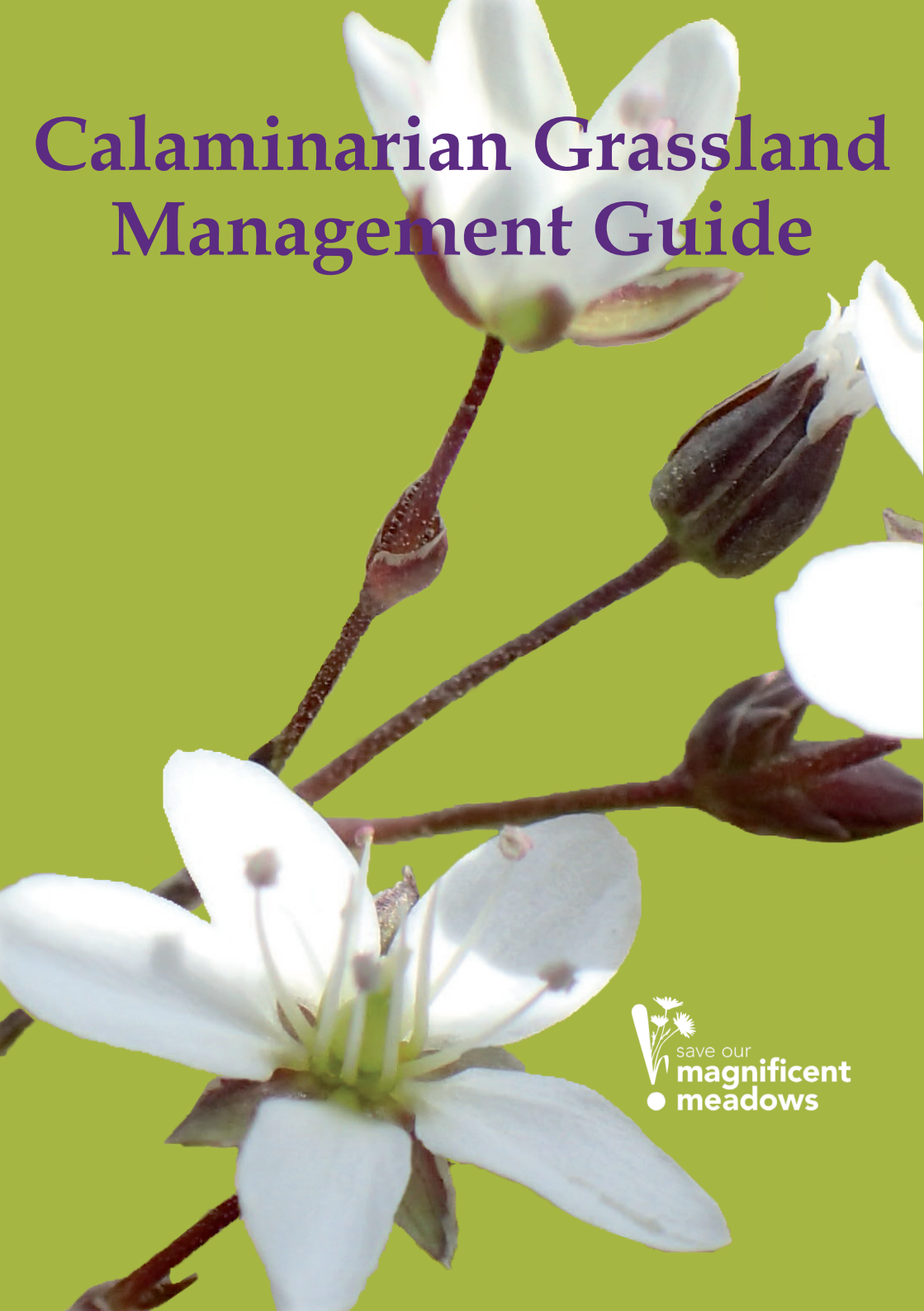
Calaminarian Grassland Management Guide



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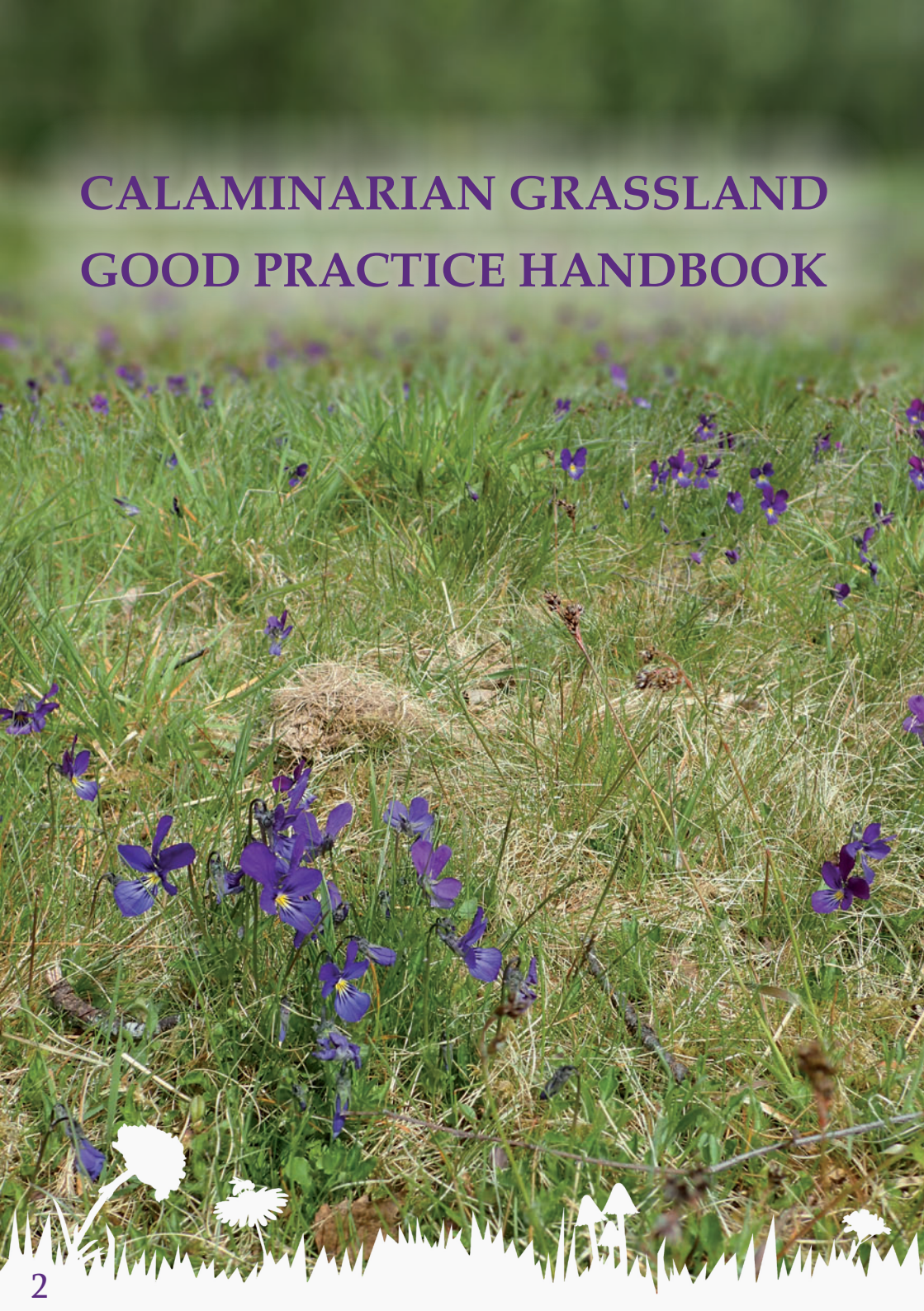
CALAMINARIAN GRASSLAND GOOD PRACTICE HANDBOOK



Acknowledgments

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Plantlife

The Wildlife Trusts Northumberland

Naomi Waite
February 2017

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Introduction

The aim of this booklet is to provide a concise source of information on calaminarian grassland and to advise on current management techniques. It is expected that this booklet will be periodically updated.

This booklet has been produced as part of the Save our Magnificent Meadows project.

Save Our Magnificent Meadows is the UK's largest partnership project transforming the fortunes of vanishing wildflower meadows, grasslands and wildlife.

Save Our Magnificent Meadows has:

Targeted just under 6,000 hectares of wildflower meadows and grasslands in nine strategic landscapes across the UK. Given people all over the UK the chance to visit, enjoy and learn about our wildflower meadows and grasslands. Raised awareness of the desperate plight of wildflower meadows and grasslands and equipped communities with the knowledge and skills to reverse this devastating trend.

