	**CR**	Native
Sorbus porrigentiformis	**VU**	**Native**
Sorbus × *pseudoporrigentiformis*	-	Native
Sorbus rupicoloides	**CR**	**Native (regional endemic)**

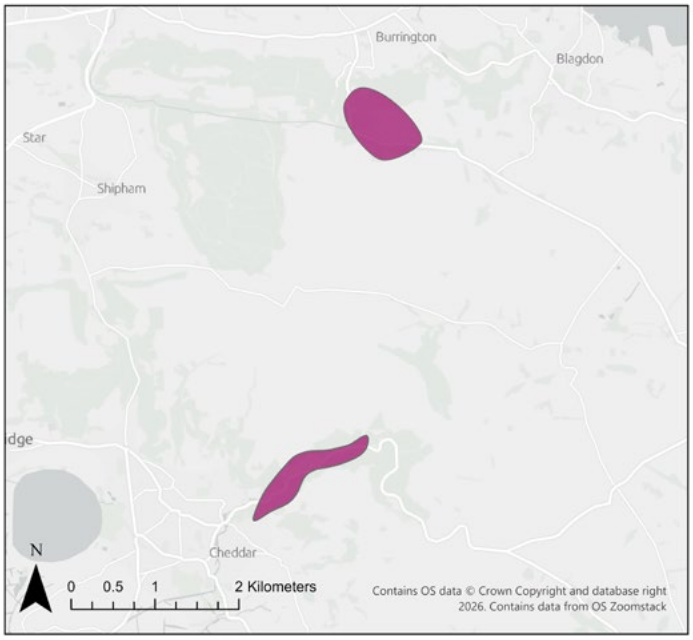


Figure 15. Regional map of Cheddar Gorge and Burrington Combe, showing the distribution of target species.

Sorbus cheddarensis in Cheddar Gorge (Dan Crowley)

Threats to wild populations

A total of 34 respondents from 31 organisations and two private individuals (see Appendix 1 for list of contributors) provided threat information for 36 target species via the Conservation Activity Questionnaire (Figure 16). Threat information was also gathered from IUCN Red List assessments, expert consultation and literature review.

Grazing: Of the seven target Cheddar Gorge and Burrington Combe species in this study, grazing was most selected as the most significant threat to wild populations and was stated as a threat to all species. Grazing by goats has been identified as a threat to populations of *S. cheddarensis*, *S. eminens*, *S. eminentoides*, *and S. rupicoloides*, through damage to trees and a lack of regeneration (Beech and Rivers, 2017c; Rivers and Beech, 2017c; Beech and Rivers, 2017g; Beech et al., 2017f). Planned goat culls by the National Trust in fields surrounding Cheddar Gorge are a source of concern, as there is a risk that culling activity could displace goats and drive them further into the Gorge itself (V. Stanfield pers. comm., 2025).

Pests or pathogens: Pests or pathogens were selected as the second most significant threat to wild populations, and was stated as a threat to all species. An unknown pathogen has been reported to be affecting trees within the gorge, particularly *S. cheddarensis* and *S. rupicoloides*. This includes the type trees of both species, which have since died (Rich et al., 2026; L. Houston pers. comm., 2025).

Invasive species competition: Invasive species competition was selected as a threat to all target species. Cheddar Gorge and Burrington Combe are affected by invasive species such as *Quercus ilex*, *Q. cerris* and *Cotoneaster* spp. which have the potential to compete and shade out *Sorbus* species (Rich et al., 2026).

Extensive clearance due to ash dieback and associated tree work on the southern side of the gorge have resulted in increased canopy opening, which is likely to promote the proliferation of *Rubus* species and may negatively affect regeneration of *Sorbus* populations (L. Houston pers. comm., 2025).

Tourism and recreation: Tourism and recreation were also selected as a threat to all target species. There are several cliffs used by rock climbers within the gorge and there is a risk that trees may be damaged in order to keep routes clear. Many trees do not resemble conventional tree morphology, which can lead to misidentification or inadvertent damage (L. Houston pers. comm., 2025). The installation of rock protection fences, installed to protect visitors and the road from rockfalls, have also been cited as a potential cause of damage to trees (L. Houston pers. comm., 2025).

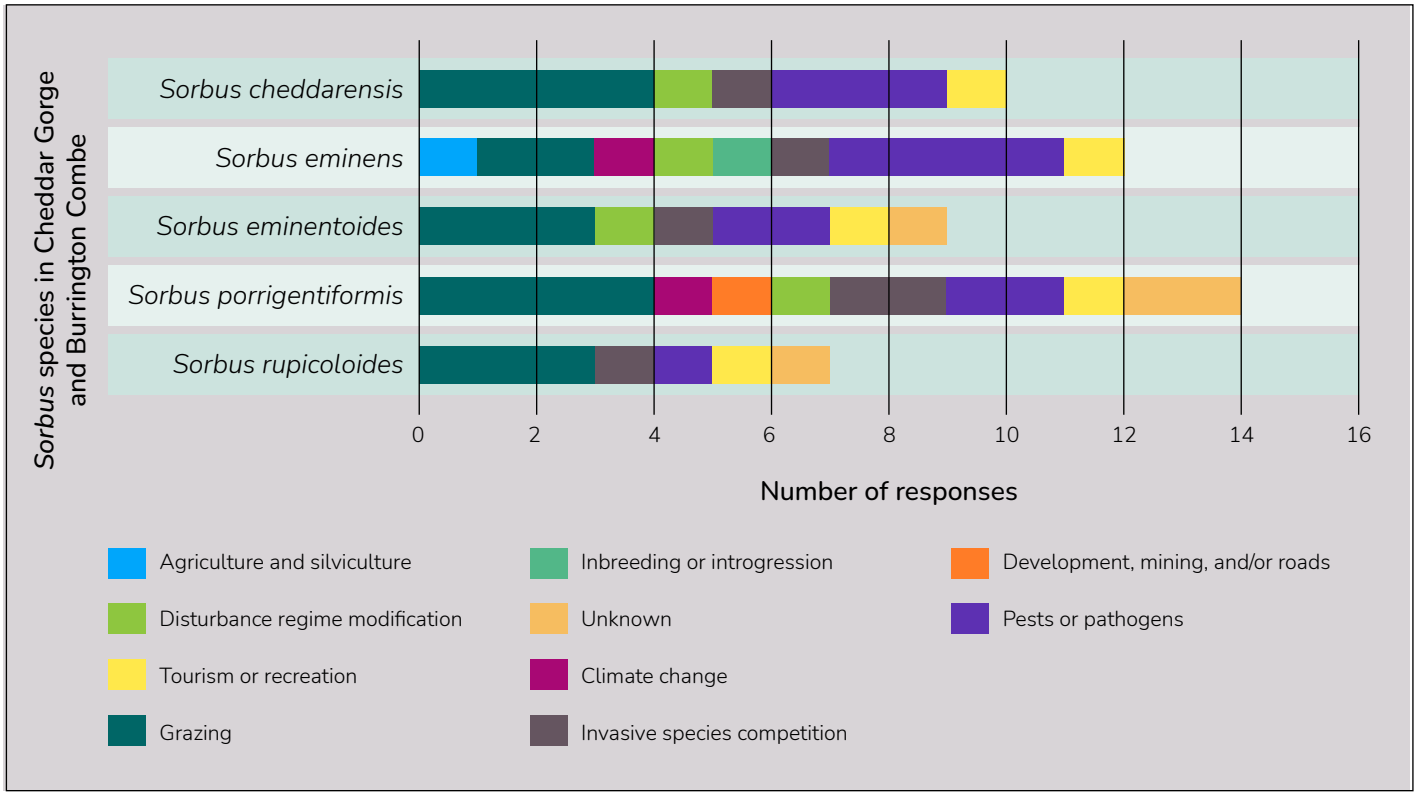


Figure 16. Threat categories reported by respondents to the Conservation Activity Questionnaire for target species occurring in Cheddar Gorge and Burrington Combe.

Conservation Activities

Ex situ collections reported

Based on data from 38 *ex situ* collections that submitted accessions data, *S. porrigentiformis* and *S. eminens* have the highest number of organisations reporting *ex situ* collections including living plants and seeds (18 and 9 organisations respectively) (Figure 17).

The number of *ex situ* accessions (including living collections and seed bank material) recorded for Cheddar Gorge and Burrington Combe target species varies considerably. The more widespread taxa, *S. eminens* and *S. porrigentiformis*, are represented by the highest numbers of accessions (45 and 39 respectively), whereas the regional endemics *S. eminentoides*, *S. cheddarensis* and *S. rupicoloides* are represented by comparatively few accessions (3, 5 and 6 respectively) (Figure 18).

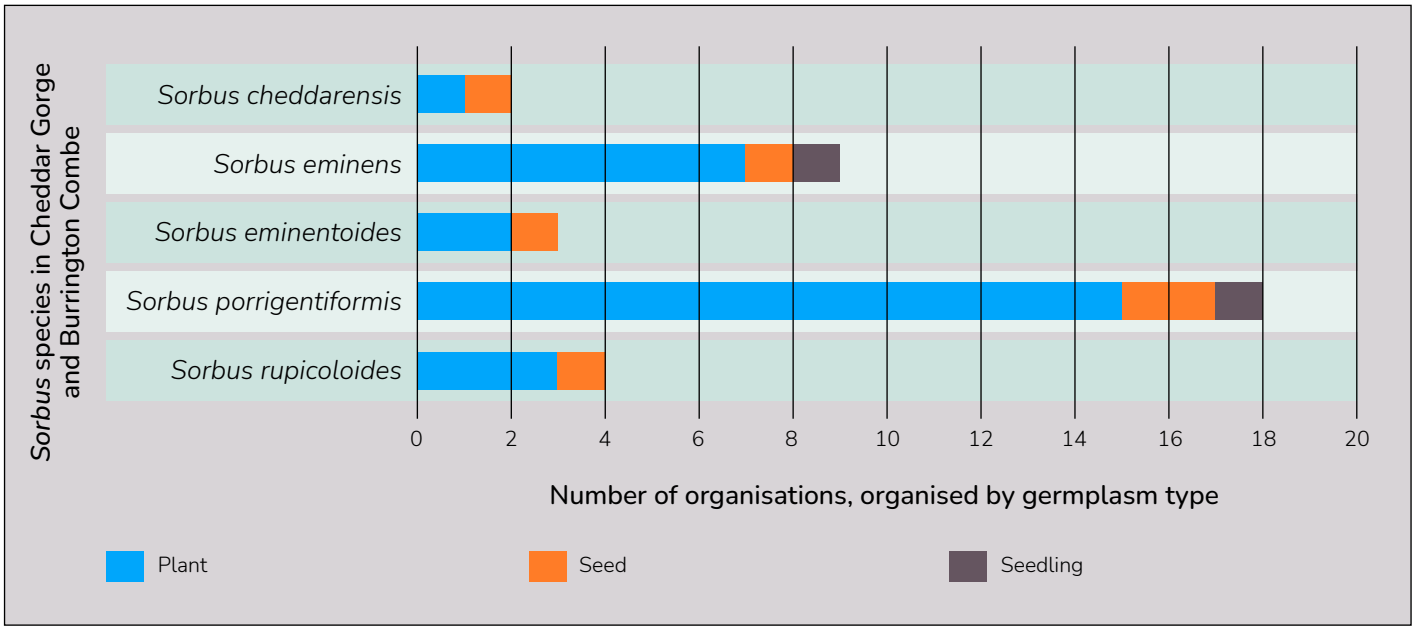


Figure 17. Number of organisations that reported *ex situ* collections of target species occurring in Cheddar Gorge and Burrington Combe.

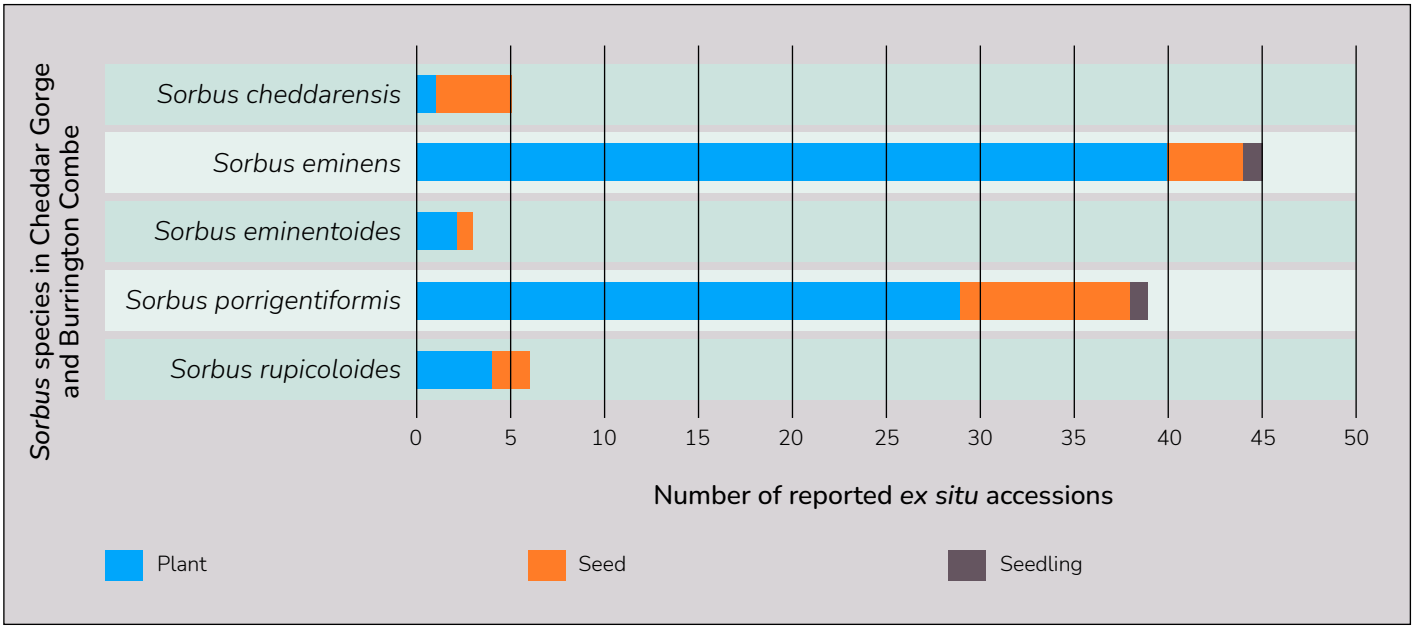


Figure 18. Number of reported *ex situ* accessions of target species in Cheddar Gorge and Burrington Combe, categorised by germplasm type.

Ex situ collections of *S. chedddarensis* and *S. eminentoides* are reported by the lowest number of organisations (2 and 3 respectively).

S. fayana was described in 2025 and therefore accession data was not requested from organisations. However, consultation with the species' co-author Tim Rich, confirms that there are currently no confirmed *ex situ* collections of this species, although it is likely that an accession banked at the Millenium Seed Bank, collected from Burrington Combe under *S. porrigentiformis* in 2006 may in fact be *S. fayana* (T. Rich, pers. comm., 2026).

Table 8. *Ex situ* prioritisation matrix for Cheddar Gorge and Burrington Combe target species. IUCN Red List categories of UK species are taken from recent unpublished reassessment data (BGCI, 2025).

Species	IUCN Red List category	# organisations with *ex situ* collections (plants and/or seeds)	# of individual plants in *ex situ* living collections	# wild provenance seedlings in nurseries	# of seeds in *ex situ* collections	Concern Score (max score = 18)
Sorbus fayana	CR	0	0	0	0	18
Sorbus cheddarensis	CR	2	2	0	662	16
Sorbus eminentoides	CR	3	15	0	750	14
Sorbus rupicoloides	CR	4	18	0	1204	14
Sorbus eminens	VU	9	41	50	669	11
Sorbus porrigentiformis	VU	16	49	68	1401	10

5 points	4 points	3 points	2 points	1 point	0 points

a) Living collections: plants

As perhaps is to be expected, *S. porrigentiformis* and *S. eminens*, species that are more widespread in several populations across South Wales and South West England, are represented by the most *ex situ* individuals (49 and 41 respectively) (Figure 19). Three wild provenance *S. eminens* accessions originate from Cheddar Gorge populations (one banked seed and 3 individual plants), while no *S. porrigentiformis* accessions originate from Cheddar Gorge.

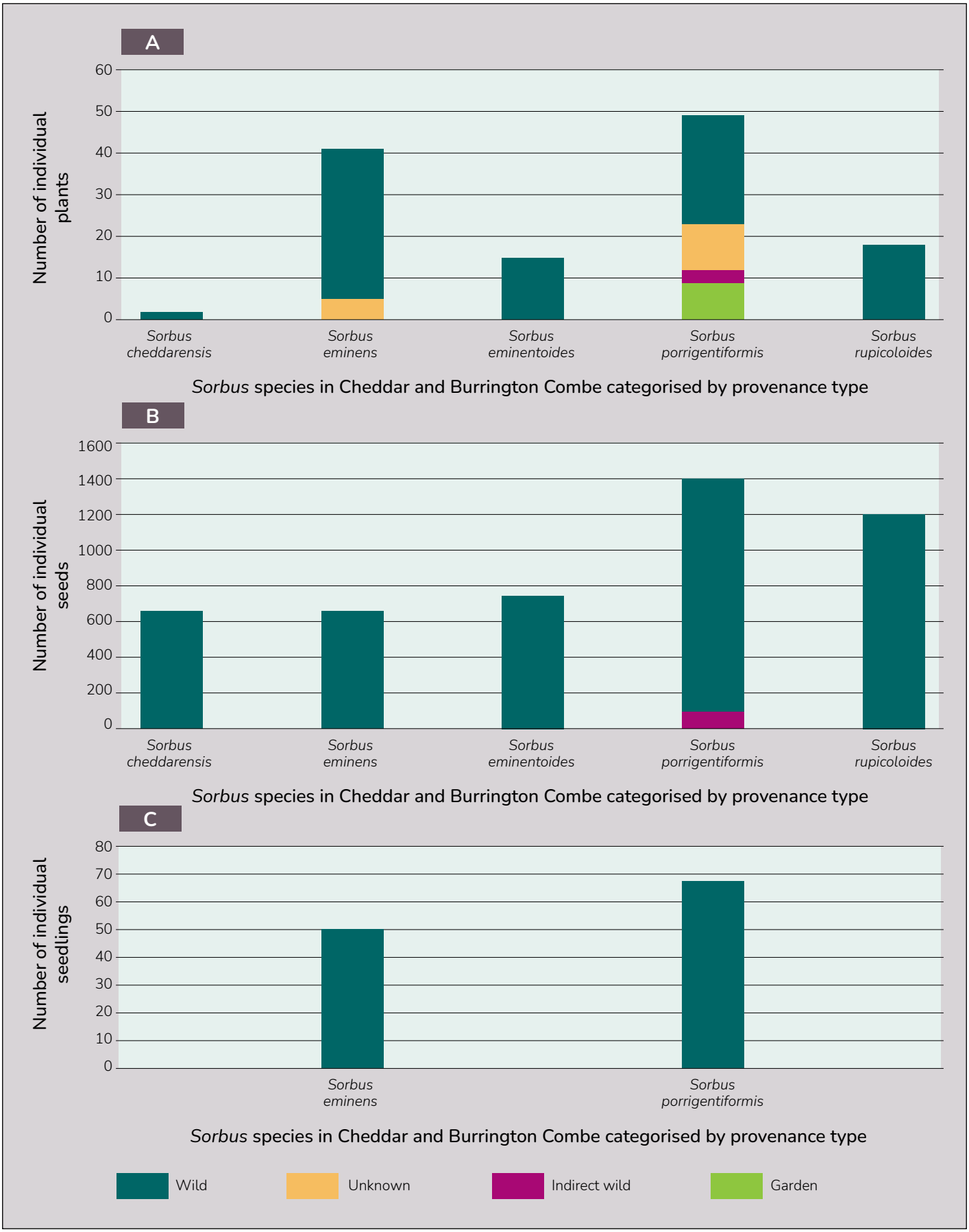
Of the three species endemic to Cheddar Gorge, *S. cheddarensis* has the lowest number of reported individual trees in *ex situ* collections (2), both of which individuals have the spatial data necessary for mapping wild *ex situ* source locality. *S. eminentoides* and *S. rupicoloides* have 15 and 18 reported individuals respectively, of which all have the spatial data necessary for mapping wild *ex situ* source locality.

b) Living collections: seedlings

S. eminens and *S. porrigentiformis* are represented by *ex situ* seedlings in nurseries (Figure 20), however no accessions of these species originate from Cheddar Gorge or Burrington Combe. No seedlings of endemic Cheddar Gorge or Burrington Combe species were reported within nurseries. Although seedling data should be interpreted with caution, as not all individuals will survive to be established in *ex situ* collections, these records nonetheless provide a useful indication of the species currently subject to active propagation and conservation effort.

c) Seed banks: seeds

All Cheddar Gorge and Burrington Combe target species have wild provenance seed banked in *ex situ* collections (Figure 21). *S. fayana* found at Burrington Combe and still to be confirmed in Cheddar, has no confirmed banked seed accessions, although it is likely that an accession banked at the Millenium Seed Bank, collected from Burrington Combe under *Sorbus porrigentiformis* in 2006 may in fact be *S. fayana* (T. Rich, pers. comm., 2026).



Figures 19, 20, 21. A: Number of individual plants reported in *ex situ* collections belonging to target species occurring in Cheddar Gorge, categorised by provenance type. No living material of *S. fayana* is held in living collections. **B:** Number of reported *ex situ* seeds banked of target species occurring in Cheddar Gorge, categorised by provenance type species in *ex situ* collections. **C:** Number of reported *ex situ* seedlings banked of target species occurring in Cheddar Gorge, categorised by provenance type species in *ex situ* collections.

Current conservation activities

A total of 34 respondents from 31 organisations and two private individuals (see Appendix 1 for list of contributors) provided information on current conservation activities for 36 target species via the Conservation Activity Questionnaire (Figure 22). Additional information was also gathered through expert consultation and a review of the literature.

Public awareness or education: Of the five target species native to Cheddar Gorge region, public awareness or education, and occurrence surveys or population monitoring was the most common activity reported (20 responses each), which were reported for all species.

Occurrence surveys or population monitoring: Surveys to map and document the distribution of rare *Sorbus* taxa on the southern side of the gorge were conducted by Libby Houston and Forestry England in 2024 and 2025 on behalf of Longleat Enterprises. These surveys were initiated in response to ash dieback clearance operations, with rare trees marked using tape to prevent accidental damage during management activities. Surveys took place on National Trust land on the northern side of gorge in 2006.

Conservation horticulture: Conservation horticulture was reported for all Cheddar and Burrington target species. One institution that did not return collection data, reported carrying out conservation horticulture, and collecting and distributing germplasm for *S. cheddarensis*, and *S. eminentoides* in the Conservation Action Questionnaire, indicating that *ex situ* collections numbers are likely to be higher.

Protect and/or manage habitat: Protecting and/or managing habitat was reported for *S. eminens*, *S. cheddarensis* and *S. porrigentiformis*.

Land protection: The distribution of all target species occurring in Cheddar Gorge and Burrington Combe lie predominantly within protected areas. See Appendix 3 for a list of protected areas in which target species occur.

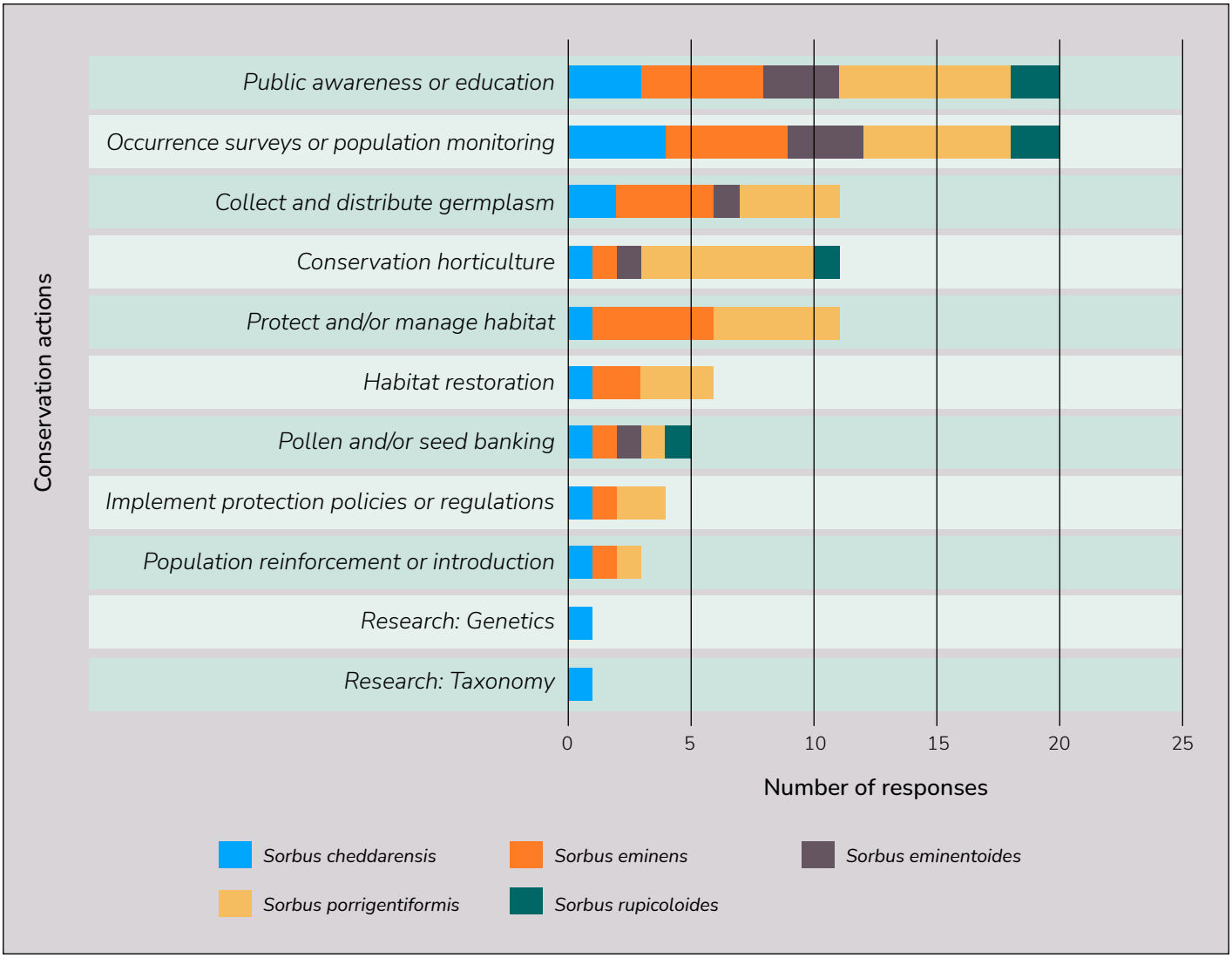


Figure 22. Number of responses for each conservation activity in the Conservation Activity Questionnaire by target species occurring in Cheddar Gorge and Burrington Combe.

Overall summary and recommendations

Priority conservation actions, identified through the Conservation Activity Questionnaire, together with findings from the *ex situ* collection survey and threats identified via the questionnaire, literature review, and expert consultation, were synthesised to develop recommendations for each of our target species.

The highest priority and recommended conservation activities for each species can be found in Table 9.

Expand and improve quality of *ex situ* collections: *S. fayana* has the highest conservation concern score of all target species native to the Cheddar region (18), followed by *S. cheddarensis* (16), *S. eminentoides* and *S. rupicoloides* (both 14). Although *ex situ* collection numbers for *S. cheddarensis* may be higher than reported in the *ex situ* collections survey, germplasm collection, and conservation horticulture remain essential conservation actions for all four species.

Despite high numbers of *ex situ* accessions of *S. porrigentiformis* present in botanic collections, no accessions originate from Cheddar Gorge or Burrington Combe, and therefore germplasm collection, and conservation horticulture is recommended.

Sorbus rupicoloides leaves (Dan Crowley)

Occurrence surveys or population monitoring: Occurrence surveys or population monitoring was the most identified urgent conservation action for all Cheddar target species. Population surveys were last carried out on the northern side of the gorge in 2006 and are therefore in need of updating, particularly in light of potential impacts from a change to goat grazing intensity within the gorge. Updated survey data will be critical to accurately assess the current and future impact of grazing and habitat management changes.

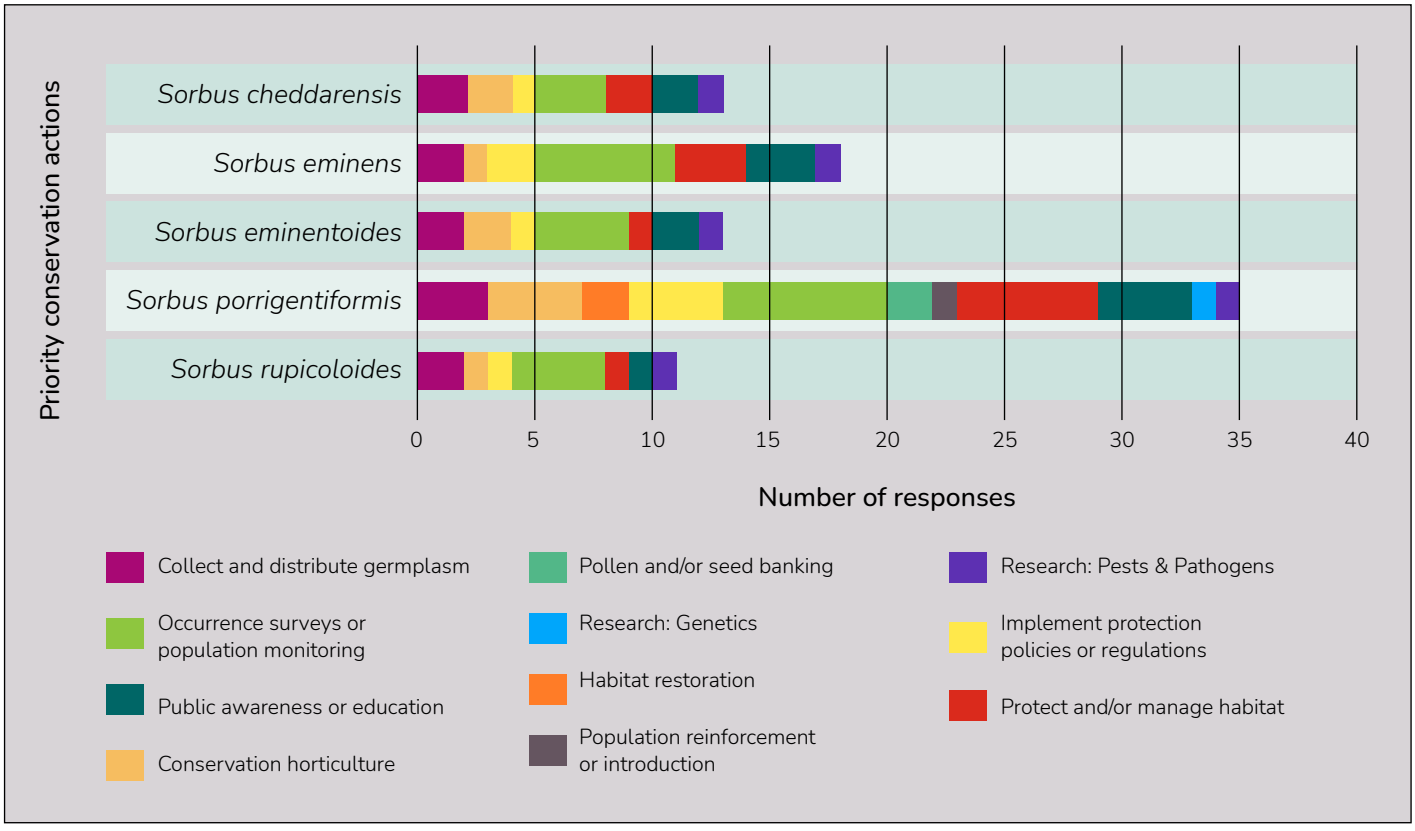


Figure 23. Priority conservation actions identified in the Conservation Activity Questionnaire reported for target species occurring in Cheddar Gorge.

