

PLANTNETWORK'S TARGET 8 PROJECT –
THE SURVEY STAGES

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The aim of PlantNetwork's Target 8 project is to involve botanic and other collections-led gardens throughout Britain (and eventually Ireland also) to cultivate nationally threatened vascular plant species. In this way, if each garden were to 'adopt' 2–3 threatened species then the network of British botanic gardens could collectively cultivate almost all of the 204 threatened species found in Britain, and therefore fulfil the requirements of Target 8 of the Global Strategy for Plant Conservation. However, before such a project could start, baseline information on the number and diversity of threatened plants in British *ex situ* collections was required. Along with this, species dossiers compiling cultivation and conservation details were considered necessary for the success of the project. Furthermore, practical details of the project such as collection and representation needed to be discussed with curators. This paper describes the background, survey work and practical aspects of the project.

THE GLOBAL STRATEGY FOR PLANT CONSERVATION

The Global Strategy for Plant Conservation (GSPC) can be traced back to the International Botanical Congress (IBC), held in St Louis, Missouri in August 1999, where a resolution was called for plant conservation to be recognised as a global priority in biodiversity conservation. The Strategy was initially drafted by a working party known as the Gran Canaria Group and was then scrutinised and refined by both the Subsidiary Body for Scientific, Technical and Technological Advice (SBSTTA) and the Conference of the Parties (COP), both bodies of the Convention of Biological Diversity (CBD). The final Strategy, consisting of 16 outcome-orientated targets to be achieved by 2010, emerged after a further meeting of COP in the Netherlands in April 2002. A more detailed description of the development and contents of the GSPC can be found in Rae (2003). Of the 16 targets horticulture, as undertaken in botanic gardens, could contribute to a maximum of 14. Realistically, however, there are eight in which botanic garden horticulturists could genuinely play a valuable part. These are:

1. A widely accessible working list of known plant species, as a step towards a complete world flora.
3. Development of models with protocols for plant conservation and sustainable use, based on research and practical experience.
7. 60% of the world's threatened species conserved *in situ*.
8. 60% of threatened plant species in accessible *ex situ* collections, preferably in the country of origin, and 10% of them included in recovery and restoration programmes.

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10. Management plans in place for at least 100 major alien species that threaten plants, plant communities and associated habitats and ecosystems.
14. The importance of plant diversity and the need for its conservation incorporated into communication, education and public awareness programmes.
15. To increase the number of trained people working with appropriate facilities in plant conservation according to national needs, in order to achieve the targets of this strategy.
16. Networks for plant conservation activities established or strengthened at national, regional, and international levels.

Rae (2004) explains in more detail the nature of the role that botanic garden horticulture can play in contributing to these targets. Target 8 is of particular relevance as it covers threatened species, *ex situ* collections and recovery and restoration programmes, all of which are ideally suited to the nature of botanic garden horticulture. The rest of this paper is devoted to Target 8 and the way in which PlantNetwork has decided to approach the challenge it offers. PlantNetwork (previously known as PlantNet) is the networking organisation for botanic and other scientific collections-driven gardens in Britain and Ireland. It seemed the obvious vehicle through which to attempt some sort of devolved, but networked, *ex situ* collection of the type called for by this target. PlantNetwork is well organised, good at communicating and includes in its membership virtually every botanic and collections-led garden in Britain and Ireland.

PROJECT AIMS

Britain has 204 Red Book listed plant species¹ (Wiggington, 1999) and the simple idea was to get the network of PlantNetwork's member gardens to cultivate their locally occurring but nationally threatened species. In this way, if each garden were to 'adopt' 2–3 species each then Britain could reach the target and, in addition, would be involving member gardens in a national, collective project. PlantNetwork includes gardens in Britain and Ireland and Ireland will eventually be included in the project, but to start with only British red-book species and British gardens will be involved. Additional aims include a strong element of public education (so that people can see the endangered species that grow in their locality and learn about the issues involved in their conservation), the compilation (and possible publication) of cultivation details and links to Local Biodiversity Action Plans (LBAPs) and other national and local conservation programmes. Finally, the project will try to take 'genetic issues' into consideration by a) collecting the widest possible diversity within each species and within each population of each species where possible, b) keeping plants from different populations of the same species where known, in different gardens, c) cultivating reasonably large numbers of individuals (e.g. 20–40 if space permits, rather than the usual botanic garden practice of only growing 1 or 2).