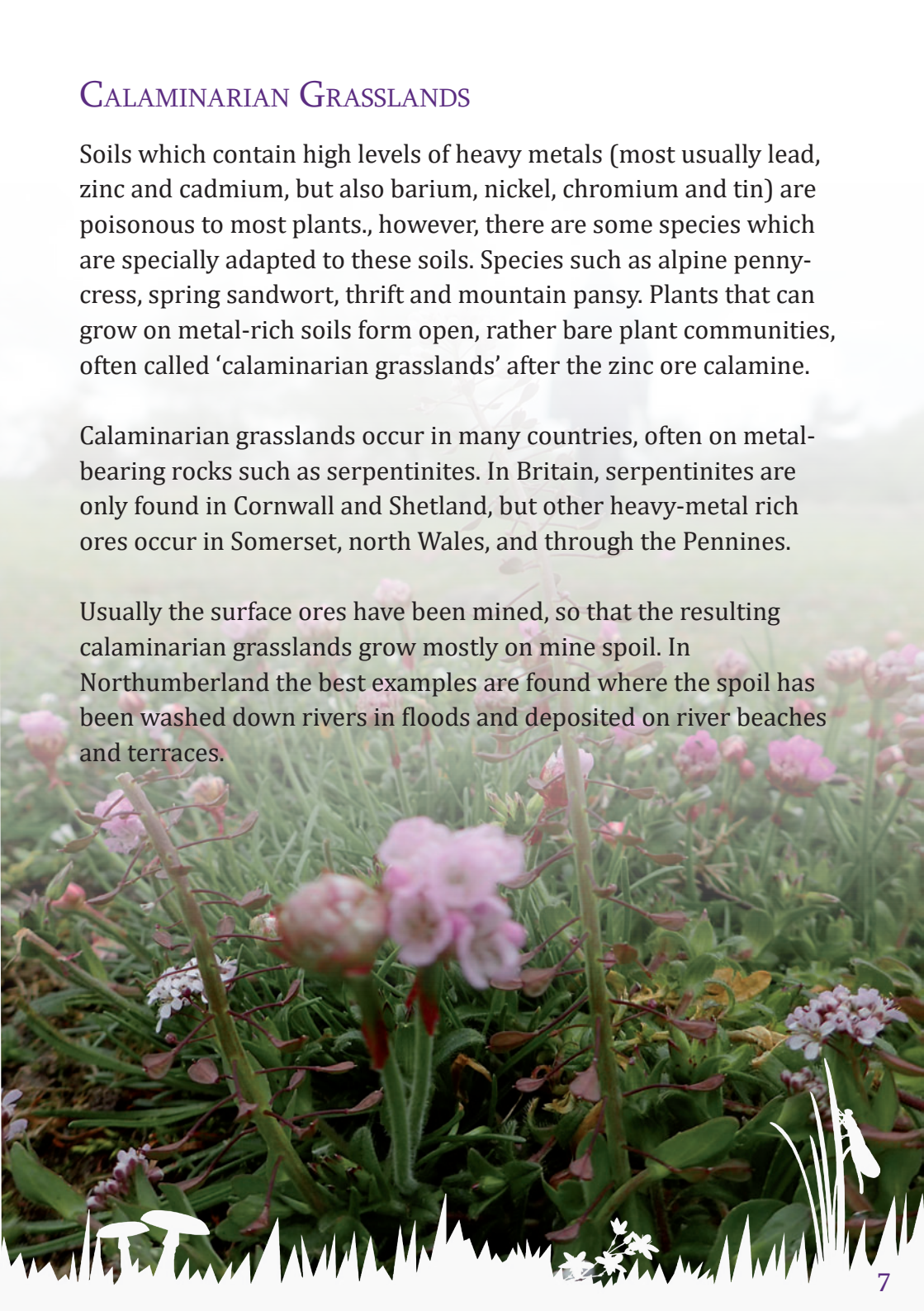
Led by Plantlife, the partnership is made up of 11 organisations and is primarily funded by the Heritage Lottery Fund.

Calaminarian Grasslands

Soils which contain high levels of heavy metals (most usually lead, zinc and cadmium, but also barium, nickel, chromium and tin) are poisonous to most plants., however, there are some species which are specially adapted to these soils. Species such as alpine penny-cress, spring sandwort, thrift and mountain pansy. Plants that can grow on metal-rich soils form open, rather bare plant communities, often called 'calaminarian grasslands' after the zinc ore calamine.

Calaminarian grasslands occur in many countries, often on metal-bearing rocks such as serpentinites. In Britain, serpentinites are only found in Cornwall and Shetland, but other heavy-metal rich ores occur in Somerset, north Wales, and through the Pennines.

Usually the surface ores have been mined, so that the resulting calaminarian grasslands grow mostly on mine spoil. In Northumberland the best examples are found where the spoil has been washed down rivers in floods and deposited on river beaches and terraces.

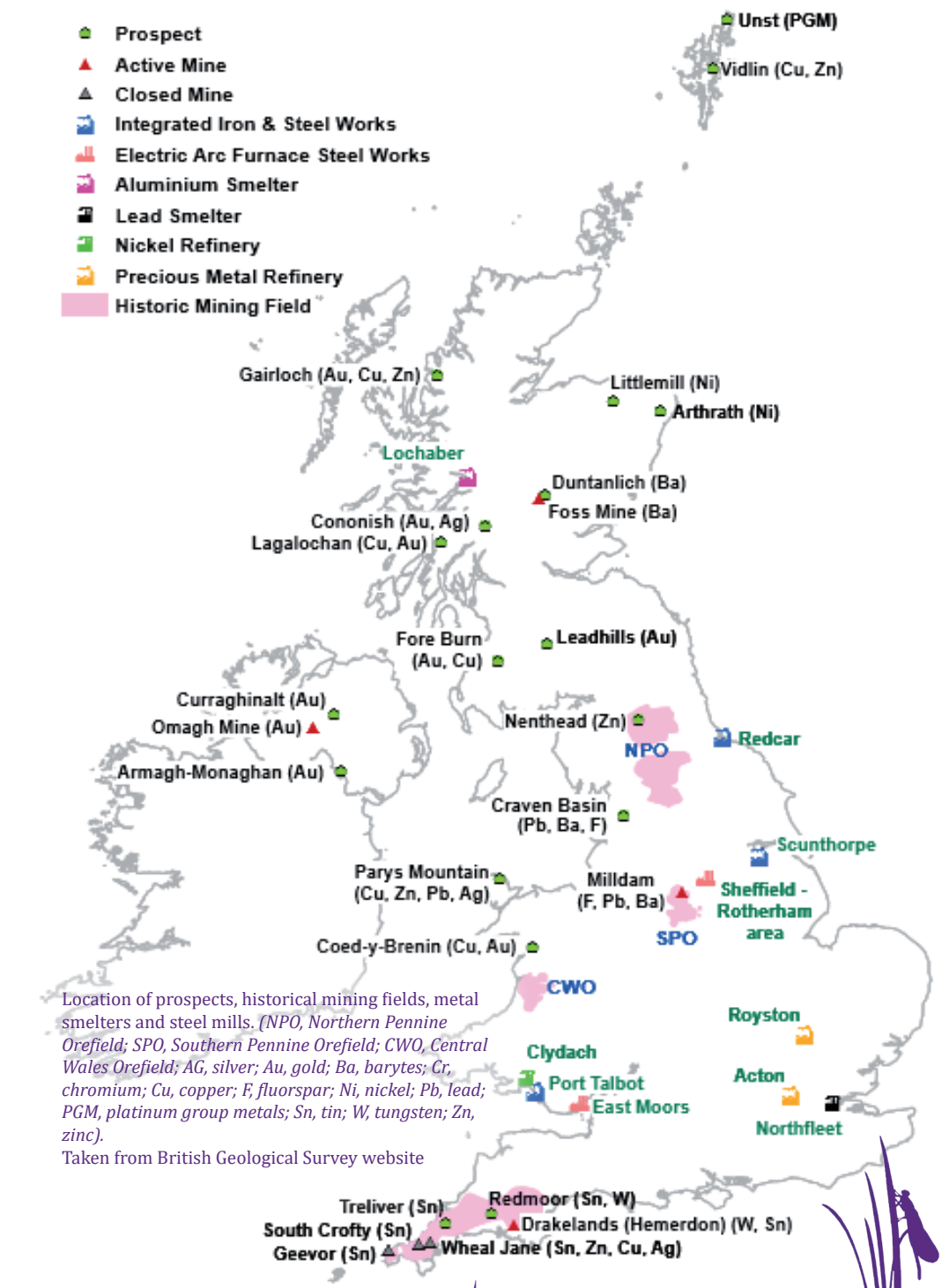


History

A large proportion of Britain's calaminarian grassland has been a by-product of metal mining.

Metal mining has only taken place in a small number of areas in Britain, concentrated mostly in Scottish Highlands, central Wales and the Pennines where much of metalliferous mineralisation occurred. Extraction of metallic ores was at its peak during early to mid-19th century and the establishment of many of today's calaminarian grasslands occurred shortly afterwards.

Where naturally occurring vein deposits of ores (e.g. galena and sphalerite) were found, heavy metals such as, lead, silver, zinc and copper were mined. The metals were extracted by crushing the rock to a fine particle size that was then subjected to froth flotation or leaching. As a result of this process the pollution from contaminated minewater and sediments entered watercourses. During periods of flooding, these watercourses then deposited contaminated alluvium creating shingle bars on which calaminarian grassland established.



