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agus Fiadhúlra
National Parks and Wildlife Service

Results of a monitoring survey and assessment of the conservation status of *Saxifraga hirculus* (Marsh Saxifrage) 2023

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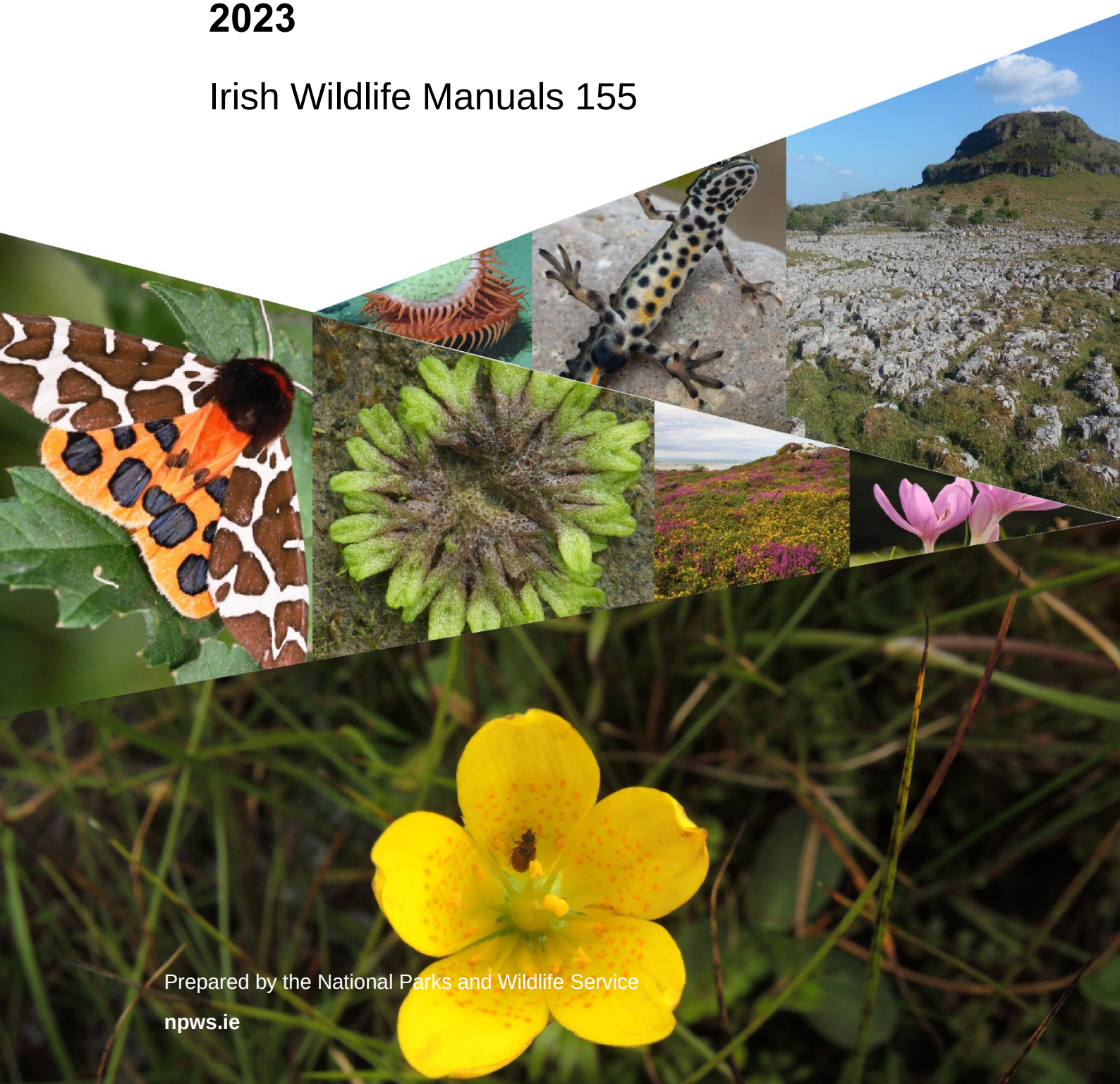

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Front cover, small photographs from top row:

A deep water fly trap anemone *Phelliactis* sp., Yvonne Leahy; **Common Newt** *Lissotriton vulgaris,* Brian Nelson; **Limestone pavement**, Bricklieve Mountains, Co. Sligo, Andy Bleasdale; **Garden Tiger** *Arctia caja,* Brian Nelson; **Violet Crystalwort** *Riccia huebeneriana*, Robert Thompson; **Coastal heath**, Howth Head, Co. Dublin, Maurice Eakin; **Meadow Saffron** *Colchicum autumnale*, Lorcan Scott

Bottom photograph: **Marsh Saxifrage** *Saxifraga hirculus*, Sheean, Co. Mayo, Rory Hodd

Results of a monitoring survey and assessment of the conservation status of *Saxifraga hirculus* (Marsh Saxifrage) in Ireland 2023

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Executive Summary

This survey was commissioned to monitor selected populations of *Saxifraga hirculus* (Marsh Saxifrage) in the Republic of Ireland, which occurs in mineral flushes within blanket bog complexes and is now restricted to a small area of Northwest Ireland. This species is listed on Annex II of the EU Habitats Directive which, as well as requiring member states to designate protected areas for the species, also obliges them to monitor populations and report on their status on a six-yearly cycle. In 2023, a survey was undertaken to monitor selected populations of this species in the Republic of Ireland and report on their status. Twenty populations of *S. hirculus* are known in the Republic of Ireland, in North Mayo and Sligo. Of these, six sites, that were assessed as having poor conservation status during the previous round of monitoring, were surveyed. The populations were surveyed according to the established methodology used in previous monitoring surveys and the conservation status of each population was assessed under the parameters of Population, Habitat for the species and Future prospects to derive an overall assessment of each population. A National Conservation Assessment (NCA) of *S. hirculus* across the Republic of Ireland was also undertaken, to contribute to Ireland's reporting obligations under Article 17 of the EU Habitats Directive. This national assessment is based on the Range, Population, Habitat for the species and Future prospects of the species across the country.

The Population of *S. hirculus* was assessed as of Unfavourable – Bad Conservation Status at three of the six sites surveyed, with no plants found at Sh12 Sheskin A and only one plant observed at Sh03 Bellacorick, indicating that these populations may be close to extinction. The Habitat for the species and Future prospects of these populations were also assessed as Unfavourable – Bad. While the Population at Sh19 Ox Mountains C was assessed as Unfavourable – Bad, the Habitat for the species and Future prospects were assessed as Unfavourable – Inadequate. Although some declines in area and a low number of flowering plants were observed at the other sites surveyed, overall they were assessed as being of Favourable Conservation Status. The pressures acting on the sites in poor condition are mainly a lack of appropriate grazing and hydrological issues. These hydrological pressures include both historical and ongoing drainage and, potentially, drying out due to climate change. The results suggest that an overall decline in the population of *S. hirculus* may have occurred, but further evidence of this is required and the declines observed may partly be due to weather conditions at the time of survey and in the preceding year. Despite these issues at individual sites, the majority of populations are thought to be of good conservation status and the National Conservation Assessment indicates that the Range, Population, Habitat for the species and Future prospects at a national level are all Favourable and show a stable trend.

Conservation measures are recommended at those sites assessed as being of Unfavourable-Bad Conservation Status. This is especially the case at Bellacorick, where grazing is required to open up the habitat by knocking back dense vegetation. At the Ox Mountains sites, the sources of drainage issues should be identified and addressed.

Acknowledgements

The fieldwork for this project was undertaken with assistance from Sharon Pilkington, George Smith and Joanne Denyer. Kate McNutt processed the GIS and mapping elements of the project. Neil Lockhart, the NPWS project officer, provided essential advice and guidance. Thanks are also due to Eoin McGreal and John Derwin of Wild Atlantic Nature and John Conaghan for proving up to date information on some populations.

1 Introduction

1.1 Saxifraga hirculus

Saxifraga hirculus L. (Marsh Saxifrage) is a herbaceous perennial in the Saxifragaceae family and is a distinctive species when in flower, with bright yellow petals that have orange spots near the base. Flowering stems can grow up to 35 cm and can bear up to seven flowers, but typically there are two to three flowers per stem. The leaves are oblong, arranged alternately along short stems. Reproduction occurs both sexually, by insect pollination, and asexually by clonal spread via runners, with the runners decaying over time, so that the clonal plants grow independently. The seeds can only travel short distances, so dispersal is generally limited to within the flush in which the parent plant occurs (Hedley & Walker, 2015; Muldoon *et al*., 2015; O'Neill *et al*., 2019). Due to the clonal nature of the spread of *S. hirculus* as a primary means of reproduction, genetic diversity within populations can be low (Finger *et al*., 2024).

In Ireland, *Saxifraga hirculus* grows only in mineral-rich, but not strongly calcareous, flushes in lowland and upland blanket bog complexes, dominated by small to medium sized sedges and mosses, which often corresponds to the Annex I Habitat 7140 Transition mires. This species requires an open habitat to thrive, as it is a weak competitor, and undergrazing at a site may lead to its extinction (Hedley & Walker, 2015). Therefore, an appropriate grazing regime and intact hydrology are key to its survival. Moderate levels of grazing are necessary to keep the habitat sufficiently open, but grazing levels that are too high are detrimental to the species' survival. A water table close to the surface is essential, as is water movement, to keep sufficient levels of Oxygen in the water and maintain suitable temperatures (O'Neill *et al*., 2019). A more detailed account of the ecology of *S. hirculus* in Ireland can be found in Muldoon (2011).

Saxifraga hirculus has a circumpolar boreo-arctic montane distribution (Stroh *et al.*, 2024), with the distribution focused primarily on northern polar regions, occurrences further south being fragmentary and disjunct. A major decline has occurred in the outlying southerly populations of this species in Europe, due to a wide range of anthropogenic impacts (O'Neill *et al.*, 2019). Within the Republic of Ireland, this species is now restricted to 20 populations in a small area of North Mayo and Sligo. It also persists at one site in Northern Ireland, in Co. Antrim. It has been lost, since the early 20th century, from a number of sites in the Midlands of Ireland, in counties Tipperary, Westmeath, Offaly, Laois and Meath, due to peat extraction and drainage and populations in Mayo have also been lost more recently due to afforestation (Muldoon, 2011).

As well as being included on Annex II of the EU Habitats Directive, *Saxifraga hirculus* is listed on the Flora (Protection) Order, 2022 (S.I. No. 235/2022), and is assessed as Near Threatened on the Irish vascular plant red list (Wyse Jackson *et al*., 2016).

1.2 Survey rationale

As *S. hirculus* is listed on Annex II of the EU Habitats Directive (92/43/EEC), Ireland is obliged to designate protected areas for this species, undertake surveillance of its populations under Article 11 of the Directive and report on its conservation status within the country under Article 17. Information is required on the parameters of Range, Population, Habitat for the species and Future prospects (DG Environment, 2023a), with field survey necessary to assess the last three parameters. Reports under Article 17 of the Directive are produced on a six-year cycle, with the current reporting period running from 2019 to 2024. For the previous reporting period of 2013–2018, the conservation status of *S. hirculus* in Ireland was assessed as Favourable on all parameters (NPWS, 2019) and was considered to be stable.

The survey detailed in this report was commissioned by the NPWS to survey a subset of sites that were assessed by O'Neill *et al*. (2019) as having Unfavourable Conservation Status in the

previous monitoring period (Table 1). This consists of six sites; five located in Co. Mayo and one in Co. Sligo. As the populations at the remaining 13 sites were assessed as being of Favourable Conservation Status since baseline surveys were established and over the past two Article 17 reporting periods, with no evidence of a decline having taken place, the populations were not visited. Informed by the results of this survey, the project also aims to create a National Conservation Status Assessment (NCA) for *S. hirculus* in Ireland, to fulfil reporting obligations under Article 17 of the EU Habitats Directive.