¹ Stop press. The new vascular plant red data list for Great Britain was launched just as this paper went to press (Cheffings & Farrell, 2005). In it 345 species are listed as threatened, greatly increasing the figure of 204 that has been used as the baseline for this PlantNetwork project. An immediate task for the Project Officer will be to update the surveys and species dossiers to include these newly included species.

More specifically, the aims are to:

- Ensure that no threatened species of plant in Britain (and Ireland) becomes extinct, and to make sure that all species are secured *in situ*
- Assess which threatened species are already in cultivation in botanic gardens in Britain (and Ireland)
- Increase the number of threatened species in cultivation, and where possible 'capture' the widest possible genetic diversity, and to increase the number of gardens growing threatened plants in order to assist current conservation projects, thereby developing horticultural knowledge of threatened species and raise awareness of the importance of plant conservation
- Develop and collate scientific and horticultural expertise for the *ex situ* cultivation of threatened plants in Britain (and Ireland), and to utilise this expertise for *in situ* conservation and recovery programmes where appropriate
- Bring together *ex situ* and *in situ* conservation efforts, using horticultural knowledge to support academic and practical conservation measures
- Raise political and public awareness of the issues of endangered plants.

Seed banks, of course, are vitally important components of *ex situ* conservation and Kew's Millennium Seed Bank at Wakehurst Place already contains in excess of 90% of Britain's threatened species. In this respect therefore, Britain is easily reaching the target of 60% of endangered species in *ex situ* collections. However, restoration or re-introduction projects using seeds are only as good as people who can germinate and cultivate the plants. Likewise, jars of seeds stored in one place do not offer the same potential for education and for allowing the public to see, and hopefully get involved in, endangered species conservation. While not intending to diminish the value of seed banks in any way at all, PlantNetwork believed that the project in question offers a possibly unique, approach to dealing with Target 8 that would complement the important work of seed banks. In addition, it would provide a focus for conservation around which a number of gardens could gather and, while perhaps offering only a small component individually, could contribute greatly in a cooperative way.

The rationale for the project is therefore that it is more than just a response to Target 8 of the GSPC. It certainly encompasses the GSPC but in particular it also takes into account the UK's response to the GSPC – *Plant Diversity Challenge* (JNCC, 2004). *Plant Diversity Challenge* emphasises the importance not simply of establishing *ex situ* collections but of integrating these into *in situ* conservation activities. The skills, expertise and facilities available in managing plant collections represent a hugely underutilised resource. Horticulture can play a vital role in support of *in situ* projects. Understanding the optimum growth requirements of plants can contribute to management of wild populations as, for instance, germination, propagation and cultivation are routine activities for horticulturists. Target 8 is not just about re-introduction schemes, gene-pools and preserving plants in *ex situ* collections, it is also about researching and comprehending the needs of plants in order to aid conservation of wild populations.

As very little was known about the number, origin or diversity of threatened species already growing in British gardens it was important to find out this information before starting the cultivation part of the project.

SURVEYS

An initial survey of 116 botanical collections in the UK was carried out to find the number of threatened species being cultivated in *ex situ* collections. The result of this survey was published in *PlantNet Newsletter* 25 (August 2004) and it showed that 136 (or 67%) of the 204 species were in cultivation. The results are shown in Appendix I.

Having established this baseline figure a further survey was required to investigate the provenance or origin of these plants. The reason for this is the second part of Target 8 that states that ‘and 10% of them included in recovery and restoration programmes’. If the plants might be used for recovery and restoration programmes then the origin becomes very important. Such plants would need to be of known wild origin from Britain and not be of hybrid, garden, unknown or ‘other country’ origin. This survey revealed that only 73 of the 136 species (53%), (or 36% of the original 204 species) were wild collected in Britain - the rest (64 species) were of European or unknown origin. Furthermore, the genetic diversity was found to be very low with 36 of the 73 (49%) species represented by only one accession in only one garden. Documentation was generally found to be poor.

If the target related to *ex situ* collections of live plants only as opposed to seed then the first survey would show that Britain was meeting its Target 8 commitment. However, the second survey reveals that we should be far from complacent as, in fact, only about a third are of British origin and, of these, half are represented by only one accession in one garden.