Location of prospects, historical mining fields, metal smelters and steel mills. *(NPO, Northern Pennine Orefield; SPO, Southern Pennine Orefield; CWO, Central Wales Orefield; AG, silver; Au, gold; Ba, barytes; Cr, chromium; Cu, copper; F, fluorspar; Ni, nickel; Pb, lead; PGM, platinum group metals; Sn, tin; W, tungsten; Zn, zinc).*
Taken from British Geological Survey website

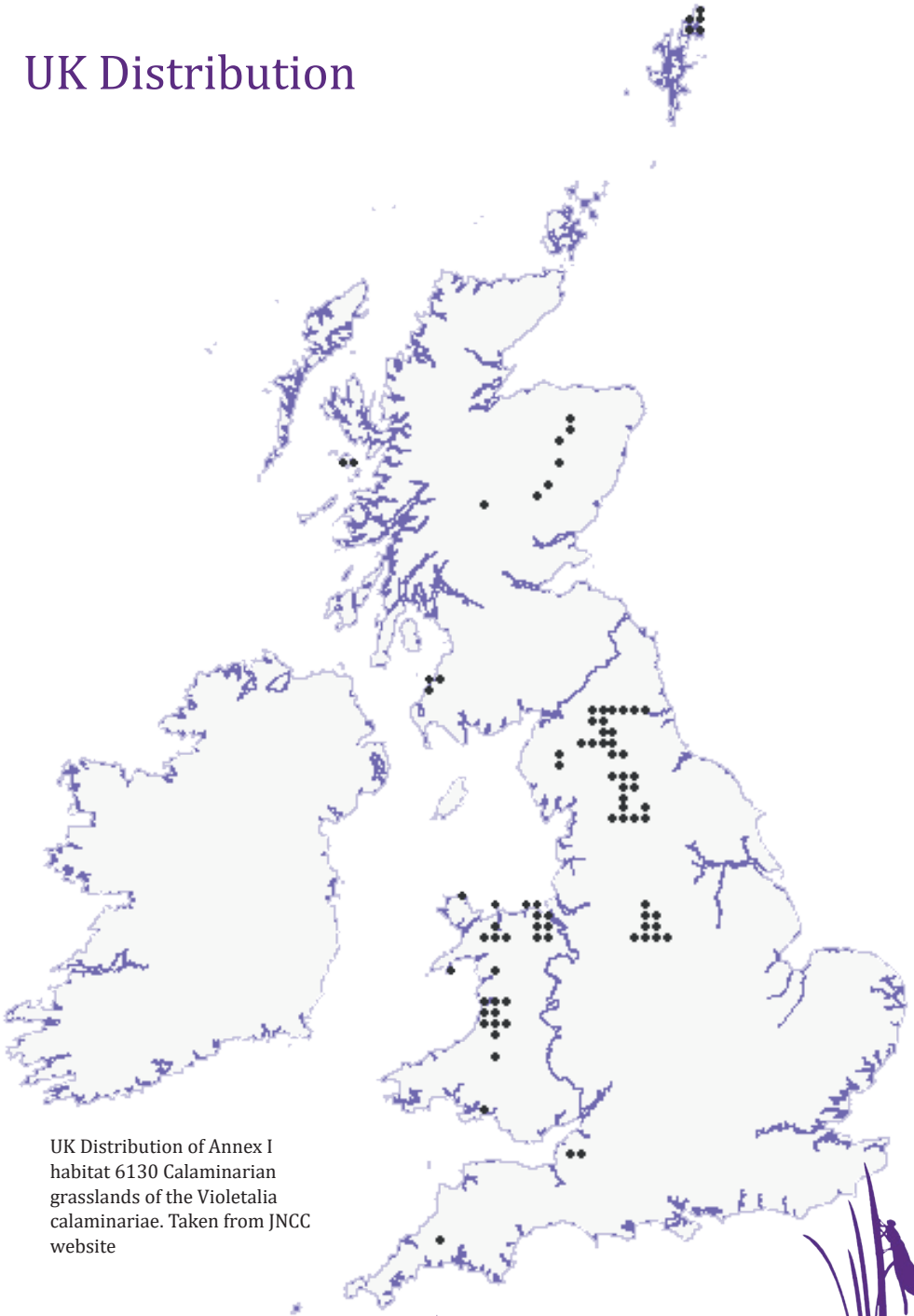
Distribution of Calaminarian Grasslands

JNCC state that there is no comprehensive data on the UK extent of calaminarian grassland; however they have produced an estimate using National Vegetation Classification and Phase 1 surveys undertaken over 15-20 years. They estimate there are approximately 450ha of calaminarian grassland across the UK, with the majority being found in England, particularly the Pennines, and Scotland.

In Northumberland calaminarian grassland is almost entirely associated with the South Tyne, Tyne and the West Allen rivers in the south western part of the county and largely within the North Pennines AONB. Under 40ha of calaminarian grassland remain in the county in 27 sites.

Outside the UK, calaminarian grassland is rare, but occurs in Belgium, Germany, northern France, and serpeninite grasslands are widespread in northern Greece.

UK Distribution



UK Distribution of Annex I habitat 6130 Calaminarian grasslands of the Violetalia calaminariae. Taken from JNCC website

Metallophytes

Plants that grow on calaminarian grasslands are small and grow slowly. These 'metallophyte' plants have evolved tolerance to the poisonous metals, and some are even 'metal miners', accumulating zinc and nickel which discourages pests. For instance, Alpine Penny-cress can contain 4% nickel when dried (more than many ores!) and is avoided by slugs unless grown in 'normal' soils, when it is quickly devoured!

Because 'metallophytes' are small and slow-growing, some such as Alpine Penny-cress, Spring Sandwort, Mountain Pansy, Pyrenean Scurvy-grass and Thrift are also found as mountain plants, and are otherwise quite rare. Other plants typical of calaminarian grasslands are otherwise found mostly in limestone grassland, for instance Thyme, Common Milkwort, Harebell and Kidney Vetch. Remarkably, the Dune Helleborine orchid, otherwise only known from western sand-dunes, has made itself at home on many calaminarian sites, where birch scrub has invaded river gravels. Such sites are also home to a distinctive race of Bladder Campion which is also known from the same habitat on Belgium and Germany.

Calaminarian grasslands are also important lichen habitats. In 2011, Janet Simkin recorded up to 25 species per square metre, with many metallophyte and nationally scarce or rare species, such as *Peltigera vernosa*. Alongside lichens, exposed stone and contaminated sediments may be covered by a soil crust of blue-green algae (cyanobacteria) which fix nitrogen and help to ameliorate the habitat.

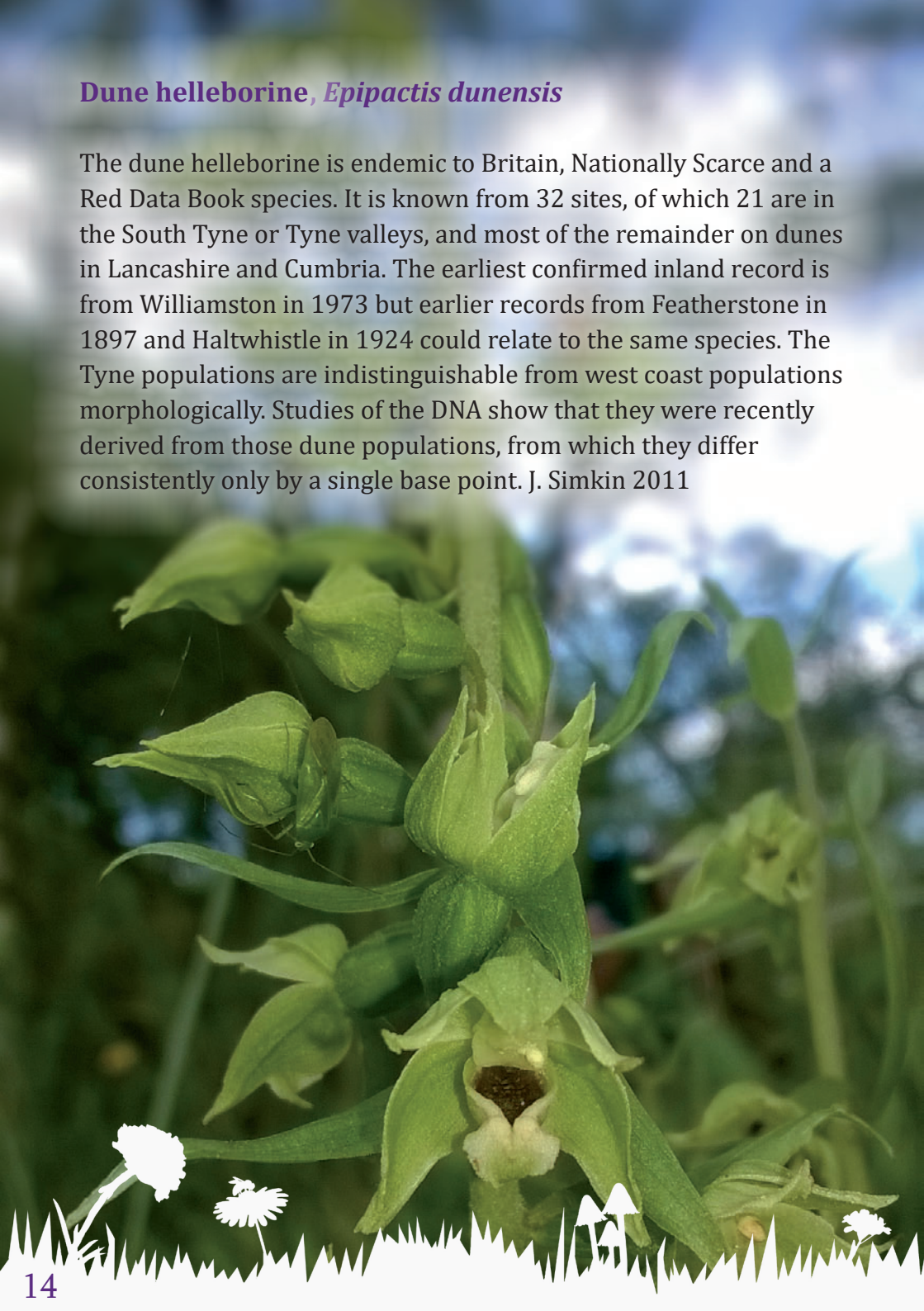
Key Species

Alpine penny-cress, *Noccaea caerulescens*

Alpine penny-cress is Nationally Scarce. It hyper-accumulates zinc and cadmium, to concentrations of 4% zinc and 0.01% cadmium in the shoot. Other metals, including lead and copper, are immobilised in the roots. It is particularly associated with sites such as Nenthead that have very high levels of zinc and cadmium. However it also occurs beside the Tyne as far east as Newburn. Away from Calaminarian sites it is a very rare British alpine. J. Simkin 2011