Table 1 Details of each of the 20 known *Saxifraga hirculus* populations in Ireland, with the county and SAC in which they occur and year of most recent survey. The population marked as 'Not Surveyed' was discovered in 2023.

Site ID	Site name	County	SAC name	Last survey
Sh01	Aghoo	Mayo	IE000500 Glenamoy Bog Complex	2018
Sh02	Barroosky	Mayo	IE000500 Glenamoy Bog Complex	2018
Sh03	Bellacorick	Mayo	IE000466 Bellacorick Iron Flush	2023
Sh04	Formoyle	Mayo	IE001922 Bellacorick Bog Complex	2023
Sh05	Largan Mor A	Mayo	IE000476 Carrowmore Lake Complex	2018
Sh06	Largan Mor B	Mayo	IE000476 Carrowmore Lake Complex	2018
Sh07	Largan Mor C	Mayo	IE000476 Carrowmore Lake Complex	2018
Sh08	Sheean A	Mayo	IE000534 Owenduff/Nephin Complex	2018
Sh09	Sheean B	Mayo	IE000534 Owenduff/Nephin Complex	2018
Sh10	Sheean C	Mayo	IE000534 Owenduff/Nephin Complex	2018
Sh11	Sheean D	Mayo	IE000534 Owenduff/Nephin Complex	2018
Sh12	Sheskin A	Mayo	IE001922 Bellacorick Bog Complex	2023
Sh13	Sheskin B	Mayo	IE001922 Bellacorick Bog Complex	2023
Sh14	Sheskin C	Mayo	IE001922 Bellacorick Bog Complex	2023
Sh15	Uggool	Mayo	IE000534 Owenduff/Nephin Complex	2018
Sh16	Croaghaun East	Mayo	IE001922 Bellacorick Bog Complex	2018
Sh17	Ox Mountains A	Sligo	IE002006 Ox Mountains Bog	2018
Sh18	Ox Mountains B	Sligo	IE002006 Ox Mountains Bog	2018
Sh19	Ox Mountains C	Sligo	IE002006 Ox Mountains Bog	2023
Sh20	Largan Mor D	Mayo	IE000476 Carrowmore Lake Complex	Not surveyed

2 Methodology

2.1 Fieldwork preparation

Six sites were selected for survey as per Section 1.2; see Figure 1 for site locations. The methodology used by O'Neill *et al*. (2019) during the previous round of monitoring was reviewed, with no significant changes deemed necessary. Any minor changes or other observations on the methodology are included in the relevant place in the following section. As *Saxifraga hirculus* is included on the Flora Protection Order, 2022, a licence was obtained from NPWS, to enable minor disturbance of its habitat, in order to carry out the survey. Local NPWS staff were contacted to inform them that the survey was taking place and for assistance with gaining access to sites, where necessary. The outputs of all previous surveys for *S. hirculus* were collated and all previous records and extent polygons at the survey sites were mapped using QGIS. Maps of each survey site were printed for use in the field and a QField project was set up containing the data from previous surveys, as well as waypoint shapefiles for recording data on population extent, habitat condition, impacting activities and other notable species encountered. A site recording card was designed in Microsoft Word, to capture all relevant data about the site and to record monitoring stop data. These files were loaded onto a ruggedised handheld tablet for use in the field.

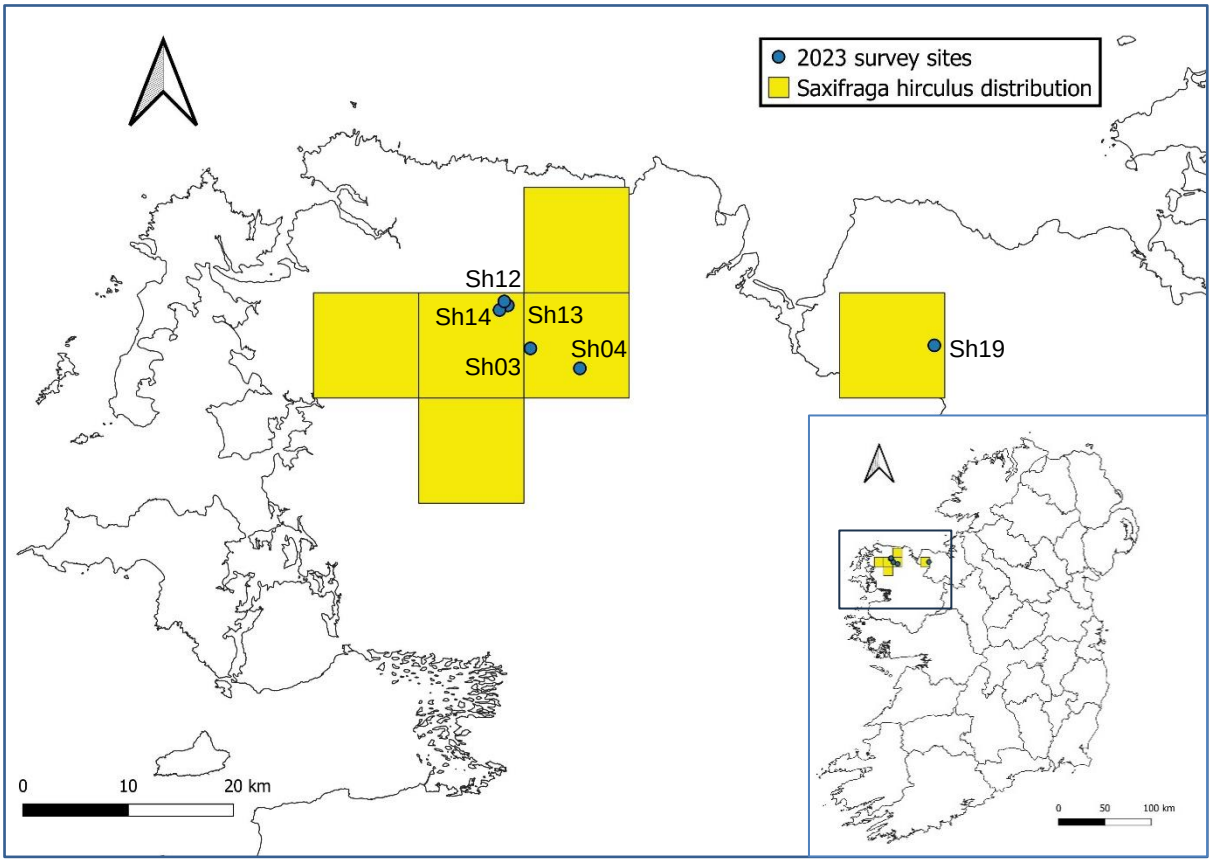

Figure 1 Locations of sites covered by the 2023 survey (blue dots) and distribution of *Saxifraga hirculus* in Ireland (yellow grid cells). Map covers part of counties Mayo and Sligo, with inset showing the distribution in a national context. See Table 1 for site details.

2.2 Field survey

The survey was carried out in August 2023. This is the best time to survey populations of *S. hirculus*, as it is the peak flowering time and non-flowering rosettes are well developed. The survey was carried out following the methodology of O'Neill *et al.* (2019).

2.2.1 Mapping of extent of occurrence

The polygons recorded during the 2015–2018 survey at each site were used as a guide and the entirety of the previously recorded extent, plus any suitable habitat in the vicinity, was carefully searched for plants of *S. hirculus*. Waypoints were recorded to delimit the boundary of the extent of the population, as determined by the current survey and notes were taken where the extent differed markedly from that previously recorded. The percentage of the extent occupied by *S. hirculus* was estimated and updated extent polygons were later digitised, using the waypoints recorded as a guide. While undertaking the mapping of the extent, attention was paid to the distribution of rosettes and flowering or fruiting plants across the extent, to ensure the placement of monitoring stops adequately represented the population. The number of flowering heads across the site was estimated by eye to an order of magnitude of 10s, 100s, 1000s *etc*.

2.2.2 Monitoring stops

Monitoring stops of 1 m x 1 m were recorded across each site, with a target of four monitoring stops per site, if population sizes were sufficiently large. These were placed to represent the variability of the *S. hirculus* population across the extent. The location of the plot was recorded within QField and two photos were taken of each plot, showing both close up and context views. For the Population assessment, the number of rosettes and the number of flowering heads were counted across each plot. Six data attributes were recorded from each plot for the Habitat for the species assessment: the hydrology was assessed by pressing a hand into the surface of the plot and noting whether the fingers were covered by water; the percentage cover of *Sagina nodosa* was measured as a positive indicator and the percentage covers of *Molinia caerulea* and *Holcus lanatus* were measured as negative indicators; and vegetation height was measured in cm in each of the four quadrants of the plot. Grazing level was categorised in one of four categories: 0–25% was assigned if there were little or no signs of grazing and the vegetation was rank; 26–50% was assigned when grazing was considered optimal, with moderate levels of grazing occurring, so that the vegetation showed signs of grazing, but flowering was still able to occur; 51–75% was assigned if the vegetation was tightly cropped, with no flowering occurring and areas of open bare ground; and 76–100% represented severe overgrazing, with little vegetation and much bare peat or soil. The grazing level was averaged across the stops at each site, so that a single overall category could be assigned.

2.2.3 Site data

A site recording form was completed for each survey site. A site description, listing the physical attributes of the site, the habitats present, the population of *S. hirculus* present and any other relevant information not included elsewhere within the form, was compiled. Any changes to the site since the last time it was surveyed were noted, by comparison with the site reports of O'Neill *et al*. (2019). Notes were taken on the current management taking place at the site and any management recommendations that would be beneficial to *S. hirculus* were also noted. General site photographs and close up photographs of *S. hirculus* were taken and the location of any other notable species were recorded in QField. Impacting activities were recorded using the standard EU codes (DG Environment, 2023b), with the impact, intensity and percentage of habitat impacted noted. Conservation Measures (DG Environment, 2023c) required at each site, to address impacting activities seen to be having a negative impact, were also recorded. The extent of occurrence was calculated from GIS post fieldwork and added to the site recording form.

2.3 Conservation assessments

Based upon the data collected in the field, the conservation status of each of the six sites was assessed under the categories of Population, Habitat for the species and Future prospects to give an overall site assessment.

2.3.1 Population assessment

The conservation status of the population at each site was assessed according to the criteria in Table 2. Site-specific targets were set for each criterion at 80% of the value recorded by the previous survey, to allow a margin for error. The total number of rosettes was calculated as the number of rosettes recorded in each 1 m x 1 m plot multiplied by the area of occupancy of the population. As noted by O'Neill *et. al.* (2019), the total number of rosettes calculated by this method is likely to be skewed higher than the true figure, as it assumes that *S. hirculus* is present in each square metre of the extent of occurrence at a similar density to that in the monitoring stops. The density of rosettes per m^2 was calculated as the average number of rosettes across the monitoring stops. At Sh03 Bellacorick, as very few rosettes occur, a count of the rosettes was possible. The number of flowering heads was estimated by eye, with the number of heads recorded in the plots used to inform the calculation.

Table 2 Criteria used in the Population assessment of *Saxifraga hirculus* for the 2023 monitoring survey (as per O'Neill *et al*., 2019).