Protect and manage habitat: Development of a comprehensive management plan is recommended for Cheddar Gorge and Burrington Combe. As with all regions of *Sorbus* diversity, it is important that target species are not considered in isolation. Management within the gorge requires a complex balance between open grassland and secondary woodland (Rich et al, 2026).

Removal of invasive species, and *Rubus* particularly in areas close to areas with high concentrations of *Sorbus* species is recommended. Localised fencing may be required to protect some trees (Rich et al, 2026). The population of *S. rupicoloides* is of particular concern, as its small size and restricted distribution make it especially vulnerable to damage from grazing by goats and as such fencing is recommended around these trees (Rich et al., 2026).

Research: Further research is required to understand the current threat from the pathogen affecting trees in the gorge. Rich et al. (2026) recommends further study of *S. eminens* populations in order and assess priorities for conservation. Additionally, research is necessary to analyse survey data and to assess the current and future impact of grazing and habitat management changes.

Public awareness/education: Public awareness and education initiatives should be targeted at climbers emphasizing the identification and ecological significance of *Sorbus* species, as many taxa may not resemble conventional tree morphology, which can lead to misidentification or inadvertent damage (L. Houston pers. comm., 2025).

Sorbus eminens and goats in Cheddar Gorge (Dan Crowley)

Table 9. Conservation recommendations for Cheddar Gorge target species, red is highest priority conservation actions and orange is recommended activities.

Species	Collect and distribute germplasm	Conservation horticulture	Habitat restoration	Implement protection policies or regulations	Occurrence surveys or population monitoring	Pollen and/or seed banking	Population reinforcement or introduction	Protect and/or manage habitat	Public awareness or education	Research: Climate Change, Genetics, Pests & Pathogens
Sorbus fayana										
Sorbus cheddarensis										
Sorbus eminens										
Sorbus eminentoides										
Sorbus porrigentiformis										
Sorbus rupicoloides										

Highest priority conservation actions

Recommended activities

Avon Gorge

Avon Gorge is a predominantly limestone gorge located in Bristol, England (Figure 24). It is likely to be the most important site for *Sorbus* in the world (Rich et al., 2026).

There are 22 *Sorbus* taxa that occur in the Avon Gorge, including five species which occur here and nowhere else (Table 10). See Appendix 3 for protected areas in which *Sorbus* occur. In February 2024, *Sorbus anglica* was reassessed from Near Threatened to Vulnerable (Rich and Beech, 2024)) and is included here without *ex situ* data and Conservation Activity Questionnaire results. The University of Bristol Botanic Garden is known to hold important local collections but was unable to contribute to the survey.

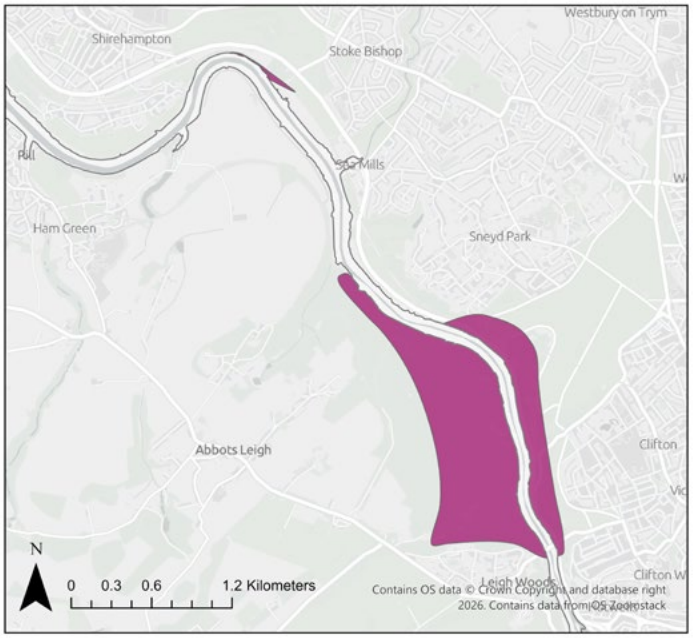


Figure 24. Regional map of the Avon Gorge, showing the distribution of target species.

Table 10. *Sorbus* taxa occurring in the Avon Gorge with target species shown in bold (IUCN Red List categories of non-native species excluded and hybrids are not assessed).

Species	IUCN Red List category	Status
Sorbus anglica	VU	**Native**
Sorbus aria	LC	Native
Sorbus aucuparia	LC	Native
Sorbus avonensis	CR	**Native (regional endemic)**
Sorbus bristoliensis	EN	**Native (regional endemic)**
Sorbus croceocarpa	-	Naturalized
Sorbus eminens	VU	**Native**
Sorbus × decipiens	-	Naturalized
Sorbus domestica	LC	Native
Sorbus × houstoniae	-	Native
Sorbus intermedia	-	Naturalized
Sorbus latifolia	-	Naturalized
Sorbus leighensis	EN	**Native (regional endemic)**
Sorbus porrigentiformis	VU	**Native**
Sorbus × pseudoporrigentiformis	-	Native
Sorbus × proctoriana	-	
Sorbus × thuringiaca	-	Naturalized
Sorbus sellii	-	Naturalized
Sorbus torminalis	LC	Native
Sorbus spectans	CR	**Native (regional endemic)**
Sorbus whiteana	CR	**Native**
Sorbus wilmottiana	EN	**Native (regional endemic)**

Threats to wild populations

A total of 34 respondents from 31 organisations and two private individuals (see Appendix 1 for list of contributors) provided threat information for 36 target species via the Conservation Activity Questionnaire (Figure 25). Threat information was also gathered from IUCN Red List assessments, expert consultation and literature review.

Pests or pathogens: Based on responses from 34 respondents to the Conservation Action Questionnaire, of the eight target Avon Gorge species in this study, pests or pathogens were selected as the most significant threat to wild populations and was stated as a threat to all species. *S. bristoliensis*, *S. whiteana*, *S. wilmottiana*, *S. spectans* and *S. leighensis* have been reported to be susceptible to an unknown pathogen which causes die-back of stems, with *S. whiteana* being particularly affected. Two individuals of *S. bristoliensis* have shown signs of recovery following infection (L. Houston pers. comm., 2025).

Invasive species: Invasive species competition was selected as the second most significant threat to wild populations, and was stated as a threat to all species. *Quercus ilex* has been identified as a threat across all species (Rich et al, 2026).

Tourism or recreation: Due to the location of *S. spectans*, below the Clifton Observatory, there is a risk that it may be affected by works to keep the view clear (Beech et al., 2017h). There are several cliff faces within the gorge that are used by rock climbers and there is a risk that trees may be damaged in order to keep routes clear. Many taxa may not resemble conventional tree morphology, which can lead to misidentification or inadvertent damage (L. Houston pers. comm., 2025).

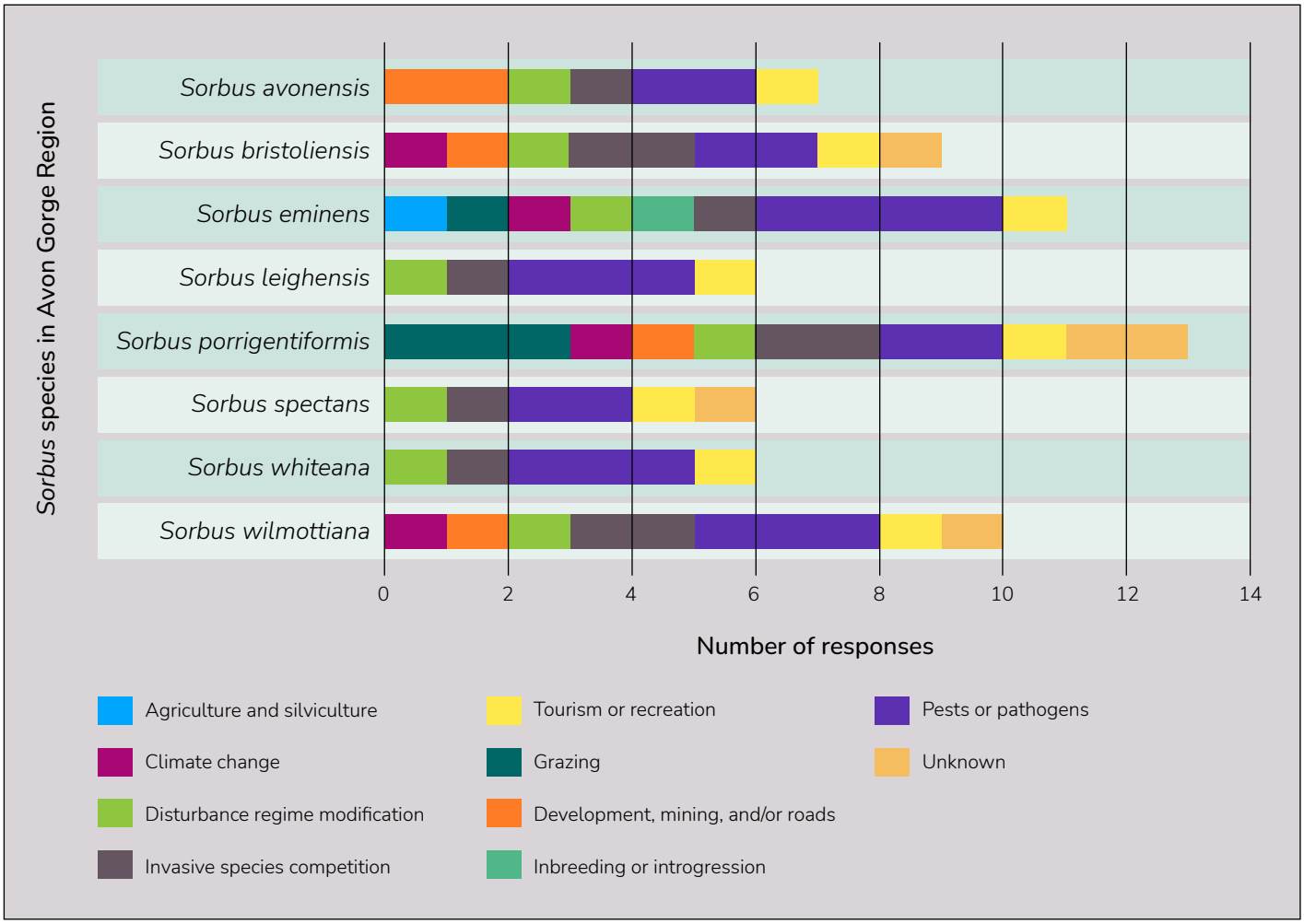


Figure 25. Threat categories reported by respondents to the Conservation Activity Questionnaire for target species occurring in Avon Gorge.

Disturbance regime modification: Disturbance regime modification was reported as a threat to all species.

Grazing: Grazing was reported as a threat to *S. porrigentiformis* and *S. eminens*. Goat grazing is resulting in barking and killing of many trees in the Gulley enclosure (T. Rich pers. comm., 2026).

Development, mining and/or roads: *S. avonensis*, *S. eminens*, *S. leighensis*, *S. wilmottiana* and *S. bristoliensis* are particularly threatened by the works being carried out for the MetroWest project to upgrade an existing railway line on the western side of the gorge, although mitigation work has taken place, including the planting trees of *S. bristoliensis*, *S. eminens*, *S. aria* and *S.* within Forestry England land at Leigh Woods (T. Rich pers. comm., 2026).

Other: Seed viability has been identified as a key issue for *S. avonensis*, many seeds which have been collected have not proved to be viable, which has implications on seed banking (L. Houston pers. comm., 2023).

Libby Houston with *Sorbus bristoliensis* (Dan Crowley)

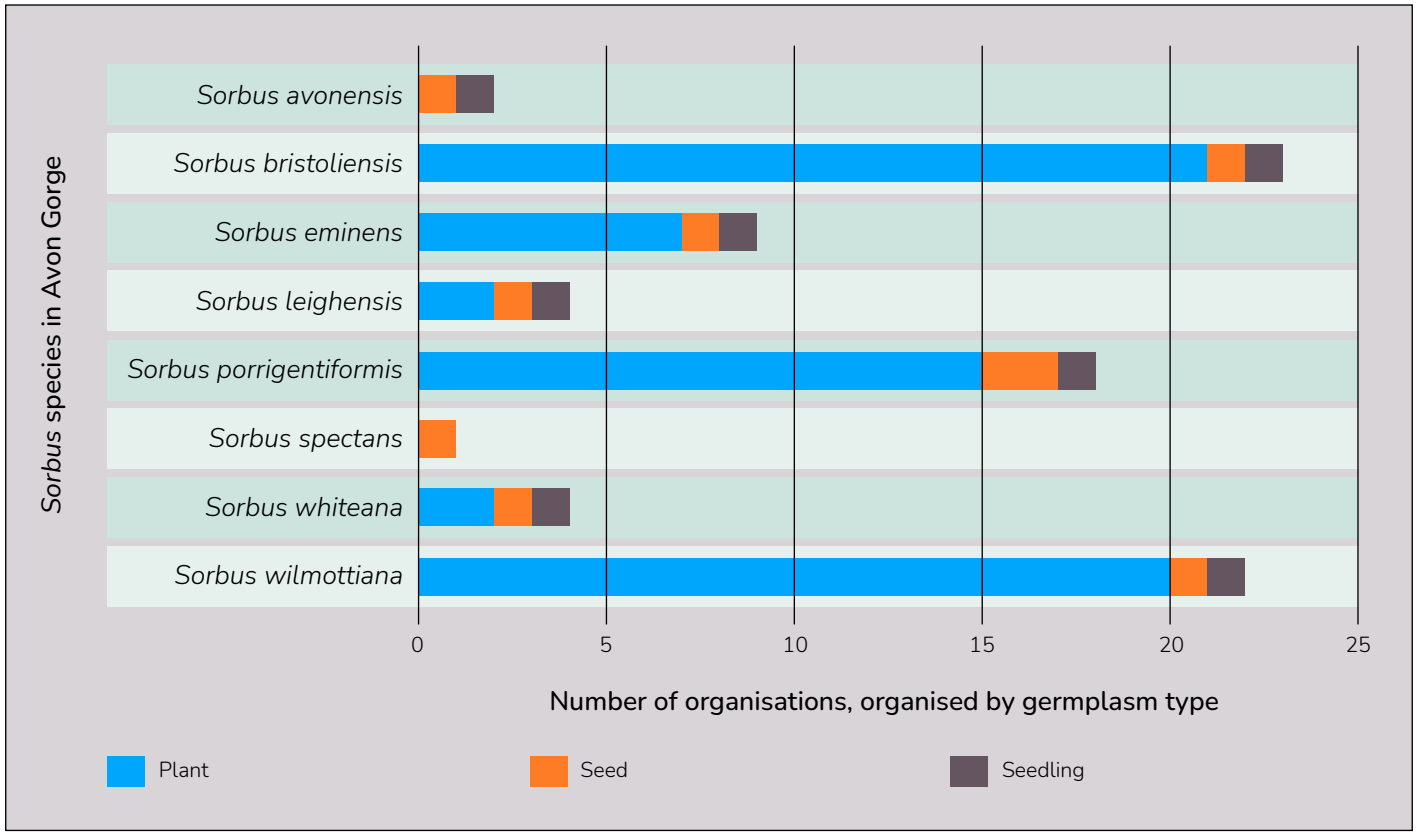


Figure 26. Number of organisations that reported *ex situ* collections of target species in Avon Gorge, categorised by germplasm type.

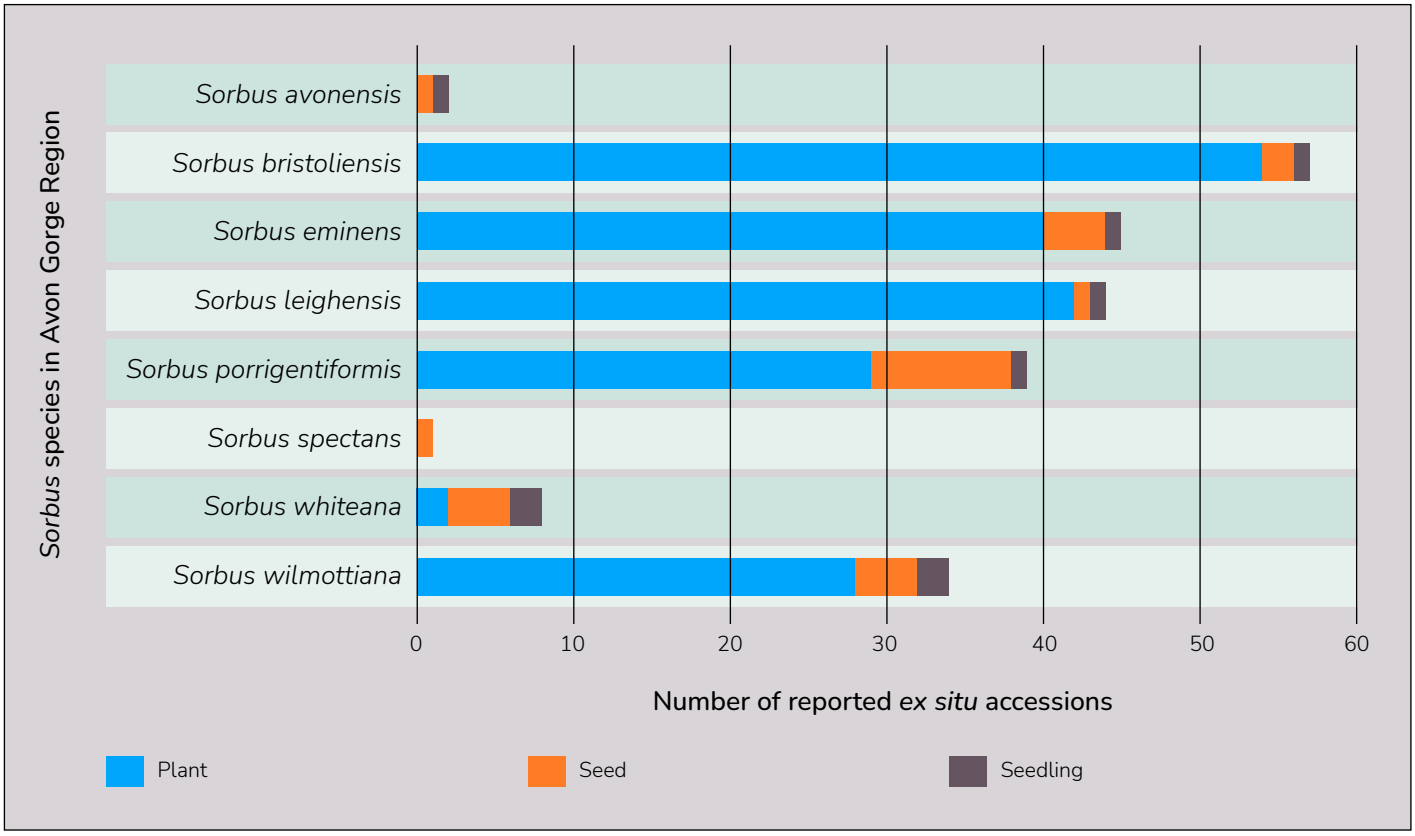


Figure 27. Number of reported *ex situ* accessions of target species in Avon Gorge, categorised by germplasm type.

Conservation Activities

Ex situ collections reported

Based on data from 38 *ex situ* collections that submitted accessions data, *S. bristoliensis* and *S. wilmottiana* have the highest number of organisations reporting *ex situ* collections including living plants and seeds (22 and 21 organisations respectively). *S. spectans* and *S. avonensis* are reported by the lowest number of *ex situ* organisations (1 and 2 respectively) (Figure 26).

The number of *ex situ* accessions (including living collections and seed bank material) recorded for Avon Gorge target species varies considerably. *S. bristoliensis* and *S. eminens* are represented by the highest numbers of accessions (57 and 45 respectively), whereas *S. spectans and S. avonensis* are represented by comparatively few accessions (1 and 2 respectively) (Figure 27).

Sorbus spectans in the Avon Gorge, Bristol (Dan Crowley)

Table 11. Prioritisation matrix identifying conservation concern score for Avon Gorge target species. IUCN Red List categories are taken from recent unpublished reassessment data (BGCI, 2025).

Species	IUCN Red List category	# organisations with *ex situ* collections (plants and/or seeds)	# of individual plants in *ex situ* living collections	# wild provenance seedlings in nurseries	# of seeds in *ex situ* collections	Concern Score (max score = 18)
Sorbus avonensis	CR	2	0	21	381	16
Sorbus spectans	CR	1	0	0	1447	15
Sorbus whiteana	CR	4	21	49	2086	14
Sorbus leighensis	EN	4	43	27	592	13
Sorbus eminens	VU	9	41	50	669	11
Sorbus porrigentiformis	VU	16	49	68	1401	10
Sorbus wilmottiana	EN	21	73	79	1138	9
Sorbus bristoliensis	EN	22	138	14	9895	7

5 points	4 points	3 points	2 points	1 point	0 points

a) Living collections: plants

S. bristoliensis and *S. wilmottiana* are represented by the most *ex situ* individuals (138 and 73 respectively), of which 58% and 30% respectively have the spatial data necessary for mapping wild *ex situ* source locality. *S. avonensis* and *S. spectans* are represented by no reported *ex situ* individual trees (Figure 28).

b) Living collections: seedlings

All Avon Gorge target species are represented by wild provenance seedlings in nurseries except *S. spectans*. *S. avonensis*, which is represented by no *ex situ* individuals, is represented by 21 *ex situ* seedlings in nurseries (Figure 28). Although seedling data should be interpreted with caution, as not all individuals will survive to be established in *ex situ* collections, these records nonetheless provide a useful indication of the species currently subject to active propagation and conservation effort.

c) Seed banks: seeds

All Avon Gorge target species are represented by wild provenance seed in a seed bank. *S. bristoliensis* is represented by the most banked *ex situ* seeds (9895), of which all are of wild provenance (Figure 28). *S. avonensis* has the lowest number of *ex situ* banked seeds (381) of which all are of wild provenance.

Sorbus bristoliensis (Dan Crowley)

Figure 28. A: Number of individual plants reported in *ex situ* collections belonging to target species occurring in Avon Gorge, categorised by provenance type. **B:** Number of reported *ex situ* seeds banked of target species in Avon Gorge, categorised by provenance type. **C:** Number of reported *ex situ* seedlings of target species in the Avon Gorge, categorised by provenance type.

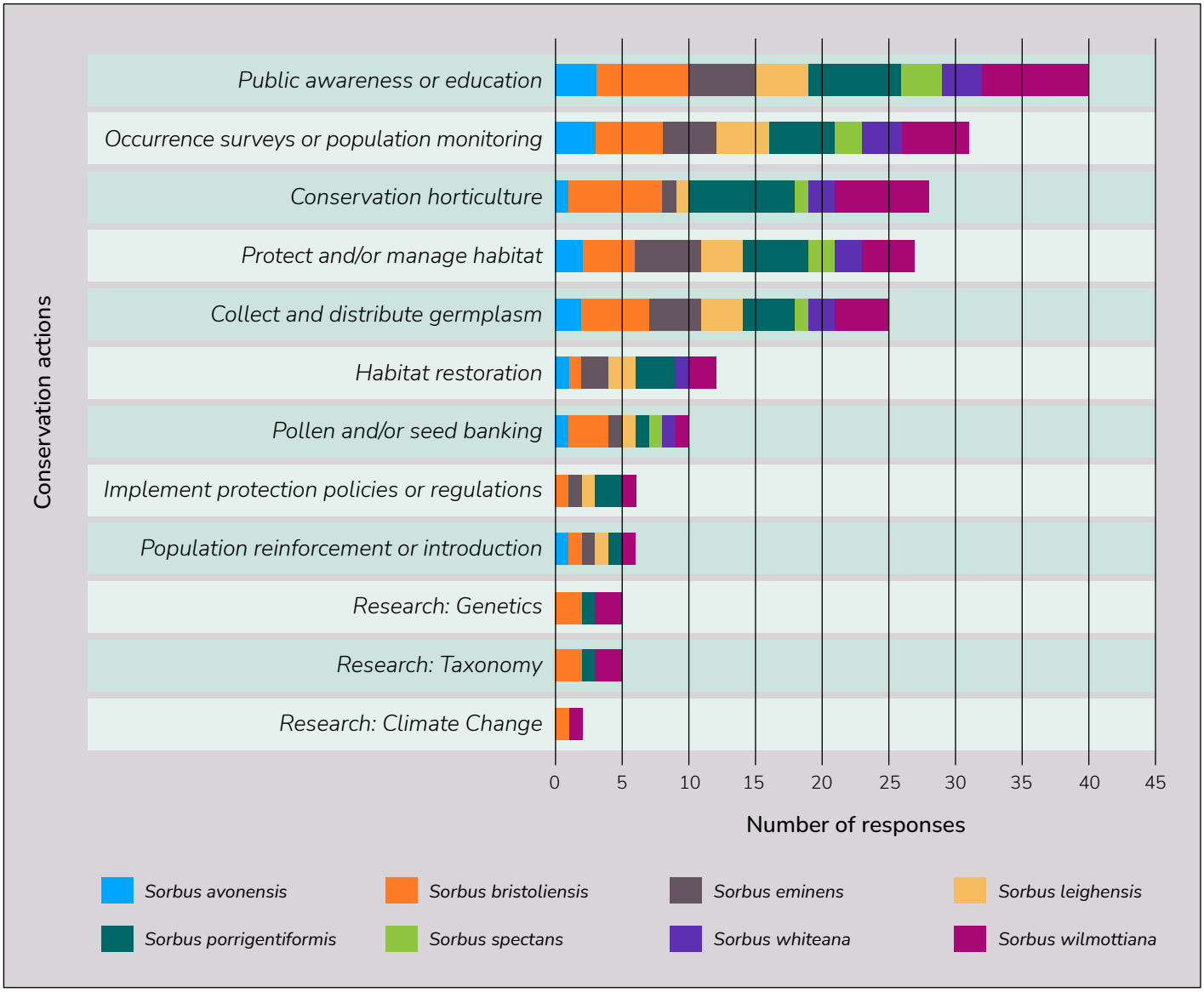


Figure 29. Number of responses for each conservation activity in the Conservation Activity Questionnaire by target species occurring in Avon Gorge.

Current conservation activities

A total of 34 respondents from 31 organisations and two private individuals (see Appendix 1 for list of contributors) provided information on current conservation activities for 36 target species via the Conservation Activity Questionnaire (Figure 29). Additional information was also gathered through expert consultation and a review of the literature.

Public awareness or education: Of the eight target species native to Avon Gorge region, public awareness or education was the most common activity reported, which were reported for all species.

Occurrence surveys or population monitoring: Reported for all species.

Conservation horticulture and collecting and distributing germplasm: Conservation horticulture was reported for all species, as was collecting and distributing germplasm. Additionally, one institution which did not return *ex situ* data has stated that they have carried out conservation horticulture and collect and distribute germplasm on: *S. wilmottiana, S. spectans, S. whiteana, S. avonensis, S. bristoliensis, S. eminens, S. leighensis, S. porrigentiformis* in the Conservation Action Questionnaire.

Protecting and/or managing habitat and habitat restoration: Protecting and/or managing habitat was reported for all species, while habitat restoration was reported for all species except *S. spectans*.

Population reinforcement or introduction: Population reinforcement or introduction was reported for *S. avonensis*, *S. bristoliensis*, *S. eminens*, *S. porrigentiformis* and *S. wilmottiana*.

Research: Genetic and taxonomic research was reported for *S. bristoliensis*, *S. wilmottiana* and *S. porrigentiformis*. While research into climate change was reported for *S. bristoliensis* and *S. wilmottiana*.

Land protection: The distribution of all target species occurring in the Avon Gorge lie predominantly within protected areas. See Appendix 3 for a list of protected areas in which target species occur.

Sorbus porrigentiformis (Dan Crowley)

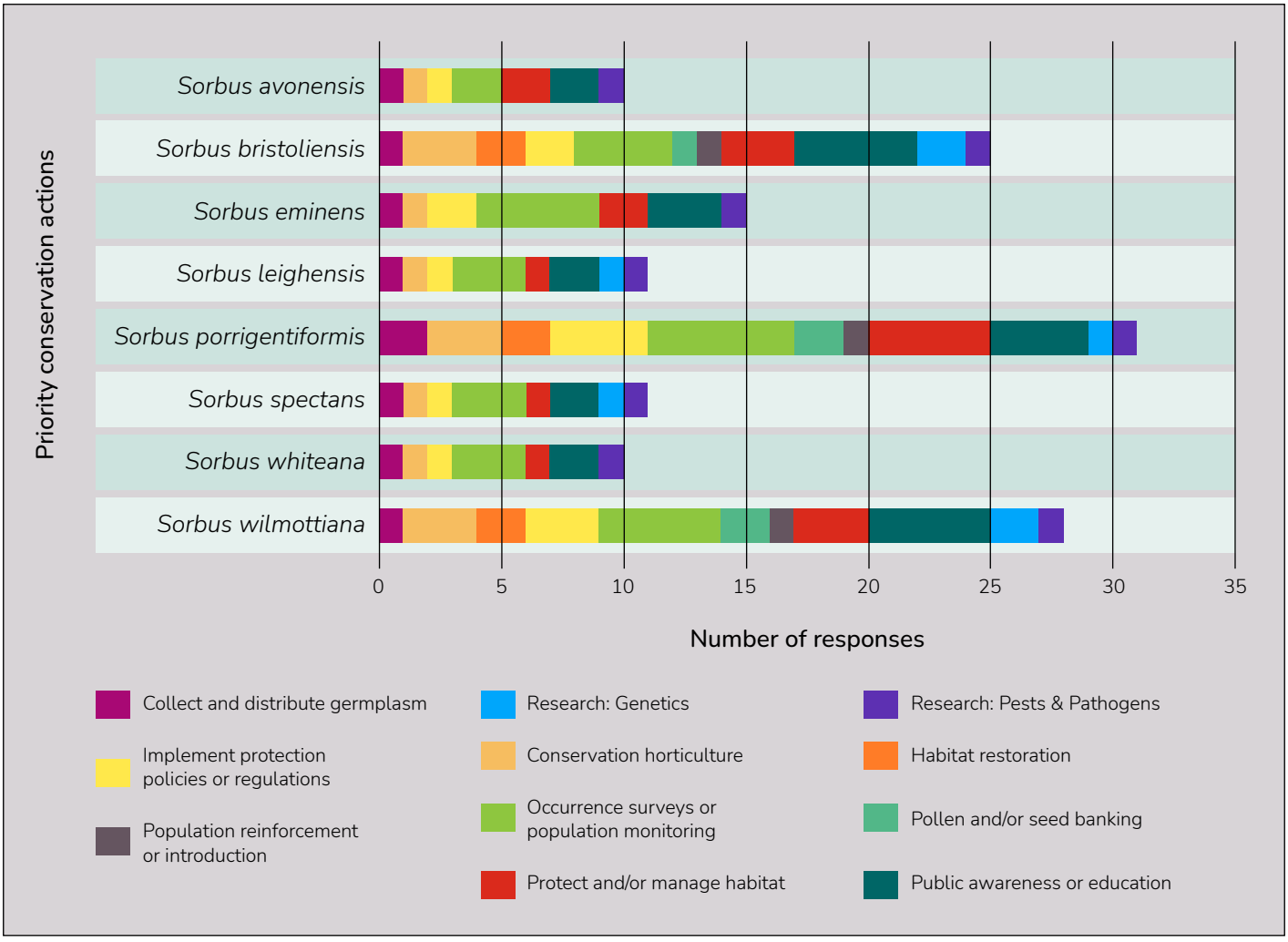


Figure 30. Priority conservation actions identified in the Conservation Activity Questionnaire reported as a proportion of responses by target species occurring in Avon Gorge.