SPECIES DOSSIERS

While waiting for the questionnaires to be returned species dossiers were compiled for each of the 204 threatened species. Each followed a standard format that included information such as name, family, IUCN status, habit, habitat, distribution, cultivation potential and links to existing conservation projects (where known). In addition, by plotting the distribution of each species (and indeed of each population of each species, where known) on a map and of also plotting the locality of PlantNetwork member gardens it has been possible to highlight the closest gardens or *ex situ* collections to each species (or population). In this way potential candidates for each species have already been selected, based on the assumption that a) climate and soil type in the garden closest to the species in question may make cultivation easier than in far away gardens, b) the public may like to see (and get involved in) the issues and conservation of locally occurring, but nationally threatened, species and c) it would be good for botanic gardens to get involved in local conservation issues and actions.

Two examples of species dossiers are shown in Appendix II.

PRACTICALITIES

While the project looked feasible as a concept we believed that it was important to speak to botanic garden curators to talk through the practicalities of the project. With this in mind Natacha visited about 10 gardens including Cambridge, Glasgow and Dundee to discuss the idea from beginning to end. Issues such as protocols for seed collecting, germination, cultivation, display, interpretation, records and links to local biodiversity projects were discussed. The visits were extremely helpful and staff at each garden made very useful suggestions. All gardens visited were enthusiastic about the project and were keen to become more involved.

NEXT STAGES

The project is now poised, ready to move into the next stage, which will start to involve individual gardens growing the plants concerned. Natacha has already compiled a list showing the nearest botanic garden(s) to each threatened species and now we need to refine this to list 2–3 potential or candidate species for each botanic garden. Once this has been done Natacha will visit about 10 gardens to discuss the project and the species allocated to them in detail, based on the initial discussion already described above. We feel that we will need about 10 'lead' gardens who are prepared to be active and enthusiastic about the project and who are keen to get involved fairly quickly. Once these initial gardens are 'up and running' and once we can get some feed back from them then we feel that we will be able to roll out the project more widely based on the experience gained from these pilot projects.

WIDER IMPLICATIONS

We are concerned that this project does not stand alone as an isolated initiative and that it links in with local and national projects. To this end we have written to every relevant wildlife trust, conservation agency and government department that we can think of to inform them of what we are doing. Natacha has also compiled lists for each species showing where they are mentioned in Biodiversity Action Plans (BAPs) and Local Biodiversity Action Plan (LBAPs) but it will be up to individual gardens to develop these links and to forge the maximum amount of collaboration between these *ex situ* collections and other measures, especially *in situ* projects. In addition we hope to generate public interest through displays and interpretation and to record cultivation details that can eventually be compiled into a manual on the cultivation of British threatened plants.

The project is being coordinated for PlantNetwork by Natacha Frachon at the Royal Botanic Garden Edinburgh under the supervision of David Rae, the Director of Horticulture and Hon President of PlantNetwork.

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APPENDIX 1-RESULTS OF SURVEY 1 & 2

Questionnaire No 1 (To investigate the total number of Red Book listed species growing in botanic gardens)

- 116 gardens were sent the questionnaire
- 52 replied having 1 or more of the listed species maintained as seed and/or live plants
- 26 replied having none of the listed species
- 38 have never replied

Results from Q1

- 204 vascular plants are classified as nationally threatened (British Red Data Book, 1999)
- 165 (81%) of these plant taxa are retained as seed
- 136 (67%) are cultivated as live plants

Questionnaire No 2 (To investigate the origin of the 136 cultivated live plants)

- 57 gardens were sent the questionnaire
- 39 replied

Results from Q2

- 136 (67%) of all threatened plants are being grown in botanical collections
- 73 (53%) are of UK wild collected origin
- 64 (47%) are either of unknown or garden origin, or have been wild collected in another country
- 36 (49% of the UK collected wild origin species) consist of 1 accession in 1 garden only