	Criterion	Scale of assessment	Target
1	Total number of rosettes	Population	No decrease from previous monitoring period
2	Density of rosettes	Average over all monitoring stops	No decrease from previous monitoring period
3	No. of flowering heads	Population	No decrease from previous monitoring period
Population assessment		Favourable (green): 2 passes	
		Unfavourable – Inadequate (amber): 1 pass	
		Unfavourable – Bad (red): 0 passes	

2.3.2 Habitat for the species assessment

Attributes for assessing Habitat for the species (Table 3) were measured in the monitoring stops and are unchanged from those used by O'Neill *et al.* (2019). Area of *Saxifraga hirculus* habitat was taken as the extent of occurrence recorded, with 90% of the area recorded by the previous survey set as the target. Hydrology was assessed by determining whether a hand pressed into the surface of the plot is covered by water. The frequency of *Sagina nodosa* across the plots was used as an assessment criterion, with presence in 40% of plots set as a target. However, although *S. nodosa* can be considered as a positive indicator of suitable habitat for *S. hirculus*, it is by no means ubiquitous across all sites, so it should not be used as a deciding factor in whether the overall assessment is passed or failed, particularly in sites where it was not recorded by previous surveys. Despite this, this criterion was still assessed, for information. Percent cover of *Molinia caerulea* and *Holcus lanatus* were used as negative indicators, with high cover of *M. caerulea* indicating undergrazing and high cover of *H. lanatus* indicating potential eutrophication. The vegetation height was also used as an assessment attribute, with a low sward height required to indicate relatively open habitat, to allow the growth of *S. hirculus*. In order for the grazing level to be considered suitable, an average value of 26–50% across the stops was required. The Habitat for the species was assessed as being in Favourable Conservation Status if six or seven of these attributes passed, of Unfavourable – Inadequate Conservation Status if between four and five of these attributes passed and of Unfavourable – Bad Conservation Status if it passed on less than four attributes. This was

modified slightly from the requirements of O'Neill *et al.* (2019), where a pass on all seven criteria was required to attain Favourable status, which was considered to be too stringent, in light of factors such as variation in judgement between surveyors and variability depending on weather conditions. Where a site only marginally failed on an attribute, and there was no obvious negative factor causing the failure, the attribute could be passed based on expert judgement.

Table 3 Habitat for the species assessment criteria used for *Saxifraga hirculus* during the 2023 survey (as per O'Neill *et al*., 2019).

	Criterion	Scale of assessment	Target
1	Area of *Saxifraga hirculus* habitat	Population	Population-specific, set at 90% of baseline area
2	Hydrology	Monitoring stop	Water covers fingers of hand pressed onto substrate; at least 40% of stops to meet target
3	Frequency of *Sagina nodosa*	Monitoring stop	Present in at least 40% of stops
4	% cover *Molinia caerulea*	Monitoring stop	Mean % cover across all stops ≤5%
5	% cover *Holcus lanatus*	Monitoring stop	Mean % cover across all stops ≤15%
6	Grazing	Monitoring stop	Grazing levels 26–50% across all stops
7	Vegetation height	Monitoring stop	Mean vegetation height across all stops ≤20 cm
Habitat for the species assessment			Favourable (green): 6–7 passes
			Unfavourable – Inadequate (amber): 4–5 passes
			Unfavourable – Bad (red): 0–3 passes

2.3.3 Future prospects assessment

Future prospects at each site were evaluated with reference to the Population and Habitat for the species assessments, to determine if the conservation status of these sites is likely to change in the future. To enable this assessment, the current pressures, recorded using the standard codes of DG Environment (2023b), and threats that may cause an impact in the future, were evaluated. Negative impacts were balanced against positive impacts and the current and future management of the site was taken into consideration. Conservation Measures (DG Environment, 2023c) currently in place or planned, and those required but not being carried out, were also factored into the assessment. In order for the Future prospects of a population to be assessed as Favourable, it was necessary that its prospects of survival in the long term should be judged as good and that the future trend of the Population and Habitat for the species are likely to be stable or improving. If it was deemed that severe impacts were expected in the future and that the Population and Habitat for the species were likely to significantly decline in the future, with eventual loss of the population, then the Future prospects were assessed as Unfavourable – Bad. An Unfavourable – Inadequate assessment was applied if the Future prospects were assessed as being between these two extremes.

2.4 National Conservation Assessment

The National Conservation Assessment (NCA) was carried out using the assessment data collected in 2023, for sites that were included in this survey, and from 2015–2018 for sites that were not resurveyed in this round of monitoring. The conservation status was assessed based on the Range, Population, Habitat for the species and Future prospects on a national level (DG Environment, 2023a). All populations recorded up to the end of 2023 were included in the

NCA. Hv20 Largan Mor D, which was first recorded in 2023, was taken into account when calculating the Range, but insufficient data exist, for it to contribute to the Population, Habitat for the species or Future prospects assessments.

The Range was calculated on a 10 km grid basis in TM75 Irish Grid projection, based on the national distribution. A distribution map was derived primarily from population envelope polygons recorded from the current monitoring survey and, for the sites not surveyed in 2023, from the 2015–2018 Rare Plants Monitoring Survey (O'Neill *et al.*, 2019). The range was calculated based on these distribution data using ArcToolBox Range Tool and was refined using expert judgement. The Favourable Reference Range was taken as the current distribution, to take newly discovered, previously overlooked populations into account.

The Population was reported using the number of individuals, in the form of rosettes, as the reporting unit, as is recommended for vascular plants (DG Environment, 2023a). This was calculated as the total number of rosettes recorded across all sites, during the most recent survey of each site, either 2015–2018 or 2023. The Favourable Reference Population was set as the population reported in 2019.

The Habitat for the species was assessed based on the habitat assessments for the sites surveyed in 2023, plus the results of the 2015–2018 survey for those sites not surveyed in 2023, to enable an overall assessment of the habitat across all sites where the species occurs.

Informed by the current survey, current pressures and future threats, active at a national scale, and conservation measures, both in progress and required, were reported on. These then informed the Future prospects assessment. Both long-term and short-term trends were also reported for each parameter. The assessment results for each of the four parameters were combined to give an overall assessment of conservation status at a national level (Table 4).

Table 4 Evaluation matrix for the assessment of Conservation Status of Annex II species (adapted from DG Environment, 2023a).

	Conservation Status			
Parameter	**Favourable ('green')**	**Unfavourable – Inadequate ('amber')**	**Unfavourable – Bad ('red')**	**Unknown**
Range	Stable (loss and expansion in balance) or increasing AND not smaller than the 'favourable reference range'	Any other combination	Large decline: Equivalent to a loss of more than 1% per year within period specified by MS OR more than 10% below favourable reference range	No or insufficient reliable information available
Population	Population(s) not lower than 'favourable reference population' AND reproduction, mortality and age structure not deviating from normal (if data available)	Any other combination	Large decline: Equivalent to a loss of more than 1% per year within period specified by MS AND below 'favourable reference population' OR More than 25% below favourable reference population OR Reproduction, mortality and age structure strongly deviating from normal (if data available)	No or insufficient reliable information available
Habitat for the species	Area of habitat is sufficiently large (and stable or increasing) AND habitat quality is suitable for the long-term survival of the species	Any other combination	Area of habitat is clearly not sufficiently large to ensure the long-term survival of the species OR Habitat quality is bad, clearly not allowing long-term survival of the species	No or insufficient reliable information available
Future prospects	Main pressures and threats to the species not significant; species will remain viable on the long-term	Any other combination	Severe influence of pressures and threats to the species; very bad prospects for its future, long-term viability at risk.	No or insufficient reliable information available
Overall assessment of CS	All 'green' OR three 'green' and one 'unknown'	One or more 'amber' but no 'red'	One or more 'red'	Two or more 'unknown' combined with green or all 'unknown'

3 Results of the 2023 survey

Individual site reports for each site surveyed in 2023 are included in Appendix 1, including details of site-specific impacting activities, conservation measures, maps and photographs.

3.1 Population

The Population was assessed as being of Favourable Conservation Status at three sites and of Unfavourable – Bad Conservation Status at the remaining three sites (Table 5). No site passed the Population assessment on all three criteria. The total number of rosettes calculated at two sites, Sh13 Sheskin B and Sh14 Sheskin C, was significantly higher than that calculated by the survey of O'Neill *et al.* (2019). At SH19 Ox Mountains C, a reduction in the total estimated number of rosettes of 96.5% from 20,600 to 735 was recorded, leading to a failure on both the number of rosettes and density of rosettes. Even accounting for the fact that the rosette numbers estimated in 2015–2018 were likely overestimated (see Section 2.3.1), a significant reduction is still thought to have taken place. Only one rosette was recorded at Sh03 Bellacorick and no rosettes were recorded at Sh12 Sheskin A, indicating that the decline at these sites noted by O'Neill *et al.* (2019) is ongoing and may lead to the extinction of these populations in the near future. Although no rosettes were observed at Sh12 Sheskin A, the species cannot yet be presumed extinct without further surveys, as the apparent loss may be down to poor weather conditions in the period leading up to the survey. Sh04 Formoyle also failed on the criterion of number of rosettes, but passed on the density of rosettes criterion. This is due to the failure to find any rosettes in part of the extent of occurrence recorded in 2015–2018, leading to a reduction in area of suitable habitat recorded (See Section 3.2). However, where it does occur, the density of rosettes still appears healthy. As there was *c*. 30 cm of standing water across the site at the time of survey, it is possible that the less than ideal survey conditions lead to rosettes being poorly developed and easily missed.

Table 5 Summary of the Population assessment of *Saxifraga hirculus* at the sites surveyed in 2023. Favourable (Fav) = 2–3 attributes passed; Unfavourable – Inadequate (U–I) = 1 attribute passed, Unfavourable – Bad (U–B) = 0 attributes passed, n/a = not assessed.

Site code	Total no. of rosettes	Density of rosettes	No. of flowering heads	No. of passes	Population estimated	Population Assessment
Sh03	Fail	n/a	Fail	0	1*	U–B
Sh04	Fail	Pass	Pass	2	835	Fav
Sh12	Fail	Fail	Fail	0	0	U–B
Sh13	Pass	n/a	Fail	1	2,075	Fav**
Sh14	Pass	Pass	Fail	2	13,153	Fav
Sh19	Fail	Fail	Fail	0	735	U–B

*Full count of rosettes carried out

**Assessed as Favourable on expert judgement, as density of rosettes was not assessed

Five out of the six sites failed on the criterion of number of flowering heads observed, with SH04 Formoyle being the only population passing on this criterion. It is suspected that a long drought in 2022, followed by a very wet summer in 2023, may have resulted in poor growth and development of *S. hirculus*, with less plants flowering across the sites than in previous years, as well as less rosettes visible. It is not known whether these patterns of low flowering and fewer rosettes were repeated across the *S. hirculus* populations not surveyed in 2023. Sh13 Sheskin B only passed the assessment on one criterion, total number of rosettes, but was passed on expert judgement. Density of rosettes was not recorded in the 2015–2018 survey, as the population was considered to occur as small patches rather than a continuous extent, so no target existed to base the assessment of this criterion on. Although the number

of flowering heads did not meet the target set, as it appeared to be a poor year for flowering across the *S. hirculus* populations visited, as outlined above, less weight was given to this than the fact that a higher number of rosettes was recorded than in 2015–2018, as well as a larger extent, suggesting that the population is healthy overall at this site.

3.2 Habitat for the species

Habitat for the species was assessed as being in Favourable condition at three of the sites surveyed in 2023, Unfavourable – Inadequate at one and Unfavourable – Bad at two (Table 6). This is an improvement on the previous reporting period, where four sites were assessed as Unfavourable – Inadequate, in addition to the two Unfavourable – Bad sites. Two of the sites for which the assessment of the condition of the habitat improved to Favourable, Sh13 Sheskin B and Sh14 Sheskin C, were previously considered to not be adequately grazed. However, in 2023, although grazing levels were still low, it was considered that the openness of the habitat was maintained by the very wet hydrology, and the sites may not support higher levels of grazing, so the Habitat for the species assessment was passed on expert judgement. The Habitat for the species also improved to Favourable at Sh04 Formoyle, despite the area occupied by the species seemingly decreasing, with previously noted signs of overgrazing no longer in evidence. The condition of the habitat at the other sites surveyed did not appear to have changed significantly, with those sites in Unfavourable – Bad condition showing signs of encroachment of rank vegetation, resulting from a lack of grazing and poor hydrology. The site that was assessed as Unfavourable – Inadequate, Sh19 Ox Mountains C, was drier than optimal, with no signs of water at the surface, even after a wet summer, and had contracted in area. Grazing levels were assessed as higher than optimal, as slightly lower levels would possibly allow more flowering and for rosettes to develop better.

Table 6 Results of the Habitat for the species assessment for the six *Saxifraga hirculus* sites surveyed in 2023; Favourable (Fav) = 6–7 attributes passed; Unfavourable – Inadequate (U–I) = 4–5 attributes passed; Unfavourable – Bad (U–B) = 0–3 attributes passed.