Overall summary and recommendations

Priority conservation actions, identified through the Conservation Activity Questionnaire (Figure 30), together with findings from the *ex situ* collection survey and threats identified via the questionnaire, literature review, and expert consultation, were synthesised to develop recommendations for each of our target species.

The highest priority and recommended conservation activities for each species can be found in Table 12.

Expand and improve quality of *ex situ* collections: *S. avonensis* and *S. spectans* have the highest concern scores (16 and 15). Further high-quality seed collections, with accurate provenance data, are recommended for all species, and are considered a high priority for *S. avonensis* and *S. spectans* which are particularly vulnerable.

Further high-quality seed banking is recommended for all species and is considered a high priority for *S. avonensis* which has viability concerns.

Occurrence surveys or population monitoring: Occurrence surveys or population monitoring were are recommended for all Avon Gorge target species.

Population reinforcement or introduction: Population reinforcement or introduction is a high priority for all species affected by the ongoing MetroWest railway development.

Research: Further research is required to understand the current threat from the pathogen affecting trees in the gorge. *S. whiteana, S. wilmottiana*, *S. leighensis*, *S. spectans*. *S. leighensis*, and *S. porrigentiformis*, found at the Great Fault and Quarry 3 and 2, along with *S. spectans* are in need more genetic work and investigation.

Protect and manage habitat: Throughout the Avon Gorge, there is a need to control invasive species such as *Quercus ilex* and to control scrub, particularly within the quarries (Rich et al., 2026). As with all regions of Sorbus diversity, it is important that target species are not considered in isolation. A respondent to the questionnaire noted that there are unnamed taxa in the Avon Gorge which are not being conserved, which emphasizes the risk of focusing purely on named taxa.

Public awareness or education: Public awareness and education initiatives should be targeted at climbers emphasizing the identification and ecological significance of *Sorbus* species, as many taxa may not resemble conventional tree morphology, which can lead to misidentification or inadvertent damage (L. Houston pers. comm., 2025).

Table 12. Conservation recommendations for Avon Gorge target species, red is highest priority conservation actions and orange is recommended activities.

Species	Collect and distribute germplasm	Conservation horticulture	Habitat restoration	Implement protection policies or regulations	Occurrence surveys or population monitoring	Pollen and/or seed banking	Population reinforcement or introduction	Protect and/or manage habitat	Public awareness or education	Research: Climate Change, Genetics, Pests & Pathogens
Sorbus avonensis										
Sorbus bristoliensis										
Sorbus eminens										
Sorbus leighensis										
Sorbus porrigentiformis										
Sorbus spectans										
Sorbus whiteana										
Sorbus wilmottiana										

Highest priority conservation actions

Recommended activities

Wye Valley

Located on the border of England and Wales, extending for around 40km north to south from Ross-on-Wye to the Severn Estuary, the Wye Valley has two concentrations of *Sorbus* species, in both the upper and lower parts (See figure 31).

There are 20 *Sorbus* taxa that occur in the Wye Valley, including seven species which occur here and nowhere else (Table 13). See Appendix 3 for protected areas in which *Sorbus* occur. In February 2024, *Sorbus anglica* was reassessed from Near Threatened to Vulnerable (Rich and Beech, 2024)) and is included here without *ex situ* data and Conservation Activity Questionnaire results.

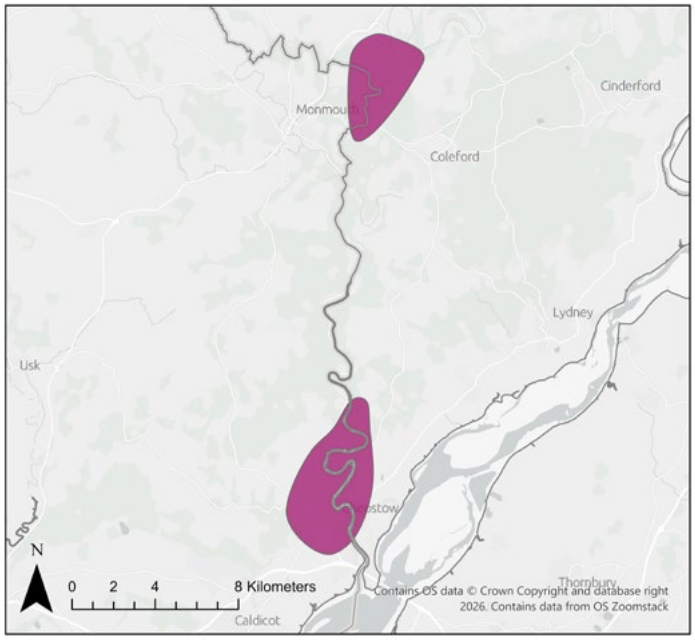


Figure 31. Regional map of the Wye Valley, showing the distribution of target species.

Table 13. *Sorbus* taxa occurring in the Wye Valley with target species shown in bold (IUCN Red List statuses of non-native species excluded and hybrids are not assessed). IUCN Red List categories are taken from recent unpublished reassessment workshop (BGCI, 2025).

Species	IUCN Red List status	Status
Sorbus anglica	**VU**	**Native**
Sorbus aria	LC	Native
Sorbus aucuparia	LC	Native
Sorbus domestica	LC	Native
Sorbus evansii	**CR**	**Native (regional endemic)**
Sorbus eminens	**VU**	**Native**
Sorbus eminentiformis	**EN**	**Native (regional endemic)**
Sorbus greenii	**CR**	**Native (regional endemic)**
Sorbus herefordensis	**EN**	**Native (regional endemic)**
Sorbus intermedia	-	Naturalized
Sorbus parviloba	**CR**	**Native (regional endemic)**
Sorbus porrigentiformis	**VU**	**Native**
Sorbus × pseudoporrigentiformis	-	Native
Sorbus rupicola	LC	Native
Sorbus saxicola	**CR**	**Native (regional endemic)**
Sorbus × thuringiaca	-	
Sorbus × decipiens	-	
Sorbus torminalis	LC	Native
Sorbus whiteana	**CR**	**Native**
Sorbus wyensis	CR	Native (regional endemic)

Threats to wild populations

A total of 34 respondents from 31 organisations and two private individuals (see Appendix 1 for list of contributors) provided threat information for 36 target species via the Conservation Activity Questionnaire (Figure 32). Threat information was also gathered from IUCN Red List assessments, expert consultation and literature review.

Amongst the six species endemic to the Wye Valley, the most selected threat was 'unknown'.

Pests or pathogens: Based on responses from 34 respondents, of the nine target Wye Valley species in this study, pests or pathogens was most selected as the most significant threat to wild populations and was stated as a threat to all species except *S. parviloba*, The type tree of *S. evansii* was killed by an unknown pathogen affecting the trees in 2016 (Beech and Rivers, 2017h).

Inappropriate and/or lack of woodland management: Agriculture and silviculture was selected as a threat to *S. saxicola*, *S. herefordensis*, *S. greenii*, *S. eminentiformis*, and *S. eminens*.

Inappropriate and/or lack of woodland management has been reported as a threats to *S. eminentiformis, S. greenii, S. parviloba, S. saxicola* and is listed as a potential threat to *S. herefordensis* (Beech and Rivers, 2017f; Beech and Rivers, 2017i; Beech et al., 2017b; Rich, 2017; Beech and Rivers, 2017j). Conservation management at the Doward which has exposed trees of *S. eminentiformis* and inadvertently caused trees to blow over (Beech and Rivers, 2017f). Shading out by trees of *Fagus sylvatica* is reported as the main threat to *S. parviloba* (Beech et al., 2017b).

Tourism or recreation: Trees of *S. saxicola* at Symonds Yat have reportedly been coppiced to open up tourist viewpoints (Rich, 2017). While not a target of our study, *S. wyensis* is known to be severely threatened by climbing route clearance and establishment, which may potentially affect other species (Rich et al., 2026).

Other: In 2024 rock falls in the Symonds Yat area required rock safety works which will affect some species, especially *S. saxicola* (Rich et al., 2026).

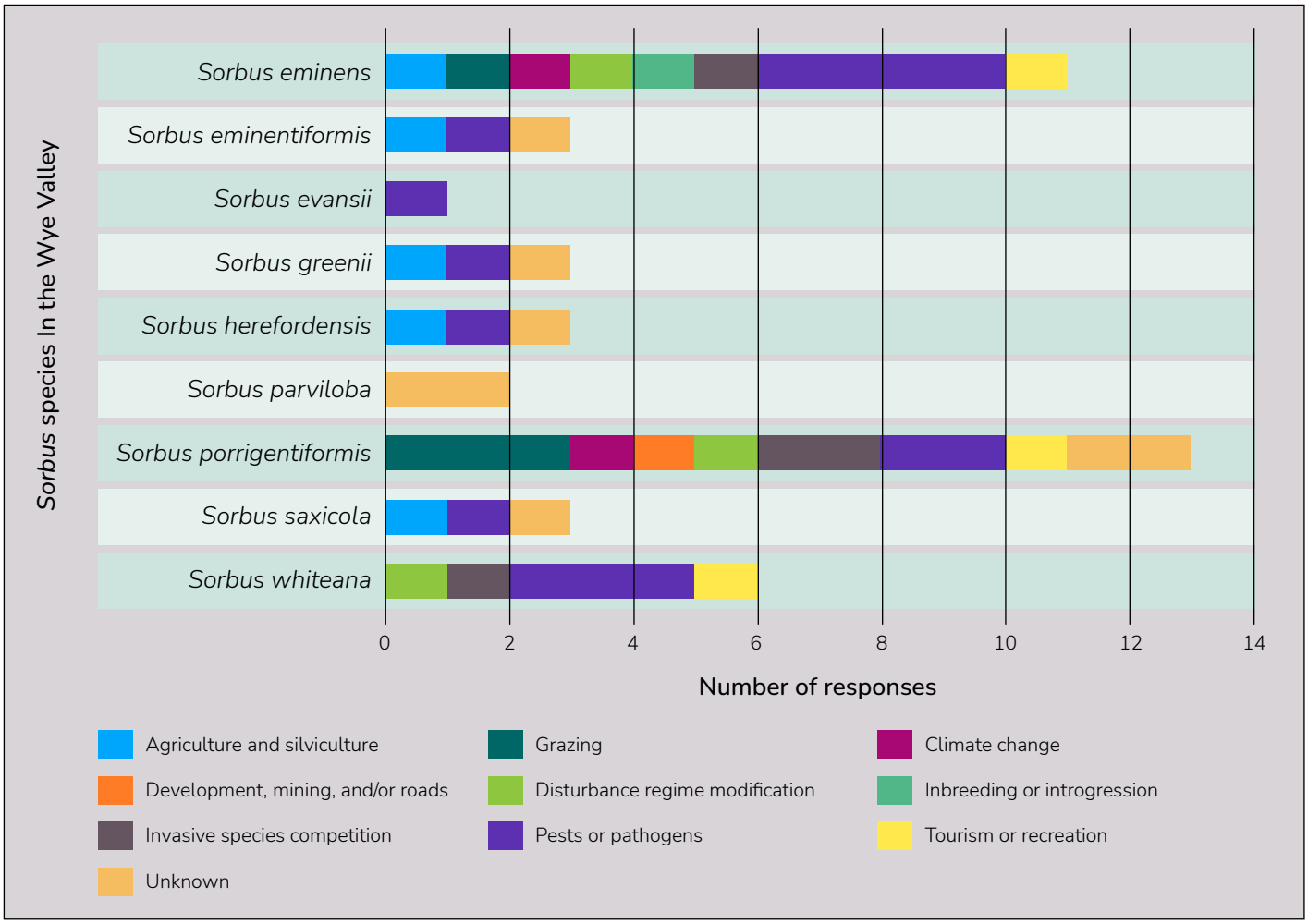


Figure 32. Threat categories reported by respondents to the Conservation Activity Questionnaire for target species occurring in the Wye Valley.

Conservation Activities

Ex situ collections reported

Based on data from 38 *ex situ* collections that submitted accessions data, *S. porrigentiformis* and *S. eminens* have the highest number of organisations reporting *ex situ* collections including living plants and seeds (16 and 9 organisations respectively) *Ex situ* collections of *S. herefordensis* and *S. greenii are* reported by the lowest number of organisations (1 and 2 respectively) (Figure 33).

The number of *ex situ* accessions (including living collections and seed bank material) recorded for the Wye Valley target species varies considerably. The more widespread taxa, *S. eminens* and *S. porrigentiformis*, are represented by the highest numbers of accessions (45 and 39 respectively), whereas the regional endemics are represented by comparatively few accessions. *S. herefordensis, S. greenii* and *S. saxicola* have the lowest (1, 2 and 4 respectively) (Figure 34).

Sorbus wyensis (Dan Crowley)

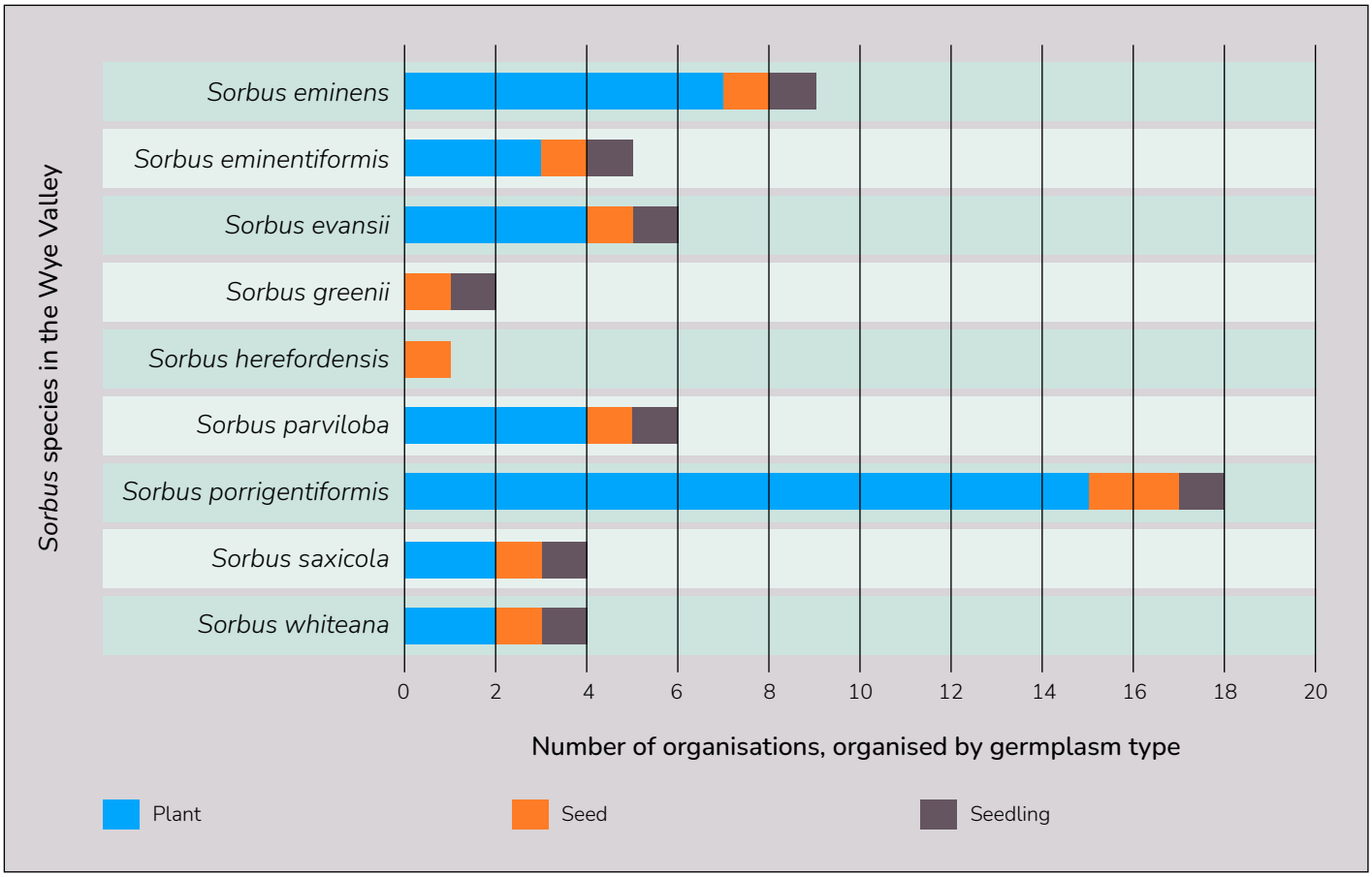


Figure 33. Number of organisations that reported *ex situ* collections of target species in the Wye Valley, categorised by germplasm type.

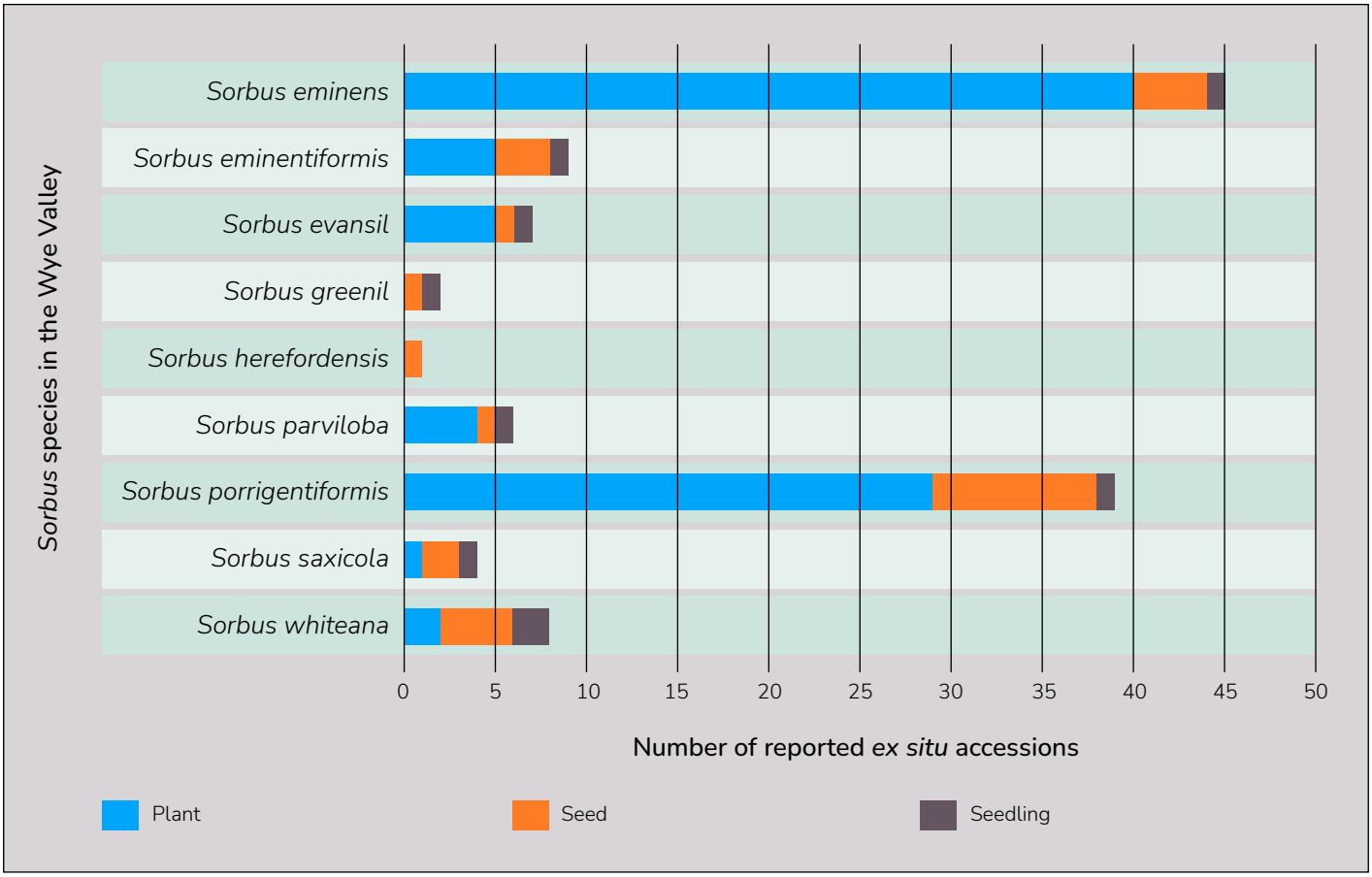


Figure 34. Number of reported *ex situ* accessions of target species in the Wye Valley, categorised by germplasm type.

a) Living collections: plants

S. porrigentiformis is represented by the most *ex situ* individual plants (49) followed by *S. eminens* (41) and *S. whiteana* (21). However, there are no *ex situ* collections of *S. whiteana* or *S. porrigentiformis* from the Wye Valley. Of the six species endemic to the Wye Valley, *S. eminentiformis*, has the most *ex situ* individual plants (10). *S. greenii* and *S. herefordensis*, have no reported individual trees in *ex situ* collections.

b) Living collections: seedlings

All Wye Valley target species are represented by wild provenance *ex situ* seedlings in nurseries, with the exception of *S. herefordensis*. Although seedling data should be interpreted with caution, as not all individuals will survive to be established in *ex situ* collections, these records nonetheless provide a useful indication of the species currently subject to active propagation and conservation effort.

c) Seed banks: seeds

All Wye Valley target species have wild provenance seed banked in *ex situ* collections. *S. greenii* and *S. herefordensis*, which have no reported individual trees in *ex situ* collections, both have banked seeds (527 and 3462 seeds respectively). *S. parviloba* has the lowest number of *ex situ* banked seeds (215) of which are all of wild provenance.

Sorbus aria at Wintour's Leap, Gloucestershire (Rosie Anderson)

Figure 35. A: Number of individual plants reported in *ex situ* collections belonging to target species occurring in the Wye Valley, categorised by provenance type. **B:** Number of reported *ex situ* seeds banked of target species in the Wye Valley, categorised by provenance type. **C:** Number of reported *ex situ* seedlings of target species in the Wye Valley, categorised by provenance type.

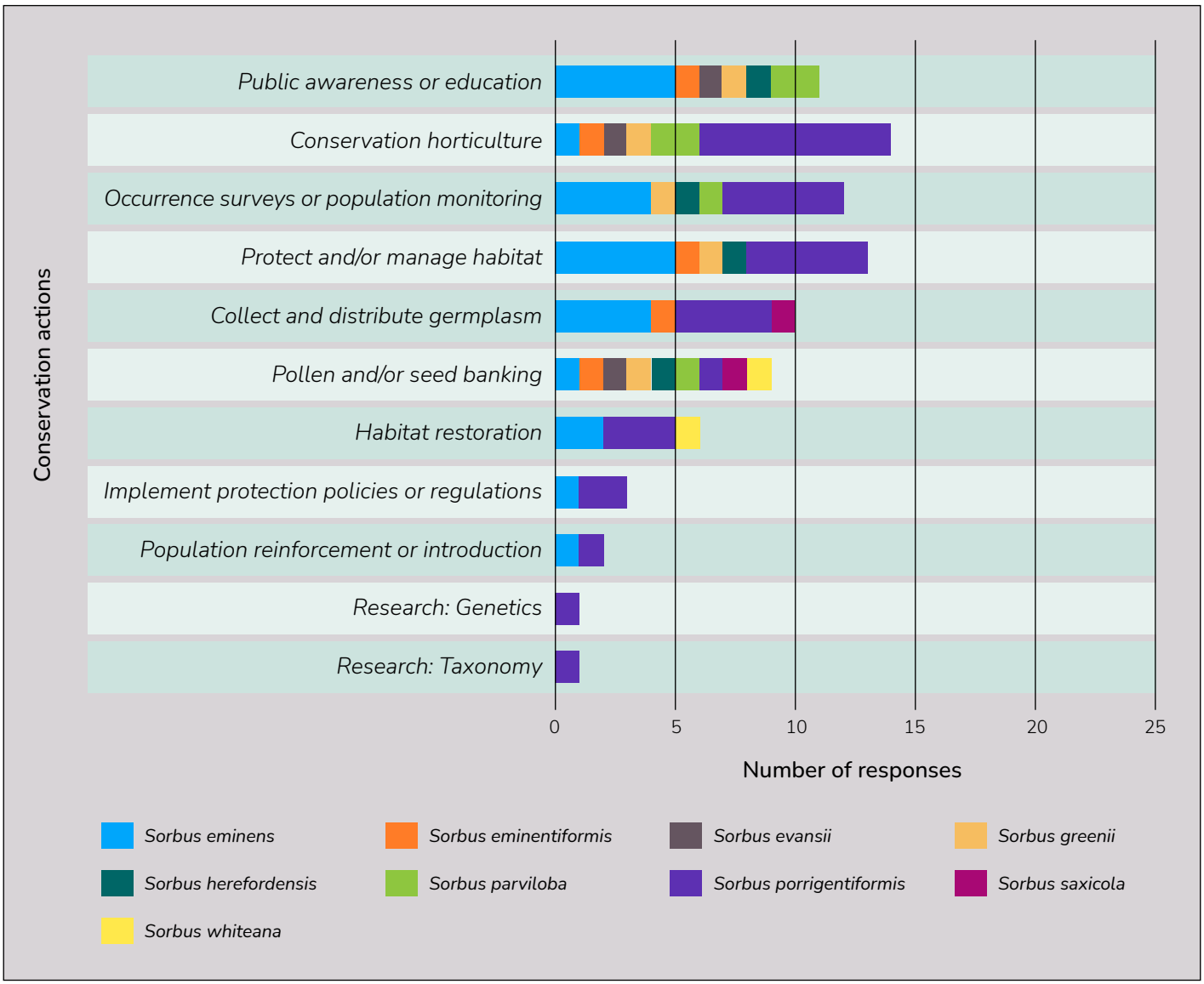


Figure 36. Number of responses for each conservation activity in the Conservation Activity Questionnaire by target species occurring in the Wye Valley.

Sorbus herefordensis leaves (Dan Crowley)

A total of 34 respondents from 31 organisations and two private individuals (see Appendix 1 for list of contributors) provided information on current conservation activities for 36 target species via the Conservation Activity Questionnaire (Figure 36). Additional information was also gathered through expert consultation and a review of the literature.

Public awareness or education: Of the nine target species native to the Wye Valley region, public awareness or education was the most common activity reported, which were reported for all species.

Occurrence surveys or population monitoring: Lady Park Wood was surveyed in September 2003 for Natural England by Colin Charles, Libby Houston and Angus Tillotson. Most recent systematic surveys were carried out in 2017 and 2018 in the Wye Valley SAC (Rich et al., 2019).

Conservation horticulture: Conservation horticulture was reported for all target species that we requested data for, except *S. herefordensis*. Tim Rich reports supplying Herefordshire Wildlife Trust with *S. herefordensis* trees to be planted at Queenswood Country Park in 2016, although we do not have *ex situ* accession data for these trees.

Research: In 2022 Forestry England sampled two diseased *S. aria* trees in Wyndcliff Wood but were unable to identify the pathogen (C. Gorton pers. comm., 2023).

Land protection: Most species occur within nationally or internationally designated protected areas; while *S. greenii*, *S. herefordensis*, are found in locally recognized nature reserves. See Appendix 3 for a list of protected areas in which target species occur.

Overall summary and recommendations

Priority conservation actions, identified through the Conservation Activity Questionnaire (Figure 37), together with findings from the *ex situ* collection survey and threats identified via the questionnaire, literature review, and expert consultation, were synthesised to develop recommendations for each of our target species.

The highest priority and recommended conservation activities for each species can be found in Table 15.

Of the nine target species native to the Wye Valley region, *S. wyensis* and *S. greenii* have the highest concern scores (18 and 16 respectively), while *S. evansii*, *S. parviloba*, *S. saxicola*, and *S. whiteana* all have a concern score of 14 (Table 14).

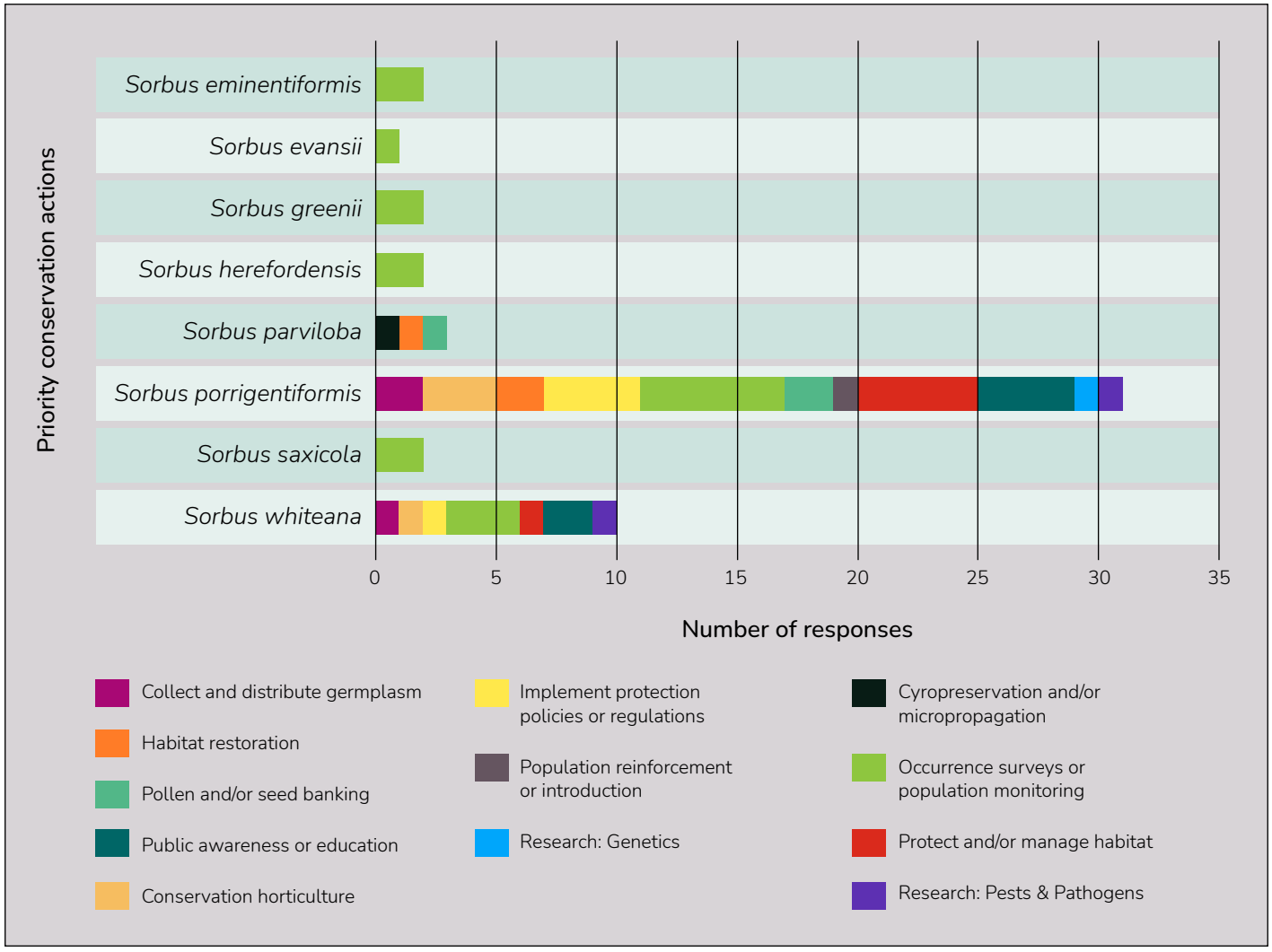


Figure 37. Priority conservation actions identified in the Conservation Activity Questionnaire reported as a proportion of responses by target species occurring in the Wye Valley.