	British Red Data Book – Vascular Plants Species	IUCN Threat Category (1997)	Number of British gardens retaining samples of the species as live plants	
			Figures from Q1	Figures from Q2
1	<i>Alisma gramineum</i>	Critically Endangered	0	0
2	<i>Apium repens</i>	Critically Endangered	3	1
3	<i>Atriplex pedunculata</i>	Critically Endangered	1	1
4	<i>Bupleurum falcatum</i>	Critically Endangered	6	0
5	<i>Carex depauperata</i>	Critically Endangered	3	1
6	<i>Carex muricata</i> ssp. <i>muricata</i>	Critically Endangered	1	1
7	<i>Cephalanthera rubra</i>	Critically Endangered	1	0
8	<i>Corrigiola litoralis</i>	Critically Endangered	0	0
9	<i>Cypripedium calceolus</i>	Critically Endangered	3	1
10	<i>Dactylorhiza incarnata</i> ssp. <i>ochroleuca</i>	Critically Endangered	0	0
11	<i>Epipogium aphyllum</i>	Critically Endangered	0	0
12	<i>Filago gallica</i>	Critically Endangered	0	0
13	<i>Galium tricornutum</i>	Critically Endangered	1	0
14	<i>Gentianella ciliata</i>	Critically Endangered	0	0
15	<i>Gnaphalium luteoalbum</i>	Critically Endangered	1	1
16	<i>Petrorhagia prolifera</i>	Critically Endangered	2	0
17	<i>Schoenoplectus triquetter</i>	Critically Endangered	1	0
18	<i>Scleranthus perennis</i> ssp. <i>perennis</i>	Critically Endangered	1	1
19	<i>Senecio paludosus</i>	Critically Endangered	2	1
20	<i>Sorbus domestica</i>	Critically Endangered	14	1
21	<i>Sorbus leptophylla</i>	Critically Endangered	7	5
22	<i>Sorbus leyana</i>	Critically Endangered	5	2
23	<i>Sorbus wilmottiana</i>	Critically Endangered	12	5
24	<i>Spergularia bocconei</i>	Critically Endangered	0	0
25	<i>Valerianella rimosa</i>	Critically Endangered	0	0
26	<i>Alchemilla subcrenata</i>	Endangered	1	1
27	<i>Allium sphaerocephalon</i>	Endangered	12	0
28	<i>Althaea hirsuta</i>	Endangered	1	0
29	<i>Arabis alpina</i>	Endangered	6	0
30	<i>Artemisia campestris</i>	Endangered	3	1
31	<i>Bupleurum baldense</i>	Endangered	1	0
32	<i>Centaurea cyanus</i>	Endangered	7	0
33	<i>Cerastium brachypetalum</i>	Endangered	0	0
34	<i>Clinopodium menthifolium</i>	Endangered	0	0
35	<i>Cotoneaster integerrimus</i>	Endangered	7	3

	British Red Data Book – Vascular Plants Species	IUCN Threat Category (1997)	Number of British gardens retaining samples of the species as live plants	
			Figures from Q1	Figures from Q2
37	<i>Crepis praemorsa</i>	Endangered	0	0
38	<i>Dactylorhiza incarnata ssp. cruenta</i>	Endangered	1	0
39	<i>Damasonium alisma</i>	Endangered	1	1
40	<i>Echium plantagineum</i>	Endangered	5	0
41	<i>Epipactis youngiana</i>	Endangered	0	0
42	<i>Euphrasia rotundifolia</i>	Endangered	0	0
43	<i>Filago pyramidata</i>	Endangered	1	0
44	<i>Fumaria reuteri</i>	Endangered	0	0
45	<i>Homogyne alpina</i>	Endangered	3	1
46	<i>Juncus pygmaeus</i>	Endangered	0	0
47	<i>Lactuca saligna</i>	Endangered	3	1
48	<i>Leersia oryzoides</i>	Endangered	2	0
49	<i>Liparis loeselii</i>	Endangered	0	0
50	<i>Lonicera xylosteum</i>	Endangered	8	1
51	<i>Melampyrum arvense</i>	Endangered	1	0
52	<i>Minuartia stricta</i>	Endangered	0	0
53	<i>Orobanche artemisiae-campestris</i>	Endangered	0	0
54	<i>Petrorhagia nanteuilii</i>	Endangered	0	0
55	<i>Polygonum maritimum</i>	Endangered	2	0
56	<i>Ranunculus ophioglossifolius</i>	Endangered	3	0
57	<i>Ranunculus reptans</i>	Endangered	1	1
58	<i>Rumex rupestris</i>	Endangered	4	0
59	<i>Scleranthus perennis ssp. prostratus</i>	Endangered	1	1
60	<i>Sorbus bristoliensis</i>	Endangered	21	7
61	<i>Stachys alpina</i>	Endangered	8	3
62	<i>Stachys germanica</i>	Endangered	6	1
63	<i>Teucrium chamaedrys</i>	Endangered	17	0
64	<i>Tordylium maximum</i>	Endangered	2	0
65	<i>Veronica triphyllos</i>	Endangered	1	1
66	<i>Viola canina ssp. montana</i>	Endangered	1	0
67	<i>Viola persicifolia</i>	Endangered	0	0
68	<i>Woodsia ilvensis</i>	Endangered	9	7
69	<i>Adonis annua</i>	Vulnerable	1	0
70	<i>Ajuga chamaepitys</i>	Vulnerable	4	1
71	<i>Alchemilla gracilis</i>	Vulnerable	2	0