Site code	Sh03	Sh04	Sh12	Sh13	Sh14	Sh19
Area (m^2)	Fail	Fail	Fail	Pass	Pass	Fail
Hydrology	Pass	Pass	Fail	Pass	Pass	Fail
Freq. *Sagina nodosa*	Fail	Pass	Fail	Fail	Fail	Pass
% *Molinia caerulea* cover	Pass	Pass	Pass	Pass	Pass	Pass
% *Holcus lanatus* cover	Pass	Pass	Pass	Pass	Pass	Pass
Grazing level	Fail	Pass	Fail	Pass**	Pass**	Fail
Mean vegetation height (cm)	Fail	Pass	Fail	Pass**	Pass	Pass
No. of passes	3	6	2	6	6	4
Habitat for the species assessment	U–B	Fav	U–B*	Fav	Fav	U–I

*No rosettes of *S. hirculus* were found, so no stops were recorded and values recorded by previous surveys were used for plot based assessment criteria, as condition assumed unchanged.
**Passed on expert judgement, as although grazing at these sites was low, the openness of the habitat was maintained by hydrology.

3.3 Impacting activities

A variety of impacts were recorded across the survey sites, most of which are negative impacts, at varying intensity (Table 7). The most frequent negative impact recorded was PA05 Abandonment of management/use of grasslands and other agricultural and agroforestry systems (*e.g.* cessation of grazing, mowing or traditional farming). This is in the form of a lack

of grazing of the flushes in which *S. hirculus* occurs, resulting in the growth of rank vegetation, to the exclusion of *S. hirculus*. This impact was recorded at three sites in 2023, at the populations at Sheskin, at a low intensity. This is balanced by the positive impact of deer grazing (PM07 Natural processes without direct or indirect influence from human activities or climate change), which appears to be adequate to balance the lack of agricultural grazing at two out of the three sites, in combination with favourable hydrology.

Table 7 Frequency of impacts, by intensity (high (H), medium (M), low (L)), % of the extent of occurrence affected and influence (positive (+), negative (-), neutral (0)), at the six *Saxifraga hirculus* sites surveyed in 2023.

		Intensity			% extent of occurrence affected						Influence			
Impact code	**Impact description**	**H**	**M**	**L**	**<1**	**1-25**	**26-50**	**51-75**	**76-99**	**100**	**+**	**-**	**0**	**Freq**
PA05	Abandonment of management/use of grasslands and other agricultural and agroforestry systems (*e.g.* cessation of grazing, mowing or traditional farming)			3						3		3		3
PA07	Intensive grazing or overgrazing by livestock		1							1		1		1
PA08	Extensive grazing or undergrazing by livestock	1		1						2		1	1	2
PH07	Intrusive and destructive research and monitoring activities	1		2		3						3		3
PJ01	Temperature changes and extremes due to climate change	1							1			1		1
PJ03	Changes in precipitation regimes due to climate change	1								1		1		1
PJ14	Other climate related changes in abiotic conditions		1							1		1		1
PL02	Drainage	1								1		1		1
PM07	Natural processes without direct or indirect influence from human activities or climate change		3			2		1			3			3
Freq		5	5	6	0	5	0	1	1	9	3	12	1	16

At Sh12 Sheskin A, where no *S. hirculus* was recorded, the hydrology was noted as being poor, with little surface water present, which may be due to climate-change induced impacts on the groundwater supply (PJ01, PJ03, PJ14). Climate change may be impacting all *S. hirculus* populations, but this requires further research to determine. At the other site that is in decline, Sh03 Bellacorick, the key negative impact is PA08 Extensive grazing or undergrazing by livestock, with prolonged lack of sufficient grazing leading to the growth of rank vegetation to the exclusion of *S. hirculus*. This is greatly exacerbated by historical drainage of the site. Sh19 Ox Mountains C is also suffering due to drainage (PL02 Drainage), much of which is likely historical. However, the installation of poles for wires connecting to a newly built windfarm directly downslope, as well as peat cutting in the vicinity, may be adding to the hydrological issues, for this and two adjacent populations (Sh17 Ox Mountains A and Sh18 Ox Mountains B) that were not surveyed in 2023, but showed possible signs of declining hydrology when visited briefly while surveying Sh19. Sh19 also shows some impacts from PA07 Intensive grazing or overgrazing by livestock, although this appears to be having a less intense impact than when the site was previously surveyed. Trampling by surveyors (PH07 Intrusive and destructive research and monitoring activities) was also considered to be a negative impact at three sites, where the ground is very wet and fragile in parts, but this is only of limited impact in terms of duration and extent and would not be considered a significant threat overall.

3.4 Conservation measures

No directly targeted conservation measures are currently being implemented that are influencing populations of *S. hirculus* or will influence *S. hirculus* populations at the six surveyed sites in the future. Although it is mainly incidental, rather than a targeted measure, most populations of *S. hirculus* are being maintained through MA03 Maintain existing extensive agricultural practices and agricultural landscape features, in the form of moderate levels of sheep and cattle grazing. At these populations, it should be ensured that the grazing regime remains appropriate and that under- or overgrazing do not occur. Where the grazing regime is not currently suitable and abandonment of management or overgrazing are occurring, notably at Sh03 Bellacorick and Sh12 Sheskin A, the measure MA05 Adapt mowing, grazing and other equivalent agricultural activities (*e.g.* burning) should be implemented, to bring the Habitat for the species back into good condition. In the face of increasing climate change impacts, particularly changes in precipitation regimes, the measure MJ01 Implement climate change mitigation measures should be considered. The implementation of this needs to be investigated at Sh12 Sheskin A, and likely at further sites in the future. It is not clear at present what the implementation of this measure would involve, but a first step would be to carry out investigations to determine the extent and severity of climate change impacts on this species. At sites where past or ongoing drainage has impacted the Habitat for the species, such as at Sh19 Ox Mountains C, MK03 Restoration of habitats impacted by multi-purpose hydrological changes would be necessary to bring the Habitat for the species back into good condition, and to maximise the resilience of the populations in the future. However, in the case of Sh03 Bellacorick, where drainage occurred over seventy years ago, it is likely that restoration would not be possible at this stage. A list of conservation measures required or in progress at the *Saxifraga hirculus* sites surveyed in 2023, and the pressures and threats addressed by these measures, is given in Table 8.

Table 8 Conservation measures required or in progress at the *Saxifraga hirculus* sites surveyed in 2023 and the pressures and threats addressed by these measures.

Measure code	Measure name	Number of sites	Pressure/threat addressed
MA03	Maintain existing extensive agricultural practices and agricultural landscape features	1	PA05
MA04	Reinstate appropriate agricultural practices to address abandonment, including mowing, grazing, burning or equivalent measures	1	PA05
MA05	Adapt mowing, grazing and other equivalent agricultural activities (*e.g*. burning)	1	PA07, PA08
MC07	Habitat restoration/creation from resources, exploitation areas or areas damaged due to installation of renewable energy infrastructure	1	PL02
MJ01	Implement climate change mitigation measures	1	PJ01, PJ02, PJ14
MK03	Restoration of habitats impacted by multi-purpose hydrological changes	1	PL02
MK05	Other measures related to multi-purpose human-induced changes in hydraulic conditions.	1	PL02

3.5 Future prospects

The Future prospects assessment of each of the survey sites is detailed and justified in Table 9. Three out of the six sites surveyed were deemed to have Favourable Future prospects. At Sh03 Bellacorick and Sh12 Sheskin A, the Future prospects of the population were assessed as Unfavourable – Bad, due to hydrological issues and a lack of adequate grazing, as outlined in previous sections, with low likelihood of restoration of the Population and Habitat for the species to Favourable status in the future. The Future prospects of Sh19 Ox Mountains C were assessed as Unfavourable – Inadequate, with drainage and overgrazing the likely reasons for a significant contraction in the population.

Table 9 Details of the Future prospects assessments for *Saxifraga hirculus* sites surveyed in 2023 and the rationale for the assessment.

Site no.	Site name	Future prospects assessment	Rationale for assessment
Sh03	Bellacorick	Unfavourable – Bad	Population has shown continual decline and habitat is in poor condition, with grazing levels unsuitable, so the long-term survival prospects are low.
Sh04	Formoyle	Favourable	Although the population shows signs of contraction in extent, the habitat is in good condition and no significant negative impacts are apparent.
Sh12	Sheskin A	Unfavourable – Bad	No rosettes were found in 2023, and grazing levels and hydrology were deemed unsuitable for the species. Although this population cannot yet be declared extinct, the future prospects are poor.
Sh13	Sheskin B	Favourable	Grazing levels are lower than the threshold set, but the very wet hydrology compensates for the low grazing levels and maintains open habitat.
Sh14	Sheskin C	Favourable	Grazing levels are lower than the threshold set, but the very wet hydrology compensates for the low grazing levels and maintains open habitat.
Sh19	Ox Mts C	Unfavourable – Inadequate	This population is much contracted from the previous assessment period, possibly due to overgrazing and drainage.

3.6 Overall site assessments

Overall, as three of the six sites surveyed in 2023 were assessed as Favourable on all three parameters, these sites were assessed as being of Favourable Conservation Status overall (Table 10). The other three sites were assessed as Unfavourable on all parameters, with Sh03 Bellacorick and Sh12 Sheskin A Unfavourable – Bad on all parameters and Sh19 Ox Mountains C being assessed as Unfavourable – Bad on Population and Unfavourable – Inadequate on the other two parameters. Therefore, the overall assessment for these three populations was Unfavourable – Bad.

Table 10 Results of the overall site assessments of the six sites surveyed for *Saxifraga hirculus* in 2023, combining the assessments outlined above.

Site no.	Site name	Population	Habitat	Future prospects	Overall assessment
Sh03	Bellacorick	Unfavourable – Bad	Unfavourable – Bad	Unfavourable – Bad	Unfavourable – Bad
Sh04	Formoyle	Favourable	Favourable	Favourable	Favourable
Sh12	Sheskin A	Unfavourable – Bad	Unfavourable – Bad	Unfavourable – Bad	Unfavourable – Bad
Sh13	Sheskin B	Favourable	Favourable	Favourable	Favourable
Sh14	Sheskin C	Favourable	Favourable	Favourable	Favourable
Sh19	Ox Mts C	Unfavourable – Bad	Unfavourable – Inadequate	Unfavourable – Inadequate	Unfavourable – Bad

3.7 National Conservation Assessment

The conservation status of *Saxifraga hirculus* at a national level was considered to be unchanged from the previous two reporting periods and was assessed as Favourable on all parameters, with stable short-term and long-term trends (Table 11).

Table 11 Summary of the conservation status assessment of *Saxifraga hirculus* for the period 2019–2024.

Parameter	Conservation Status	Trend	Future prospects
Range	Favourable	Stable	Good
Habitat for the Species	Favourable	Stable	Good
Population	Favourable	Stable	Good
Future prospects	Favourable		
Overall National Conservation Assessment	Favourable	Stable	

The Range (Figure 2) is reported as six occupied 10 km x 10 km grid cells, unchanged from the previous reporting period, as no expansion or contraction of range has occurred. One new population of *Saxifraga hirculus* was reported in 2023, but this is located in very close proximity to three other known populations, so does not extend the range. Although no rosettes were recorded at Sh12 Sheskin A, this population is still considered extant, subject to further monitoring. As this population is located in close proximity to two other populations, the loss of this population would have no impact on the range. The potential loss of the population at Sh03 Bellacorick, which is also showing signs of decline, would also be unlikely to change the range, due to the close proximity of most *S. hirculus* populations. The short-term trend is stable, as

no losses or gains in range have been recorded since the previous reporting period. Current range is equal to the Favourable Reference Range.