Dune helleborine, *Epipactis dunensis*

The dune helleborine is endemic to Britain, Nationally Scarce and a Red Data Book species. It is known from 32 sites, of which 21 are in the South Tyne or Tyne valleys, and most of the remainder on dunes in Lancashire and Cumbria. The earliest confirmed inland record is from Williamston in 1973 but earlier records from Featherstone in 1897 and Haltwhistle in 1924 could relate to the same species. The Tyne populations are indistinguishable from west coast populations morphologically. Studies of the DNA show that they were recently derived from those dune populations, from which they differ consistently only by a single base point. J. Simkin 2011

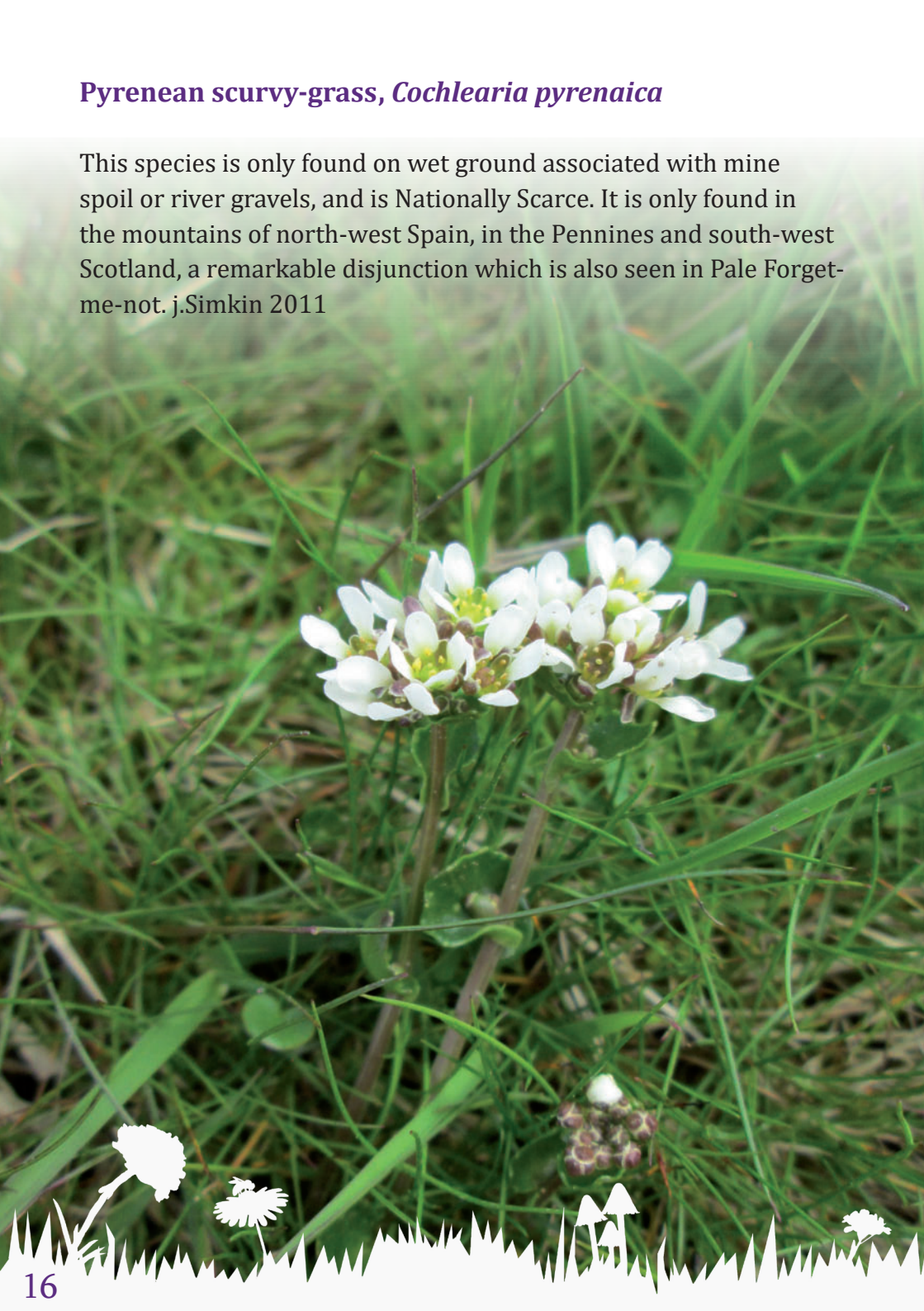


Mountain pansy, *Viola lutea*

This plant also occurs on limestone in the uplands. In the Pennines and beside the Tyne a dark purple form dominates, and the large flowers and intermediate characters suggest that it may be a hybrid between the mountain pansy *Viola lutea* and heartsease *Viola tricolor*. These species can occur together when weedy fields accompany river gravels. Comparison of modern and historical specimens shows that flower size is reducing with time and the frequency of the purple form is increasing. In the Scottish Highlands and the Craven limestones of Yorkshire, populations are predominantly yellow-flowered. J. Simkin 2011

Pyrenean scurvy-grass, *Cochlearia pyrenaica*

This species is only found on wet ground associated with mine spoil or river gravels, and is Nationally Scarce. It is only found in the mountains of north-west Spain, in the Pennines and south-west Scotland, a remarkable disjunction which is also seen in Pale Forget-me-not. j.Simkin 2011

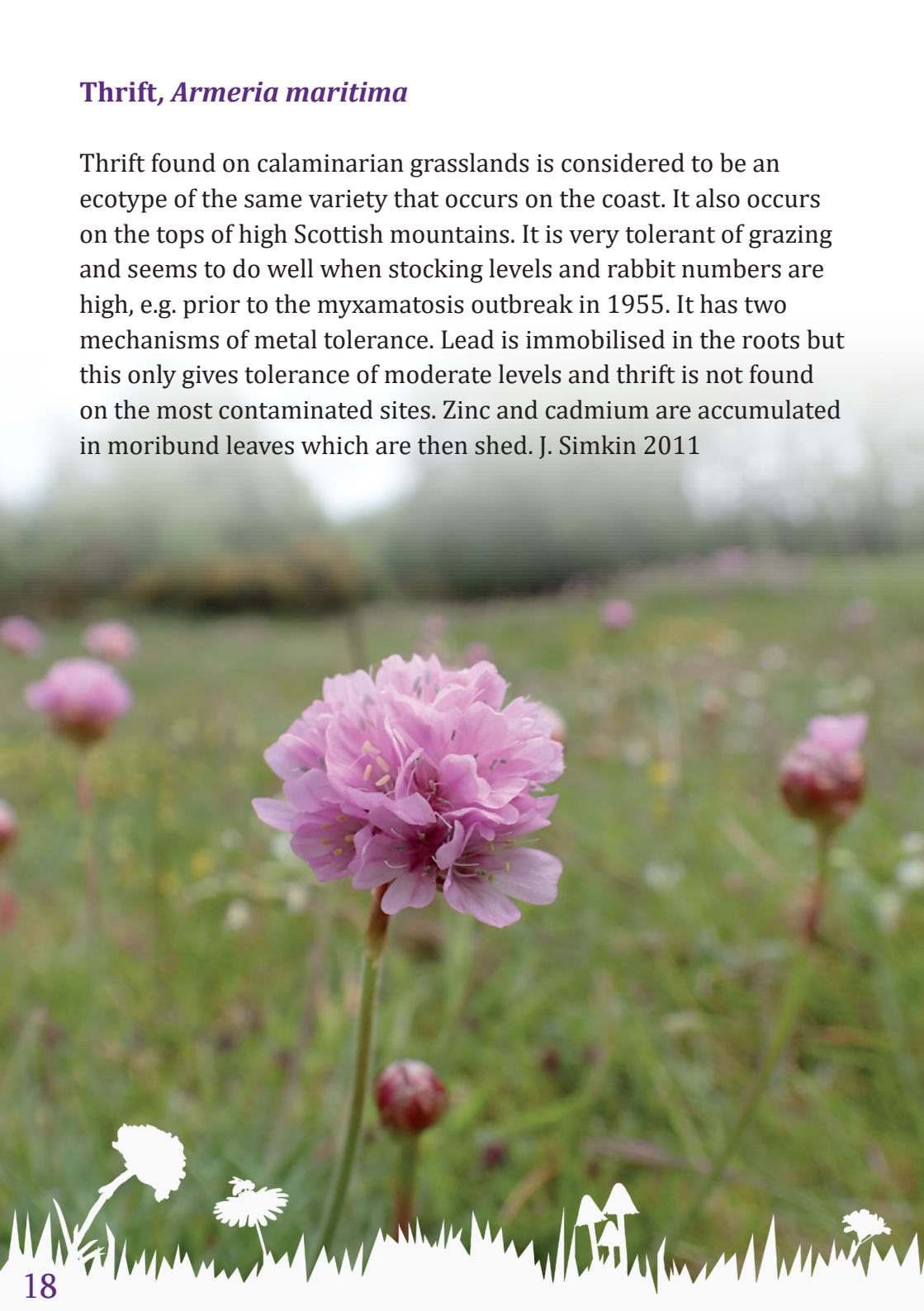


Spring sandwort, *Minuartia verna*

Spring sandwort is Nationally Scarce, with a Red Data Book status of Near-Threatened. It is tolerant of disturbance, but although it has a tap root it is intolerant of severe drought and so it succeeds best damp ground or where the roots are shaded by rocks. It is also a zinc hyperaccumulator and tolerant of extremely high levels of lead, zinc and cadmium, but is a poor competitor and is soon lost if the grass sward closes. It is known in some areas as leadwort, from its value to early miners as an indicator of the presence of a vein of galena. In some parts of the Pennines, away from metal soils, it is a characteristic alpine of high-altitude limestone. J. Simkin 2011