Expand and improve quality of *ex situ* collections: *S. wyensis* and *S. herefordensis* have no individual plants or seedlings in *ex situ* conservation, so collection of material is urgent. It is also recommended that further seed of *S. eminentiformis*, *S. evansii*, *S. greenii*, *S. herefordensis* and *S. parviloba* is collected for seed banking. However, the single individual of *S. parviloba* is currently resprouting and will not be mature for a few years (T. Rich, pers. comm., 2026).

Occurrence surveys or population monitoring: Occurrence surveys or population monitoring was the most identified urgent conservation action for all Wye Valley target species. Further surveys are particularly important in the case of *S. parviloba* where there is a need to resolve the population size (Rich et al., 2026).

Research: Among the seven species endemic to the Wye Valley, 'unknown' was the most frequently selected threat category. The limited number of responses for these taxa perhaps reflects their recent description and the relatively early stage of conservation action in the region.

Genetic research will be necessary to support further surveys to identify the population size of *S. parviloba* which is currently unresolved (Rich et al., 2026).

Further research is required to understand the current threat from the unknown pathogen affecting trees.

Protect and manage habitat: Development of a comprehensive landscape management plan across all areas of *Sorbus* diversity in the Wye Valley is recommended. The reintroduction of woodland coppicing across parts of the Upper Wye Gorge SSSI and the wider Wye Valley, particularly along cliff-edge habitats, is likely to benefit *Sorbus* species such as *S. eminentiformis*, *S. saxicola* and *S. parviloba*. However, caution is required when undertaking halo-thinning or scrub removal as this has the potential to increase risk of wind damage to trees (Rich et al., 2026).

Table 14. Prioritisation matrix identifying conservation concern score for Wye Valley target species. IUCN Red List categories are taken from recent unpublished reassessment data (BGCI, 2025).

Species	IUCN Red List category	# organisations with *ex situ* collections (plants and/or seeds)	# of individual plants in *ex situ* living collections	# wild provenance seedlings in nurseries	# of seeds in *ex situ* collections	Concern Score (max score = 18)
Sorbus wyensis	CR	0	0	0	0	18
Sorbus greenii	CR	2	0	25	527	16
Sorbus evansii	CR	5	7	5	1259	14
Sorbus parviloba	CR	6	8	15	215	14
Sorbus saxicola	CR	4	7	14	1209	14
Sorbus whiteana	CR	4	21	49	2086	14
Sorbus eminentiformis	EN	5	10	5	1599	13
Sorbus herefordensis	EN	1	0	0	3462	13
Sorbus porrigentiformis	VU	16	49	68	1401	10
Sorbus eminens	VU	9	41	50	669	11

5 points	4 points	3 points	2 points	1 point	0 points

Public awareness or education: An education program for climbers across the Wye Valley would be beneficial to reduce the threat of damage to trees from climbers, who have been clearing climbing routes – as seen with trees of *S. wyensis* (Rich et al., 2026). Many trees do not resemble conventional tree morphology, which can lead to misidentification or inadvertent damage, so work should focus on increasing awareness and identification skills.

Population reinforcement or introduction: *S. parviloba* on Coldwell Rocks, is particularly vulnerable, with only one confirmed non-flowering individual. A recovery project aiming to reinforce the population with new plantings, and undertake suitable habitat management along cliff edges along with the planting of new trees is urgently recommended. Roped access surveys and genetic analysis are also recommended to confirm exact population numbers and the location of individuals (Rich et al., 2026).

Sorbus wyensis above climbing bolts, Wynd Cliff Quarry, Monmouthshire (Dan Crowley)

Table 15. Conservation recommendations for Wye Valley target species, red is highest priority conservation actions and orange is recommended activities.

Species	Collect and distribute germplasm	Conservation horticulture	Cryopreservation and/or micropropagation	Habitat restoration	Implement protection policies or regulations	Occurrence surveys or population monitoring	Pollen and/or seed banking	Population reinforcement or introduction	Protect and/or manage habitat	Public awareness or education	Research: Climate Change, Genetics, Pests & Pathogens
Sorbus eminens											
Sorbus eminentiformis											
Sorbus evansii											
Sorbus greenii											
Sorbus herefordensis											
Sorbus parviloba											
Sorbus porrigentiformis											
Sorbus saxicola											
Sorbus whiteana											
Sorbus wyensis											

Highest priority conservation actions

Recommended activities

South Wales
(excluding the Wye Valley)

There are 11 *Sorbus* taxa that occur in South Wales (excluding the Wye Valley), including five species which occur here and nowhere else (Table 16). See Appendix 3 for protected areas in which *Sorbus* occur. In February 2024, *S. anglica* was reassessed from Near Threatened to Vulnerable (Rich and Beech, 2024)) and is included here without *ex situ* data and Conservation Activity Questionnaire results.

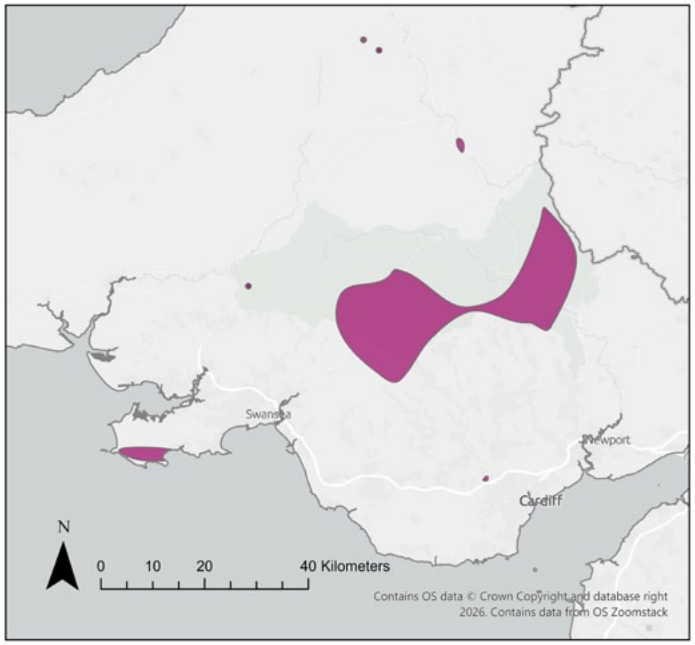


Figure 38. Regional map of South Wales, showing the distribution of target species.

Craig y Cilau, Wales (Tim Rich)

Table 16. *Sorbus* taxa occurring in South Wales with target species shown in bold (IUCN Red List categories of non-native species excluded and hybrids are not assessed).

Species	IUCN Red List category	Status
Sorbus anglica	VU	**Native**
Sorbus aucuparia	LC	Native
Sorbus aucuparia × *S. minima*	-	Native
Sorbus cambrensis	EN	**Native (regional endemic)**
Sorbus leyana	CR	**Native (regional endemic)**
Sorbus leptophylla	EN	**Native (regional endemic)**
Sorbus × *liljeforsii*	-	Native
Sorbus minima	VU	**Native (regional endemic)**
Sorbus × *motleyi*	-	Native
Sorbus porrigentiformis	VU	**Native**
Sorbus rupicola	LC	Native
Sorbus stenophylla	EN	**Native (regional endemic)**

Threats to wild populations

A total of 34 respondents from 31 organisations and two private individuals (see Appendix 1 for list of contributors) provided threat information for 36 target species via the Conservation Activity Questionnaire (Figure 39). Threat information was also gathered from IUCN Red List assessments, expert consultation and literature review.

Of the seven target South Wales species in this study, the most selected answer to what the most significant threat to wild populations and was *unknown*.

Grazing: Grazing was identified as a threat to all South Wales species, except *S. leyana* and *S. stenophylla*. Grazing by sheep has been reported to limit regeneration of *S. stenophylla* and *S. minima* and is limiting expansion of populations of *S. leyana* (Rich et al, 2010). Regeneration of *S. stenophylla* has been observed on rocky areas inaccessible to grazing sheep (Rich et al., 2026).

Disturbance regime modification; agriculture and/or silviculture: *S. leyana* is affected by the cessation of traditional woodland management which has caused canopy closure and reduced light (Rich et al. 2026)

Development, mining and/or roads: *S. minima* and *S. rupicola* (not a target species) have been impacted by historic quarrying, which has caused the loss of populations at Blaen Onneu (Rich *et al*. 2026). Quarrying in the Craig y Cilau area, Crickhowell has also has destroyed significant numbers of whitebeams but recolonisation is occurring (Rich 2003).

Other: Rich et al. (2026) report poor seed set within *S. minima* and *S. leyana*, which affects the species ability to recruit new trees.

Conservation Activities

Ex situ collections reported

Based on data from 38 *ex situ* collections that submitted accessions data, *S. porrigentiformis* and *S. minima* have the highest number of organisations reporting *ex situ* collections including living plants and seeds (18 and 17 organisations respectively) (Figure 40). *Ex situ* collections of *S. stenophylla* and *S. cambrensis* are reported by the lowest number of organisations (3 and 4 respectively).

The number of *ex situ* accessions (including living collections and seed bank material) recorded for the South Wales target species varies considerably. *S. porrigentiformis* and *S. leyana* are represented by the highest numbers of accessions (39 and 27 respectively), whereas *S. stenophylla* and *S. cambrensis* are represented by comparatively few accessions (5 and 9 respectively) (Figure 41).

b) Living collections: plants

S. leyana is represented by the most *ex situ* individuals (58) but of this 54 are of unknown, garden or indirect wild provenance (93%) (Figure 42). *S. minima* has the second highest number of individuals (53), of which 72% are of unknown, garden or indirect wild provenance. *S. stenophylla* and *S. cambrensis* and have the lowest number of reported individuals (7 and 9 respectively) but have a higher proportion of wild provenance individuals with the spatial data necessary for mapping wild *ex situ* source locality (75% and 56% respectively).

c) Living collections: seedlings

S. porrigentiformis is the only target species that occurs in South Wales represented by *ex situ* seedlings in nurseries, however there is no accession that originates from South Wales (Figure 42).

d) Seed banks: seeds

All South Wales target species are represented by wild provenance seed in a seed bank. *S. stenophylla* is represented by the most banked *ex situ* seeds (1908), of which all are of wild provenance (Figure 42). *S. leyana* has the lowest number of *ex situ* banked seeds (291) of which all are of wild provenance.

Sorbus leyana, Darren Fach, Mid Glamorgan (Tim Rich)

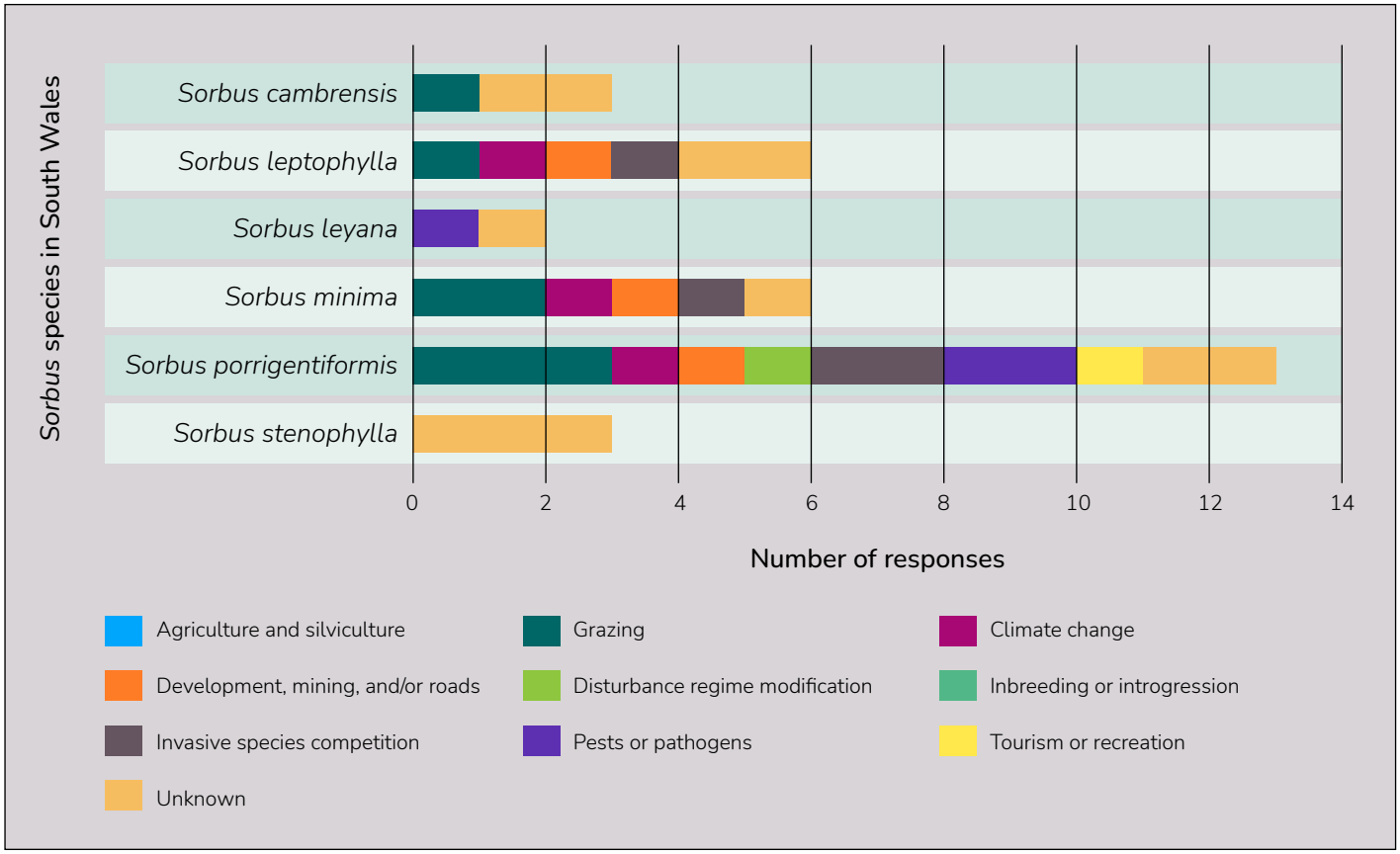


Figure 39. Threat categories reported by respondents to the Conservation Activity Questionnaire for target species occurring in South Wales.

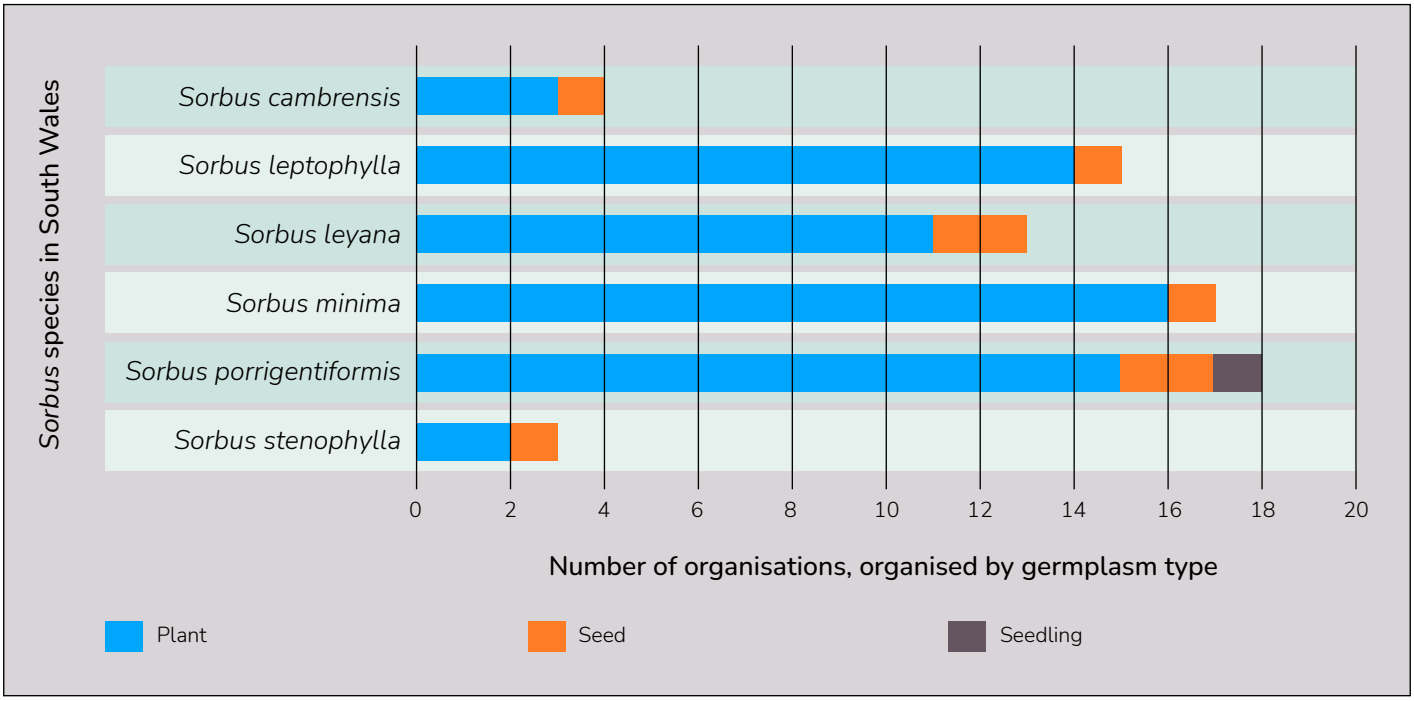


Figure 40. Number of organisations that reported *ex situ* collections of target species in South Wales, categorised by germplasm type.

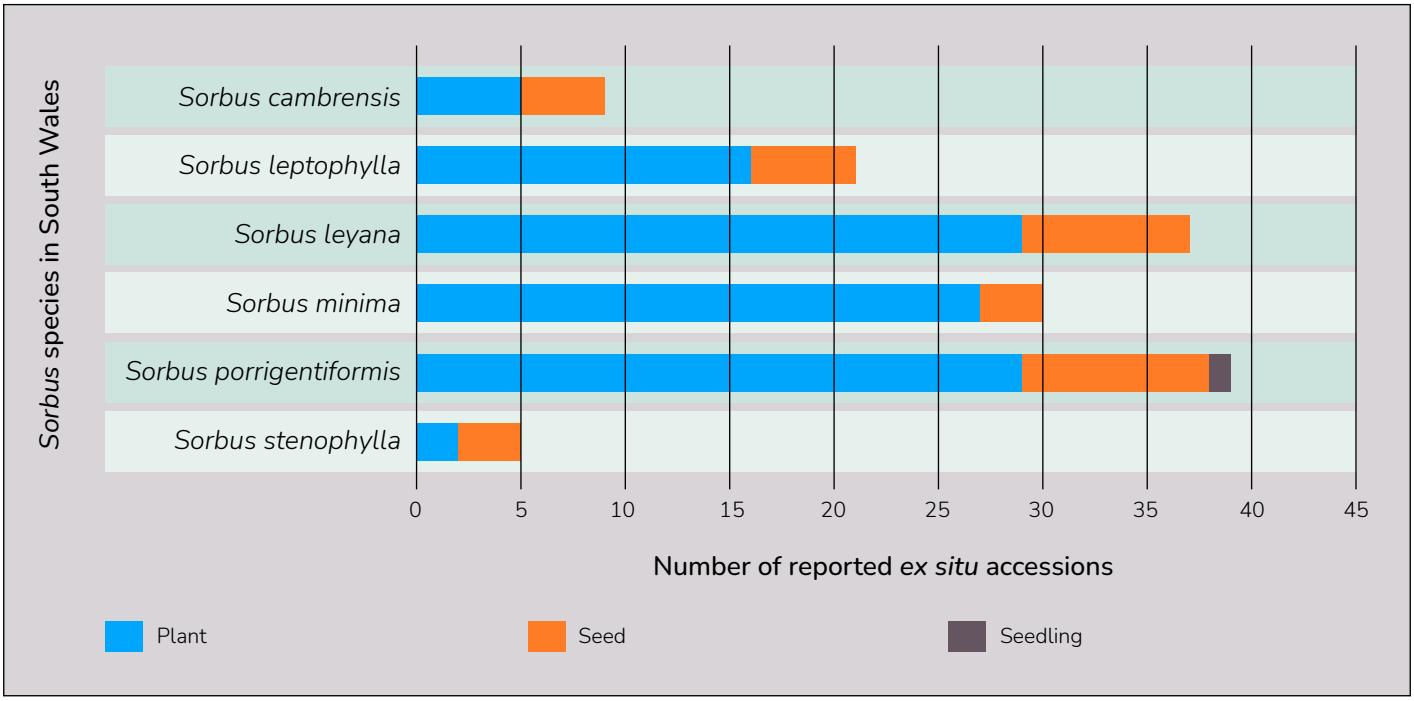


Figure 41. Number of reported *ex situ* accessions of target species in South Wales, categorised by germplasm type.

Current conservation activities

A total of 34 respondents from 31 organisations and two private individuals (see Appendix 1 for list of contributors) provided information on current conservation activities for 36 target species via the Conservation Activity Questionnaire (Figure 43). Additional information was also gathered through expert consultation and a review of the literature.

Public awareness or education: Public awareness or education was the most common activity reported by respondents.

Conservation horticulture; Collect and distribute germplasm; Pollen and seed banking: These activities have been reported for all species occurring within South Wales without further detail.

Occurrence surveys or population monitoring: The most recent surveys of populations of *S. cambrensis* and *S. stenophylla* were undertaken in autumn 2012 by M. Lepší with updates by T. Rich in 2014 (Lepší and Rich, 2022) .

Land protection: The distribution of all target species occurring in South Wales lie predominantly within protected areas and within the Bannau Brycheiniog National Park. See Appendix 3 for a list of protected areas in which target species occur.

Sorbus minima, Craig y Cilau,
Bannau Brycheiniog National Park (Tim Rich)

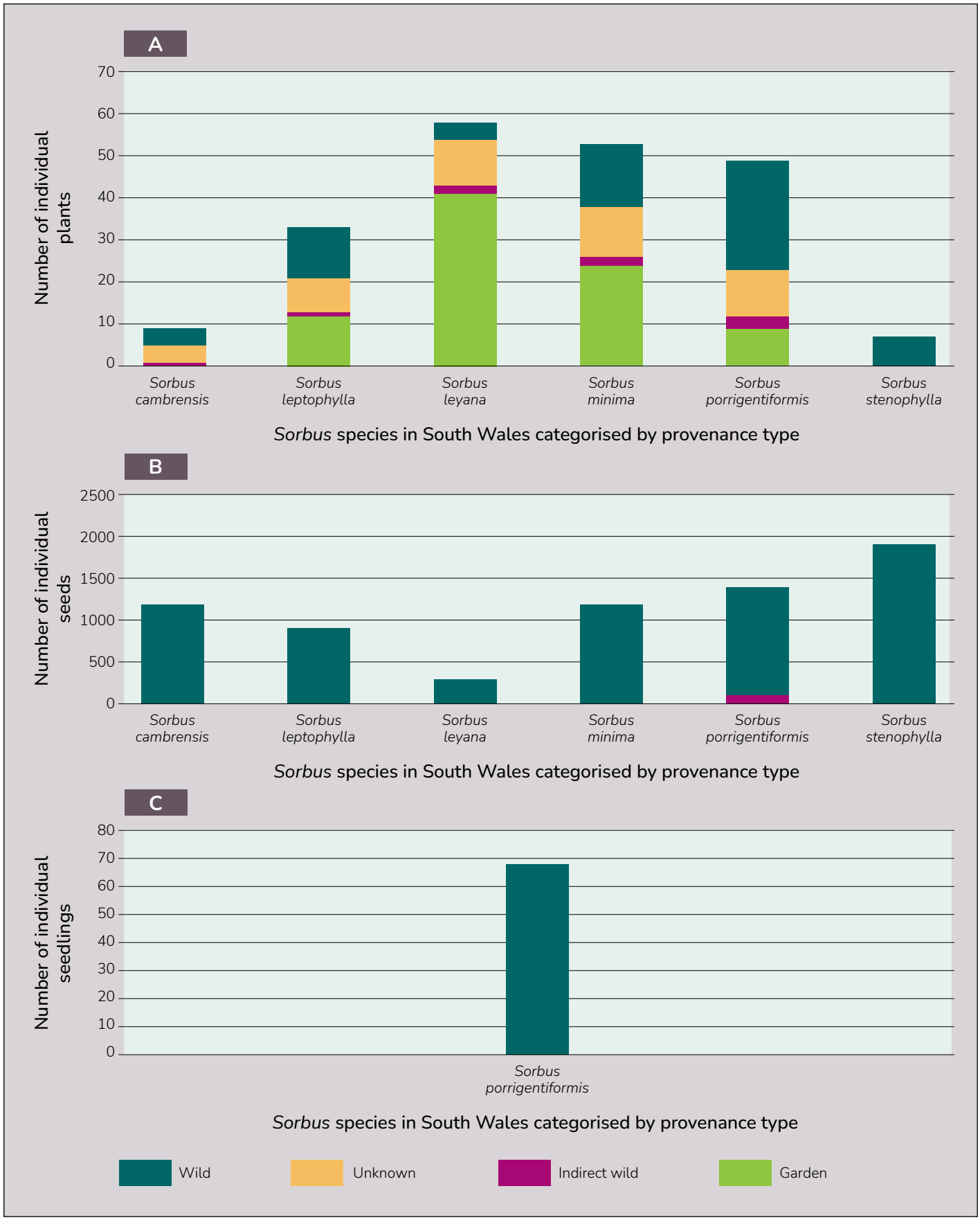


Figure 42. A: Number of individual plants reported in *ex situ* collections belonging to target species occurring in South Wales, categorised by provenance type. **B:** Number of reported *ex situ* seeds banked of target species in South Wales, categorised by provenance type. **C:** Number of reported *ex situ* seedlings banked of target species in South Wales categorised by provenance type.

Overall summary and recommendations

Priority conservation actions, identified through the Conservation Activity Questionnaire (Figure 44), together with findings from the *ex situ* collection survey and threats identified via the questionnaire, literature review, and expert consultation, were synthesised to develop recommendations for each of our target species.

The highest priority and recommended conservation activities for each species can be found in Table 18.

Sorbus minima flowers, Craig y Cilau, Bannau Brycheiniog National Park (Tim Rich)

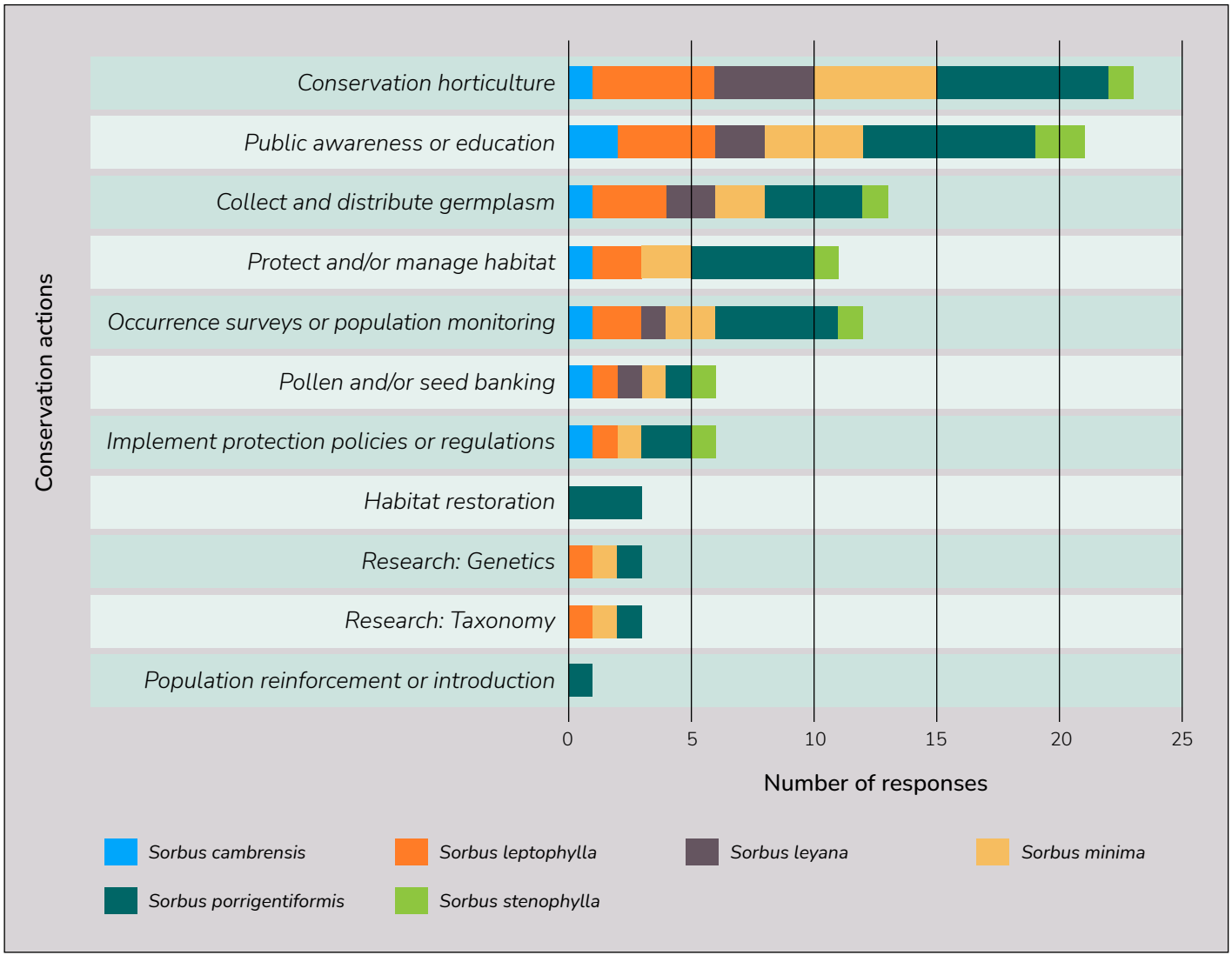


Figure 43. Number of responses for each conservation activity in the Conservation Activity Questionnaire by target species occurring in South Wales.

Expand and improve quality of ex situ collections: *S. cambrensis* and *S. stenophylla* have the highest concern score out of target species native to the South Wales region (13) (Table 17). *S. cambrensis* and *S. stenophylla* are the only known pentaploid *Sorbus* taxa and both show some morphological variation (Rich et al., 2022d). Work by Lepší et al. (2019) demonstrated that *S. cambrensis* is self-pollinated, with 77% seeds developing sexually with the remainder developing apomictically, while 92% of *S. stenophylla* seeds are produced apomictically. Therefore, it is recommended to develop good quality *ex situ* collections of *S. cambrensis* from all three sites in the Mynydd Llangatwg and Cwm Clydach area and three sites in the Llanthony Valley to capture genetic diversity.

Although all South Wales target species species are represented in *ex situ* collections these individuals often do not have clear records of source location. Despite the Critically Endangered *S. leyana* having 58 individual trees in *ex situ* collections, only four have the spatial data necessary for mapping wild *ex situ* source locality. Accordingly, the expansion of high-quality, well-documented seed collections and the further development of *ex situ* collections are identified as high-priority conservation actions for all South Wales target species, with the exception of *S. porrigentiformis*, for which these actions are recommended rather than categorised as highest priority (Table 17)

Protect and manage habitat: Development of a comprehensive landscape management plan across all areas of *Sorbus* diversity across South Wales is recommended**.** Management requirements for *Sorbus* is complex due to a need for a careful balance between grazing and canopy closure.

Research: Plants of *S. stenophylla* from Govilon and Darren demonstrate morphological differences to those at the type locality at Tarren-yr-Esgob and therefore further genetic work and flower and fruit studies are recommended to resolve the origins and taxonomy (Rich et al., 2026).

Occurrence surveys or population monitoring: Occurrence surveys are recommended to assess the current and future impact of habitat management.