Combining the population estimates from the sites surveyed in 2023 and those surveyed between 2015 and 2018, the number of rosettes is estimated as 3,113,099. This figure is only marginally lower that reported in 2019, by 0.3%, as the largest populations, containing the majority of rosettes, were not surveyed in 2023, with the majority of the small decrease due to the decrease in population size reported at Sh19 Ox Mountains C. Therefore, the conservation status is assessed as Favourable on the Population parameter and the trend in Population is reported as stable, with the reported population approximately equal to the Favourable Reference Population. However, if only the populations surveyed in 2023 are taken into account, a 36% decrease in number of rosettes is indicated, with four out of six sites showing a decrease. This decrease cannot be extrapolated to the sites not surveyed in 2023.

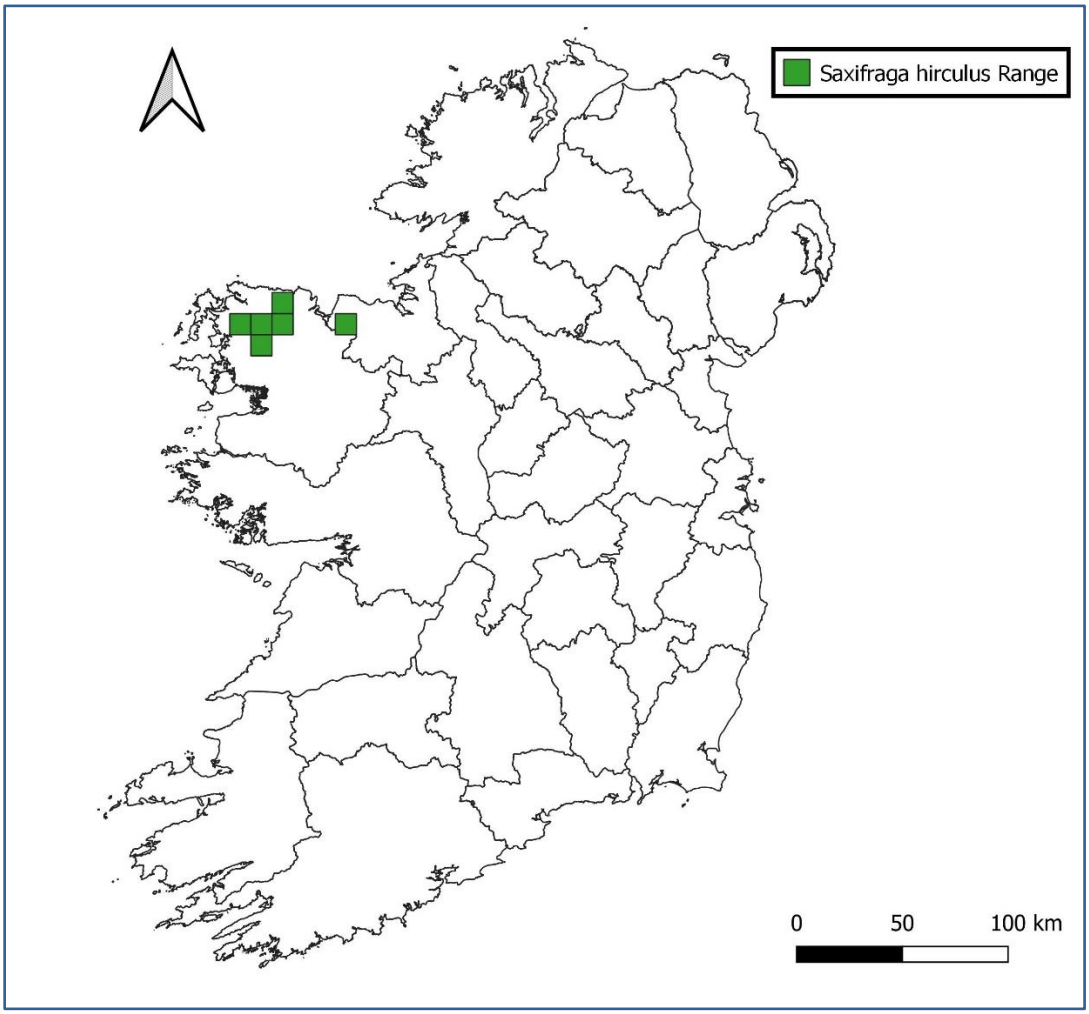

Figure 2 The Range of *Saxifraga hirculus* in Ireland, as at the end of 2023, represented by green grid squares.

Taking the assessments of the Habitat of the Species across all sites surveyed in 2023, three sites have improved in status from Unfavourable – Inadequate to Favourable, while the other three sites surveyed have remained of Unfavourable – Bad or Unfavourable – Inadequate status. However, this does not represent a significant increase in habitat quality and the improvement is either due to marginal improvements or differences in interpretation. Based on what little evidence is available, the condition of the habitat at the other sites is likely to be unchanged since 2019. Therefore, the Habitat for the species was assessed as Favourable and shows stable long and short-term trends.

Similarly, the Future prospects were assessed as Favourable. Pressures and threats acting on the populations were not deemed to be having a significant impact on a national scale and the species is expected to remain viable in the future. If the impacts of climate change intensify in the future and significantly change the hydrology of the habitat of *S. hirculus*, this assessment may change in future reporting periods.

3.8 Populations within and outside the SAC network

As populations of Annex II species within SACs, for which the species is listed as a Qualifying Interest (QI) have a greater level of protection than those outside SACs or within SACs for which they are not listed as QIs, it is important to report on the proportion of the national population within SACs that the species is listed as a QI for. The entirety of all extant *S. hirculus* populations are located within SACs.

4 Discussion

Although the national conservation status of *Saxifraga hirculus* was assessed as Favourable, the results of the survey undertaken in 2023 indicate that a slight decline may have taken place. However, as the survey covered only six out of 20 known populations, and with these populations (estimate 16,799) representing only 0.5% of the total population (estimate 3,113,099), the trends observed at the surveyed sites cannot be extrapolated to the remaining sites that were previously assessed as being of Favourable Conservation Status in 2019. Although two sites surveyed show an increase in rosette numbers, a decline was recorded at the remaining sites, with two populations, Sh03 Bellacorick and Sh12 Sheskin A, possibly on the brink of extinction. One rosette was recorded at Sh03 and no rosettes were found at Sh12. Very few flowering plants were recorded across the populations surveyed, with five out of six populations failing on the assessment of this criterion. The extent of occupancy has also declined at four out of the six sites surveyed. These results may represent an ongoing, and possibly accelerating, decline, or may be due to the timing of the survey during a year when weather trends resulted in poor growth of *S. hirculus*. The survey was carried out at the end of a very wet summer, which followed on from an atypically warm and dry summer, which may have caused stress to the populations and negatively impacted flowering and development of rosettes. With increasing climatic instability brought on by the impacts of climate change, it may also be that these populations will not recover in the future and these declines represent more than just fluctuations from year to year. The remaining sites, unsurveyed in 2023, which constitute the majority, have remained in Favourable Conservation Status since baseline surveys were established and over the last two Article 17 reporting cycles (2013 and 2019), largely due to the fact that *Saxifraga hirculus* occurs in remote semi-natural habitats that have been relatively unaffected by agricultural intensification or by developmental pressures. A wider monitoring survey and further research is needed to determine whether these sites are experiencing a similar decline or are likely to be impacted by climate change in the near future.

The two most important factors for maintaining populations of *S. hirculus* in good condition are appropriate grazing levels and suitable hydrology. If grazing levels are too low, then rank vegetation will dominate and outcompete *S. hirculus*, while if grazing levels are too high, flowering of *S. hirculus* will be suppressed, alongside other negative impacts resulting from overgrazing (O'Neill *et al.*, 2019). Therefore, a careful balance should be maintained to optimise grazing levels where *S. hirculus* occurs. Drainage and drying out of flushes is also a serious negative impact, both historical and ongoing. Suboptimal hydrology interacts with and exacerbates the impacts of insufficient grazing levels, as is particularly the case at the two sites where the largest declines have occurred, Sh03 Bellacorick and Sh12 Sheskin A.

As a large proportion of the individuals in *S. hirculus* populations are clonal, counts of the number of rosettes in a population does not give an accurate indication of the number of genetically distinct individuals present and may not be the most appropriate unit for measuring population size, as populations containing a large number of rosettes may only consist of a

small number of distinct genotypes (Finger *et al.*, 2024). Number of flowering individuals in a population is useful for assessing the ecology and reproductive state of a population, but the flowering season is short and flowering may vary significantly between years, and it does not provide a proxy for genetic diversity. Monitoring of the number of genetically distinct individuals may give the most accurate information on the true diversity of a population, and therefore its longer-term viability.

5 Conclusions and recommendations

The key priorities for the future conservation of a viable population of *Saxifraga hirculus* in Ireland are to halt the decline and prevent the extinction of the populations that are threatened and to maximise the resilience of the currently healthy populations to climate change and other threats that may become apparent in the future. It may already be too late to halt the decline of the population at Bellacorick, as the drainage that led to the initial damage to the population occurred over 60 years ago. However, as the population has persisted in the intervening period of time, with the number of rosettes present fluctuating to reach a much higher number less than 15 years ago (Muldoon, 2011), the introduction of targeted conservation grazing may maintain enough suitable habitat for the species to persist and once again expand its population. Mowing or scything of areas where the species was previously recorded may also produce results.

The quality of the habitat at Sheskin A may similarly be improved by introduction of targeted grazing or mowing, but its remote location makes such activities difficult to carry out successfully. As there are no obvious contributing factors to the poor condition of the hydrology at this site visible on the ground, hydrological investigations would be needed to assess whether there are any measures that can be taken to improve the hydrology of this flush and maximise its resistance to climate-induced drying out.

Hydrological investigations are also desirable at Ox Mountains C and the adjacent populations Ox Mountains A and B, to investigate the reasons for the dryness of the springhead where the Ox Mountains C population occurs and ascertain what impact the network of old drains and other potential sources of drying out may be having on the other two populations.

Monitoring methodologies should be reviewed, with two primary aims in mind. Firstly, it should be investigated whether it is viable to monitor genetic diversity within populations, as outlined in Finger *et al.* (2024), as a more accurate way of measuring true population size. The current measure of population size greatly overestimates the number of individuals present and potentially gives a false impression of the health of the population. Secondly, as hydrology is of such vital importance to *Saxifraga hirculus*, a more in-depth and detailed assessment of the hydrology of each site should be considered as part of the Habitat for the species assessment.

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7 Appendix 1 Site reports

Site name	Bellacorick	**Site number**	SH03
County	Co. Mayo	**SAC site code**	000466
Dates surveyed	15/08/2023	**Surveyors**	SP, GS
No. of rosettes	1	**Area of pop. envelope (m^2)**	1
No. of flowering heads	0	**No. of monitoring stops**	1

Site description

This is a large, densely vegetated flush with some runnels. Although it has much surface water with iron-rich flows it lacks short vegetation as 'rafts' or more extensive patches. *Carex rostrata, C. diandra, Comarum palustre*, *Holcus lanatus* and *Epilobium palustre* are all abundant and dense and the vegetation is too tall for *S. hirculus*, which has nearly disappeared. Dense banks of *Sphagnum fallax* and *S. girgensohnii* are prominent within the area where *S. hirculus* was found.

Changes from baseline

Since the population was last monitored, it has continued to decline, from 23 rosettes to 1. It is possible that other rosettes were overlooked in the dense vegetation but there is little doubt that *S. hirculus* is on the brink of extinction at this site.

Management notes

Oweninny Windfarm construction Phase II has been completed recently. The flush remains very wet but it appears to have had negligible grazing during the windfarm construction period and possibly longer than that. The vegetation is now too tall and dense to support *S. hirculus*.

Management recommendations

Remedial action is needed to prevent the loss of *S. hirculus* from this site. It is recommended that the flush is fenced off temporarily while sheep are introduced immediately to hard-graze the vegetation and open it up. Cutting may also be used to reduce the vegetation height, but it is a very wet and fragile site and hand-cutting/scything would be needed, followed by careful removal of arisings by hand. Once the vegetation height has been successfully lowered, the fence should be removed and sheep allowed to graze lightly in the windfarm/area around the flush.