Thrift, *Armeria maritima*

Thrift found on calaminarian grasslands is considered to be an ecotype of the same variety that occurs on the coast. It also occurs on the tops of high Scottish mountains. It is very tolerant of grazing and seems to do well when stocking levels and rabbit numbers are high, e.g. prior to the myxamatosis outbreak in 1955. It has two mechanisms of metal tolerance. Lead is immobilised in the roots but this only gives tolerance of moderate levels and thrift is not found on the most contaminated sites. Zinc and cadmium are accumulated in moribund leaves which are then shed. J. Simkin 2011



Soils

Metal-bearing ores were often deposited when rocks such as Carboniferous limestone were 'cooked' by later volcanic activity. Consequently, shingles and soils formed from these ores tend to be less acidic. Soils found on the former mining sites tend to be more acidic and are significantly higher in toxic metals, whereas river shingles tend to be more lime-rich, have higher soil moisture levels and more soil nutrients. The composition and cover of the vegetation reflects this. Mine workings support few metallophytes, although alpine penny-cress can occur and old trackways to lead mines sometimes support good populations of spring sandwort. In contrast, river shingles carry a wider variety of plants which are often less patchy. In general the older (pre-1890) and more up-stream sites are predominantly lead-rich, whereas the downstream sites and those which were deposited later are dominated by lighter zinc ores which became the main target after 1890.

Scottish calaminarian grasslands tend to be associated with mineral-rich serpentinite soils. Whilst these soils also have high levels of heavy metals, these are mostly nickel and chromium rather than lead and zinc. Furthermore, these soils have more magnesium than calcium. This imbalance is thought to contribute towards the distinctive flora that occurs there.

All metal-rich soils tend to have low concentrations of essential plant nutrients (nitrogen, potassium and phosphorous) and have a low water holding capacity, so metallophytes are also adapted to cope with these conditions. Some species will germinate in metalliferous soils but are unable to tolerate the harsh conditions and ultimately fail to establish.

Successional Stages

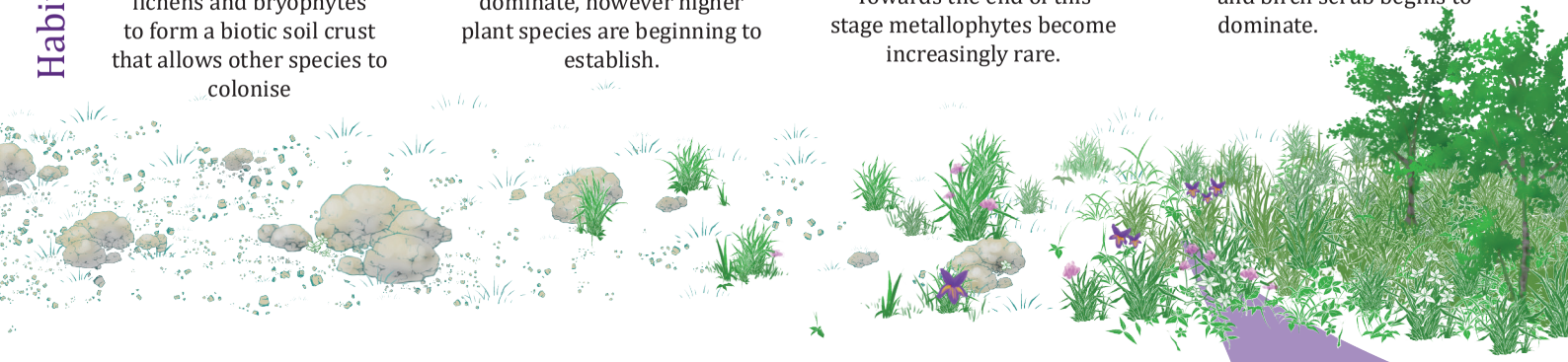
Habitat

Early colonisation by cyanobacteria, algae, crustose lichens and bryophytes to form a biotic soil crust that allows other species to colonise

Open ground is still present and lichens and bryophytes dominate, however higher plant species are beginning to establish.

The sward closes over and large mosses proliferate. Towards the end of this stage metallophytes become increasingly rare.

Soil enriches and gets deeper. Lichens are lost and gorse and birch scrub begins to dominate.



Pioneer stage → Early stage → Late stage → Climax stage

Species

Crustose lichens:
Vezdaea aestivalis, Sarcosagium campestre, Trapelia coarctata, Porpidia crustulata, Poridia tuberculosa.
Byrophytes:
Weissa controversa, Bryum pallens.

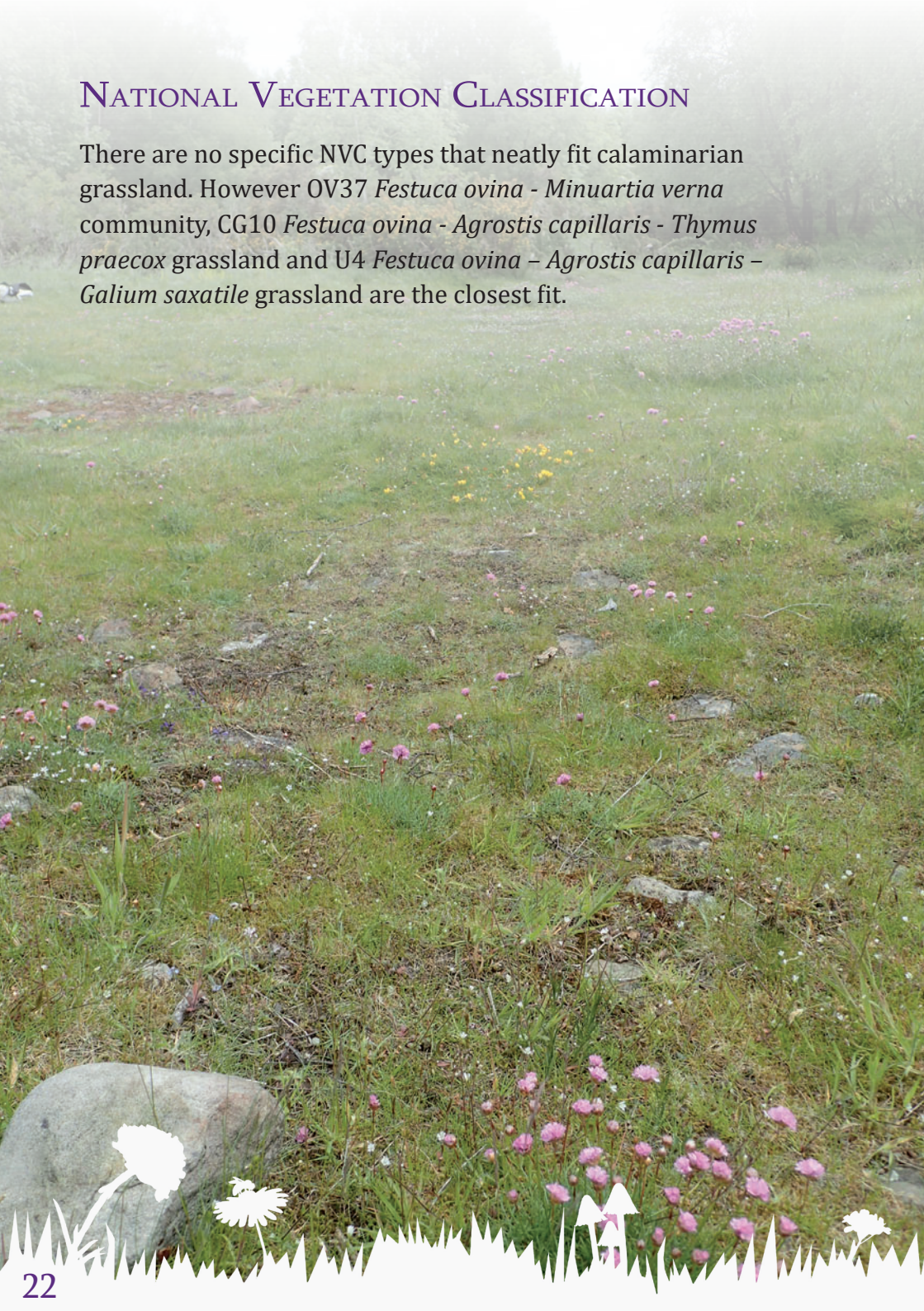
Scattered plants of spring sandwort, sheep's fescue and common bent.
Larger lichens would also be colonising at this stage *Cladonia, Peltigera* and *Cetraria.*

A more closed, species-rich, sward with spring sandwort, thrift, alpine pennycress, and metal tolerant ecotypes such as harebell, common mouse ear and common milkwort.

Most calaminarian species are out competed by commoner species, such as self heal, common ragwort and germander speedwell. Dune helleborine can however be found in birch woodland.

National Vegetation Classification

There are no specific NVC types that neatly fit calaminarian grassland. However OV37 *Festuca ovina - Minuartia verna* community, CG10 *Festuca ovina - Agrostis capillaris - Thymus praecox* grassland and U4 *Festuca ovina – Agrostis capillaris – Galium saxatile* grassland are the closest fit.



Threats

Since the 1970s it is estimated that at least 60% of the calaminarian grasslands have been lost in the North Pennines, and a similar picture is to be seen across the rest of the UK.