	British Red Data Book – Vascular Plants Species	IUCN Threat Category (1997)	Number of British gardens retaining samples of the species as live plants	
			Figures from Q1	Figures from Q2
72	<i>Alchemilla minima</i>	Vulnerable	2	2
73	<i>Anisantha madritensis</i>	Vulnerable	1	0
74	<i>Arabis glabra</i>	Vulnerable	1	0
75	<i>Arabis scabra</i>	Vulnerable	4	1
76	<i>Arenaria norvegica</i> ssp. <i>anglica</i>	Vulnerable	0	0
77	<i>Armeria maritima</i> ssp. <i>elongata</i>	Vulnerable	4	0
78	<i>Artemisia norvegica</i>	Vulnerable	2	1
79	<i>Asparagus prostratus</i>	Vulnerable	3	1
80	<i>Astragalus alpinus</i>	Vulnerable	0	0
81	<i>Athyrium flexile</i>	Vulnerable	3	2
82	<i>Calamagrostis scotica</i>	Vulnerable	0	0
83	<i>Carex buxbaumii</i>	Vulnerable	1	1
84	<i>Carex chordorrhiza</i>	Vulnerable	2	0
85	<i>Carex flava</i>	Vulnerable	1	0
86	<i>Carex microglochis</i>	Vulnerable	0	0
87	<i>Carex norvegica</i>	Vulnerable	0	0
88	<i>Carex recta</i>	Vulnerable	0	0
89	<i>Carex vulpina</i>	Vulnerable	2	0
90	<i>Centaurea calcitrapa</i>	Vulnerable	0	0
91	<i>Centaurium scilloides</i>	Vulnerable	2	1
92	<i>Centaurium tenuiflorum</i>	Vulnerable	0	0
93	<i>Cerastium fontanum</i> ssp. <i>scoticum</i>	Vulnerable	0	0
94	<i>Cerastium nigrescens</i>	Vulnerable	0	0
95	<i>Chenopodium vulvaria</i>	Vulnerable	1	0
96	<i>Cicerbita alpina</i>	Vulnerable	4	1
97	<i>Cirsium tuberosum</i>	Vulnerable	3	1
98	<i>Coincya wrightii</i>	Vulnerable	3	1
99	<i>Crassula aquatica</i>	Vulnerable	0	0
100	<i>Cynodon dactylon</i>	Vulnerable	3	0
101	<i>Cynoglossum germanicum</i>	Vulnerable	3	1
102	<i>Cyperus fuscus</i>	Vulnerable	1	0
103	<i>Cystopteris dickieana</i>	Vulnerable	6	2
104	<i>Cytisus scoparius</i> ssp. <i>maritimus</i>	Vulnerable	3	0
105	<i>Dianthus armeria</i>	Vulnerable	4	0
106	<i>Dianthus gratianopolitanus</i>	Vulnerable	10	3