Other notable species

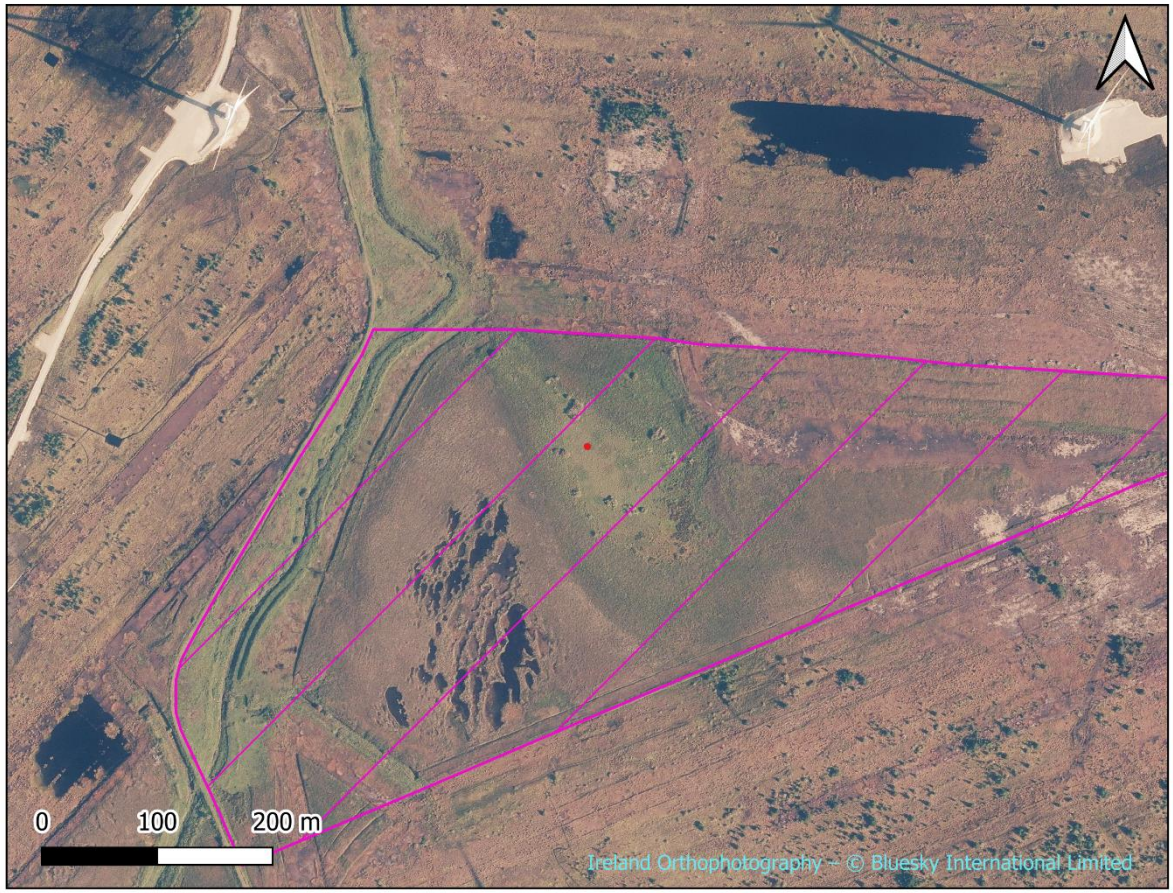
None.

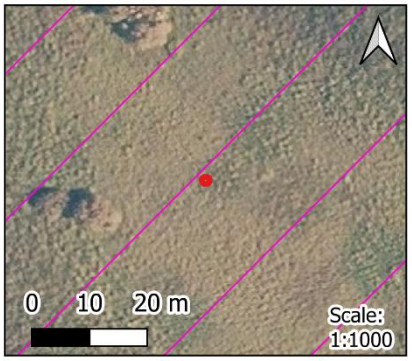
Impact Code/Description	**Influence**	**Intensity**	**% Habitat impacted**
PA08 Under-grazing by livestock	Negative	High	100
PH07 Intrusive and destructive research and monitoring activities	Negative	Low	25

Conservation measure code	**Conservation measure description**
MA04	Reinstate appropriate agricultural practices to address abandonment i.e. cutting and grazing.
MC07	Restore habitat damaged due to installation of renewable energy infrastructure by urgent reinstatement of livestock grazing.

Figure 1 View across flush containing *Saxifraga hirculus* at Bellacorick.

Figure 2 Habitat of *Saxifraga hirculus* at Bellacorick.





Legend:

Population extent

Bellacorick Iron Flush SAC

Project:

Article 17 monitoring 2023

Map Title:

Saxifraga hirculus population Sh03 Bellacorick

Surveyor Initials:

SP GS

Projection: IRENET95 / Irish Transverse Mercator	**Scale of main map @ A4;** 1:5,000
Drawn by: KMN	**Date:** 15/10/2024

Site name	Formoyle	**Site number**	Sh04
County	Mayo	**SAC site code**	001922
Dates surveyed	22/08/2023	**Surveyors**	RH, JD
No. of rosettes	835	**Area of pop. envelope (m^2)**	37
No. of flowering heads	6	**No. of monitoring stops**	2

Site description

Saxifraga hirculus occurs on the eastern side of a narrow channel within a broad extensive and very wet fen amongst a lowland blanket bog complex. The vegetation is akin to transition mire, with a high cover of *Carex* species and is influenced by the minerals carried in the adjacent channel, as it is different in character to the rest of the fen and hosts a number of species not found elsewhere within the fen. The entire area is very wet underfoot, with 10 cm or more of standing water throughout after a very wet summer.

Changes from baseline

There seems to be a smaller area occupied than previously, no plants were found in upper part, but the site was very wet and waterlogged after a very wet summer, so that may be a factor. Little sign was seen of heavy grazing. The heavy grazing recorded previously may have been an isolated incident. The height of the sward is significantly higher than that recorded previously, but as the habitat is very wet, this vegetation is not very dense, so the sward height should not be an issue for *S. hirculus*.

Management notes

Current light grazing, with occasional animals passing through, seems ideal. If grazing levels were increased significantly, or if grazing were to cease, the population may be negatively impacted, as the very wet nature of the site makes it very sensitive to poaching and trampling.

Management recommendations

Grazing levels should be maintained as is, with occasional passage of cattle to keep the habitat open.

Other notable species

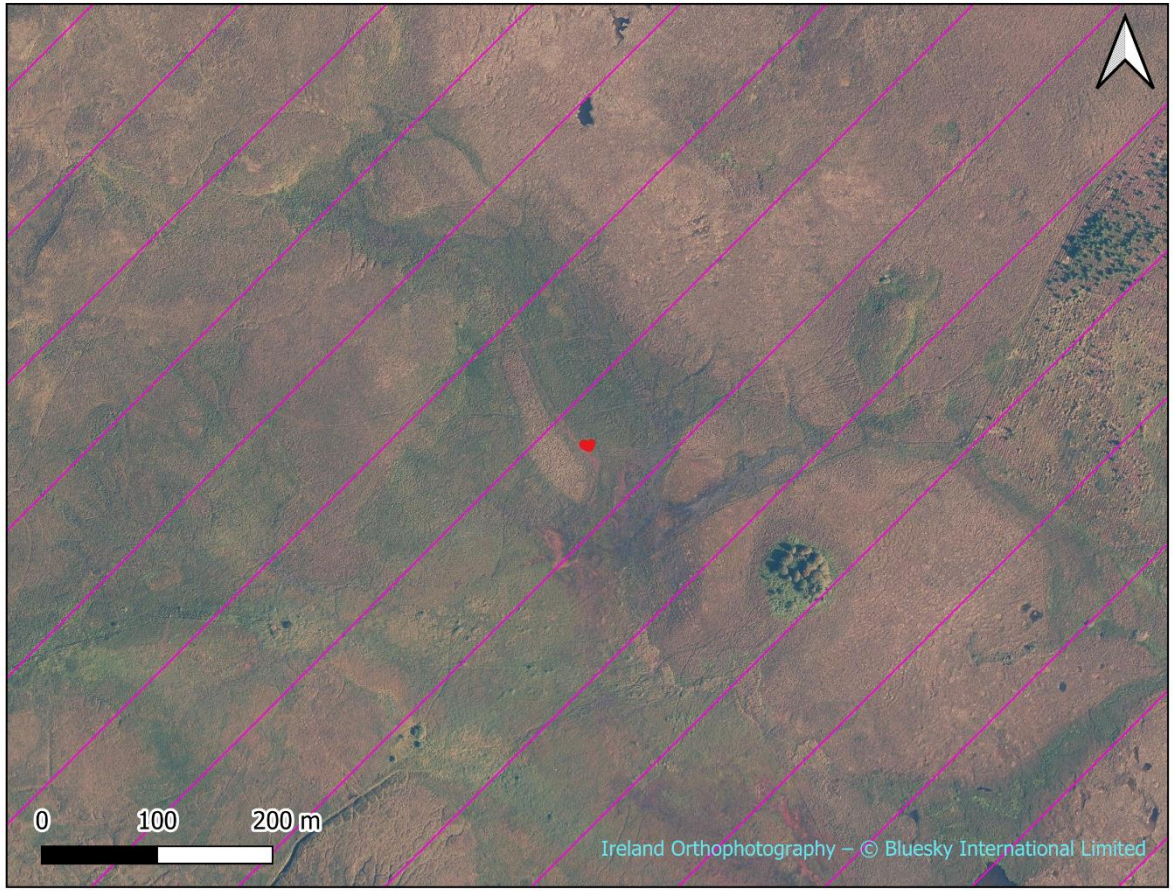
Paludella squarrosa was seen in two locations in the flush, one patch 40 x 20 cm solid with scattered shoots around. *Tomenthypnum nitens, Sphagnum warnstorfii* and *Hammarbya paludosa* were also seen within the fen.

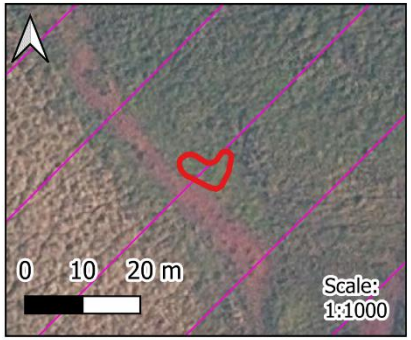
Impact Code/Description	**Influence**	**Intensity**	**% Habitat impacted**
PA08 Extensive grazing	+	L	100

Conservation measure code	**Conservation measure description**
MA03	Maintain grazing regime as is

Figure 1 View across fen at Formoyle, with *Saxifraga hirculus* occurring alongside the open channel on the right.

Figure 2 View of vegetation within which *Saxifraga hirculus* occurs at Formoyle.





Legend:

Population extent

Bellacorick Bog Complex SAC

Project:

Article 17 monitoring 2023

Map Title:

Saxifraga hirculus population Sh04 Formoyle

Surveyor Initials:

RH JD

Projection: IRENET95 / Irish Transverse Mercator	**Scale of main map @ A4;** 1:5,000
Drawn by: KMN	**Date:** 10/10/2024

Site name	Sheskin A	**Site number**	SH12
County	Co. Mayo	**SAC site code**	001922
Dates surveyed	14/08/2023	**Surveyors**	SP, GS
No. of rosettes	0	**Area of pop. envelope (m^2)**	0
No. of flowering heads	0	**No. of monitoring stops**	0

Site description

This small flush has much less surface water than others supporting populations of *S. hirculus* nearby (SH13, SH14). It is visited frequently by deer and there is a well-used wallow at the upper end. Its vegetation is structurally variable, with significant patches of muddy, sparsely vegetated ground created by deer poaching. This flush supports abundant *Molinia*, with *Carex rostrata* and *Juncus effusus* and most of it is too tall and rank for *Saxifraga hirculus*. A few small patches of shorter open vegetation remain although *Holcus lanatus* is frequent and the ground generally looks quite dry.

Changes from baseline

No rosettes were found, despite careful searching.

Management notes

Deer appear to be the only vectors of management at this site and although some grazing is evident, they have had little impact on the tall and dense vegetation. As noted in 2017, the habitat has little surface water and is probably too dry for *S. hirculus*.