There have been a number of contributing factors in this decline; hard engineering of rivers, changes in livestock, seral succession, mine remediation and loss of heavy metals.

River authorities have, in the past, pursued policies to straighten and canalise rivers to "protect" and optimise farmland, removing calaminarian grassland on river alluvium. This practice has largely come to an end with increasing pressure on the Environment Agency. Following an increase in winter floods, hard engineering of our rivers may return, but this time to protect houses downstream.

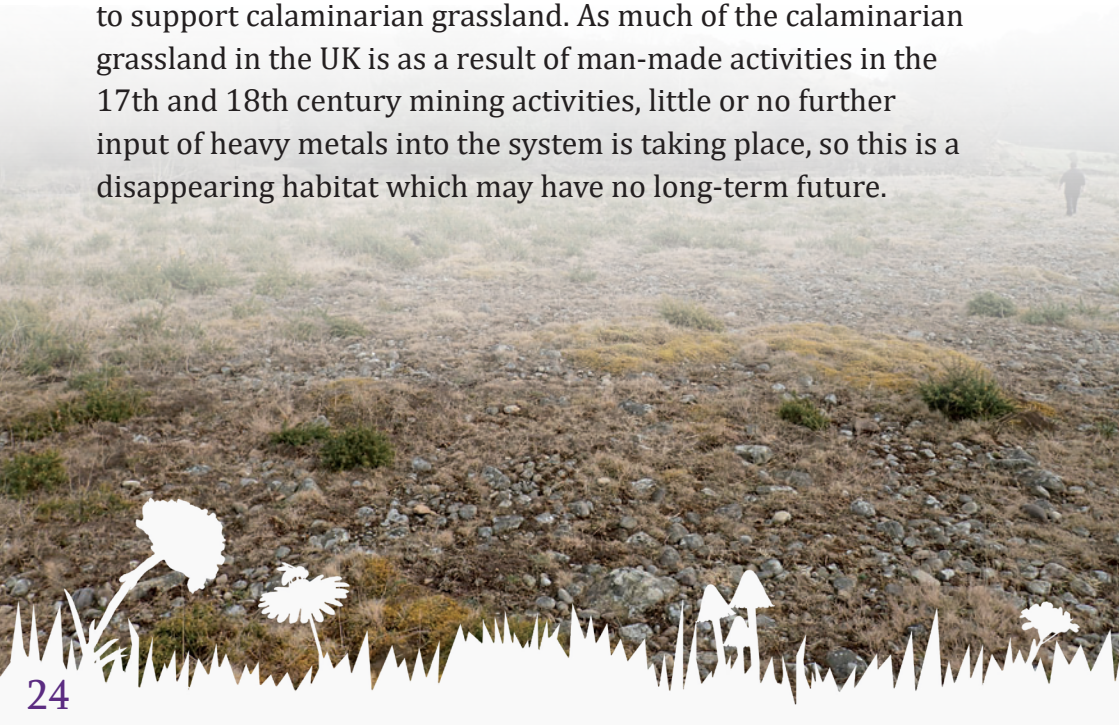
Upland hill farmers have increased cattle usage at the expense of sheep. The dung from cattle tends to complex and lock up heavy metals so that they are no longer bio-available, leading to what is essentially an uncontaminated soil, not favoured by the key calaminarian species.

Gorse and birch appear to tolerate later seral successional stages of calaminarian grassland. Their leaf litter ameliorates the topsoil, encouraging the development of an uncontaminated soil and as such a more "normal" floral assemblage.

As the heavy metals of calaminarian grassland are not only toxic to most plant species, but also to humans, extensive work has been carried out, particularly on the mining and river alluvium sites, to remove or make safe the sediments. In the case of mining this has often meant burying the contaminated areas to prevent the spread of dust containing toxic levels of heavy metals. At the same time valuable calaminarian plant communities are buried.

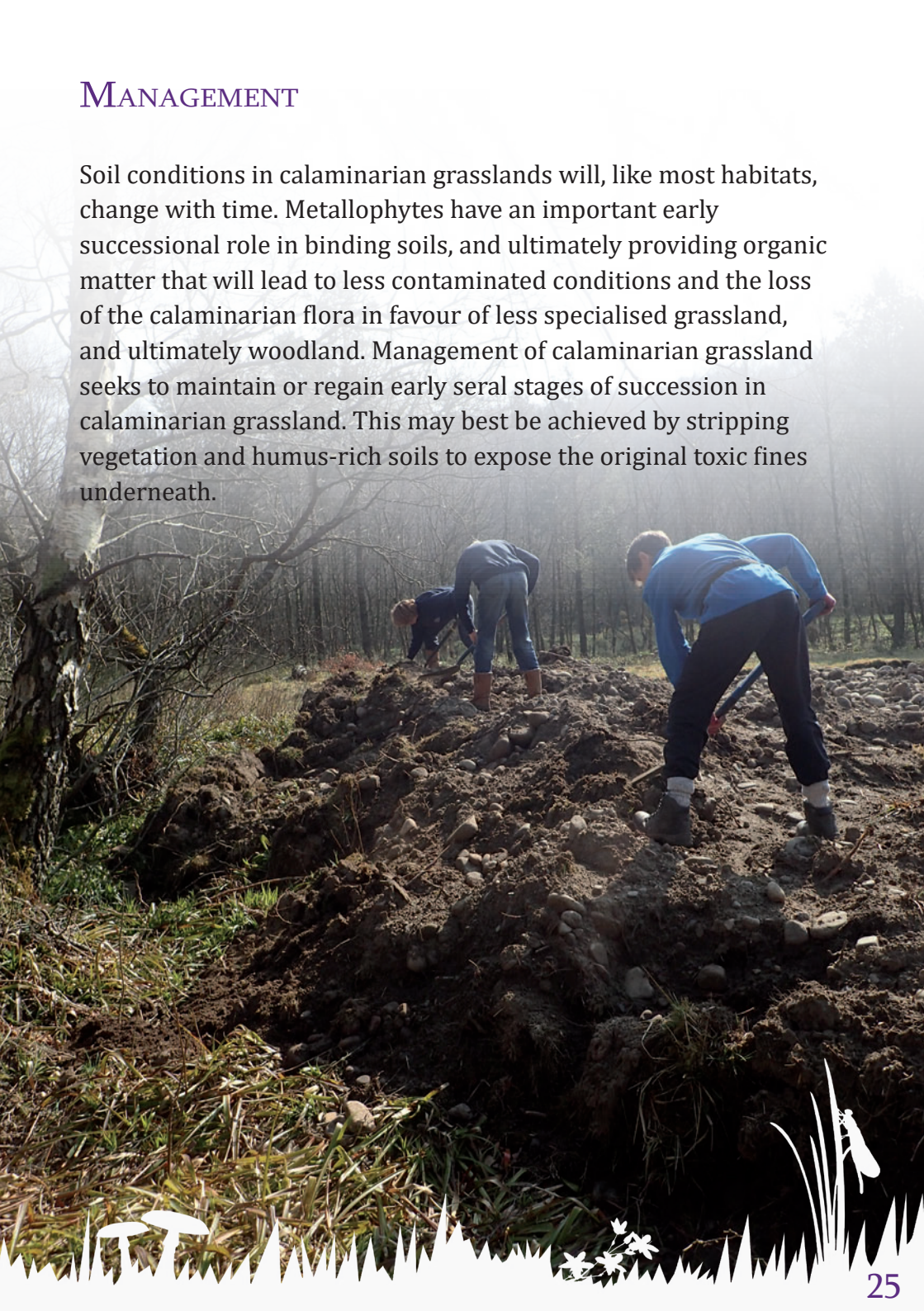
Recently, there has been a push towards removing the heavy metals from river courses, as many are spread throughout a watercourse suspended in fine sediments and in some cases, particularly zinc, in solution. Methods of removal have concentrated at removing the metals at source.

Although most of the heavy metals tend not to be water soluble, many wash through the soil horizon with sediments and leave the soil/dissipate. This results in ever-decreasing levels of contamination and as such it reduces the suitability of the soil to support calaminarian grassland. As much of the calaminarian grassland in the UK is as a result of man-made activities in the 17th and 18th century mining activities, little or no further input of heavy metals into the system is taking place, so this is a disappearing habitat which may have no long-term future.



Management

Soil conditions in calaminarian grasslands will, like most habitats, change with time. Metallophytes have an important early successional role in binding soils, and ultimately providing organic matter that will lead to less contaminated conditions and the loss of the calaminarian flora in favour of less specialised grassland, and ultimately woodland. Management of calaminarian grassland seeks to maintain or regain early seral stages of succession in calaminarian grassland. This may best be achieved by stripping vegetation and humus-rich soils to expose the original toxic fines underneath.