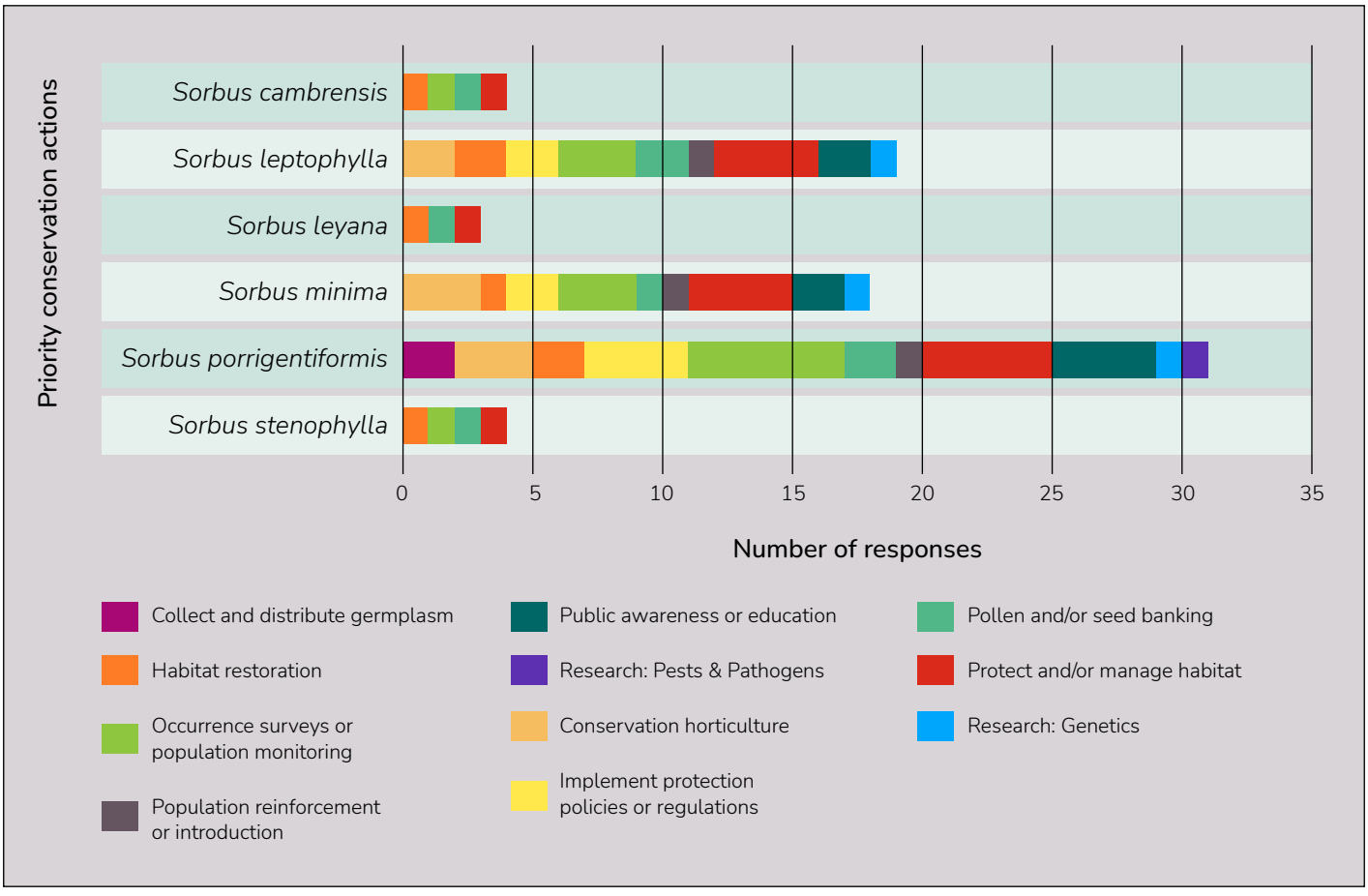


Figure 44. Priority conservation actions identified in the Conservation Activity Questionnaire reported as a proportion of responses by target species occurring in South Wales.

Table 17. Prioritisation matrix identifying conservation concern score for South Wales target species. IUCN Red List categories are taken from recent unpublished reassessment data (BGCI, 2025).

Species	IUCN Red List category	# organisations that reported ex *situ* collections (plants and/or seeds)	# of reported individual plants in ex reported *situ* living collections	# reported wild provenance seedlings in nurseries	# of reported seeds in ex *situ* reported collections	Concern Score
Sorbus cambrensis	EN	4	9	0	1189	13
Sorbus stenophylla	EN	3	7	0	1908	13
Sorbus leptophylla	EN	15	33	0	910	12
Sorbus leyana	CR	12	58	0	292	12
Sorbus porrigentiformis	VU	16	49	68	1401	10
Sorbus minima	VU	17	53	0	1184	9

5 points	4 points	3 points	2 points	1 point	0 points

Table 18. Conservation recommendations for South Wales target species, red is highest priority conservation actions and orange is recommended activities.

Species	Collect and distribute germplasm	Conservation horticulture	Cryopreservation and/or micropropagation	Habitat restoration	Implement protection policies or regulations	Occurrence surveys or population monitoring	Pollen and/or seed banking	Population reinforcement or introduction	Protect and/or manage habitat	Public awareness or education	Research: Climate Change, Genetics, Pests & Pathogens
Sorbus cambrensis											
Sorbus stenophylla											
Sorbus leptophylla											
Sorbus leyana											
Sorbus porrigentiformis											
Sorbus minima											

Highest priority conservation actions

Recommended activities

North Wales and Shropshire

There are 11 *Sorbus* taxa that occur in North Wales and Shropshire, including three species which occur here and nowhere else (Table 19). See Appendix 3 for protected areas in which *Sorbus* occur. In February 2024, *Sorbus anglica* was reassessed from Near Threatened to Vulnerable (Rich and Beech, 2024)) and is included here without *ex situ* data and Conservation Activity Questionnaire results.

Table 19. *Sorbus* taxa occurring in North Wales and Shropshire with target species shown in bold (IUCN Red List statuses of non-native species excluded and hybrids are not assessed).

Species	IUCN Red List category	Status
Sorbus anglica	**VU**	**Native**
Sorbus aria	LC	Native
Sorbus aucuparia	LC	Native
Sorbus arvonicola	**CR**	**Native (regional endemic)**
Sorbus croceocarpa	LC	Native
Sorbus cuneifolia	**EN**	**Native (regional endemic)**
Sorbus lancastriensis	LC	Native
Sorbus rupicola	LC	Native
Sorbus stirtoniana	**CR**	**Native (regional endemic)**
Sorbus × *decipiens*	-	Native
Sorbus torminalis	LC	Native

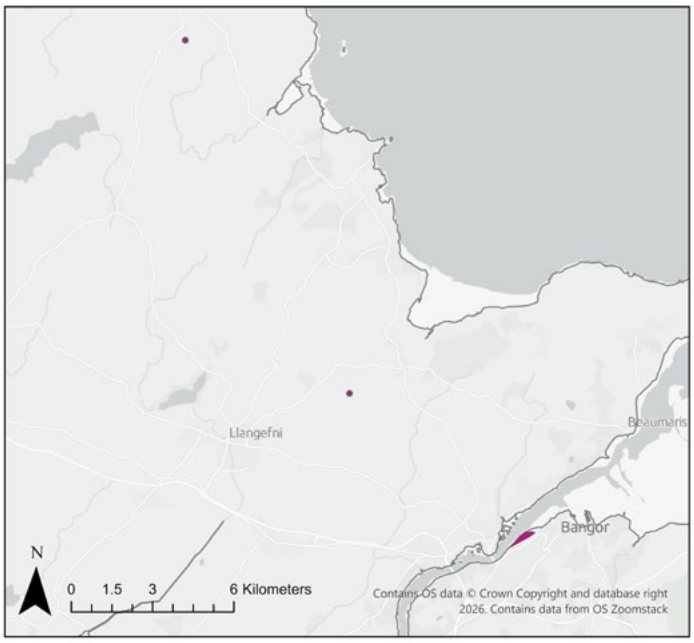


Figure 45. Regional map of the Menai Strait and Anglesey, showing the distribution of target species.

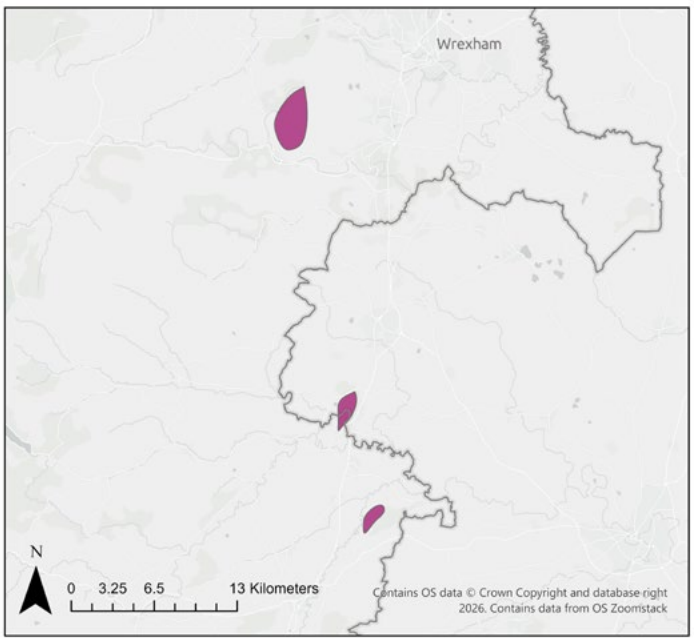


Figure 46. Regional map of North Wales and Shropshire, showing the distribution of target species.

Threats to wild populations

A total of 34 respondents from 31 organisations and two private individuals (see Appendix 1 for list of contributors) provided threat information for 36 target species via the Conservation Activity Questionnaire (Figure 47). Threat information was also gathered from IUCN Red List assessments, expert consultation and literature review.

Climate change and sea level rise: Based on responses, of the three target North Wales and Shropshire species in this study, the most selected answer to what the most significant threat to wild populations and was 'climate change', which was selected as a threat to all species. Due to location of the primary *S. arvonicola* population, scattered along the shore of the Menai Strait at Nantporth, sea level rises and subsequent erosion of the shoreline have been reported as a threat and there have been several instances of erosion have caused trees to uproot and fall onto the shore (Rivers and Rich, 2017a; Rich et al., 2026).

Disturbance regime modi ication; agriculture and/ or silviculture: At Nantporth, *S. arvonicola* is also found in strips of tall woodland, up to around 20m above sea level needs woodland management as becoming shaded (Rich et al., 2026). At Blodwel Rock succession to tall woodland and conifer plantation growth is shading out *S. cuneifolia* (Rich et al., 2026).

Sorbus arvonicola, Nantporth Gwynedd (Tim Rich)

Grazing: Overgrazing at Creigiau Eglwyseg is reported as a threat to *S. cuneifolia*, where the intensive sheep grazing is preventing colonisation on the screes and quarries (Rich et al., 2026).

Development, mining and/or roads: The main population of *S. stirtoniana* occurs on the southern end of Criggion Quarry at Craig Breidden, Montgomeryshire, where it is potentially threatened by quarrying though is somewhat protected within an SSSI (Rich et al., 2026).

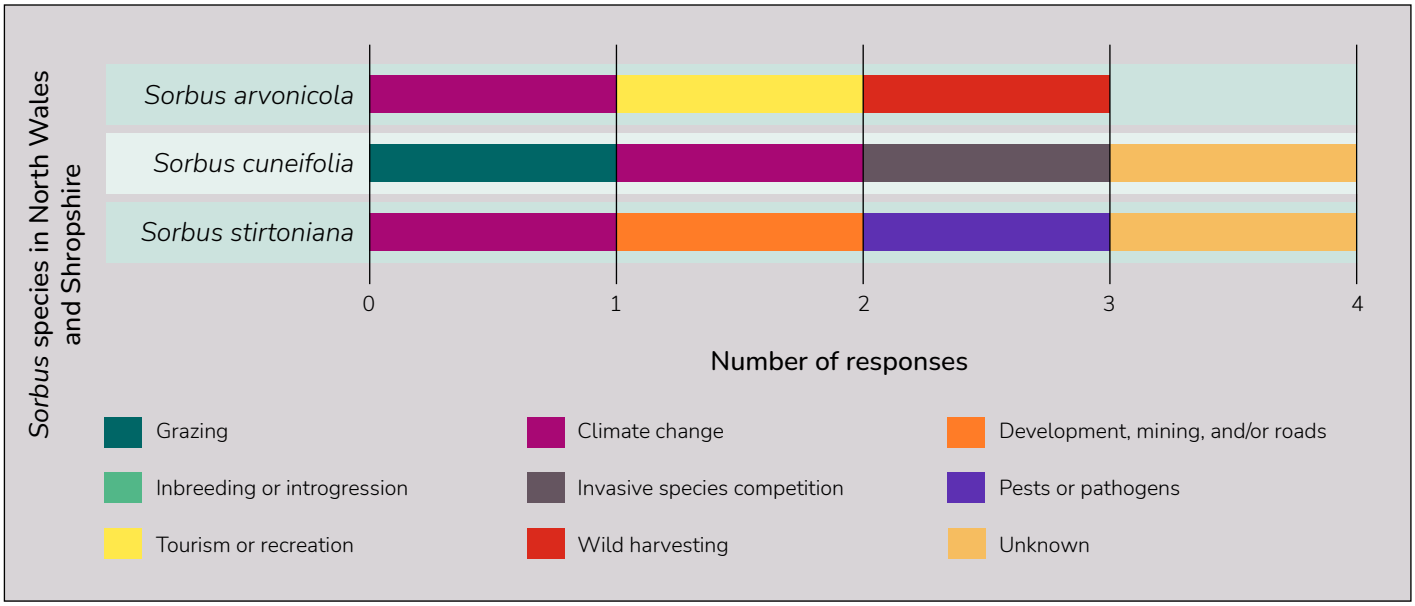


Figure 47. Threat categories reported by respondents to the Conservation Activity Questionnaire for target species occurring in North Wales and Shropshire.

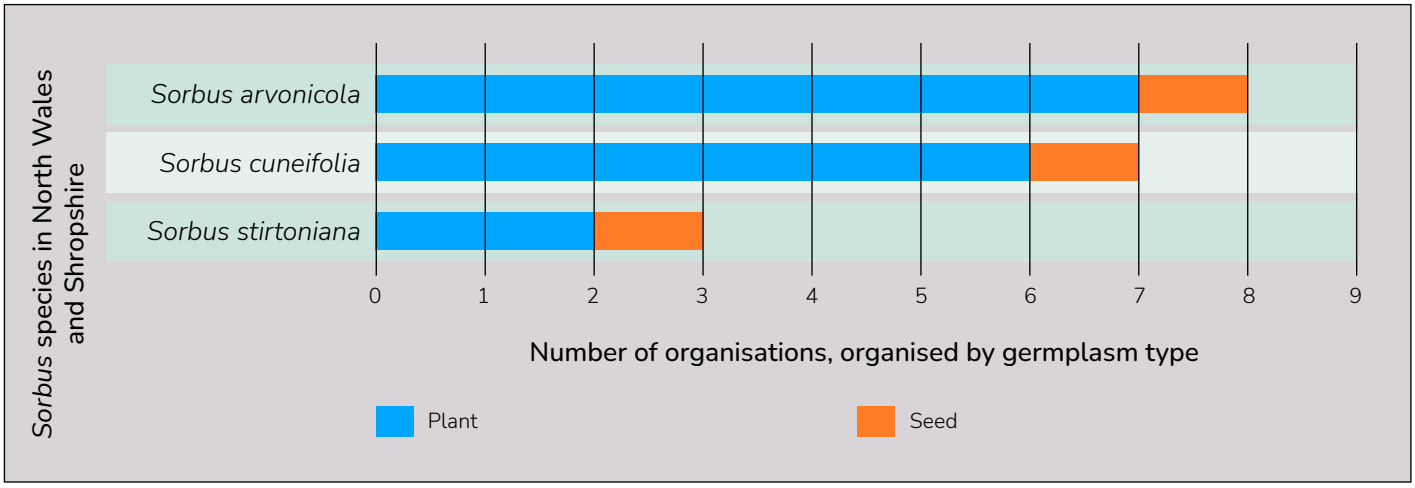


Figure 48. Number of organisations that reported *ex situ* collections of target species in North Wales and Shropshire, categorised by germplasm type.

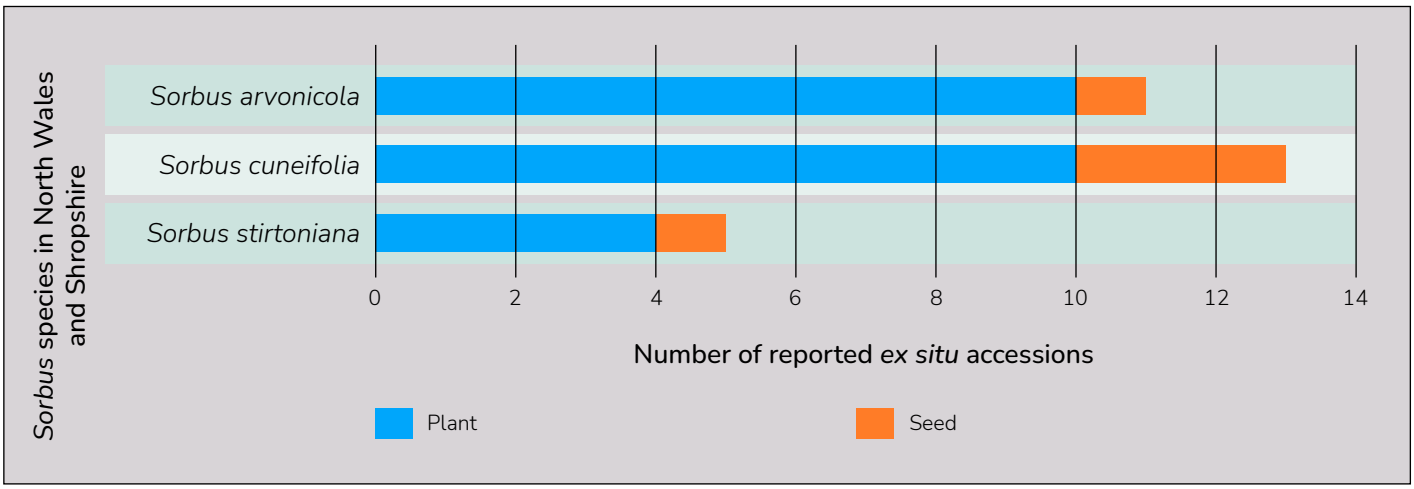


Figure 49. Number of reported *ex situ* accessions of target species in North Wales and Shropshire, categorised by germplasm type.

Creigiau Eglwyseg , Denbighshire (Rosie Anderson)

Conservation Activities

Ex situ collections reported

Based on data from 38 *ex situ* collections that submitted accessions data, *S. arvonicola* and *S. cuneifolia* have the highest number of organisations reporting *ex situ* collections including living plants and seeds (8 and 7 respectively). *S. stirtoniana* is reported by the lowest number of organisations (3) (Figure 48).

S. arvonicola and *S. cuneifolia* are represented by the highest numbers of *ex situ* living and seed banked accessions (13 and 11 respectively), while *S. stirtoniana* has the lowest number of accessions (3) (Figure 49).

Two accessions (totalling 5 plants) recorded under *S. leptophylla* from Craig Breiddan were treated as *S. stirtoniana* for this study (Rich and Proctor, 2009). Six accessions (totalling 19 plants) recorded under *S. porrigentiformis* from the Menai Strait have been treated as *S. arvonicola* for this study (Sell and Murrell, 2014).

a) Living collections: plants

S. arvonicola is the North Wales species represented by the most *ex situ* individuals (68) of which 81% are wild provenance individuals with the spatial data necessary for mapping wild *ex situ* source locality. *S. cuneifolia* has the second highest number of individuals (46), of which 100% are wild provenance individuals with the spatial data necessary for mapping wild *ex situ* source locality (Figure 50).

S. stirtoniana has the lowest number of reported individuals (9), of which 89% are wild provenance individuals with the spatial data necessary for mapping wild *ex situ* source locality.

b) Living collections: seedlings

No target species occurring in North Wales or Shropshire are currently represented by *ex situ* seedlings within nurseries.

c) Seed banks: seeds

All North Wales and Shropshire target species are represented by wild provenance seeds in seed banks (Figure 50).

Sorbus cuneifolia planted at Castell Dinas Brân, Denbighshire (Rosie Anderson)

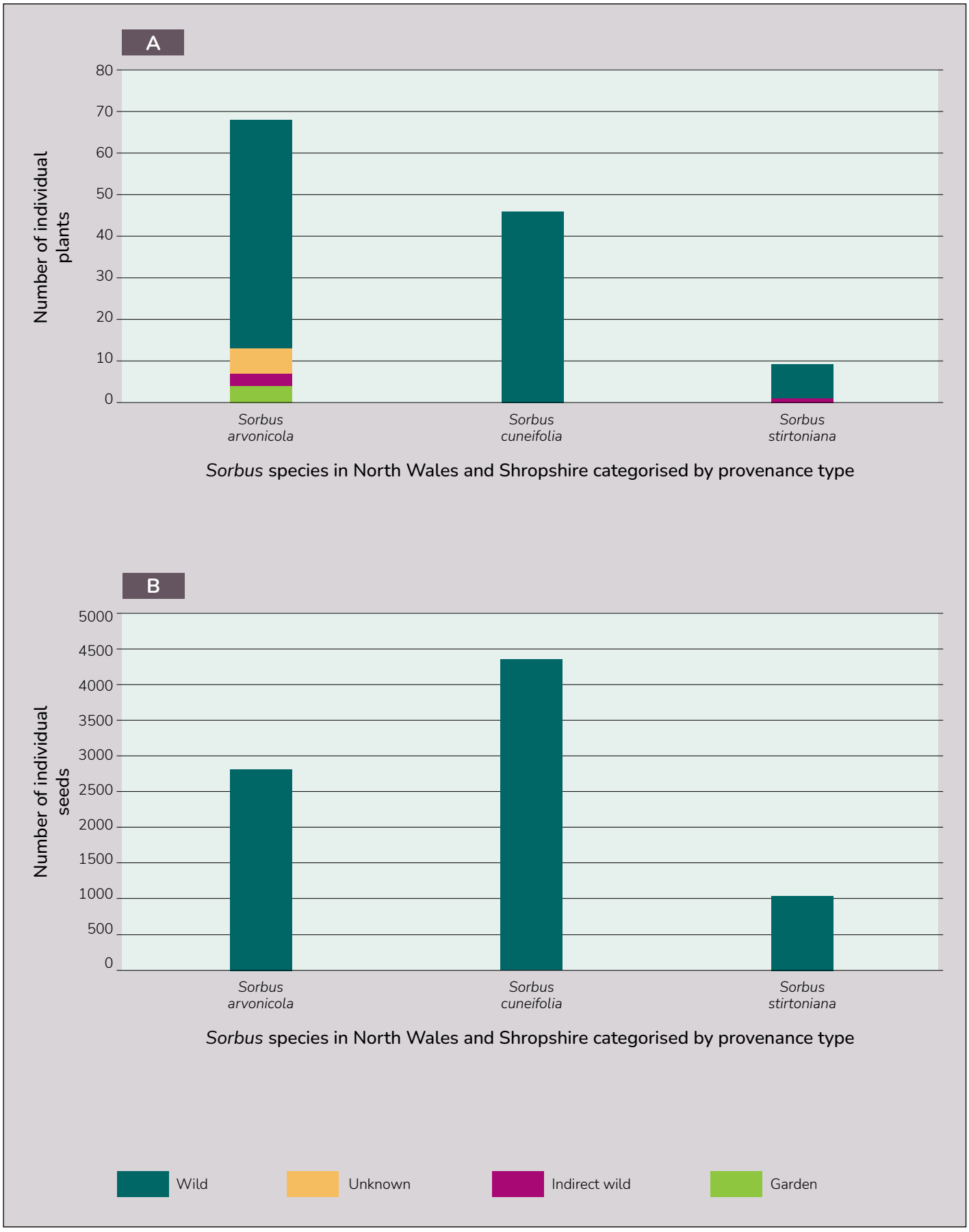


Figure 50. A: Number of individual plants reported in *ex situ* collections belonging to target species occurring in North Wales and Shropshire categorised by provenance type. **B:** Number of reported *ex situ* seeds banked of target species in North Wales categorised by provenance type.

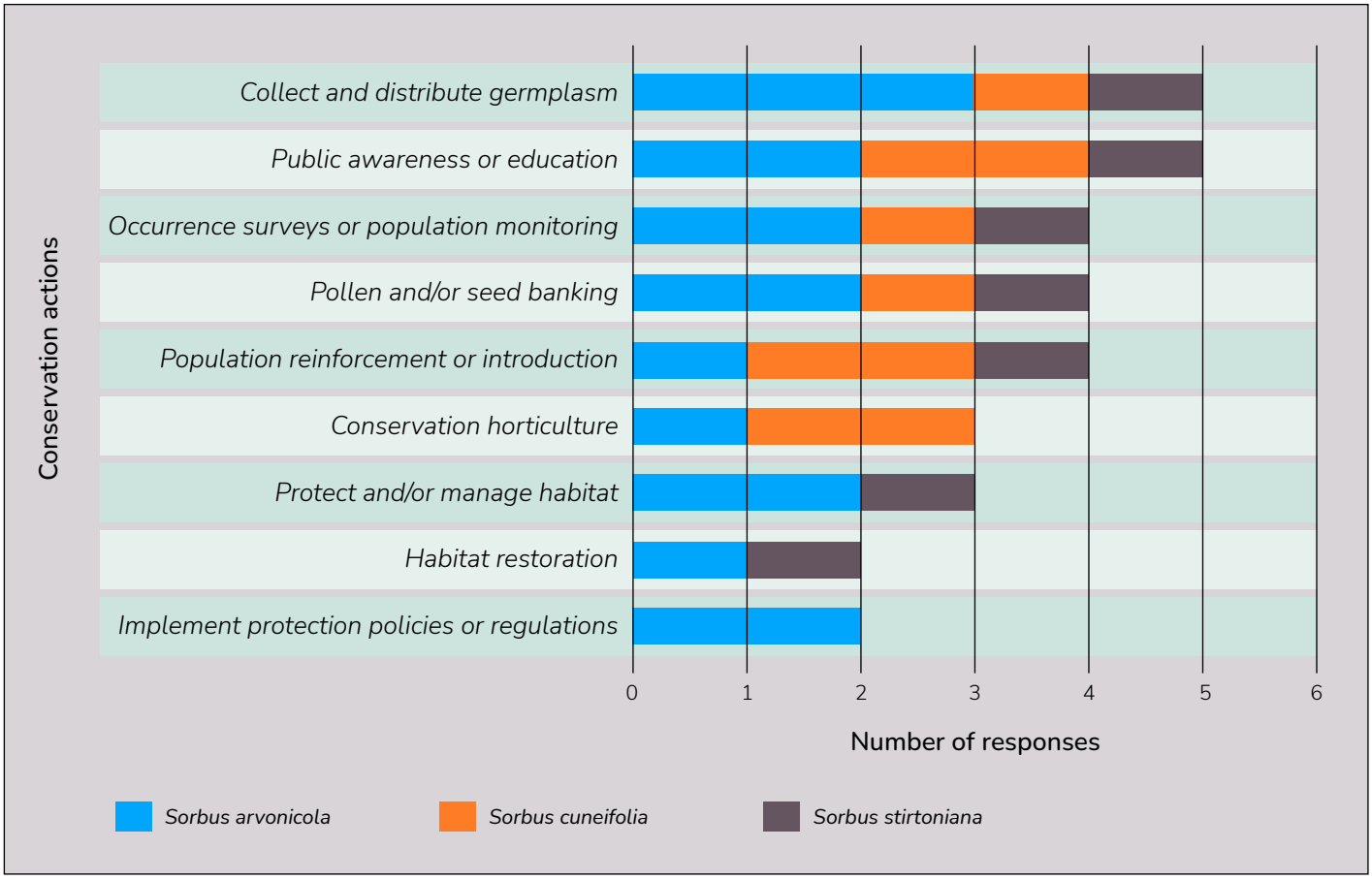


Figure 51. Number of responses for each conservation activity in the Conservation Activity Questionnaire by target species occurring in North Wales and Shropshire.

Current conservation activities

A total of 34 respondents from 31 organisations and two private individuals (see Appendix 1 for list of contributors) provided information on current conservation activities for 36 target species via the Conservation Activity Questionnaire (Figure 51). Additional information was also gathered through expert consultation and a review of the literature.

Public awareness or education: This was reported for all species.

Occurrence surveys or population monitoring: Occurrence surveys or population was reported for all species. The most recent survey of *S. cuneifolia* populations was carried out in September 2017 to inform collaborative conservation work between Chester Zoo, the Clwydian Range and Dee Valley Area of Outstanding Natural Beauty, Denbighshire County Council and Natural Resources Wales. The survey recorded 8 trees at Blodwel Rocks and 307 trees at Creigiau Eglwyseg, with a diverse age structure and a fruiting rate of 66% (Rich et al., 2019).

Conservation horticulture and pollen and/or seed banking: Of the three target species native to North Wales and Shropshire, collect and distributing germplasm and pollen and/or seed banking was reported for all species. *S. cuneifolia* has been the focus of collaborative conservation work between Chester Zoo, the Clwydian Range and Dee Valley Area of Outstanding Natural Beauty, Denbighshire County Council and Natural Resources Wales (Rich et al., 2022a).

Bangor University, the North Wales Wildlife Trust and FossilPlants have collaborated to propagate and share trees of *S. arvonicola* (Bangor University, 2021).

Population reinforcement or introduction: Trees of *S. cuneifolia* have been planted at six sites around Llangollen, including a planting at Castell Dinas Brân as part of the collaborative project mentioned in the previous paragraph (Rich et al., 2022a).

Land protection: The distribution of all target species occurring in North Wales and Shropshire lie predominantly within protected areas. See Appendix 3 for a list of protected areas in which target species occur.

Overall summary and recommendations

Priority conservation actions, identified through the Conservation Activity Questionnaire (Figure 52), together with findings from the *ex situ* collection survey and threats identified via the questionnaire, literature review, and expert consultation, were synthesised to develop recommendations for each of our target species.

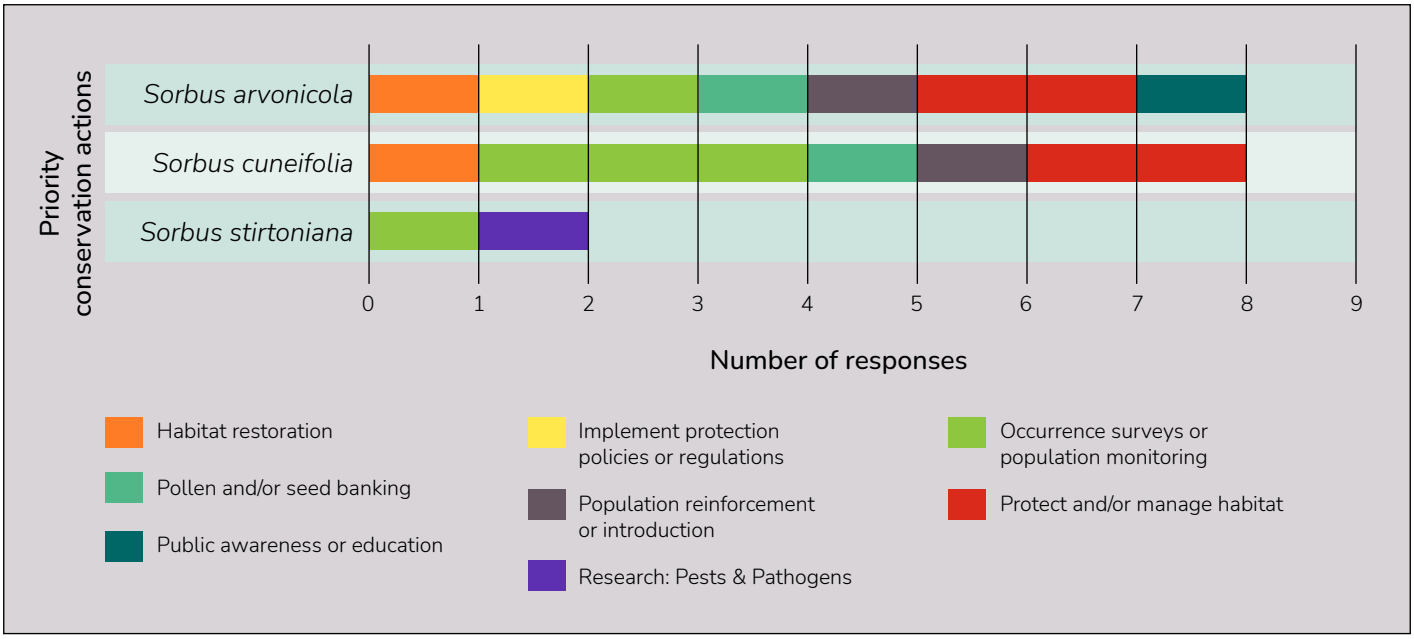


Figure 52. Priority conservation actions identified in the Conservation Activity Questionnaire reported as a proportion of responses by target species occurring in North Wales and Shropshire.