	British Red Data Book – Vascular Plants Species	IUCN Threat Category (1997)	Number of British gardens retaining samples of the species as live plants	
			Figures from Q1	Figures from Q2
107	<i>Diapensia lapponica</i>	Vulnerable	2	0
108	<i>Eleocharis parvula</i>	Vulnerable	0	0
109	<i>Erigeron borealis</i>	Vulnerable	3	0
110	<i>Eriophorum gracile</i>	Vulnerable	0	0
111	<i>Eryngium campestre</i>	Vulnerable	8	0
112	<i>Euphorbia hyberna</i>	Vulnerable	3	0
113	<i>Euphorbia serrulata</i>	Vulnerable	3	1
114	<i>Euphrasia cambrica</i>	Vulnerable	0	0
115	<i>Euphrasia vigursii</i>	Vulnerable	0	0
116	<i>Festuca longifolia</i>	Vulnerable	3	1
117	<i>Filago lutescens</i>	Vulnerable	0	0
118	<i>Gagea bohemica</i>	Vulnerable	2	1
119	<i>Gentiana nivalis</i>	Vulnerable	2	0
120	<i>Gentianella uliginosa</i>	Vulnerable	1	1
121	<i>Helianthemum canum ssp. levigatum</i>	Vulnerable	0	0
122	<i>Himantoglossum hircinum</i>	Vulnerable	0	0
123	<i>Hypochaeris maculata</i>	Vulnerable	1	0
124	<i>Lavatera cretica</i>	Vulnerable	3	0
125	<i>Limonium binervosum ssp. cantianum</i>	Vulnerable	0	0
126	<i>Limonium binervosum ssp. mutatum</i>	Vulnerable	0	0
127	<i>Limonium dodartiforme</i>	Vulnerable	0	0
128	<i>Limonium loganicum</i>	Vulnerable	1	1
129	<i>Limonium paradoxum</i>	Vulnerable	0	0
130	<i>Limonium parvum</i>	Vulnerable	1	1
131	<i>Limonium procerum ssp. cambrense</i>	Vulnerable	1	1
132	<i>Limonium procerum ssp. devoniense</i>	Vulnerable	0	0
133	<i>Limonium recurvum ssp. portlandicum</i>	Vulnerable	1	0
134	<i>Limonium recurvum ssp. recurvum</i>	Vulnerable	0	0
135	<i>Limonium transwallianum</i>	Vulnerable	1	1
136	<i>Limosella australis</i>	Vulnerable	0	0
137	<i>Lloydia serotina</i>	Vulnerable	2	0
138	<i>Lobelia urens</i>	Vulnerable	2	0
139	<i>Luzula pallidula</i>	Vulnerable	0	0
140	<i>Lychnis alpina</i>	Vulnerable	4	0
141	<i>Lychnis viscaria</i>	Vulnerable	13	2

	British Red Data Book – Vascular Plants Species	IUCN Threat Category (1997)	Number of British gardens retaining samples of the species as live plants	
			Figures from Q1	Figures from Q2
142	<i>Lythrum hyssopifolia</i>	Vulnerable	3	0
143	<i>Maianthemum bifolium</i>	Vulnerable	7	0
144	<i>Matthiola sinuata</i>	Vulnerable	1	0
145	<i>Mentha pulegium</i>	Vulnerable	6	2
146	<i>Moneses uniflora</i>	Vulnerable	2	1
147	<i>Muscari neglectum</i>	Vulnerable	6	0
148	<i>Najas marina</i>	Vulnerable	0	1
149	<i>Ononis reclinata</i>	Vulnerable	2	0
150	<i>Ophioglossum lusitanicum</i>	Vulnerable	1	1
151	<i>Ophrys fuciflora</i>	Vulnerable	0	0
152	<i>Orchis militaris</i>	Vulnerable	0	0
153	<i>Orchis simia</i>	Vulnerable	1	0
154	<i>Orobanche caryophyllacea</i>	Vulnerable	0	0
155	<i>Orobanche purpurea</i>	Vulnerable	1	0
156	<i>Oxytropis campestris</i>	Vulnerable	3	0
157	<i>Phyllodoce caerulea</i>	Vulnerable	5	0
158	<i>Physospermum cornubiense</i>	Vulnerable	0	0
159	<i>Phyteuma spicatum</i>	Vulnerable	5	1
160	<i>Pilosella flagellaris</i> ssp. <i>bicapitata</i>	Vulnerable	0	0
161	<i>Pilosella peleteriana</i>	Vulnerable	1	0
162	<i>Poa flexuosa</i>	Vulnerable	0	1
163	<i>Polygala amarella</i>	Vulnerable	0	0
164	<i>Polygonatum verticillatum</i>	Vulnerable	10	0
165	<i>Potamogeton acutifolius</i>	Vulnerable	0	0
166	<i>Potamogeton epihydus</i>	Vulnerable	0	0
167	<i>Potentilla rupestris</i>	Vulnerable	11	1
168	<i>Pulicaria vulgaris</i>	Vulnerable	0	0
169	<i>Pulmonaria obscura</i>	Vulnerable	2	0
170	<i>Pyrus cordata</i>	Vulnerable	9	2
171	<i>Ranunculus tripartitus</i>	Vulnerable	0	0
172	<i>Rhinanthus angustifolius</i>	Vulnerable	0	0
173	<i>Romulea columnae</i>	Vulnerable	3	0
174	<i>Rumex aquaticus</i>	Vulnerable	1	1