Management recommendations

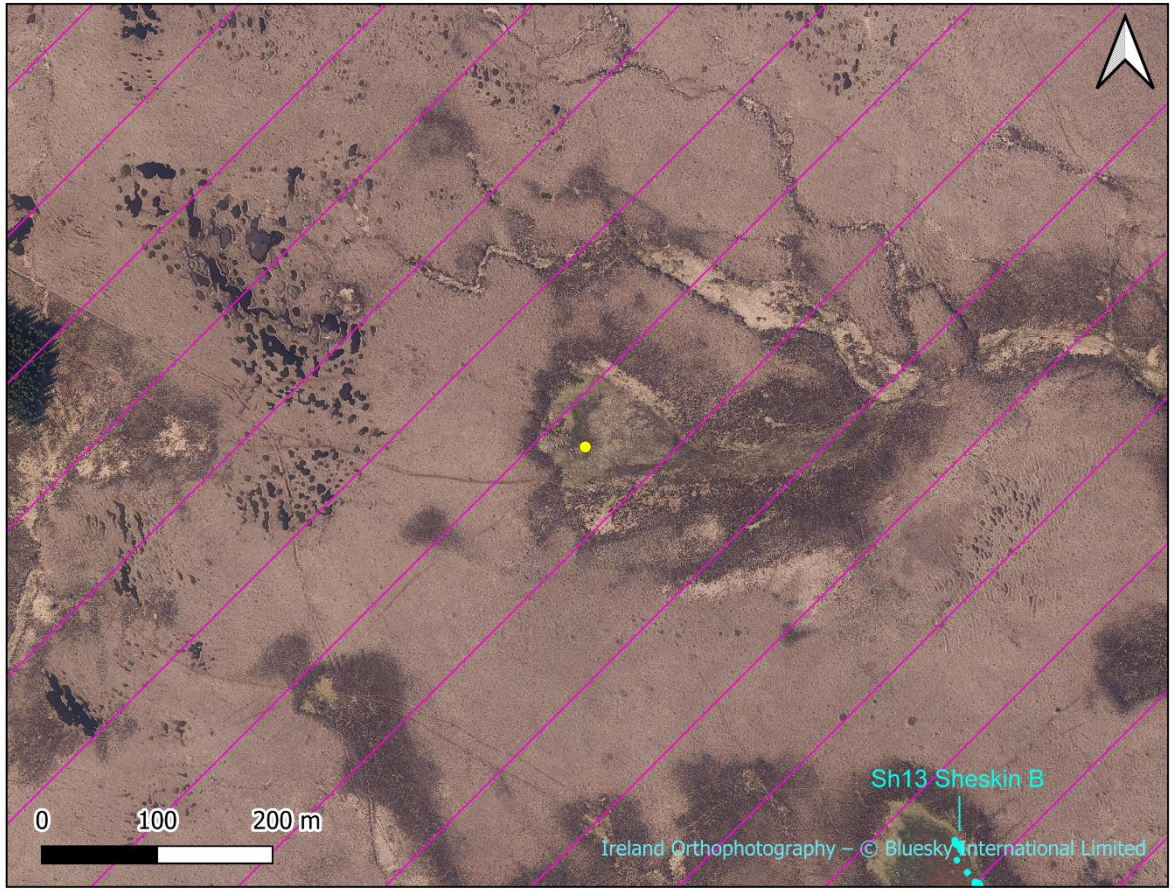
S. hirculus has been in decline at this site and appears to have now been lost, most likely because of the effects of low/reduced groundwater flows. There are no obvious drains or activities nearby that might be causing this. Climate change may be a significant factor influencing local hydrology and there is little that can be recommended to mitigate its impacts.

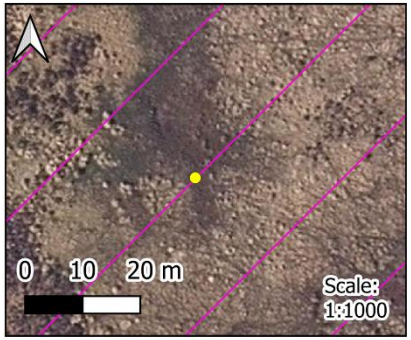
Other notable species

None.

Impact Code/Description	Influence	Intensity	% Habitat impacted
PA05 abandonment of management	Negative	Low	100
PJ01 temperature changes and extremes due to climate change	Negative	Low	100
PM07 Natural processes without direct or indirect influence from human activities or climate change	Positive	Moderate	15
PJ03 changes in precipitation regimes due to climate change	Negative	Low	100
PJ14 other climate related changes in abiotic conditions: groundwater flow changes	Negative	Moderate	100

Conservation measure code	Conservation measure description
None	





Legend:

- Previous records
- Other population extents
- Bellacorick Bog Complex SAC

Project:

Article 17 monitoring 2023

Map Title:

Saxifraga hirculus population Sh12 Sheskin A (none recorded in 2023)

Surveyor Initials:

SP GS

Projection: IRENET95 / Irish Transverse Mercator	**Scale of main map @ A4;** 1:5,000
Drawn by: KMN	**Date:** 10/10/2024

Site name	Sheskin B	**Site number**	SH13
County	Co. Mayo	**SAC site code**	001922
Dates surveyed	14/08/2023	**Surveyors**	SP, GS
No. of rosettes	2,075	**Area of pop. envelope (m^2)**	83
No. of flowering heads	7	**No. of monitoring stops**	3

Site description

This is a large, very wet flush on a south-east facing slope. It supports a strong population of *S. hirculus* which is confined to its upper eastern edge where water flows are rich in iron. The rosettes are scattered but the majority are concentrated in the lower (southern) part of the population envelope. The area that supports it is very wet, soft and inevitably damaged by monitoring footfall. The habitat has much open water and is sparsely vegetated with *Carex rostrata*, *C. nigra*, *Eriophorum angustifolium* and *Juncus acutiflorus*. Rosettes of *S. hirculus* are typically found on small rafts of vegetation in the wettest areas.

Changes from baseline

No significant changes, although the 2017 assessment reported the largest numbers of rosettes at the very northern end of the population envelope, where only a few were found in 2023. The vegetation height is lower than in the previous assessment and deer grazing is maintaining adequate open habitat.

Management notes

The site is grazed by wild deer at appropriate levels, with no sign of any sheep or other livestock. There is little poaching. The population of *S. hirculus* appears to be healthy and thriving.

Management recommendations

Light grazing by sheep would also help to maintain low vegetation; however this is an unlikely proposition in such a remote location and the area that supports *S. hirculus* is so wet that livestock would almost certainly avoid it in favour of more accessible vegetation.

Other notable species

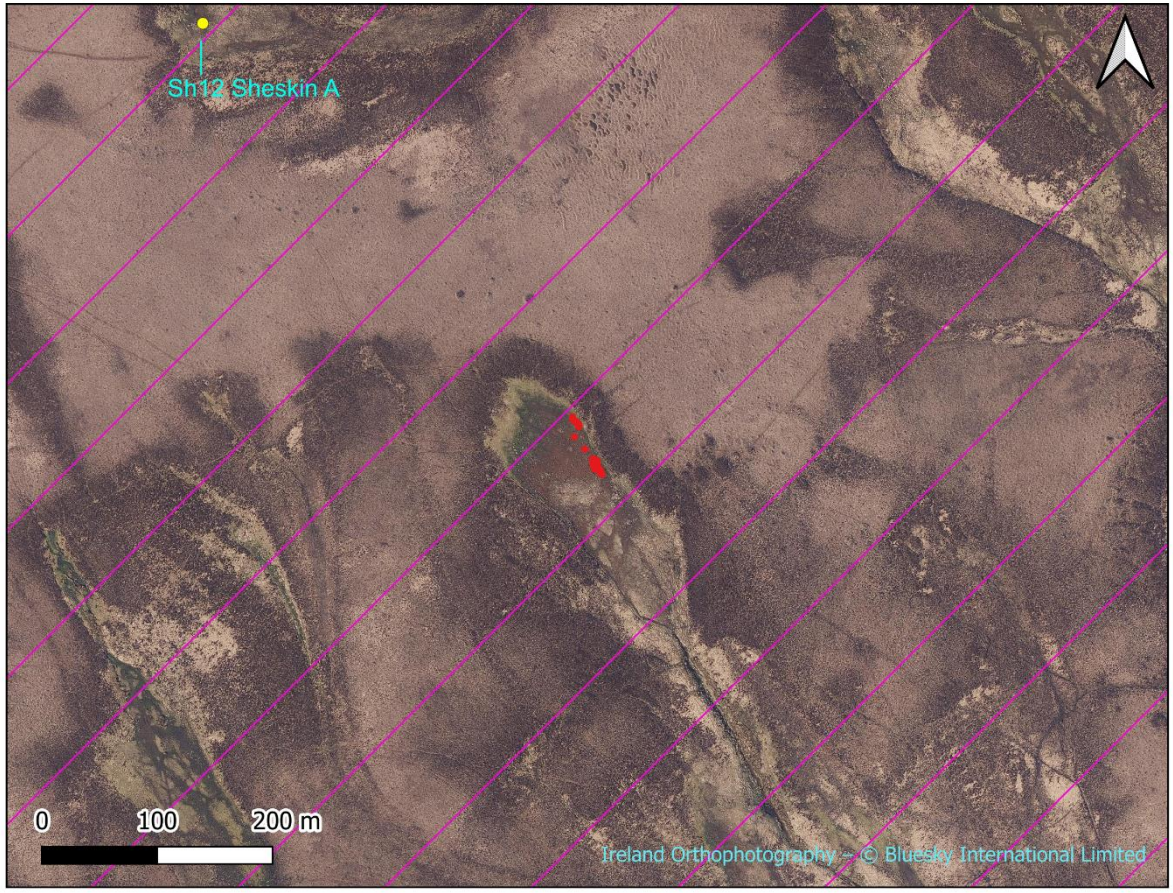
Tomentypnum nitens (Plot 2)

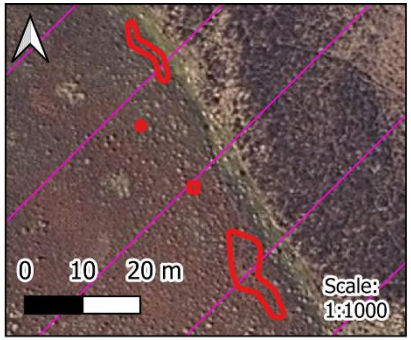
Impact Code/Description	**Influence**	**Intensity**	**% Habitat impacted**
PA05 abandonment of management	Negative	Low	100
PH07 Intrusive and destructive research and monitoring activities	Negative	High	15
PM07 Natural processes without direct or indirect influence from human activities or climate change i.e. deer browsing	Positive	Moderate	10

Conservation measure code	**Conservation measure description**
None	

Figure 1 View across flush with *Saxifraga hirculus* at Sheskin B.

Figure 2 Habitat of *Saxifraga hirculus* at Sheskin B.





Legend:

- Population extent
- Previous records
- Bellacorick Bog Complex SAC

Project:

Article 17 monitoring 2023

Map Title:

Saxifraga hirculus population Sh13 Sheskin B

Surveyor Initials:

SP GS

Projection: IRENET95 / Irish Transverse Mercator	**Scale of main map @ A4;** 1:5,000
Drawn by: KMN	**Date:** 10/10/2024

Site name	Sheskin C	**Site number**	SH14
County	Co. Mayo	**SAC site code**	001922
Dates surveyed	14/08/2023	**Surveyors**	SP, GS
No. of rosettes	13,153	**Area of pop. envelope (m^2)**	239
No. of flowering heads	6	**No. of monitoring stops**	5

Site description

The population of *S. hirculus* is locally abundant along the central axis of a narrow iron-rich neutral flush. This habitat is very wet, soft and easily damaged by monitoring footfall. Rosettes are mainly confined to numerous small rafts of short vegetation in areas where there is much open water. Few of the plants have flowers or fruits. The population does not extend to the drier margins of the flush, which are dominated by *Sphagnum fallax*, nor south of a point where the flush becomes more acid, as indicated by increasingly abundant *S. fallax*, *Aulacomnium palustre* and *Potamogeton polygonifolius*.