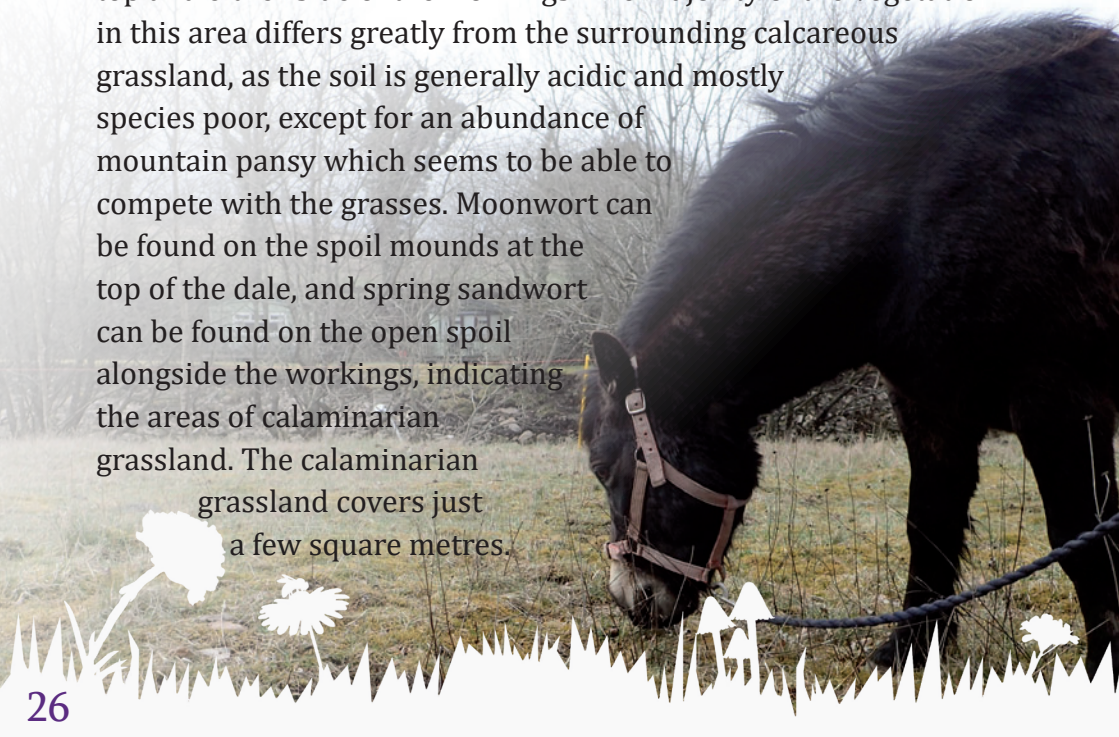


Case study: Derbyshire

Deep Dale Nature Reserve

Deep Dale is a magnificent limestone valley in the heart of the Peak District National Park in Derbyshire. The east side is a 36 hectare nature reserve owned and managed by Plantlife. The dale sides are steeply sloping with flower-rich calcareous grassland and along the top of the dale, on the deeper soils, is acid grassland. However, in the middle of the gorge is a lead 'rake'- a fissure in the limestone containing lead-rich deposits. This was mined in the 18th / 19th Centuries, creating a small u-shaped depression into the valley side surrounded by mounds of spoil. It is a very small area of the dale, less than 0.5 hectares, but provides a unique habitat.

Spoil from the mining activity was deposited on the flatter dale top and either side of the workings. The majority of the vegetation in this area differs greatly from the surrounding calcareous grassland, as the soil is generally acidic and mostly species poor, except for an abundance of mountain pansy which seems to be able to compete with the grasses. Moonwort can be found on the spoil mounds at the top of the dale, and spring sandwort can be found on the open spoil alongside the workings, indicating the areas of calaminarian grassland. The calaminarian grassland covers just a few square metres.



As the area of the lead rake and calaminarian grassland is so small in comparison to the overall reserve, it does not receive any special management. Deep Dale was traditionally grazed by cattle between May to October or even December in a good grass growing and dry year. Around 2001 the management was changed as part of an agri-environment scheme to cattle grazing just between July to November, but over the years the acid grassland began to become rank. From 2014 onwards 30 cattle were brought onto the grassland from May onwards with an end date in November. Sheep were also allowed to graze the grassland for the first time, with around 30 animals brought onto the grassland around the same time as the cattle, but the ability to continue sheep grazing until November or December to reduce the grass cover and allow the wildflowers to increase. Although there have been changes in the grasslands overall botanical diversity depending on the grazing, the calaminarian grassland has remained relatively stable throughout this time with no visible changes in plant abundance or distribution. There are no sampling quadrats on the lead rake and any change in plant abundance and/or distribution isonly anecdotal.

There are a few of reasons why the calaminarian grassland is thought to have endured in this area. Firstly, the steep side of the dale leads to occasional slumping of the spoil along the edge of the rake, continually opening new areas which spring sandwort can colonise. Secondly, the vegetation looks to be relatively palatable for cattle, and they have favoured eating the grasses in this area even when the period of grazing was reduced. Certainly, lead has a sweet taste which is why it can lead to poisoning if livestock get a 'taste' for it and why some calaminarian grasslands cannot be grazed. At Deep Dale the amount of Calaminarian grassland is so small and the steep sides prevent standing water, making poisoning from leached lead extremely unlikely. Finally, it looks like the area around the rake is regularly rabbit grazed keeping the vegetation short and benefiting the diminutive specialist plants, and possibly further facilitating the grazing by cattle and now sheep.

The extent of calaminarian grassland at Deep Dale has remained stable since Plantlife acquired the site in 1999, but it is not known whether there was a larger area in the more distant past. Given the apparent stability in extent of the habitat, there is currently no intervention (e.g. creation of scrapes) to increase the area of calaminarian grassland vegetation. There is concern that the moonwort on the hummocks of vegetated spoil at the top of the slope may struggle in future as the toxicity levels in the soil decrease, and the mounds become more vegetated with tufted grasses. However, it is not known at what seral stage moonwort develops, so it is not clear whether the creation of scrapes would benefit this species. Further monitoring and research may be required.

Case study: Somerset

Mendip Hills

The Mendip Hills is the most southerly area of calaminarian grassland found in Britain and is of local and national importance. Calaminarian grassland is identified on the Mendip Hills when one or more of the following indicator species are found:
Alpine Pennycress *Thlaspi caerulescens*
Spring sandwort *Minuartia verna*
Sea Campion *Silene uniflora*

Figure 1: Alpine pennycress

For Somerset Wildlife Trust one of the aims of the Save Our Magnificent Meadows project was to gain a better understanding of the habitats and ecological networks present on the Mendip Hills. Habitat surveys of potential calaminarian grassland sites were undertaken across the Mendip Hills covering 143.66 hectares across 12 sites.

Across the 12 sites we found 0.33 hectares of calaminarian grassland existing in very small patches. These patches consist of a few plants of one or more indicator species. Even in areas where lead mining activity was high, the distribution of these species is extremely limited. However this was a lower amount of hectares than we expected to record as there was less of the habitat present than predicted.

Figure 2: Calaminarian grassland on slag heap

For the landowners who owned calaminarian grassland, SWT provided survey reports and provided management advice where possible. Advising management of calaminarian grassland is tricky for a number of reasons. Most grassland habitat of conservation importance in the UK has been created through various methods of agriculture. Management typically mimics the management that used to take place (i.e. traditional hay meadows are managed as they would have been in the past with a haycut and aftermath grazing). Calaminarian grassland is created by natural regeneration after lead mining/industry activity. This means that management can be somewhat difficult and often rather subtle. Many of the sites surveyed on the Mendip Hills are open access and therefore are popular places for walkers. This also limits what management can take place as creating new patches of this habitat would mean exposing contaminated soil.

However open access could actually benefit calaminarian grassland as it can provide a constant level of disturbance (by walkers/horse riders) which is essential if calaminarian grassland is to survive at the site. Over time the heavy metals in the soil, essential for the presence of calaminarian indicator species, leach out. Disturbance can bring heavy metals back to the surface and provide fresh bare ground for the rare species to germinate in.

Figure 3: The flues at Blackmoor Reserve

One of the sites surveyed for calaminarian grassland was Blackmoor reserve, an old lead mining site at Charterhouse, high up on the Mendip Hills plateau. The site is managed by the South West Heritage Trust for its historic interest. The remains of the lead ore fields at Charterhouse are of great historical importance and date from Roman times up until the nineteenth century. In Victorian times, lead mining began at Charterhouse in 1844 when the Mendip Hills Mining Company began work at Blackmoor. This involved the construction of the large pond and the flues in order to extract lead from the slag heaps left behind from previous mining in the area. A fall in the price of lead ended work at the site in 1885.

The pond and the flues are still present today, as are the slag heaps where patches of calaminarian grassland can be found. Visitor presence at the site is high, resulting in high levels of disturbance over the spoil heaps. This has ensured the survival of calaminarian grassland at the site and therefore people are not discouraged from walking on the slag heaps.

Encroachment of scrub is an issue in some parts of the site where it is shading out the calaminarian habitats. Scrub clearance carried out through the site's Countryside Stewardship agreement will ensure that this is controlled.