The highest priority and recommended conservation activities for each species can be found in Table 21.

Table 20. Prioritisation matrix identifying conservation concern score for North Wales and Shropshire target species. IUCN Red List categories are taken from recent unpublished reassessment data (BGCI, 2025).

Species	IUCN Red List category	# organisations with *ex situ* collections (plants and/or seeds)	# of individual plants in *ex situ* living collections	# wild provenance seedlings in nurseries	# of seeds in *ex situ* collections	Concern Score
Sorbus stirtoniana	CR	3	9	0	1045	14
Sorbus arvonicola	CR	8	68	0	2839	11
Sorbus cuneifolia	EN	7	46	0	4370	10

5 points	4 points	3 points	2 points	1 point	0 points

Expand and improve quality of *ex situ* collections: *S. stirtoniana* has the highest concern score out of target species native to the North Wales region (14). *S. arvonicola* and *S. cuneifolia* have benefited from targeted *ex situ* conservation, which has resulted in high quality *ex situ* collections of each species.

S. stirtoniana has the lowest number of reported individuals (9). As a result, further high-quality seed collections, with accurate provenance data, is recommended from *S. stirtoniana* on both the North Crags and West Crags of Craig Breidden, Wales.

Population reinforcement or introduction: The majority of wild *S. arvonicola* trees are threatened by climate change-led sea level rises. Therefore a managed programme of conservation translocation, to new sites along the Menai Strait and Anglesey is recommended.

Protect and manage habitat: For *S. cuneifolia*, targeted habitat management is required, including removal of *Cotoneaster* at Llangollen and invasive conifers at Blodwell Rocks adjacent to the plantation, together with selective canopy opening at Craig Breidden to reduce shading around the isolated northern population of two *S. stirtoniana* individuals.

Occurrence surveys or population monitoring: Occurrence surveys are recommended to assess the current and future impact of habitat management.

Sorbus cuneifolia planted at Castell Dinas Bran, Wales (Rosie Anderson)

Table 21. Conservation recommendations for North Wales and Shropshire target species, red is highest priority conservation actions and orange is recommended activities.

Species	Collect and distribute germplasm	Conservation horticulture	Cryopreservation and/or micropropagation	Habitat restoration	Implement protection policies or regulations	Occurrence surveys or population monitoring	Pollen and/or seed banking	Population reinforcement or introduction	Protect and/or manage habitat	Public awareness or education	Research: Climate Change, Genetics, Pests & Pathogens
Sorbus stirtoniana											
Sorbus arvonicola											
Sorbus cuneifolia											

Highest priority conservation actions

Recommended activities

Isle of Arran

The Isle of Arran is the most important site for *Sorbus* in Scotland (Robertson, 2004) and is the only part of the country in which threatened *Sorbus* occur (Table 22). Unlike all other British endemic *Sorbus* species, the Arran species occur on granite substrates, rather than base-rich or limestone soils (Bignal, 1980).

There are five *Sorbus* taxa that occur on the Isle of Arran including three species which occur here and nowhere else (Table 22). See Appendix 3 for protected areas in which *Sorbus* occur.

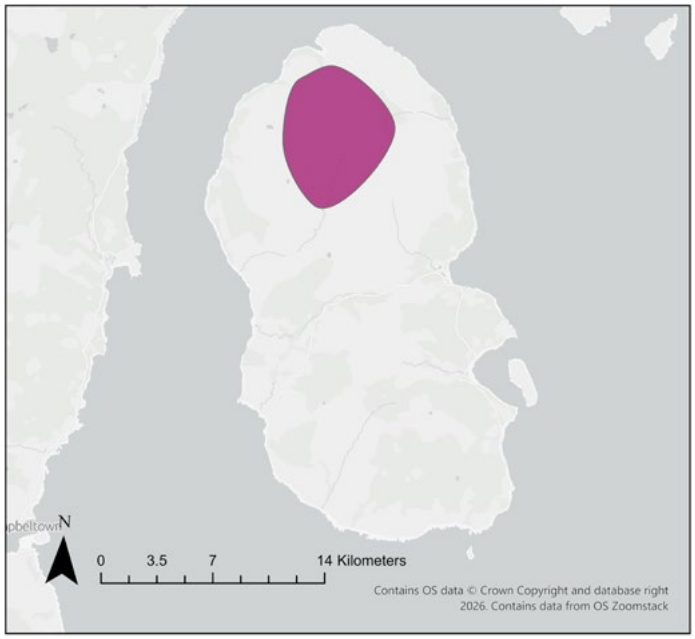


Figure 53. Regional map of the Isle of Arran, showing the distribution of target species.

Table 22. *Sorbus* taxa occurring on the Isle of Arran with target species shown in bold (IUCN Red List categories of non-native species excluded. Hybrids are not assessed).

Species	IUCN Red List status	Status
Sorbus arranensis	EN	Native (regional endemic)
Sorbus aucuparia	LC	Native
Sorbus pseudofennica	CR	Native (regional endemic)
Sorbus pseudomeinichii	CR	Native (regional endemic)
Sorbus rupicola	LC	Native

Glen Catacol, Arran (Rosie Anderson)

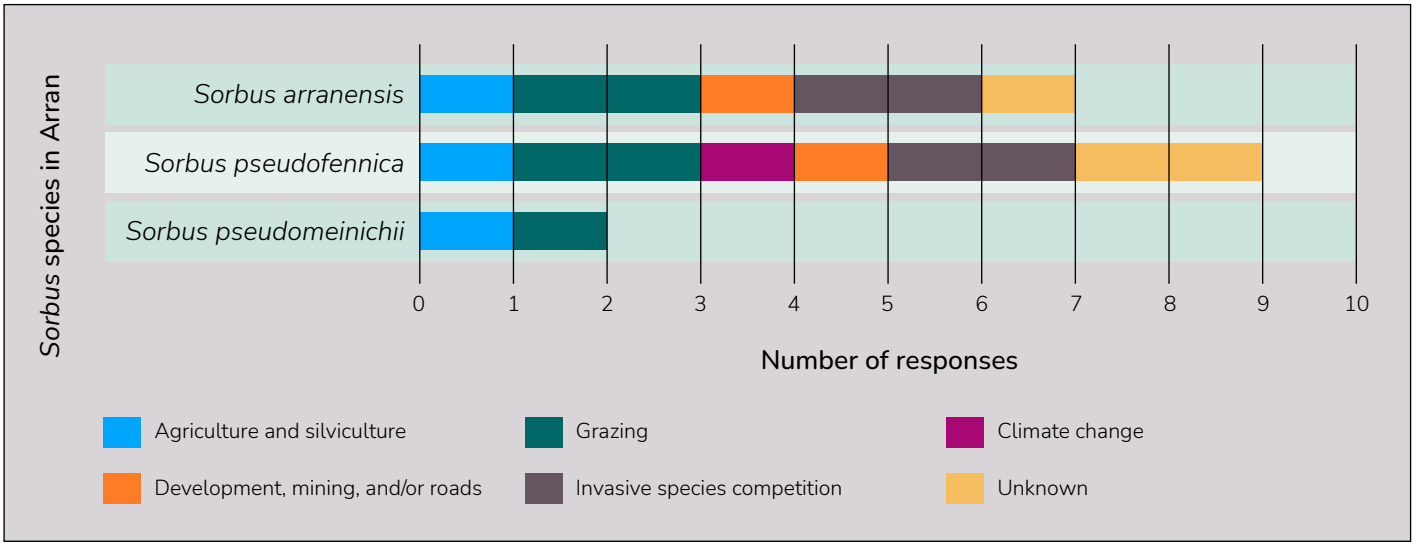


Figure 54. Threat categories reported by respondents to the Conservation Activity Questionnaire for target species occurring on Arran.

Threats to wild populations

A total of 34 respondents from 31 organisations and two private individuals (see Appendix 1 for list of contributors) provided threat information for 36 target species via the Conservation Activity Questionnaire (Figure 54). Threat information was also gathered from IUCN Red List assessments, expert consultation and literature review.

Grazing and, agriculture and silviculture: Grazing was identified as the most significant threat to wild populations and was stated as a threat to all species. Glen Catacol and Gleann Diomhan are currently managed for red deer shooting, causing an unnaturally high deer level of grazing pressure which limits flowering and fruiting and seedling recruitment. The fenced enclosure, erected in Glen Catacol and Glen Diomhan in the 1990s to protect the trees, has fallen in places rendering it ineffective against deer, which has led to a 27% loss of *S. pseudofennica* trees.

Heavy gazing has also led to a decline in the quality of the surrounding woodland and subsequently of shelter, which is increasing the threat from extreme weather events and makes the trees increasingly vulnerable to further grazing.

Pest and Disease: Apple moth larvae have been found to considerably reduce seed set due to the predation of seeds (Rich et al., 2026).

Invasive species competition: This was identified by respondents as a threat to *S. arranensis* and *S. pseudofennica*. *Rhododendron ponticum* is a common invasive found along the east coast of Arran (T. Rich pers. comm., 2026).

Climate change: *S. pseudomeinichii* is vulnerable to flooding and rockfall events, risks that are likely to increase in frequency and severity as a result of more intense storm activity associated with climate change (Rich et al., 2026). A wildfire that occurred in Glen Rosa, near Brodick in April 2025 highlights the potential risk that wildfires pose to *Sorbus* habitat on Arran (National Trust for Scotland, n.d.).

Sorbus pseudomeinichii leaves (Dan Crowley)

Ex situ collections reported

Based on data from 38 *ex situ* collections that submitted accessions data, *S. arranensis has* the highest number of organisations reporting *ex situ* collections including living plants and seeds, of all target species occuring on Arran (20) (Figure 55). *S. pseudomeinichii* has the lowest number of *ex situ* collections of reported organisations (6).

S. arranensis and *S. pseudofennica* are represented by the highest numbers of accessions (20 and 18) respectively), whereas *S. pseudomeinichii*, is represented by the lowest number (6)(Figure 56).

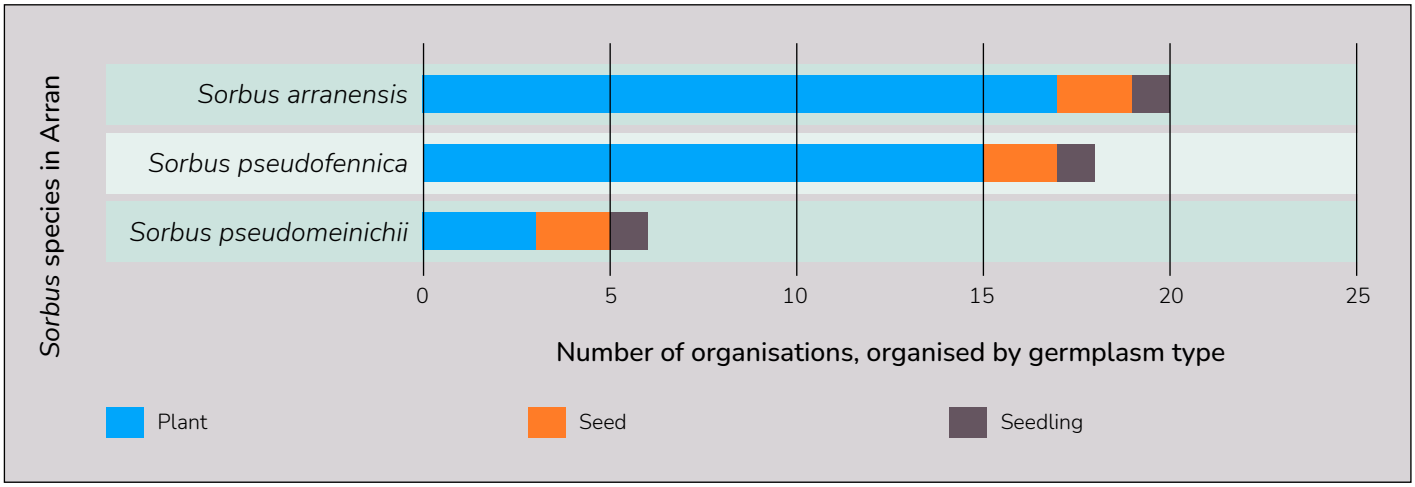


Figure 55. Number of organisations that reported *ex situ* collections of target species in Arran, categorised by germplasm type.

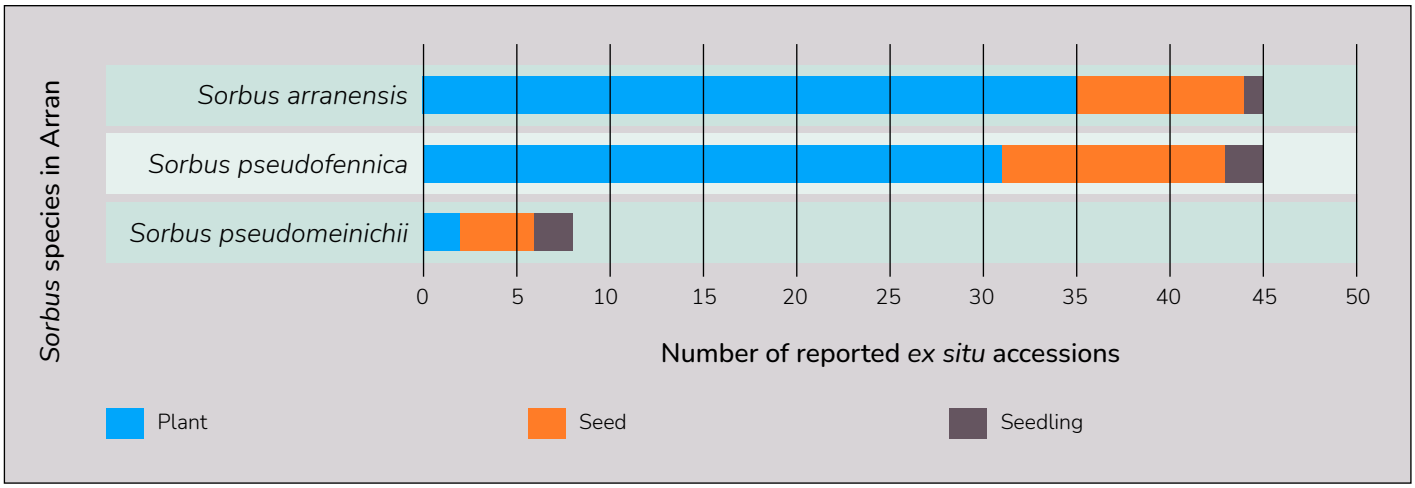


Figure 56. Number of reported *ex situ* accessions of target species on Arran, categorised by germplasm type.

a) Living collections: plants

S. pseudofennica is represented by the most *ex situ* individuals (102) of which 79% of individual specimens have the spatial data necessary for mapping wild *ex situ* source locality (wild provenance). *S. arranensis* has the second highest number of individuals (92) of which 54% are of wild provenance. *S. pseudomeinichii* has the lowest number of reported individual specimens (21) of which 95% are of wild provenance. For the purpose of this study we have treated RBGE's four regional specialist gardens as separate institutions, while treating their 'safe site' plantings under the RBGE umbrella. See Appendix 1 for list of RBGE safe sites reporting target species.

b) Living collections: seedlings

All Arran target species are represented by *ex situ* seedlings in nurseries. All seedlings of *S. pseudofennica* and *S. pseudomeinichii* are of indirect wild provenance, whereas all seedlings of *S. arranensis* are of wild origin. Although seedling data should be interpreted with caution, as not all individuals will survive to be established in *ex situ* collections, these records nonetheless provide a useful indication of the species currently subject to active propagation and conservation effort.

c) Seed banks: seeds

All Arran target species have wild provenance seed banked in *ex situ* collections. *S. pseudomeinichii* has the lowest representation in seed banks (196) of which 50% are of wild provenance.

The fenced planting of Arran *Sorbus* species at the entrance to Glen Catacol, Arran (Rosie Anderson)

Current conservation activities

A total of 34 respondents from 31 organisations and two private individuals (see Appendix 1 for list of contributors) provided information on current conservation activities for 36 target species via the Conservation Activity Questionnaire (Figure 58). Additional information was also gathered through expert consultation and a review of the literature.

Public awareness or education: Public awareness or education were reported for all three species.

Occurrence surveys or population monitoring: Occurrence surveys or population monitoring were reported for all three species. All three species have been the focus of the Scottish Plant Recovery project, a collaboration between Scottish National Heritage and Royal Botanic Garden Edinburgh (RBGE), for which population surveys have been undertaken in recent years.

Conservation horticulture: Of the three target species native to Arran, conservation horticulture was the most common activity reported. As part of the Scottish Plant Recovery project, RBGE have been carrying out experimentation with propagation techniques for all Arran endemics (W. Hinchliffe pers. comm., 2025). Trees of all Arran endemics have also been planted by RBGE within a fenced area near the entrance to Glen Catacol (included within this study as *ex situ* plants).

Habitat restoration: Habitat restoration was reported for all three species. Trees of *S. arranensis* were planted unsuccessfully in the 1960s and 1978 (Rich et al., 2026). All three endemics have been planted by The National Trust for Scotland as part of a woodland creation project within Glen Rosa, but a fire in April 2025 has caused considerable losses (National Trust for Scotland, n.d.).

Land protection: The distribution of all target species occurring on Arran lie predominantly within the Arran Northern Mountains SSSI protected area. See Appendix 3 for a list of protected areas in which target species occur.

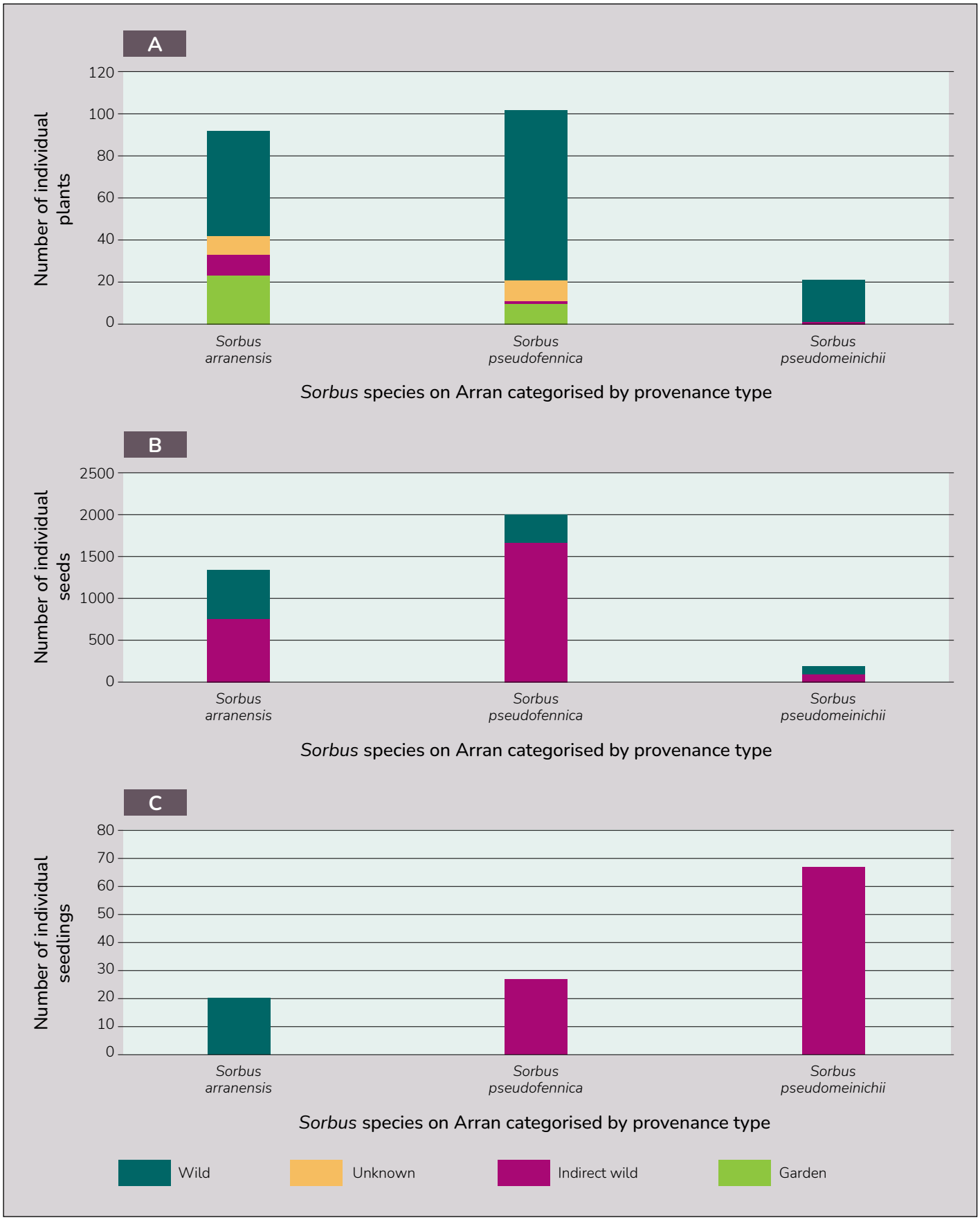


Figure 57. A: Number of individual plants reported in *ex situ* collections belonging to target species occurring in Arran, categorised by provenance type. **B:** Number of reported *ex situ* seeds banked of target species in Arran, categorised by provenance type. **C:** Number of reported *ex situ* seedlings of target species on Arran, categorised by provenance type.

Overall summary and recommendations

Priority conservation actions, identified through the Conservation Activity Questionnaire (Figure 59), together with findings from the *ex situ* collection survey and threats identified via the questionnaire, literature review, and expert consultation, were synthesised to develop recommendations for each of our target species.

Expand *ex situ* collections: Royal Botanic Garden Edinburgh have made considerable progress in increasing *ex situ* collections of all endemic Arran *Sorbus* and in developing propagation protocols and it is recommended that this work is continued. *S. pseudomeinichii* has the highest concern score out of target species native to the Arran (15). As there are only two known mature individuals of *S. pseudomeinichii*, wild provenance seed is limited, therefore it is recommended that vegetative propagation work is continued.

A sustained decline in habitat quality and extent, alongside a reduction in the number of mature individuals is currently documented across all endemic Arran *Sorbus* (Rich et al., 2026).

Protect and/or manage habitat, and habitat restoration: This was the most identified urgent conservation action for all Arran species. Reducing grazing pressure across Glen Catacol and Gleann Diomhan, through deer management and the restoration of the existing enclosure are vital to stop the continued loss of individual trees and lack of seedling recruitment.

As with all regions of *Sorbus* diversity, it is important that the management of target species are not considered in isolation. Robertson (2004), recommends that conservation management of the *Sorbus* taxa on Arran should prioritise the maintenance of the evolutionary processes that generate and sustain endemic diversity. Therefore, management should ensure the continued coexistence of *S. arranensis*, *S. pseudofennica*, *S. rupicola* and *S. aucuparia* within the northern glens of Arran.

Increasing woodland cover in Glen Catacol and Gleann Diomhan would have several benefits, including through a reduction in erosion damage to the rocky riverbanks, habitat in which all Arran endemics can be found. Additionally it is thought that this may reduce herbivory, by increasing alternative food sources for deer (Robertson, 2004).

Sorbus pseudomeinichii, Glen Catacol, Arran (Rosie Anderson)

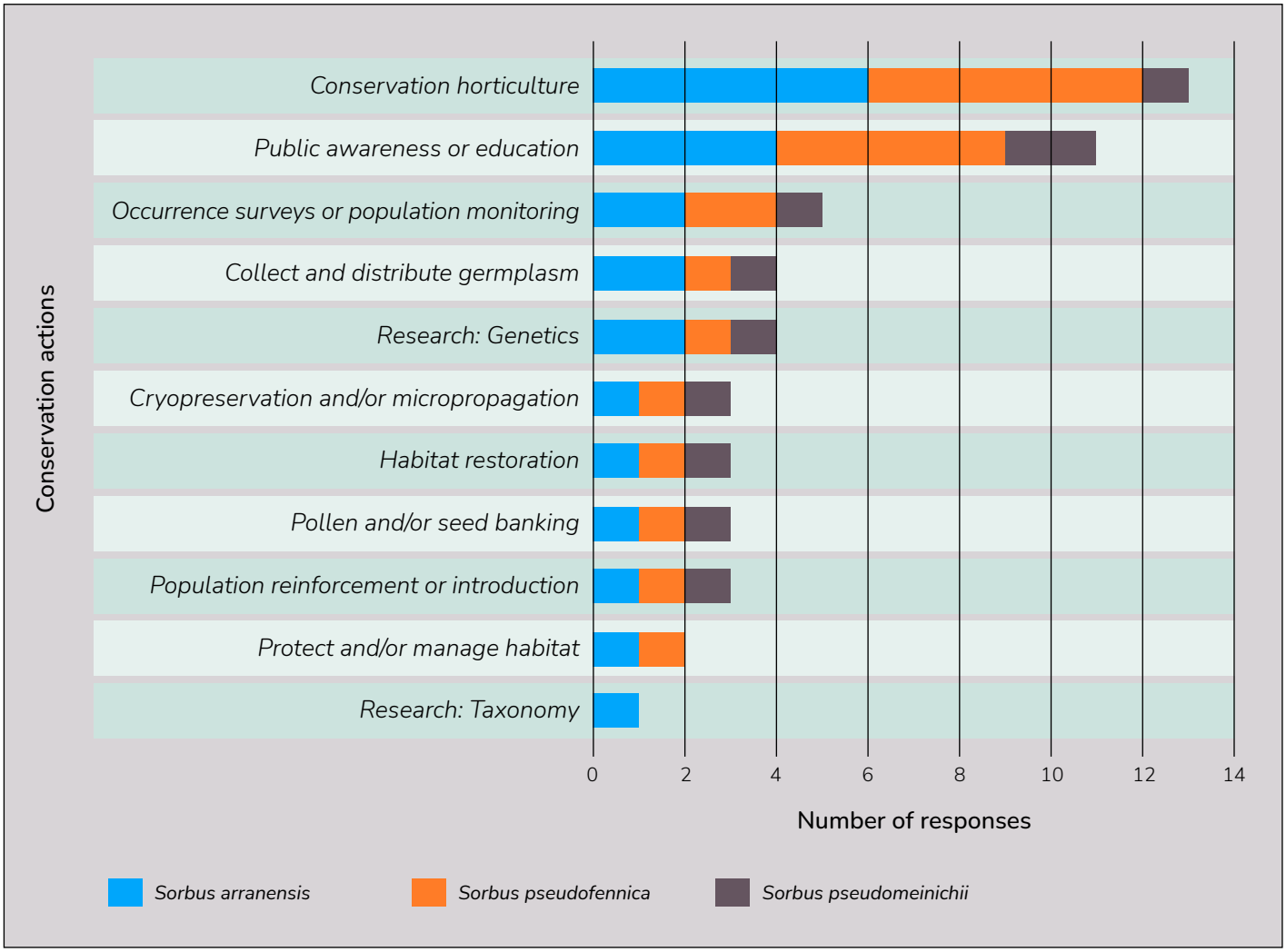


Figure 58. Number of responses for each conservation activity in the Conservation Activity Questionnaire by target species occurring on Arran.

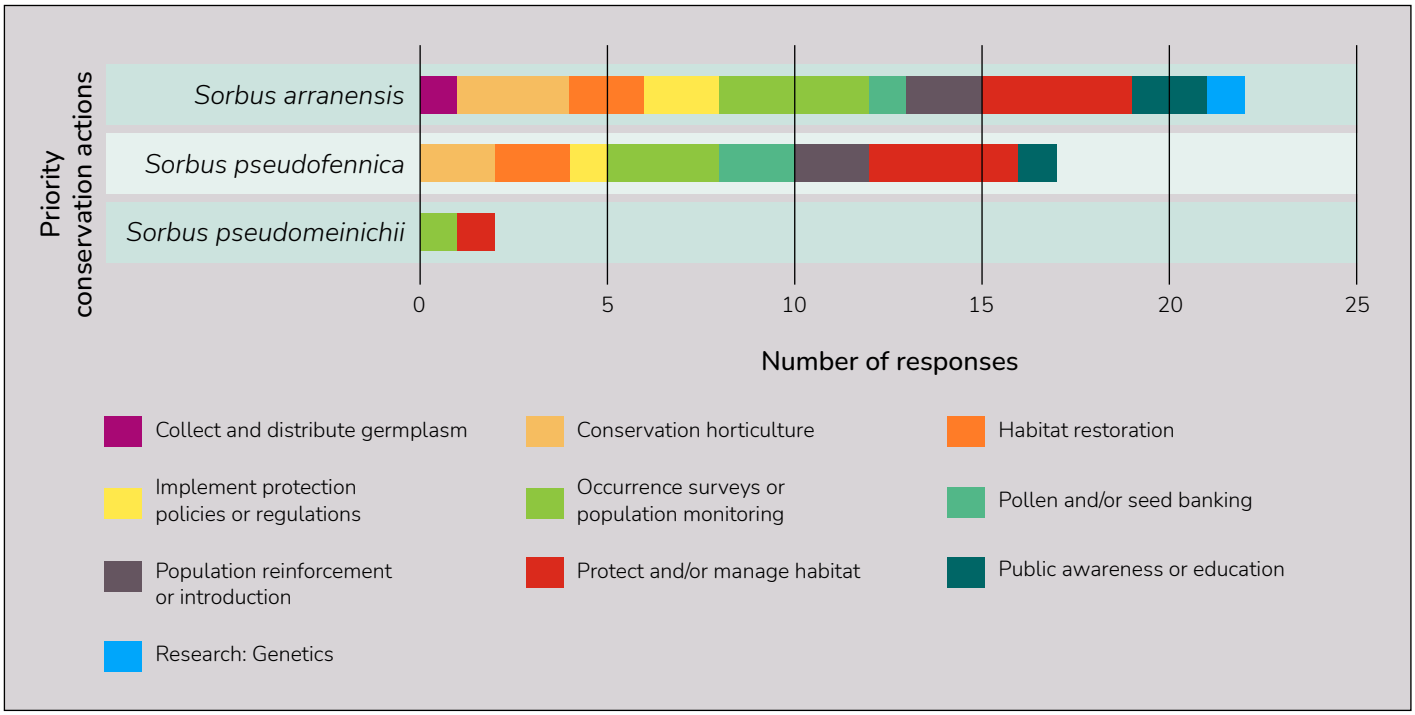


Figure 59. Priority conservation actions identified in the Conservation Activity Questionnaire reported as a proportion of responses by target species occurring on Arran.

Table 23. Prioritisation matrix identifying conservation concern score for Arran target species. IUCN Red List categories are taken from recent unpublished reassessment data (BGCI, 2025).