Changes from baseline

The distribution of rosettes within the population envelope has contracted a little, especially at the upper end of the flush, which is quite poached.

Management notes

The flush is grazed by wild deer, with no sign of any sheep or other livestock. The deer have also heavily poached the ground at the upper end of the flush.

Management recommendations

The population appears to be thriving at this site and there are no recommendations.

Other notable species

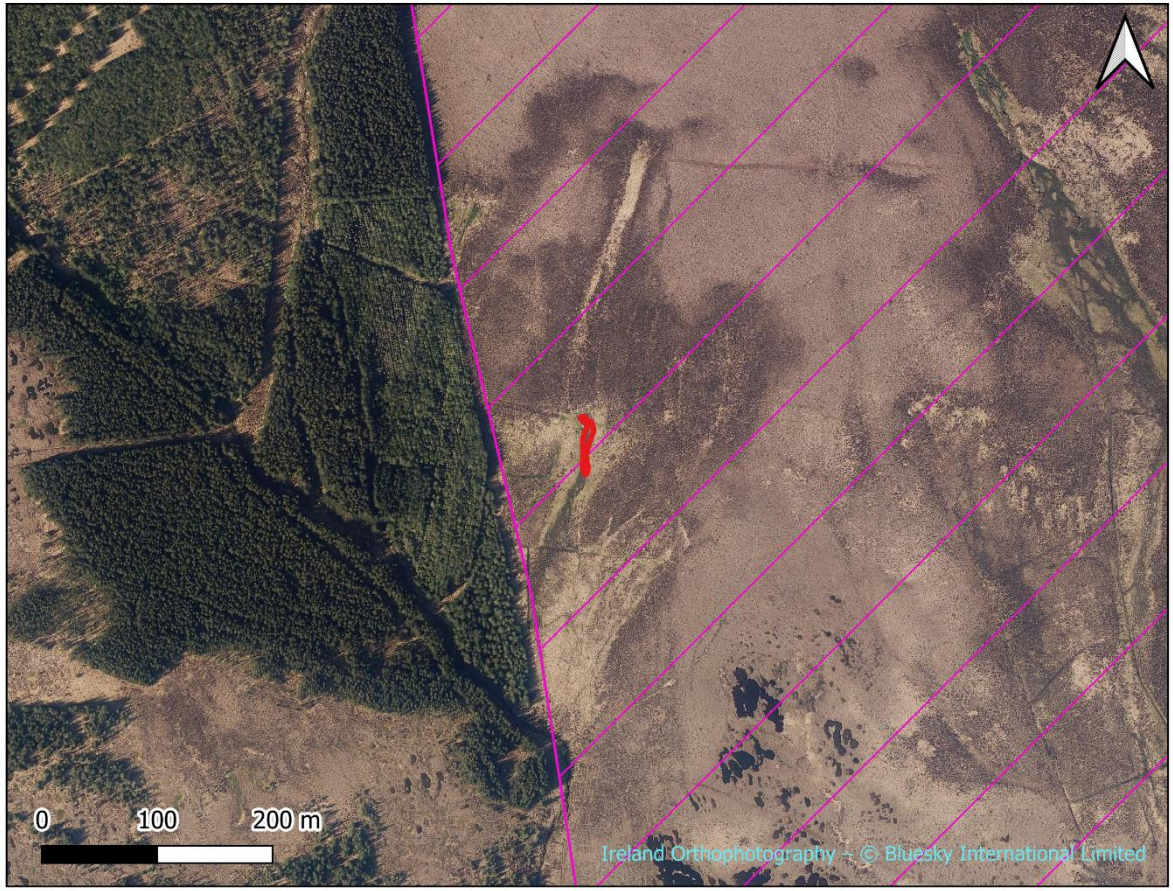
None.

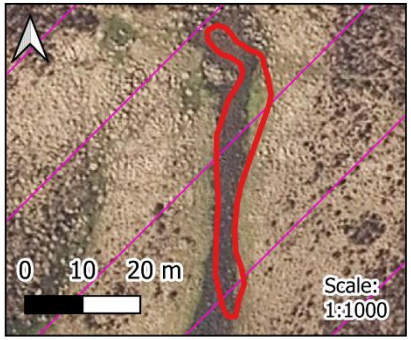
Impact Code/Description	**Influence**	**Intensity**	**% Habitat impacted**
PA05 abandonment of management	Negative	Low	100
PH07 Intrusive and destructive research and monitoring activities	Negative	Low	25
PM07 Natural processes without direct or indirect influence from human activities or climate change i.e. deer browsing	Positive	Medium	70

Conservation measure code	**Conservation measure description**
None.	

Figure 1 Very wet flush at Sheskin C within which *Saxifraga hirculus* occurs.

Figure 2 View of habitat in which *Saxifraga hirculus* occurs, illustrating its vulnerability to trampling.





Legend:

Population extent

Bellacorick Bog Complex SAC

Project:

Article 17 monitoring 2023

Map Title:

Saxifraga hirculus population Sh14 Sheskin C

Surveyor Initials:

SP GS

Projection: IRENET95 / Irish Transverse Mercator	**Scale of main map @ A4;** 1:5,000
Drawn by: KMN	**Date:** 10/10/2024

Site name	Ox Mts C	**Site number**	SH19
County	Sligo	**SAC site code**	002006
Dates surveyed	21/08/2023	**Surveyors**	RH, JD
No. of rosettes	735	**Area of pop. envelope (m^2)**	6
No. of flowering heads	2	**No. of monitoring stops**	1

Site description

This site is located within a series of springheads and flushes gently sloping into a river valley within a broad area of lowland blanket bog. These flushes support three populations of *Saxifraga hirculus*, of which this is the smallest. The population occurs on a small domed and relatively dry grassy springhead, surrounded by rushy flushes. *S. hirculus* occurs as numerous rosettes over a small area, with some dense patches. Flowering heads were rare at the time of survey.

Changes from baseline

This population already covered only a small area, but it is contracted from the previous survey to cover only an area of ca. 2 x 2.5 m, with dense growth of rosettes over a small area. Grazing levels seem to be lower than previously recorded and are currently closer to suitable levels for *S. hirculus*, but still slightly too high and possibly impacting flowering and development of rosettes. The springhead is still drier than this habitat typically should be.

Management notes

Grazing levels are moderate and perhaps impacting flowering, but overall seem to be slightly lower than previous. An old drainage ditch leading away from the springhead, and a network of ditches surrounding the flush complex, may be responsible for the dryness of the habitat. It is also possible that nearby wind turbines and associated infrastructure, especially a wooden electricity pole directly downslope of these flushes are altering the hydrology of this springhead and the adjacent flushes which contain larger populations of *S. hirculus* and other important rare species.

Management recommendations

The ditches around this springhead and adjacent flushes should be blocked to reverse the impacts of drying out that occurred before this rich flush and spring complex was first documented in 2012. Hydrological investigations should be carried out to investigate the impacts of the recently constructed adjacent windfarm and associated infrastructure on this and adjacent populations and other rare species present in the vicinity. A moderate reduction in grazing may be beneficial for this population.

Other notable species

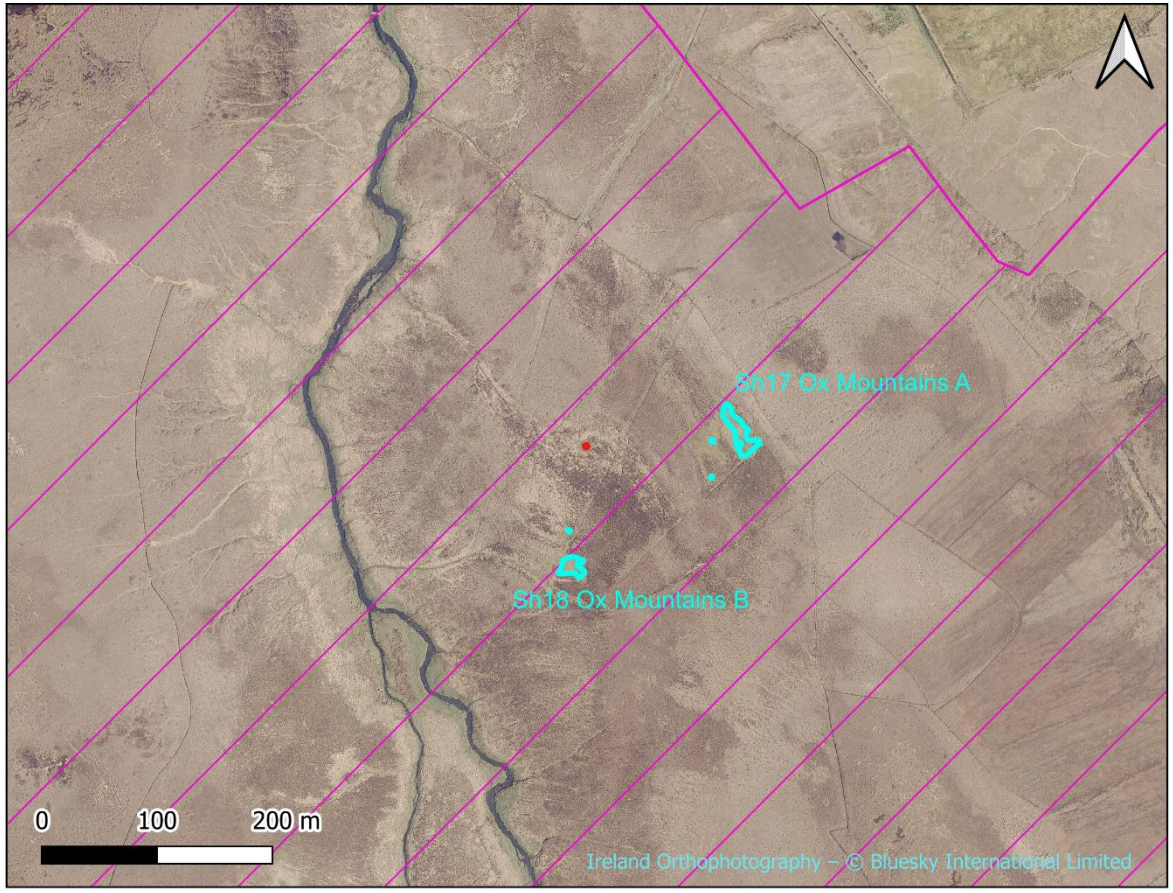
Tomethypnum nitens

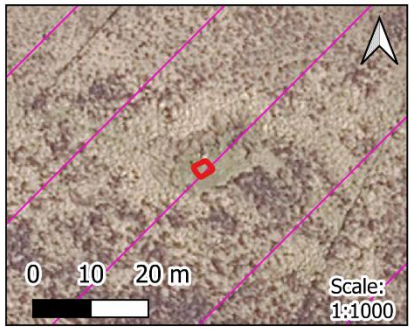
Impact Code/Description	**Influence**	**Intensity**	**% Habitat impacted**
PL02 Drainage	-	H	100
PA07 Overgrazing by sheep	-	M	100

Conservation measure code	**Conservation measure description**
MA05	Reduce grazing levels slightly
MK03	Block drains and restore water table to appropriate levels
MK05	Conduct hydrological investigations of impact of adjacent windfarm construction

Figure 1 View of location of population of *Saxifraga hirculus* at Ox Mountains C, with the extent marked out by string and tape.

Figure 2 Habitat of *Saxifraga hirculus,* rosettes are scattered through relatively dry habitat.





Legend:

- Population extent
- Other population extents
- Ox Mountains Bogs SAC

Project:

Article 17 monitoring 2023

Map Title:

Saxifraga hirculus population Sh19 Ox Mountains C

Surveyor Initials:

RH JD

Projection: IRENET95 / Irish Transverse Mercator	**Scale of main map @ A4;** 1:5,000
Drawn by: KMN	**Date:** 15/10/2024

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