	British Red Data Book – Vascular Plants Species	IUCN Threat Category (1997)	Number of British gardens retaining samples of the species as live plants	
			Figures from Q1	Figures from Q2
175	<i>Sagina nivalis</i>	Vulnerable	0	0
176	<i>Salix lanata</i>	Vulnerable	16	2
177	<i>Saxifraga cernua</i>	Vulnerable	1	1
178	<i>Saxifraga cespitosa</i>	Vulnerable	2	1
179	<i>Saxifraga hirculus</i>	Vulnerable	1	1
180	<i>Scheuchzeria palustris</i>	Vulnerable	1	0
181	<i>Schoenus ferrugineus</i>	Vulnerable	0	0
182	<i>Scirpoides holoschoenus</i>	Vulnerable	0	0
183	<i>Scorzonera humilis</i>	Vulnerable	1	1
184	<i>Seseli libanotis</i>	Vulnerable	6	2
185	<i>Sorbus anglica</i>	Vulnerable	21	10
186	<i>Sorbus arranensis</i>	Vulnerable	14	5
187	<i>Sorbus eminens</i>	Vulnerable	9	6
188	<i>Sorbus minima</i>	Vulnerable	13	6
189	<i>Sorbus pseudofennica</i>	Vulnerable	13	4
190	<i>Sorbus subcuneata</i>	Vulnerable	5	2
191	<i>Sorbus vexans</i>	Vulnerable	6	3
192	<i>Tephrosieris intergrifolia ssp. maritima</i>	Vulnerable	1	0
193	<i>Teucrium botrys</i>	Vulnerable	2	1
194	<i>Teucrium scordium</i>	Vulnerable	4	0
195	<i>Thlaspi perfoliatum</i>	Vulnerable	1	0
196	<i>Trichomanes speciosum</i>	Vulnerable	3	0
197	<i>Trifolium bocconeii</i>	Vulnerable	0	0
198	<i>Trifolium incarnatum ssp. molinerii</i>	Vulnerable	0	0
199	<i>Trifolium strictum</i>	Vulnerable	0	0
200	<i>Tuberaria guttata</i>	Vulnerable	1	0
201	<i>Valerianella eriocarpa</i>	Vulnerable	0	0
202	<i>Veronica spicata ssp. spicata</i>	Vulnerable	7	2
203	<i>Veronica verna</i>	Vulnerable	1	0
204	<i>Viola kitaibeliana</i>	Vulnerable	1	0

APPENDIX II

Key:

Dots refer to the native sites of the species

Numbers refer to the nearby Botanical Collections

*Woodsia ilvensis* (L.) R. Br.

Starting references

Family	Woodsiaceae
IUCN category	Endangered
Habit	Deciduous fern
Habitat	Open rock
Distribution in wild	

Country	Locality & Vice County	Sites (10km ² occurrences)	Population (plants)
Wales	Caernarvonshire	2	12
England	Borrowdale, Cumberland	1	
Scotland	Moffat Hills, Dumfriesshire Clova, Angus	1	4 clumps

*Ex situ Collections***Gardens close to the region of distribution of the species**

- 1 University of Dundee Botanic Garden
- 2 St Andrews Botanic Garden
- 3 Branklyn Garden
- 4 RBG Edinburgh
- 5 Dawyck Botanic Garden
- 6 Holehird Gardens
- 7 Sizergh Castle
- 8 Treborgh Botanic Garden
- 9 Bodnant
- 10 Portmeirion Gardens

Gardens with a specialisation in the species (*Woodsia ilvensis*)

RBG, Edinburgh

Potential to grow the species in *ex situ* collections

Information obtained from Andrew Ensoll and Clare Morter, Indoor Department of Horticulture, Royal Botanic Garden Edinburgh (RBGE).