Species	IUCN Red List category	# organisations with ex *situ* collections (plants and/or seeds)	# of individual plants in ex *situ* living collections	# wild or indirect wild provenance seedling in nurseries	# of seeds in ex *situ* collections	Concern Score
Sorbus pseudomeinichii	CR	4	21	67	196	15
Sorbus arranensis	EN	18	88	20	1350	10
Sorbus pseudofennica	CR	16	102	27	1997	10

5 points	4 points	3 points	2 points	1 point	0 points

Table 24. Conservation recommendations for Arran target species, red is highest priority conservation actions and orange is recommended activities.

Species		Collect and distribute germplasm	Conservation horticulture	Cryopreservation and/or micropropagation	Habitat restoration	Implement protection policies or regulations	Occurrence surveys or population monitoring	Pollen and/or seed banking	Population reinforcement or introduction	Protect and/or manage habitat	Public awareness or education	Research: Climate Change, Genetics, Pests & Pathogens
Sorbus pseudomeinichii	15											
Sorbus arranensis	10											
Sorbus pseudofennica	10											

Highest priority conservation actions

Recommended activities

Republic of Ireland and Northern Ireland

There are 11 *Sorbus* taxa that occur in the Republic of Ireland and Northern Ireland, including 2 species which occur here and nowhere else (Table 25). See Appendix 3 for protected areas in which *Sorbus* occur. In February 2024, *S. anglica* was reassessed from Near Threatened to Vulnerable (Rich and Beech, 2024) and is included here without *ex situ* data and Conservation Activity Questionnaire results.

Sorbus scannelliana on Ross Island, Killarney National Park, County Kerry (Dan Crowley)

Table 25. *Sorbus* taxa occurring in the Republic of Ireland and Northern Ireland (IUCN Red List categories of non-native species excluded and hybrids are not assessed).

Species	IUCN Red List category	Status
Sorbus anglica	VU	**Native**
Sorbus aria	LC	Native
Sorbus aucuparia	LC	Native
Sorbus croceocarpa	-	Naturalized
Sorbus devoniensis	NT	**Native**
Sorbus hibernica	VU	**Native (regional endemic)**
Sorbus intermedia	-	Naturalized
Sorbus latifolia	-	Naturalized
Sorbus × *liljeforsii*	-	Naturalized
Sorbus rupicola	LC	Native
Sorbus scannelliana	CR	**Native (regional endemic)**

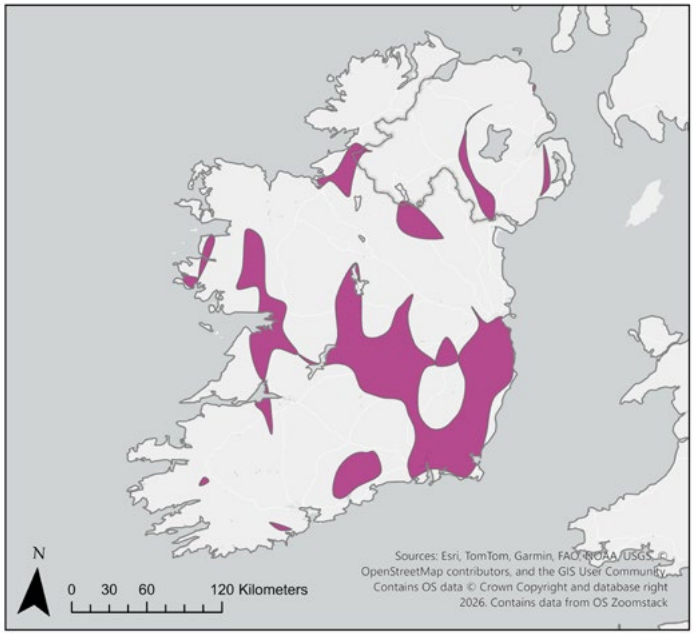


Figure 60. Regional map of Ireland and Northern Ireland, showing the distribution of target species.

Threats to wild populations

A total of 34 respondents from 31 organisations and two private individuals (see Appendix 1 for list of contributors) provided threat information for 36 target species via the Conservation Activity Questionnaire (Figure 61). Threat information was also gathered from IUCN Red List assessments, expert consultation and literature review.

Responses to the Conservation Activity Questionnaire, regarding the three target species native to the Northern Ireland and The Republic of Ireland were limited. Of the responses, unknown was selected as the most significant threat to wild populations and was stated as a threat to all species.

Grazing: There were no responses reporting grazing as a threat to target species occurring in the Republic of Ireland and Northern Ireland but grazing is a potential threat to *S. scannelliana* should the fence around the wild population fail (Beech et al.,2017g).

Agriculture and silviculture: This was reported as a threat to *S. hibernica* and *S. devoniensis*. Shading out by woodland trees is a potential threat to *S. scannelliana* (Beech et al.,2017g).

Development, mining, and/or roads: This was reported as a threat to *S. hibernica* and *S. devoniensis*.

Invasive species competition: This was reported as a threat to *S. hibernica* and *S. devoniensis*.

Climate change: This was reported as a threat to *S. devoniensis*.

Trunk and bark of *Sorbus scannelliana* on Ross Island, Killarney National Park, County Kerry (Dan Crowley)

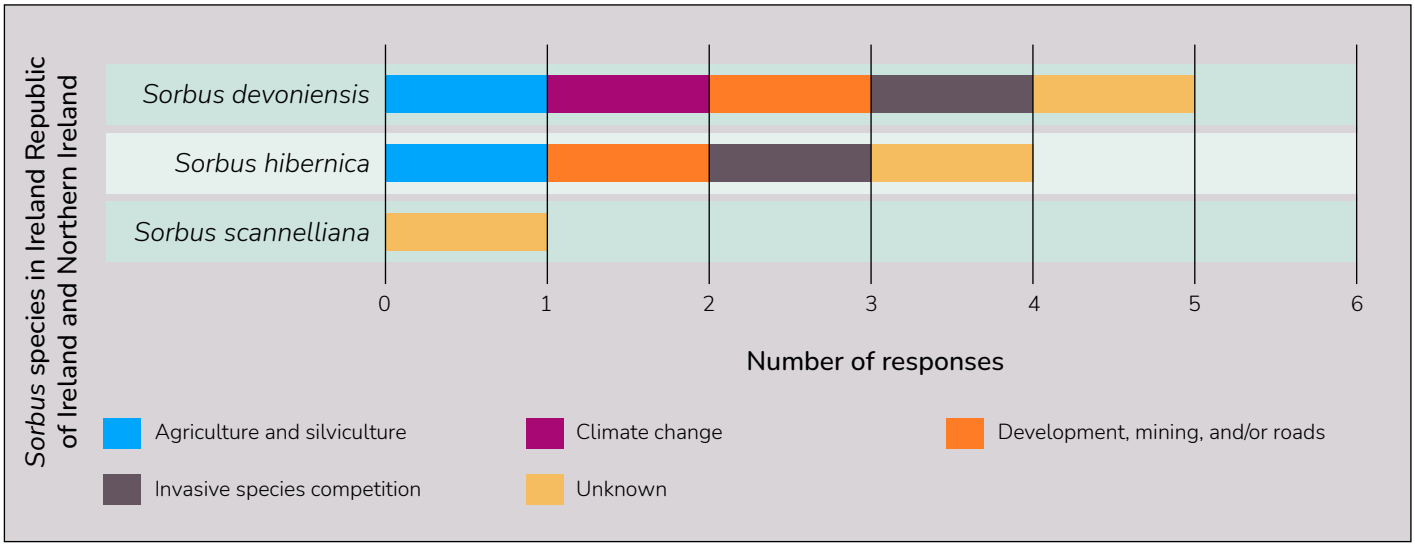


Figure 61. Threat categories reported by respondents to the Conservation Activity Questionnaire for target species occurring in the Republic of Ireland and Northern Ireland.

Conservation Activities

Ex situ collections reported

Based on data from 38 institutions that submitted accessions data, *S. devoniensis* and *S. hibernica* have the highest number of organisations reporting *ex situ* collections (including living plants and seeds) of target species occurring in the Republic of Ireland and Northern Ireland (18 and 11 organisations respectively). *S. scannelliana* is reported by the lowest number of organisations (1) (Figure 62).

S. devoniensis and *S. hibernica* are represented by the highest numbers of accessions (46 and 16 respectively), whereas *S. scannelliana* is represented by the lowest (2) (Figure 63).

Seedling of *Sorbus scannelliana* on Ross Island (Dan Crowley)

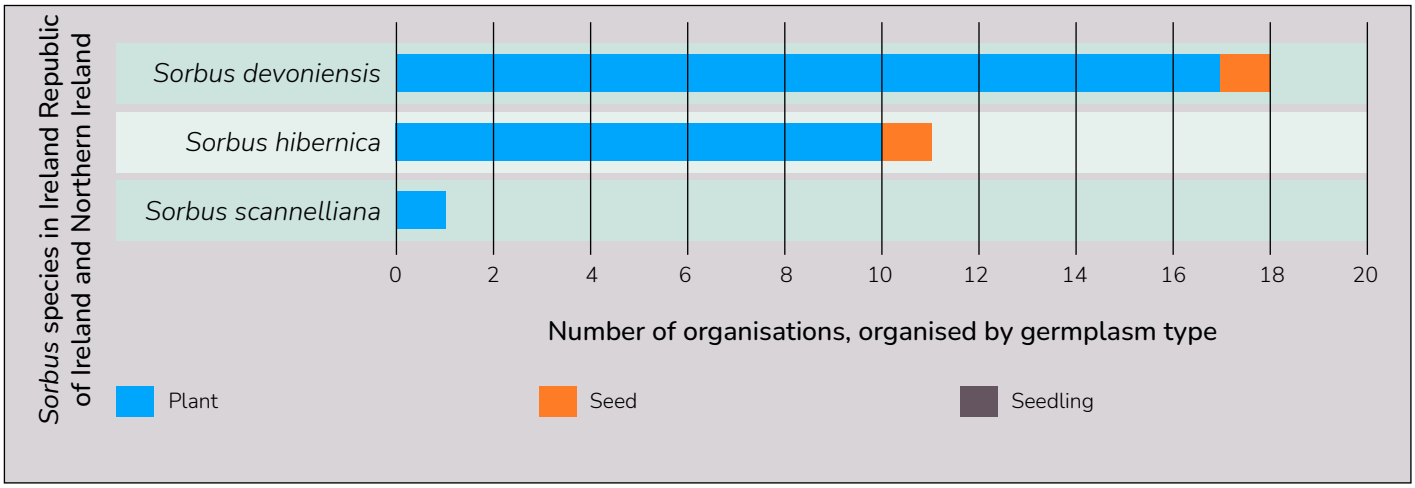


Figure 62. Number of organisations that reported *ex situ* collections of target species in the Republic of Ireland and Northern Ireland, categorised by germplasm type.

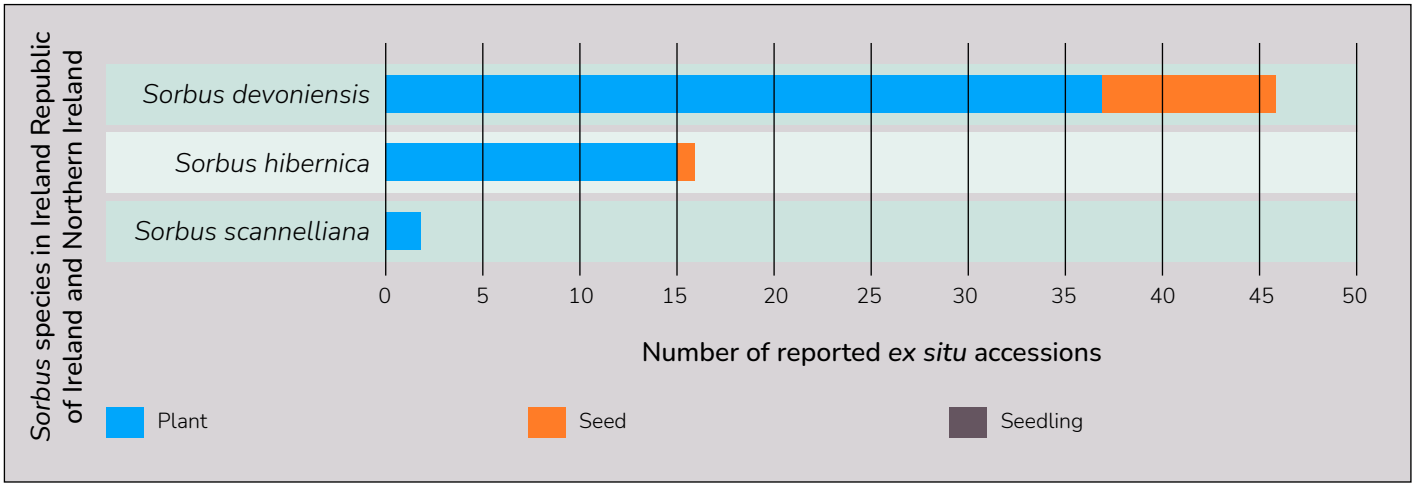


Figure 63. Number of reported *ex situ* accessions of target species occurring in the Republic of Ireland and Northern Ireland, categorised by germplasm type.

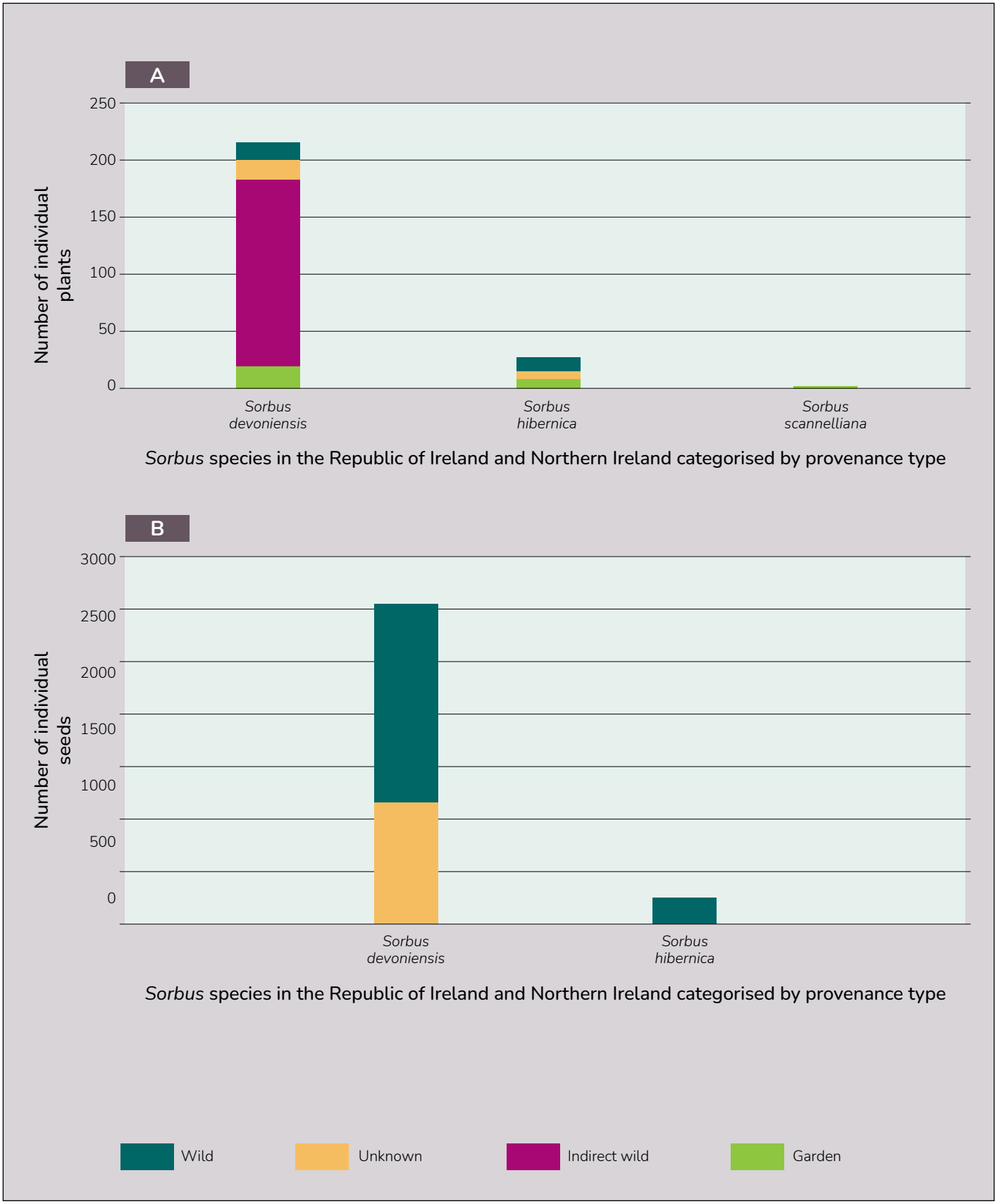


Figure 64. A: Number of individual plants reported in *ex situ* collections belonging to target species occurring in the Republic of Ireland and Northern Ireland, categorised by provenance type. **B:** Number of reported *ex situ* seeds banked of target species in the Republic of Ireland and Northern Ireland, categorised by provenance type.

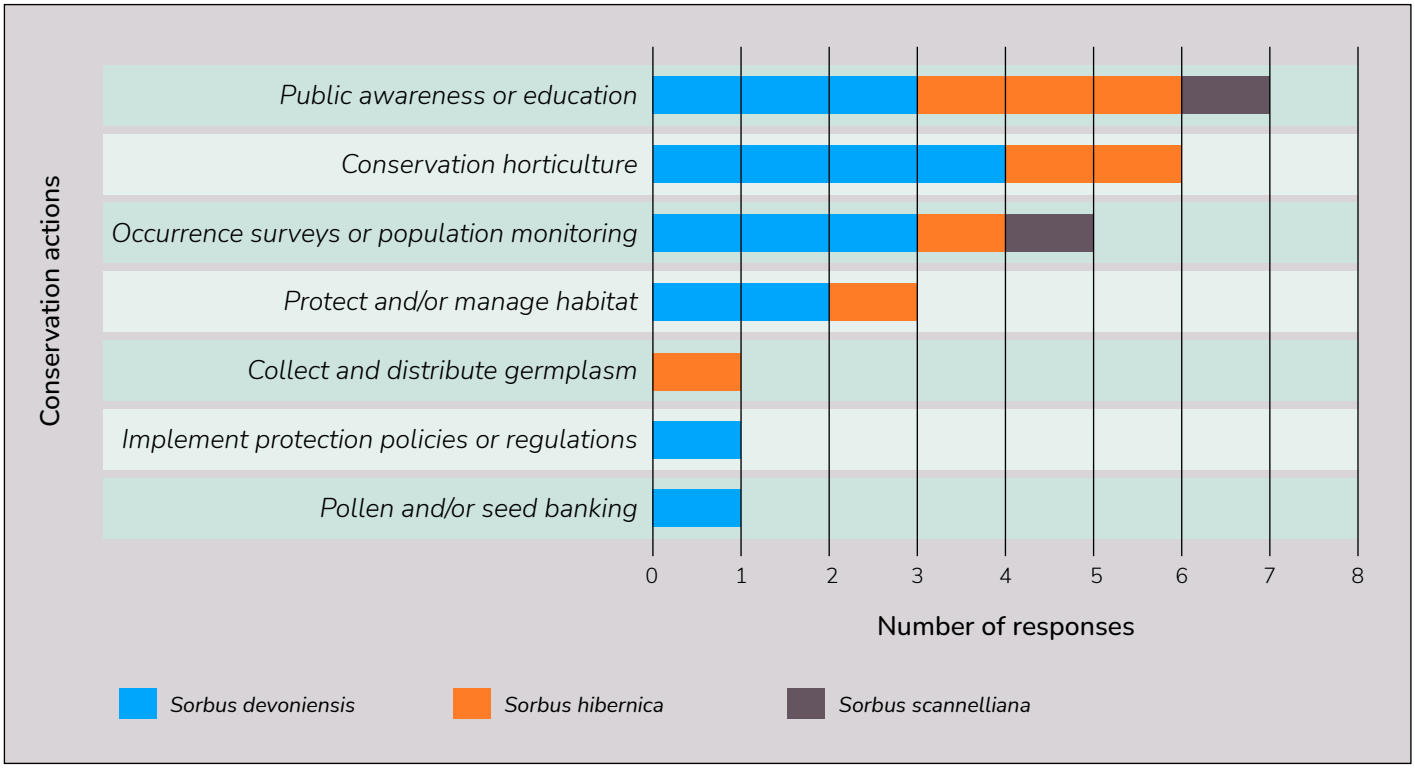


Figure 67. Number of responses for each conservation activity in the Conservation Activity Questionnaire by target species occurring in the Republic of Ireland and Northern Ireland.

a) Living collections: plants

S. devoniensis is represented by the most *ex situ* individuals (215). However, only 7% of these specimens are accompanied by the spatial data required to map their wild source localities (wild provenance). Neither of the two Irish accessions of *S. devoniensis* have geolocatable locality data accompanying their records. *S. hibernica* has the second highest number of individuals (27) of which 44% are of wild provenance. *S. scannelliana* has the lowest number of reported individual specimens (2) of which 100% are of garden origin (Figure 64).

b) Living collections: seedlings

No target species occurring in the Republic of Ireland and Northern Ireland are currently represented by *ex situ* seedlings within nurseries (Figure 64).

c) Seed banks: seeds

S. scannelliana has no banked seed accessions, while *S. hibernica* only has 202 seeds currently in a seed bank (Figure 64). There are three accessions of *S. devoniensis* seed, collected in the Republic of Ireland, all of which have associated locality data.

Sorbus anglica on Ross Island, Killarney National Park, County Kerry (Rosie Anderson)

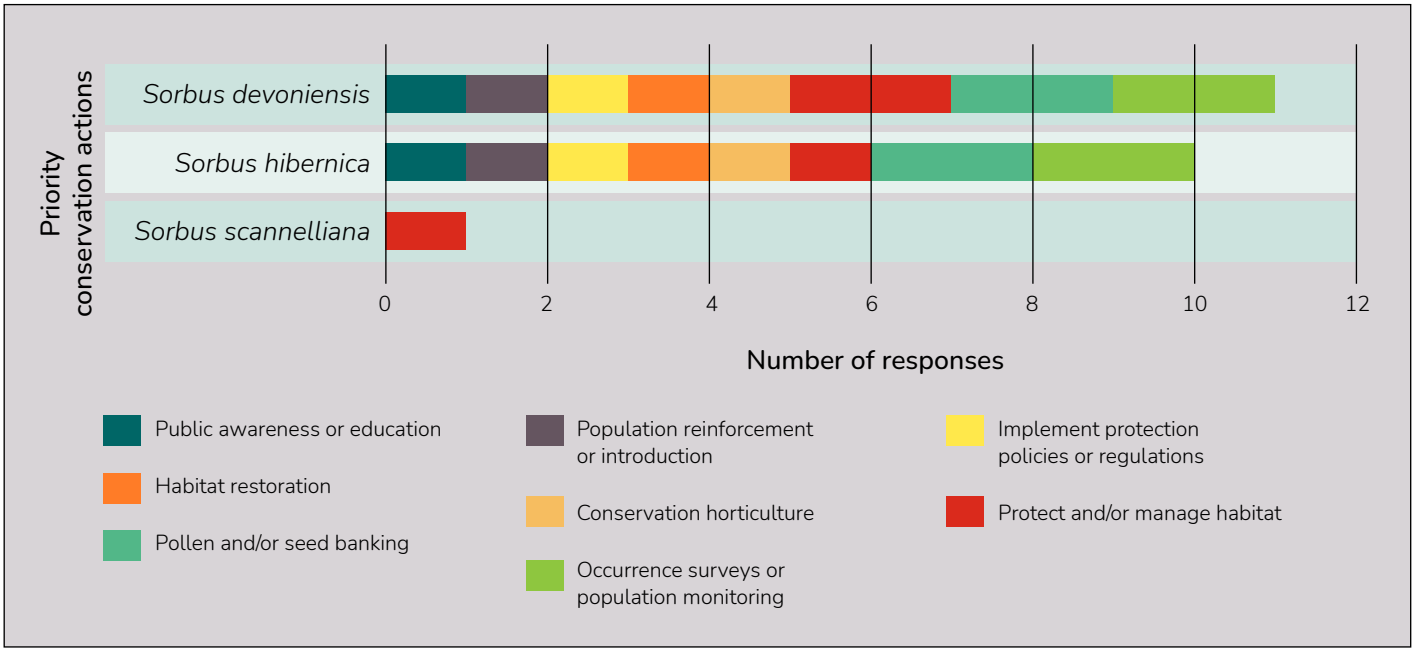


Figure 68. Priority conservation actions identified in the Conservation Activity Questionnaire reported as a proportion of responses by target species occurring in Republic of Ireland and Northern Ireland.

Current Conservation actions

Public awareness or education:
Of the three target species native to the Republic of Ireland and Northern Ireland, public awareness or education was the most common activity reported, which were reported for all three species.

Occurrence surveys or population monitoring:
Occurrence surveys or population monitoring were reported for all three species occurring in the Republic of Ireland and Northern Ireland, that we requested data for.

Conservation horticulture:
Conservation horticulture was reported for *S. devoniensis* and *S. hibernica* but not *S. scannelliana*.

Habitat management:
In 2011 a fence was installed around the location of the mature *S. scannelliana* tree and four known saplings, to exclude deer and at the same time the canopy was thinned to reduce shading out (Beech et al., 2017g). Deer management is currently taking place within Killarney National Park (C. Sweeney pers. comm., 2025).

Land protection:
See Appendix 3 for a list of protected areas in which target species occur.

Overall summary and recommendations

The highest priority and recommended conservation activities for each species can be found in Table 27.

Expand *ex situ* collections:
S. scannelliana has the highest concern score of the species native to the Republic of Ireland and Northern Ireland (17) and of all target species (Table 26). As such, further high-quality seed collections with accurate provenance data, along with vegetative propagation are urgently recommended for this species. *S. scannelliana* is not held in seed banks, and therefore once propagation has been successful, further collection for seed banking is urgently recommended. *S. hibernica* is only represented by 202 seeds in seed banks and therefore further collection for seed banking is also recommended for this species.

While we have no *ex situ* collection data for *S. anglica*, high-quality seed collections with accurate provenance data is recommended to ensure the Irish population is adequately represented in *ex situ* collections.

Occurrence surveys or population monitoring: Further occurrence surveys or population monitoring recommended for all four target species occurring in the Republic of Ireland and Northern Ireland.

Table 26. Prioritisation matrix identifying conservation concern score for Republic of Ireland and Northern Ireland target species. *Sorbus anglica* is absent from this data as we have not collected *ex situ* collection data for this species.

Species	IUCN Red List category	# organisations with *ex situ* collections (plants and/or seeds)	# of individual plants in *ex situ* living collections	# wild provenance seedlings in nurseries	# of seeds in *ex situ* collections	Concern score
Sorbus scannelliana	CR	1	2	0	0	17
Sorbus hibernica	VU	11	27	0	202	11
Sorbus devoniensis	NT	18	215	0	2585	7

5 points	4 points	3 points	2 points	1 point	0 points

Table 27. Conservation recommendations for Republic of Ireland and Northern Ireland target species. Red is highest priority conservation actions and orange is recommended activities.

Species	Collect and distribute germplasm	Conservation horticulture	Cryopreservation and/or micropropagation	Habitat restoration	Implement protection policies or regulations	Occurrence surveys or population monitoring	Pollen and/or seed banking	Population reinforcement or introduction	Protect and/or manage habitat	Public awareness or education	Research: Climate Change, Genetics, Pests & Pathogens
Sorbus devoniensis											
Sorbus hibernica											
Sorbus scannelliana											

Highest priority conservation actions

Recommended activities

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Sorbus cheddarensis (Dan Crowley)

Appendices

Appendix 1 – List of contributors

Institutional contributors to the 2023– 2024 *ex situ* collections survey:

Arboretum Wespelaar
Bedgebury National Pinetum and Forest
Benmore Botanic Garden
Bergen Botanical Garden
Botanical Garden of Vilnius University
Botanische Gärten der Universität Bonn
Cambridge University Botanic Garden
Chester Zoo
Dawyck Botanic Garden
Dendrological Garden Průhonice (Silva Tarouca Research Institute for Landscape and Horticulture)
Forestry England at Leigh Woods
FossilPlants
Jardin des Plantes de Nantes
John F. Kennedy Memorial Park and Arboretum
Millennium Seed Bank
National Botanic Garden of Wales
National Botanic Gardens of Latvia
National Botanic Gardens, Glasnevin (Ireland)
National Botanic Gardens, Kilmacurragh (Ireland)
National Trust gardens: Antony; Brownsham; Castle Drogo; Clumber Park; Colby Woodland Garden; Cragside; Dyffryn Gardens; Emmetts; Killerton; Knightshayes; Mount Stewart; Plant Conservation Centre; Powis; Shugborough; Stourhead; The Weir Garden; Winkworth
Ness Botanic Gardens
Oxford Botanic Garden and Arboretum
Plantentuin Meise (Meise Botanic Garden)
RHS Garden Rosemoor
Rogów Arboretum of Warsaw University of Life Sciences
Royal Botanic Garden Edinburgh, plus designated safe sites: Beale Arboretum; Castle Leod; Drummond Castle; Heriot Watt University; James Aitken Arboretum; Kilchoan; Lang Craigs; Leith Links; Moray Place Gardens; Scone Palace; The Lodge Grounds; Thenford House
Royal Botanic Gardens, Kew
Royal Botanic Gardens, Kew - Wakehurst Place
St. Andrews Botanic Garden
The Arnold Arboretum of Harvard University
The Dawes Arboretum
The Linnaean Gardens of Uppsala
The Sir Harold Hillier Garden and Arboretum
The Yorkshire Arboretum
University of Tartu Botanical Gardens
University of Washington Botanic Gardens
VanDusen Botanical Garden

Sorbus devoniensis (Dan Crowley)

Institutional contributors to the 2023–2024 Conservation Action Questionnaire:

Arboretum Wespelaar
Botanical Garden of Vilnius University
Bristol City Council
Chester Zoo
Forestry England
Westonbirt, The National Arboretum
FossilPlants
Gwent Wildlife Trust
Heidelberg Materials
Jardin des Plantes, Nantes
Longleat Enterprises
Meise Botanic Garden
National Botanic Garden of Latvia
National Botanic Garden of Wales
Natural Resources Wales
Ness Botanic Gardens
Rogów Arboretum of Warsaw University of Life Sciences
Royal Botanic Gardens, Edinburgh
Silva Tarouca Research Institute for Landscape and Horticulture
St. Andrews Botanic Garden
The Arnold Arboretum of Harvard University
The Dawes Arboretum
The Sir Harold Hillier Gardens
University of Bergen
University of Bristol Botanic Garden
University of Oxford Botanic Garden and Arboretum
University of Tartu Natural History Museum and Botanical Garden
Wild Planet Trust- Paignton Zoo
Yorkshire Arboretum

Additional contributors to the 2023–2024 Conservation Action Questionnaire:

Dr Tim Rich
Libby Houston

Sorbus leighensis in the Avon Gorge, Bristol (Dan Crowley)

Appendix 2

Native and naturalised *Sorbus* taxa occurring in United Kingdom and Ireland diversity centres:

Species	Synonyms	Range	IUCN category
Sorbus admonitor M.Proctor	*Aria admonitor* (M.Proctor) Mosyakin, Fedor. & McNeill *Karpatiosorbus admonitor* (M.Proctor) Sennikov & Kurtto *Pyrus admonitor* (M.Proctor) M.F.Fay & Christenh. *Sorbus devoniensis* E.F.Warb. in part.	South West England	EN
Sorbus anglica Hedl.	*Hedlundia anglica* (Hedl.) Sennikov & Kurtto *Pyrus britannica* M.F.Fay & Christenh., *Sorbus mougeotii* Soy.-Will. & Godr. var. *anglica* (Hedl.) C.E.Salmon *Sorbus waltersii* P.D.Sell	South West England and Ireland	VU
Sorbus arranensis Hedl.	*Hedlundia neglecta* (Hedl.) Sennikov & Kurtto *Pyrus arranensis* (Hedl.) Druce *Pyrus scandica* auct. Angl. *Sorbus* × *pinnatifida* auct. Angl., in part.	Arran	EN
Sorbus arvonicola P.D.Sell	*Aria arvonicola* (P.D.Sell) Sennikov & Kurtto *Pyrus arvonicola* (P.D.Sell) M.F.Fay & Christenh. *Sorbus arvonensis* auct. Angl., *nom. nud.* *Sorbus porrigentiformis* E.F.Warb., in part.	North Wales	CR
Sorbus aria (L.) Crantz	*Aria edulis* (Willd.) M.Roem. *Crataegus aria* L. *Pyrus aria* (L.) Ehrh. *Pyrus edulis* Willd. *Sorbus globulifera* Hedl. ex Ridd.	Western, central and southern Europe, northwestern Africa	LC
Sorbus aucuparia L.	*Pyrus aucuparia* (L.) Ehrh	Europe to Iran, Russian Far East to northern China and Korea	LC
Sorbus aucuparia. × *S. minima* (Ley) Hedl.		South Wales	N/A
Sorbus avonensis T.C.G.Rich	*Aria avonensis* (T.C.G.Rich) Sennikov & Kurtto *Pyrus avonensis* (T.C.G.Rich) M.F.Fay & Christenh.	Avon Gorge	CR
Sorbus bristoliensis Wilmott	*Aria bristoliensis* (Wilmott) Mosyakin, Fedor. & McNeill *Karpatiosorbus bristoliensis* (Wilmott) Sennikov & Kurtto *Pyrus aria γ intermedia* Ehrh. *sensu* White *Pyrus bristoliensis* (Wilmott) M.F.Fay & Christenh.	Avon Gorge	EN

Species	Synonyms	Range	IUCN category
Sorbus cambrensis M.Proctor	*Aria cambrensis* (M.Proctor) Sennikov & Kurtto *Pyrus cambrensis* (M.Proctor) M.F.Fay & Christenh. *Sorbus porrigentiformis* E.F.Warb. in part.	South Wales	EN
Sorbus cheddarensis L.Houston & Ashley Robertson	*Aria cheddarensis* (L.Houston & Ashley Robertson) Sennikov & Kurtto *Pyrus cheddarensis* (L.Houston & Ashley Robertson) M.F.Fay & Christenh.	Cheddar Gorge	CR
Sorbus cuneifolia T.C.G.Rich	*Hedlundia cuneifolia* (T.C.G.Rich) Sennikov & Kurtto *Pyrus llangollenica* M.F.Fay & Christenh. *Sorbus anglica* Hedl., in part	North Wales	EN
Sorbus croceocarpa P.D.Sell	*Aria croceocarpa* (P.D.Sell) Mosyakin, Fedor. & McNeill, *Ukrainian Botanical Journal* 82: 212 (2025). *Karpatiosorbus croceocarpa* (P.D.Sell) Sennikov & Kurtto *Pyrus aria* var. *theophrasta* sensu A.W.Hill *Sorbus aria* var. *theophrasta* sensu W.J.Bean *Sorbus decipiens* var. *paucicrenata* (Ilse) Fritsch *sensu* Riddelsdell *et al*. *Sorbus theophrasta* Lombart sensu P.Lombart *Sorbus* 'Theophrasta' sensu W.J.Bean	Unknown (known only as a cultivated or naturalized plant)	DD
Sorbus × *decipiens* (Bechst.) G.Kirchn.	*Aria decipiens* (Borkh.) M.Roem. *Azarolus hybrida* Borkh. *Crataegus hybrida* Bechst. *Karpatiosorbus* × *hybrida* (Borkh.) Sennikov & Kurtto *Pyrus decipiens* Bechst. *Pyrus latifolia* auct. Angl., in part, non (Lam.) Syme. *Pyrus rotundifolia* Bechst. *Sorbus* × *confusa* Gremli ex Rouy & E.G.Camus, *nom. nud.* *Sorbus* × *latifolia* auct. Angl. in part, non (Lam.) Pers. *Sorbus* × *rotundifolia* (Bechst.) Hedl. *Sorbus* × *tomentella* Gand. *Sorbus vagensis* Wilmott	Northern and central Europe	N/A
Sorbus devoniensis E.F.Warb.	*Karpatiosorbus devoniensis* (E.F.Warb.) Sennikov & Kurtto *Pyrus rotundifolia* auct. Angl. in part. *Pyrus scandica* Syme in part. *Pyrus scandica* Bab. var. *mougeotii* auct. Angl. in part. *Sorbus latifolia* auct. Angl. in part, non (Lam.) Pers. *Sorbus latifolia* 'Devon Form' *sensu* E. F. Warburg & A. J. Wilmott	South West England; Ireland	VU

Species	Synonyms	Range	IUCN category
Sorbus domestica L.	*Cormus domestica* (L.) Spach *Pyrus domestica* (L.) Ehrh *Pyrus domestica* (L.) Sm. *Pyrus sorbus* Gaertn.	Central and southern Europe to northwestern Caucasus, northwestern Africa.	LC
Sorbus eminens E.F.Warb.	*Aria eminens* (E.F.Warb.) Sennikov & Kurtto *Pyrus eminens* (E.F.Warb.) M.F.Fay & Christenh. *Sorbus subeminens* P.D.Sell	South West England; South Wales; Avon Gorge; Cheddar Gorge; Wye Valley	VU
Sorbus eminentiformis T.C.G.Rich	*Aria eminentiformis* (T.C.G.Rich) Sennikov & Kurtto *Pyrus eminentiformis* (T.C.G.Rich) M.F.Fay & Christenh. *Sorbus eminens* E.F.Warb. in part. *Sorbus eminens* E.F.Warb. sensu Sell & Murrell	Wye Valley	EN
Sorbus eminentoides L.Houston	*Aria eminentoides* (L.Houston) Sennikov & Kurtto *Pyrus eminentoides* (L.Houston) M.F.Fay & Christenh.	Cheddar Gorge	CR
Sorbus evansii T.C.G.Rich	*Aria evansii* (T.C.G.Rich) Sennikov & Kurtto *Pyrus evansii* (T.C.G.Rich) M.F.Fay & Christenh. *Sorbus graeca sensu lato*, *sensu* Proctor & Groenhof, non (Spach) Kotschy.	Wye Valley	CR
Sorbus fayana L.Houston & T.C.G.Rich	*Pyrus fayana* (L.Houston & T.C.G.Rich) Christenh.	Cheddar Gorge and Burrington Combe	CR
Sorbus glabriuscula McAll.	-	China	LC
Sorbus greenii T.C.G.Rich	*Aria greenii* (T.C.G.Rich) Sennikov & Kurtto *Pyrus greenii* (T.C.G.Rich) M.F.Fay & Christenh.	Wye Valley	CR
Sorbus herefordensis D.Green	*Aria herefordensis* (D.Green) Sennikov & Kurtto *Pyrus herefordensis* (D.Green) M.F.Fay & Christenh.	Wye Valley	EN
Sorbus × *houstoniae* T.C.G.Rich	*Aria houstoniae* (T.C.G.Rich) Mosyakin, Fedor. & McNeill *Karpatiosorbus houstoniae* (T.C.G.Rich) Sennikov & Kurtto *Pyrus* × *houstoniae* (T.C.G.Rich) M.F.Fay & Christenh.	Avon Gorge	N/A
Sorbus hibernica E.F.Warb	*Aria hibernica* (E.F.Warb.) Sennikov & Kurtto *Pyrus hibernica* (E.F.Warb.) M.F.Fay & Christenh.	Ireland	VU
Sorbus hybrida (L.) L.	*Crataegus hybrida* L. *Hedlundia hybrida* (L.) Sennikov & Kurtto *Pyrus fennica* (Kalm) Bab. *Pyrus hybrida* (L.) Sm. *Pyrus pinnatifida* Ehrh. *Sorbus fennica* Kalm ex Fr. *Sorbus meinichii* hort. in part, non (Hartm.) Hedl.	Northern Europe	LC

Species	Synonyms	Range	IUCN category
Sorbus intermedia (Ehrh.) Pers.	*Scandosorbus intermedia* (Ehrh.) Sennikov *Borkhausenia intermedia* (Ehrh.) Sennikov & Kurtto *Crataegus aria* var. *suecica* L. *Hedlundia intermedia* (Ehrh.) Mosyakin, Fedor. & McNeill *Pyrus intermedia* Ehrh. in Hirschfeld *Sorbus scandica* (L.) Fr.	Northern Europe	LC
Sorbus latifolia (Lam.) Pers.	*Aria latifolia* (Lam.) M.Roem. *Crataegus latifolia* Lam. *Karpatiosorbus latifolia* (Lam.) Sennikov & Kurtto *Pyrus latifolia* (Lam.) R.Thomps. *Pyrus latifolia* (Lam.) Syme, *nom. illeg. superfl.* *Torminaria latifolia* (Lam.) Dippel × *Tormaria latifolia* (Lam.) Mezhenskyj		
Sorbus lancastriensis E.F.Warb.	*Aria lancastriensis* (E.F.Warb.) Sennikov & Kurtto *Pyrus lancastriensis* (E.F.Warb.) M.F.Fay & Christenh.	Northern England; North Wales	LC
Sorbus leighensis T.C.G.Rich	*Aria leighensis* (T.C.G.Rich) Sennikov & Kurtto *Pyrus leighensis* (T.C.G.Rich) M.F.Fay & Christenh. *Sorbus* 'Bristol *porrigentiformis*' auct. Angl.	Avon Gorge	EN
Sorbus leptophylla E.F.Warb	*Aria leptophylla* (E.F.Warb.) Sennikov & Kurtto *Pyrus leptophylla* (E.F.Warb.) M.F.Fay & Christenh.	South Wales	EN
Sorbus leyana Wilmott	*Hedlundia leyana* (Wilmott) Sennikov & Kurtto *Pyrus leyana* (Wilmott) M.F.Fay & Christenh.	South Wales	CR
Sorbus × *liljeforsii* T.C.G.Rich (*S. aucuparia* × *S.* intermedia)	*Borkhausenia* × *liljeforsii* (T.C.G.Rich) Sennikov & Kurtto *Hedlundia liljeforsii* (T.C.G.Rich) Mosyakin, Fedor. & McNeill *Pyrus* × *liljeforsii* (T.C.G.Rich) M.F.Fay & Christenh. *Scandosorbus liljeforsii* (T.C.G.Rich) Sennikov *Sorbus* × *pinnatifida* auct. Angl., non Düll	Northern Europe	N/A
Sorbus margaretae M.Proctor	*Aria margaretae* (M.Proctor) Sennikov & Kurtto *Pyrus margaretae* (M.Proctor) M.F.Fay & Christenh.	South West England	EN
Sorbus margaretae × *S. vexans*	N/A	South West England	N/A
Sorbus minima (Ley) Hedl.	*Hedlundia minima* (Ley) Sennikov & Kurtto *Pyrus minima* Ley	South Wales	VU
Sorbus × *motleyi* T.C.G.Rich (*S. aucuparia* × *S. leyana*)	*Hedlundia motleyi* (T.C.G.Rich) Sennikov & Kurtto *Pyrus* × *motleyi* (T.C.G.Rich) M.F.Fay & Christenh.	South Wales	N/A
Sorbus parviloba T.C.G.Rich	*Aria parviloba* (T.C.G.Rich) Sennikov & Kurtto *Karpatiosorbus parviloba* (T.C.G.Rich) Sennikov & Kurtto *Pyrus parviloba* (T.C.G.Rich) M.F.Fay & Christenh.	Wye Valley	CR

Species	Synonyms	Range	IUCN category
Sorbus porrigentiformis E.F.Warb.	*Aria porrigentiformis* (E.F.Warb.) Sennikov & Kurtto *Pyrus porrigentiformis* (E.F.Warb.) M.F.Fay & Christenh. *Sorbus humphreyana* P.D.Sell *Sorbus porrigens* Hedl. in part.	South West England; South Wales; Wye Valley; Avon Gorge; Cheddar Gorge	VU
Sorbus × *proctoriana* T.C.G.Rich (*S. aucuparia* × *S. scalaris*)	*Sorbus* × *proctoris* T.C.G.Rich	Avon Gorge	N/A
Sorbus pseudofennica E.F.Warb.	*Hedlundia pseudofennica* (E.F.Warb.) Sennikov & Kurtto *Pyrus pinnatifida* Ehrh. sensu Smith *Pyrus pseudofennica* (E.F.Warb.) M.F.Fay & Christenh. =*Sorbus fennica* auct. Angl. in part, non L. *Sorbus hybrida* auct. Angl. in part	Arran	CR
Sorbus pseudomeinichii Ashley Robertson	*Hedlundia pseudomeinichii* (Ashley Robertson) Sennikov & Kurtto *Pyrus pseudomeinichii* (Ashley Robertson) M.F.Fay & Christenh.	Arran	CR
Sorbus × *pseudoporrigentiformis* T.C.G.Rich & L.Houston (*S. aria* × *S. porrigentiformis*)	*Sorbus porrigentiformis* E.F.Warb., in part. *Pyrus* × *pseudoporrigentiformis* (T.C.G.Rich & L.Houston) M.F.Fay	Avon Gorge, Cheddar Gorge, Wye Valley	N/A
Sorbus richii L.Houston	*Aria richii* (L.Houston) Sennikov & Kurtto *Pyrus richii* (L.Houston) M.F.Fay & Christenh. *Sorbus subeminens* P.D.Sell	South West England	CR
Sorbus × *robertsonii* T.C.G.Rich	*Aria* × *robertsonii* (T.C.G.Rich) Sennikov & Kurtto *Pyrus* × *robertsonii* (T.C.G.Rich) M.F.Fay & Christenh.	Avon Gorge	N/A
Sorbus rupicola (Syme) Hedl.	*Aria rupicola* (Syme) Mezhenskyj *Pyrus aria* (L.) Ehrh. subsp. *rupicola* Syme *Pyrus rupicola* (Syme) Bab. *Sorbus aria* subsp. *salicifolia* (Myrin) Hedl. *Sorbus salicifolia* (Myrin) Prain *Sorbus scandica* subsp. *rupicola* (Syme) Nyman	Northwest Europe	LC
Sorbus rupicoloides L.Houston & T.C.G.Rich	*Aria rupicoloides* (L.Houston & T.C.G.Rich) Sennikov & Kurtto *Pyrus rupicoloides* (L.Houston & T.C.G.Rich) M.F.Fay & Christenh.	Cheddar Gorge	CR
Sorbus saxicola T.C.G.Rich	*Aria saxicola* (T.C.G.Rich) Sennikov & Kurtto *Pyrus saxicola* (T.C.G.Rich) M.F.Fay & Christenh.	Wye Valley	CR
Sorbus scannelliana T.C.G.Rich	*Hedlundia scannelliana* (T.C.G.Rich) Sennikov & Kurtto *Pyrus scannelliana* (T.C.G.Rich) M.F.Fay & Christenh	Ireland	CR
Sorbus sellii T.C.G.Rich	*Aria sellii* (T.C.G.Rich) Mosyakin, Fedor. & McNeill *Karpatiosorbus sellii* (T.C.G.Rich) Sennikov & Kurtto *Pyrus sellii* (T.C.G.Rich) M.F.Fay & Christenh. *Sorbus decipiens* auct. Angl., non (Bechst.) Irmisch.	Unknown (occurs as a naturalised plant)	DD

Species	Synonyms	Range	IUCN category
Sorbus spectans L.Houston	*Aria spectans* (L.Houston) Sennikov & Kurtto *Pyrus spectans* (L.Houston) M.F.Fay & Christenh. *Sorbus* 'Observatory Hill taxon' auct Angl.	Avon Gorge	CR
Sorbus stenophylla M.Proctor	*Aria stenophylla* (M.Proctor) Sennikov & Kurtto *Pyrus draconis* M.F.Fay & Christenh. *Sorbus porrigentiformis* E.F.Warb. in part.	South Wales	EN
Sorbus stirtoniana T.C.G.Rich	*Aria stirtoniana* (T.C.G.Rich) Sennikov & Kurtto *Pyrus stirtoniana* (T.C.G.Rich) M.F.Fay & Christenh. *Sorbus leptophylla* E.F.Warb., in part.	North Wales	CR
Sorbus subcuneata Wilmott	*Aria subcuneata* (Wilmott) Mosyakin *Karpatiosorbus subcuneata* (Wilmott) Sennikov & Kurtto *Pyrus latifolia* var. *decipiens* auct. Angl. *Pyrus rotundifolia* var. *decipiens* auct. Angl. *Pyrus subcuneata* (Wilmott) M.F.Fay & Christenh. *Sorbus latifolia* var. *decipiens* auct. Angl. *Sorbus minima* × *S. latifolia sensu* E. S. Marshall	South West England	EN
Sorbus torminalis (L.) Crantz	*Aria torminalis* (L.) Beck *Crataegus torminalis* L. *Pyrus torminalis* (L.) Ehrh. *Pyrus torminalis* var. *glaberrima* (Gand.) Asch. & Graebn. *Sorbus glaberrima* Gand. *Sorbus orientalis* Schönbeck-Temesy =*Torminalis clusii* (M.Roem.) K.R.Robertson & J.B.Phipps *Torminalis glaberrima* (Gand.) Sennikov & Kurtto	Europe to northern Iran, northwestern Africa	LC
Sorbus × *thuringiaca* (Nyman) Fritsch (*S. aria* × *S. aucuparia*)	× *Arsorbus thuringiaca (Nyman)* Z.H.Feng & Su Liu *Hedlundia* × *thuringiaca* (Nyman) Sennikov & Kurtto *Pyrus thuringiaca* Ilse *Sorbus hybrida* var. *thuringiaca* Nyman *Sorbus quercifolia* Hedl.	Europe, east to Turkey	N/A
Sorbus vexans E.F.Warb.	*Aria vexans* (E.F.Warb.) Sennikov & Kurtto *Pyrus vexans* (E.F.Warb.) M.F.Fay & Christenh.	South West England	CR
Sorbus whiteana T.C.G.Rich & L.Houston	*Aria whiteana* (T.C.G.Rich & L.Houston) Sennikov & Kurtto *Pyrus whiteana* (T.C.G.Rich & L.Houston) M.F.Fay & Christenh. *Sorbus hungarica* Hedl. ex C.E.Salmon	Avon Gorge; Wye Valley	CR
Sorbus wilmottiana E.F.Warb.	*Aria wilmottiana* (E.F.Warb.) Sennikov & Kurtto *Pyrus wilmottiana* (E.F.Warb.) M.F.Fay & Christenh.	Avon Gorge	EN
Sorbus wyensis (D.Green) T.C.G.Rich	*Aria wyensis* D.Green *Pyrus wyensis* (D.Green) M.F.Fay	Wye Valley	CR

Appendix 3

Data derived from protected area shapefiles (National Parks and Wildlife Service, n.d.-a, n.d.-b; Natural England, n.d.-a, n.d.-b, n.d.-c, n.d.-d, n.d.-e; Natural Resources Wales, n.d.-a, n.d.-b, n.d.-c; NatureScot, 2024; Northern Ireland Environment Agency, n.d.).

Species	Site of Special Scientific Interest (SSSI) - England, Scotland and Wales Areas of Special Scientific Interest (ASSI) - Northern Ireland Natural Heritage Area (NHA) - Ireland	Special Protection Areas	Special Areas of Conservation	Local Nature Reserves and National Nature Reserves - England, Wales, Scotland and Northern Ireland
Sorbus admonitor	Exmoor Coastal Heaths; Watersmeet		Exmoor & Quantock Oakwoods	
Sorbus anglica	Blackcliff - Wyndcliff; Breidden Hill; Dinas Bran; Llanymynech And Llynclys Hills; Mynyddoedd Llangynidr A Llangatwg, Cefn Yr Ystrad A Chomin Merthyr; Pierce, Alcove And Piercefield Woods; River Wye (Lower Wye) / Afon Gwy (Gwy Isaf); Ruabon / Llantysilio Mountains And Minera; Upper Wye Gorge; Avon Gorge; Cheddar Wood; Llanymynech And Llynclys Hills; River Wye; Shorn Cliff And Caswell Woods; The Cheddar Complex; Upper Wye Gorge; West Exmoor Coast And Woods	Killarney National Park	Berwyn A Mynyddoedd De Clwyd / Berwyn And South Clwyd Mountains; River Wye / Afon Gwy (England); River Wye / Afon Gwy (Wales); Usk Bat Sites / Safleodd Ystlumod Wysg; Wye Valley Woodlands / Coetiroedd Dyffryn Gwy (England); Wye Valley Woodlands / Coetiroedd Dyffryn Gwy (Wales); Avon Gorge Woodlands; Exmoor Heaths; North Somerset & Mendip Bats; River Wye; Wye Valley Woodlands; Killarney National Park, Macgillycuddy'S Reeks And Caragh River Catchment	Lady Park Wood; Leigh Woods; Mendip; Lady Park Wood
Sorbus arranensis	Arran Northern Mountains			
Sorbus arvonicola	Coedydd Afon Menai		Y Fenai A Bae Conwy / Menai Strait and Conwy Bay	
Sorbus avonensis	Avon Gorge		Avon Gorge Woodlands	Leigh Woods
Sorbus bristoliensis	Avon Gorge		Avon Gorge Woodlands	Leigh Woods
Sorbus cambrensis	Cwm Clydach; Mynyddoedd Llangynidr A Llangatwg, Cefn Yr Ystrad A Chomin Merthyr		Cwm Clydach Woodlands / Coedydd Cwm Clydach; Usk Bat Sites / Safleodd Ystlumod Wysg	Craig Y Cilau; Cwm Clydach
Sorbus cheddarensis	The Cheddar Complex		North Somerset & Mendip Bats	Mendip
Sorbus cuneifolia	Ruabon / Llantysilio Mountains And Minera; Llanymynech And Llynclys Hills		Berwyn A Mynyddoedd De Clwyd / Berwyn and South Clwyd Mountains	

Species	Site of Special Scientific Interest (SSSI) - England, Scotland and Wales Areas of Special Scientific Interest (ASSI) - Northern Ireland Natural Heritage Area (NHA) - Ireland	Special Protection Areas	Special Areas of Conservation	Local Nature Reserves and National Nature Reserves - England, Wales, Scotland and Northern Ireland
Sorbus devoniensis	Beaford Moor; Exmoor Coastal Heaths; Halsdon; Little Haldon Heaths; Mambury And Stowford Moors; Marsland To Clovelly Coast; Mermaid's Pool To Rowden Gut; Shaugh Prior Woods; Watersmeet; West Exmoor Coast And Woods	Bannow Bay; Tramore Back Strand	Culm Grasslands; Exmoor & Quantock Oakwoods; Exmoor Heaths; South Dartmoor Woods; Tintagel-Marsland-Clovelly Coast; Bannow Bay; Lower River Suir; River Barrow And River Nore; Slaney River Valley; Tramore Dunes And Backstrand	
Sorbus eminens	Blackcliff - Wyndcliff; Pierce, Alcove And Piercefield Woods; River Wye (Lower Wye) / Afon Gwy (Gwy Isaf); Upper Wye Gorge; Avon Gorge; Crook Peak To Shute Shelve Hill; Goblin Combe; Horseshoe Bend, Shirehampton; King'S Wood And Urchin Wood; Lower Wye Gorge; Nightingale Valley; Portishead Pier To Black Nore; River Wye; Severn Estuary; Shorn Cliff And Caswell Woods; The Cheddar Complex; Upper Wye Gorge; Weston Big Wood	Severn Estuary (England); Severn Estuary	River Wye / Afon Gwy (England); River Wye / Afon Gwy (Wales); Severn Estuary (England); Wye Valley Woodlands / Coetiroedd Dyffryn Gwy (England); Wye Valley Woodlands / Coetiroedd Dyffryn Gwy (Wales); Avon Gorge Woodlands; Mendip Limestone Grasslands; North Somerset & Mendip Bats; River Wye; Severn Estuary; Wye Valley Woodlands	Lady Park Wood; Leigh Woods; Mendip; Lady Park Wood
Sorbus eminentiformis	River Wye (Lower Wye) / Afon Gwy (Gwy Isaf); Upper Wye Gorge; Upper Wye Gorge		River Wye / Afon Gwy (Wales); Wye Valley Woodlands / Coetiroedd Dyffryn Gwy (England); Wye Valley Woodlands / Coetiroedd Dyffryn Gwy (Wales); Wye Valley Woodlands	Lady Park Wood; Lady Park Wood
Sorbus eminentoides	The Cheddar Complex		North Somerset & Mendip Bats	Mendip
Sorbus evansii	Upper Wye Gorge		Wye Valley Woodlands / Coetiroedd Dyffryn Gwy (England); Wye Valley Woodlands	
Sorbus fayana	Burrington Combe			
Sorbus greenii	Great Doward; Upper Wye Gorge		Wye Valley Woodlands / Coetiroedd Dyffryn Gwy (England); Wye Valley Woodlands	
Sorbus herefordensis	River Wye; Upper Wye Gorge		River Wye / Afon Gwy (England); Wye Valley Woodlands / Coetiroedd Dyffryn Gwy (England); River Wye; Wye Valley Woodlands	

Species	Site of Special Scientific Interest (SSSI) - England, Scotland and Wales Areas of Special Scientific Interest (ASSI) - Northern Ireland Natural Heritage Area (NHA) - Ireland	Special Protection Areas	Special Areas of Conservation	Local Nature Reserves and National Nature Reserves - England, Wales, Scotland and Northern Ireland
Sorbus hibernica	Galboly; Murlough; Crockauns/ Keelogyboy Bogs Nha; Hawkswood Bog Nha	Connemara Bog Complex; Coole-Garryland; Lough Carra; Lough Corrib; Lough Derg (Shannon); Lough Mask; Lough Ree; Slieve Aughty Mountains; Slieve Bloom Mountains; The Murrough; Wexford Harbour And Slobs	Murlough; Black Head-Poulsallagh Complex; Connemara Bog Complex; Coole-Garryland Complex; Curraghchase Woods; East Burren Complex; Lough Carra/Mask Complex; Lough Corrib; Lough Derg, North-East Shore; Lough Gill; Lough Oughter And Associated Loughs; Lough Ree; Moneen Mountain; Oldhead Wood; Raheenmore Bog; River Barrow And River Nore; Slaney River Valley; Split Hills And Long Hill Esker; The Murrough Wetlands; Thomastown Quarry	Castlecaldwell Forest
Sorbus leighensis	Avon Gorge		Avon Gorge Woodlands	Leigh Woods
Sorbus leptophylla	Craig Y Rhiwarth; Mynyddoedd Llangynidr A Llangatwg, Cefn Yr Ystrad A Chomin Merthyr; Ogof Ffynnon Ddu		Usk Bat Sites / Safleodd Ystlumod Wysg	Craig Y Cilau
Sorbus leyana	Daren Fach; Penmoelallt			
Sorbus margaretae	Exmoor Coastal Heaths; West Exmoor Coast And Woods		Exmoor & Quantock Oakwoods; Exmoor Heaths	
Sorbus minima	Mynyddoedd Llangynidr A Llangatwg, Cefn Yr Ystrad A Chomin Merthyr		Usk Bat Sites / Safleodd Ystlumod Wysg	Craig Y Cilau
Sorbus parviloba	Upper Wye Gorge		Wye Valley Woodlands / Coetiroedd Dyffryn Gwy (England); Wye Valley Woodlands	

Species	Site of Special Scientific Interest (SSSI) - England, Scotland and Wales Areas of Special Scientific Interest (ASSI) - Northern Ireland Natural Heritage Area (NHA) - Ireland	Special Protection Areas	Special Areas of Conservation	Local Nature Reserves and National Nature Reserves - England, Wales, Scotland and Northern Ireland
Sorbus porrigentiformis	Black Mountains; Brecon Beacons; Carreg Cennan; Castell Coch Woodlands And Road Section; Coed Aberedw; Craig-Y-Llyn; Craig Y Rhiwarth; Cwarrau Ton Mawr A Ffynnon Taf - Ton Mawr And Taffs Well Quarries; Daren Fach; Gower Coast: Rhossili To Porteynon; Horton, Eastern And Western Slade; Llandeilo, Rhulen And Llanbedr Hills; Mynyddoedd Llangynidr A Llangatwg, Cefn Yr Ystrad A Chomin Merthyr; Nicholaston Wood; Oxwich Bay; River Wye (Lower Wye) / Afon Gwy (Gwy Isaf); Upper Wye Gorge; Asham Wood; Avon Gorge; Babbacombe Cliffs; Burrington Combe; Ebbor Gorge; Hope'S Nose To Wall'S Hill; Lower Wye Gorge; River Lemon Valley Woods; River Wye; Shorn Cliff And Caswell Woods; The Cheddar Complex; Upper Wye Gorge; Watersmeet; West Exmoor Coast And Woods		Brecon Beacons; Cardiff Beech Woods; Gower Ash Woods / Coedydd Ynn Gwyr; Limestone Coast Of South West Wales / Arfordir Calchfaen De Orllewin Cymru; River Wye / Afon Gwy (England); River Wye / Afon Gwy (Wales); Usk Bat Sites / Safleodd Ystlumod Wysg; Wye Valley Woodlands / Coetiroedd Dyffryn Gwy (England); Wye Valley Woodlands / Coetiroedd Dyffryn Gwy (Wales); Avon Gorge Woodlands; Exmoor & Quantock Oakwoods; Mendip Woodlands; North Somerset & Mendip Bats; River Wye; Wye Valley Woodlands	Wick Golden Valley; Lady Park Wood; Leigh Woods; Mendip; Craig Cerrig Gleisiad A Fan Frynych; Craig Y Cilau; Gower Coast; Lady Park Wood; Oxwich
Sorbus pseudofennica	Arran Northern Mountains			
Sorbus pseudomeinichii	Arran Northern Mountains			
Sorbus richii	Portishead Pier To Black Nore; Severn Estuary	Severn Estuary (England); Severn Estuary	Severn Estuary (England); Severn Estuary	Church And Wains Hill; Eastwood And Battery Point
Sorbus rupicoloides	The Cheddar Complex		North Somerset & Mendip Bats	Mendip
Sorbus saxicola	Upper Wye Gorge		Wye Valley Woodlands / Coetiroedd Dyffryn Gwy (England); Wye Valley Woodlands	
Sorbus scannelliana		Killarney National Park	Killarney National Park, Macgillycuddy'S Reeks And Caragh River Catchment	
Sorbus spectans	Avon Gorge		Avon Gorge Woodlands	
Sorbus stenophylla	Black Mountains			
Sorbus stirtoniana	Breidden Hill			

Species	Site of Special Scientific Interest (SSSI) - England, Scotland and Wales Areas of Special Scientific Interest (ASSI) - Northern Ireland Natural Heritage Area (NHA) - Ireland	Special Protection Areas	Special Areas of Conservation	Local Nature Reserves and National Nature Reserves - England, Wales, Scotland and Northern Ireland
Sorbus subcuneata	Exmoor Coastal Heaths; Watersmeet; West Exmoor Coast And Woods		Exmoor & Quantock Oakwoods; Exmoor Heaths	
Sorbus vexans	Exmoor Coastal Heaths; Watersmeet; West Exmoor Coast And Woods		Exmoor & Quantock Oakwoods; Exmoor Heaths	
Sorbus whiteana	Avon Gorge; River Wye; Shorn Cliff And Caswell Woods		River Wye / Afon Gwy (England); Wye Valley Woodlands / Coetiroedd Dyffryn Gwy (England); Avon Gorge Woodlands; River Wye; Wye Valley Woodlands	Leigh Woods
Sorbus wilmottiana	Avon Gorge		Avon Gorge Woodlands	Leigh Woods
Sorbus wyensis	Blackcliff - Wyndcliff		Wye Valley Woodlands / Coetiroedd Dyffryn Gwy (Wales)	

Sorbus anglica (Dan Crowley)

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