- Propagation from spores. In spring or summer the spores are sown in plastic pots containing 1:1 peat/bark sieved, added with N-Mag fertiliser (~ 5ml for 10 L of compost) and sterilised with boiling water (to kill the spores of algae, mosses, fungi and alien ferns as they germinate and develop faster than the sown fern spores). The pots are sealed with cling film to create a closed environment and stored in a growing room under artificial light 12h/day at 18°C. Germination occurs about 4 weeks later. The fresher the spores are, the quicker they germinate. After germination the prothalli are left untouched for an extra 2 months until they become sporelings and therefore big enough to be held with tweezers. The young sporelings are pricked out into 70mm square plastic pots containing 1:1 sieved peat/sieved bark. The pots are wrapped with cling film and stored in a growing room under artificial light 12h/day at 18°C. Later on, the pots are left uncovered in the growing room as the sporophytes need a lower humidity environment for hardening-off. Once they have hardened-off and thicker fronds appear, the young ferns are pricked out into a tray for further development, in a free draining compost containing 75%:15%:10% propagation bark/John Innes No. 1/fine grit, fine charcoal, N-Mag. The tray is placed in a growing room with a propagation tray cover to maintain a humid atmosphere. The top is taken off later, once the plants are well established. Mature sporophytes are transplanted in individual pots (3–4 sporophytes per pot) containing the same compost and placed in the glasshouse at 10–13°C. In late spring-early summer, the pots may be transferred outdoors to a shaded tunnel. Plants are susceptible to aphids and vine weevil infestations. They get the usual feeding for indoor plants: a liquid fertiliser every 2 weeks and osmocote. The difficulty in propagating *Woodsia ilvensis* from spores, is maintaining the humidity all the way through.
- Vegetative propagation by division in March-April.
- Outdoor conditions

Woodsia ilvensis should be planted in a free-draining soil (crucial), in a light (avoid sites with prolonged exposure to sun), open site.

Conservation information

Linkages to BAPs

In 1995, *W. ilvensis* was listed as a priority species in the UK Government's Biodiversity Action Plan (UKBAP) and in 1998 the national Species Action Plan (SAP) for *W. ilvensis* was agreed and published.

Lead partner is Dr Mary Gibby, RBGE, Tel: 0131 248 2973.

The following LBAPs are working on the species:

Bioamrywiaeth yn Eryri

Dumfries and Galloway

Known conservation programmes

The conservation collection of *Woodsia ilvensis* is held at the RBGE and represents most of the genetic variation in the British populations.

Re-introductions were made by the RBGE into several secret sites near Moffat in 1999 and in Teesdale in 1999 and 2000.

A new re-introduction was started in autumn 2003 at another site north of Moffat.

Habitat Management

Most colonies are within NNRs or SSSIs.

The English re-introduction site is within the Teesdale National Nature Reserve and the Scottish site is in the Southern Uplands within a SSSI.

Re-introduction localities are kept secret and are monitored regularly.

References

- MC HAFFIE, H. 2004. *Woodsia ilvensis* re-introduction programme. *Pteridologist* **4**, 3, p. 67.
- LUSBY, P., LINDSAY, S. & DYER, A.F. 2002. Principles, practice and problems of conserving the rare British fern *Woodsia ilvensis* (L.) R.Br. *Fern Gazette*. **16** (6, 7 & 8), pp. 350–355.

Key:

Dots refer to the native sites of the species

Numbers refer to the nearby Botanical Collections

***Galium tricornutum* Dandy****Starting references**

Family	Rubiaceae
IUCN category	Critically Endangered
Habit	Herb (annual)
Habitat	Cereal fields and disturbed ground, on dry calcareous soils

Country	Locality & Vice County	Sites (10km ² occurrences)	Population (plants)
England	A roadside verge in Cambridgeshire Rothamsted, Hertfordshire	3	2 4

Ex situ Collections**Gardens close to the region of distribution of the species**

- 1 Cambridge University Botanic Garden
- 2 Docwra's Manor, Royston
- 3 University of Hertfordshire, Hatfield

Gardens of specialisation on family Rubiaceae or genus *Galium*

None

Potential to grow the species in ex situ collections

- Probably short-lived seed-bank (Wigginton, M.J. 1999. *British Red Data Book*. 3rd Ed.).
- Information obtained from Cambridge University Botanic Garden, *Conservation Collection* from the 1970s to the 1990s:

Appears to have a critical chilling requirement.

Seed sown in March and chilled gave 55% germination as compared to 0% for unchilled seed (Annual report, 1981).

Conservation information**Linkages to BAPs**A Species Action Plan has been produced for *G. tricornutum*, lead partner is Amanda Miller, Plantlife, Tel: 01722 342749

The LBAP working on the species is Teignbridge BAP.

Known conservation programmes

At Broadbalk field, Rothamsted, the species grows in an experimental plot which has never received chemical fertiliser.

Re-introduction into protected sites is occasionally attempted using seed of English origin.

Habitat Management

The sites have received beneficial management for several years.