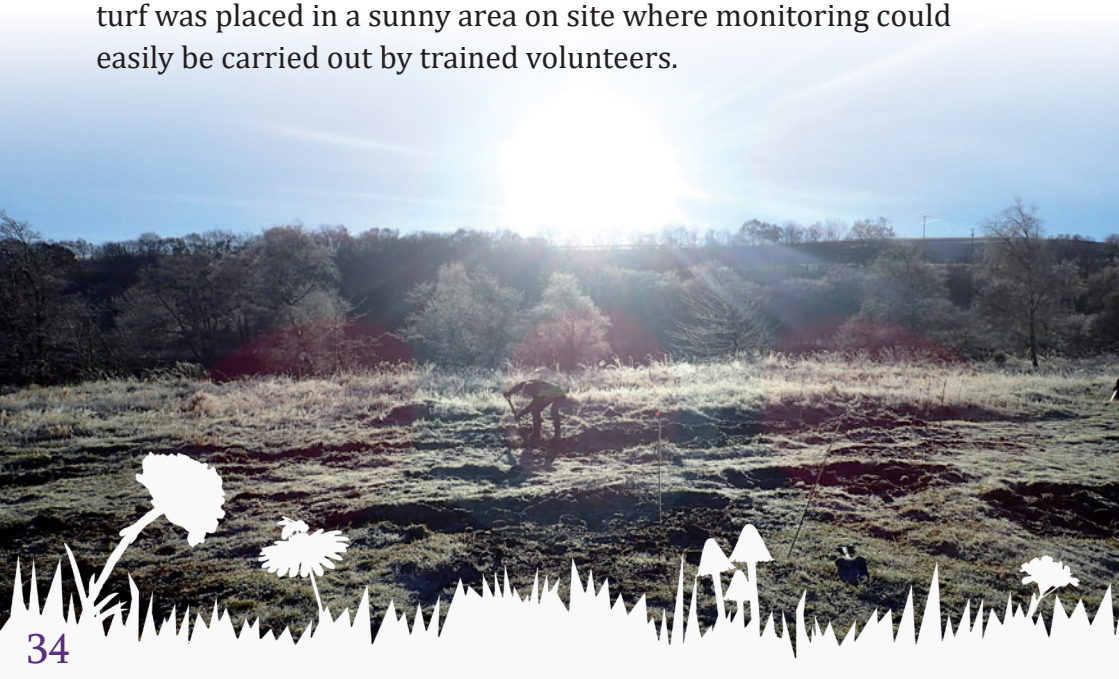
Sites with calaminarian grassland will continue to be monitored after the Save Our Magnificent Meadows project by the Somerset Rare Plant Group to ensure the survival of this rare habitat.

Figure 4: Slag heap at Blackmoor Reserve

Case studies: Northumberland

The aim of the management was to create more calaminarian grassland by removing top soil exposing the underlying contaminated sediments. Over time deposits of contaminated sediments have become buried beneath topsoil. This has resulted in the decline of species associated with the mine spoil and a reduction in the extent of this rare grassland community.

To restore the conditions that these plants require, a series of scrapes were created on two sites. Soil was removed using a Bobcat 2.5 tonne mini-excavator where access allowed. Where it was felt that target species/vegetation communities could be detrimentally affected by using heavy machinery, the turf/soil was removed by hand. All soil removal areas were surveyed thoroughly to ensure no existing species indicative of calaminarian grassland were already present. Also all removed areas of turf were searched to ensure no calaminarian species were removed by mistake. Removed soil and turf was placed in a sunny area on site where monitoring could easily be carried out by trained volunteers.



Plug plants were grown from locally harvested seed (from calaminarian sites along the South Tyne). Seeds were sown in a mixture of non-peat based compost (wool and bracken compost) and sand/gravel in a 1:1 ratio. Each plug was grown-on, outside (no greenhouse) for a minimum of a year to establish a good root system (until roots could be seen growing out of the bottom of the plug plant cells), and were not over watered to ensure that the young plants produced root systems that would be able to withstand periodic/short term drought. The species planted were mountain pansy, alpine pennycress and spring sandwort. Mycorrhizal fungi was used on all plants, following early experiments where it was found that this increased germination and survival rate. Germination and survival varied between species, with alpine pennycress being most successful (provided it was protected from slugs and woodlice predation) and mountain pansy the least successful. Mountain pansy required greenhouse germination with constant but low watering.

All works to statutorily designated sites were carried out under licence from Natural England. All soil removal was undertaken outside of the Environment Agency's flood risk zones and no contaminated sediments were taken off-site. As such, no consents were required for this work from the Environment Agency.

Williamston SSSI

Williamston Site of Special Scintific Interest (SSSI) has a small area (0.55 ha) of calaminarian grassland, and is located on the South Tyne river. The area of soil removal was carried out approximately 30 m away from the existing area of calaminarian grassland. It was considered that this area, due to this distance, would benefit from plug planting of key species to encourage the development of calaminarian grassland, but would still have the underlying soil conditions that are essential for the establishment of calaminarian grassland.

Prior to soil removal, surrounding trees were felled to allow the new grassland area to be unshaded. Calaminarian grassland does not flourish in shade. Topsoil was removed to a depth of approximately 30-50 cm exposing the contaminated river gravels, by mechanical means (2 tonne bobcat mini-digger) and by hand. The contaminated river gravels were characterised by a mixture of cobbles, gravels and sand, with a low content of organic-matter/ top soil. Soil removal was carried out outside of the main vegetation growing season to ensure any that any target plants within the working area would not be damaged, and to avoid disturbing any nesting birds during the scrub and tree removal. Costs were approximately £240 per day for use of the mini-digger.

Plate 1. Volunteers planting native plug plants at Williamston

Plug plants were planted at a density of approximately 7 species per m2. The species planted were mountain pansy, alpine pennycress and spring sandwort. Experience elsewhere showed that a lack of water, resulting in drought, can hamper the success of plug plants establishing in shallow/sandy soils such as those found in calaminarian grasslands. All plug plants were thoroughly watered in and transplanted at times when rain was forecast. Each plant was 'mulched' with a small amount of grassland cut from around the site. This created a humid environment around the root and reduced leaf evaporation. The mulch was then removed a week later to ensure no additional nutrients entering the soil or shaded of the plant, and that the uncontaminated soil remained exposed to help natural seeding from the transplanted plugs in the future.

Burnfoot Shingles SSSI

Burnfoot had a much larger area of calaminarian grassland. However, scrub woodland has established on most of the site shading and reducing the remaining calaminarian grassland communities, so that they only existed as small areas in a 1.6 ha mosaic grassland. The work carried out on site aimed to expand the area of calaminarian grassland tenfold, from 50 m2 to 510 m2.

Shallower and deeper areas of rich topsoil were removed; the minimum depth was approximately 5 cm and the maximum depth was approximately 50 cm. No plug plants were introduced to the cleared areas. Surveys carried out one year after the scrapes were created showed little re-growth of non-calaminarian species, indicating that heavy metal levels remained too toxic in the exposed sediments for most species to survive. Spring sandwort and alpine pennycress were recorded in this first year. These plants were found in the centre of the soil stripped areas, and it was assumed that they had grown from the existing seed bank.

Plate 2. Volunteer surveying area of exposed sediments

Wydon Shingles SSSI

Wydon Shingles SSSI is a 2.5 ha site with a much larger area of existing calaminarian grassland compared with Burnfoot SSSI. Good quality calaminarian communities existed in areas with very shallow or no topsoil, and the target species indicative of calaminarian grassland were present. Between these patches of calaminarian grassland, there were 'lenses' of deeper uncontaminated flood sediments and topsoil. An independent grassland consultant Dr. J. Simkin who is a specialist in calaminarian grassland and had studied Wydon Shingles for approximately 15years, advised that the lenses had expanded to the detriment of the calaminarian grassland as topsoil had collected and built-up. As a consequence, removal of the topsoil in the lenses to expose the sediments beneath was considered essential to maintain the existing areas of calaminarian grassland. The depth of soil removed was between 05-35 cm; the majority of which was excavating the turf layer. Prior to soil removal, surrounding gorse and birch scrub was removed to allow the new grassland area to be unshaded.

Plate 3. Areas of removed turf part way through the work, showing canes marking key species/calaminarian communities.

In order to avoid all areas of existing calaminarian grassland and any key species associated with the community, each area of calaminarian grassland, location of indicative plants and lichens was clearly marked using canes. This was undertaken during the growing season before the work was carried out, and immediately before creating the scrapes. Each section of lense removed was checked again before being dug with the subsequent surveys of the removed material.

No plug plants were transplanted within the scrapes at Wydon Shingles SSSI.

The work was undertaken in late 2016, and all removed areas of turf which have been left on site will be monitored in 2017 to ensure no calaminarian species were removed by mistake.


Conservation Work
We are undertaking some conservation work to the grasslands.
Here at Burnfoot shingles, Calaminarian grassland (a rare type of grassland contaminated by heavy metals) , grows. This relies on very little soil. Unfortunately, too much soil has accumulated so the rare plants are disappearing. To stop this happening we are removing the top layer of soil on parts of the site. This may look a little drastic, but in time the wild flowers will come back and the site will look more fabulous than before.
If you would like anymore information on the project please visit www.magnificentmeadows.org.uk
save our magnificent meadows
heritage lottery fund
LOTTERY FUNDED
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Plantlife

Glossary

Alluvium – a deposit of clay, silt, and sand left by flowing floodwater in a river valley or delta, typically producing fertile soil.

AONB – Area of Natural Beauty.

Bioavailable – the amount of an element or compound that is accessible to an organism for uptake or adsorption across its cellular membrane.

Cyanobacteria – a division of microorganisms that are related to the bacteria but are capable of photosynthesis. They are prokaryotic and represent the earliest known form of life on the earth.

Ecotype – a distinct form or race of a plant or animal species occupying a particular habitat.

Endemic – a plant or animal native or restricted to a certain place.

Flora – plant life or vegetation

Humus – organic component of soil, formed by the decomposition of leaves and other plant material by soil microorganisms.

Hybrid – the offspring of two plants or animals of different species or varieties.

Hyperaccumulator – a plant capable of growing in soils with very high concentration of metals, absorbing these metals through their roots, and concentrating extremely high levels of metals in their tissues.

JNCC – Joint Nature Conservation Committee.

Metallophytes – a plant that can tolerate high levels of heavy metals.

Mine spoil – waste rock removed during ore mining.

Morphologically – form or structure of an organism or one of its parts.

Seral – intermediate stage found in ecological succession in an ecosystem advancing towards its climax community.

Serpentinite – a dark, typically greenish metamorphic rock, consisting largely of serpentine or related minerals, formed when mafic igneous rocks are altered by water.

Soil horizon – a layer generally parallel to the soil crust, whose physical characteristics differ from the layers above and beneath.

Succession – the process by which a plant or animal community successively gives way to another until a stable climax is reached.

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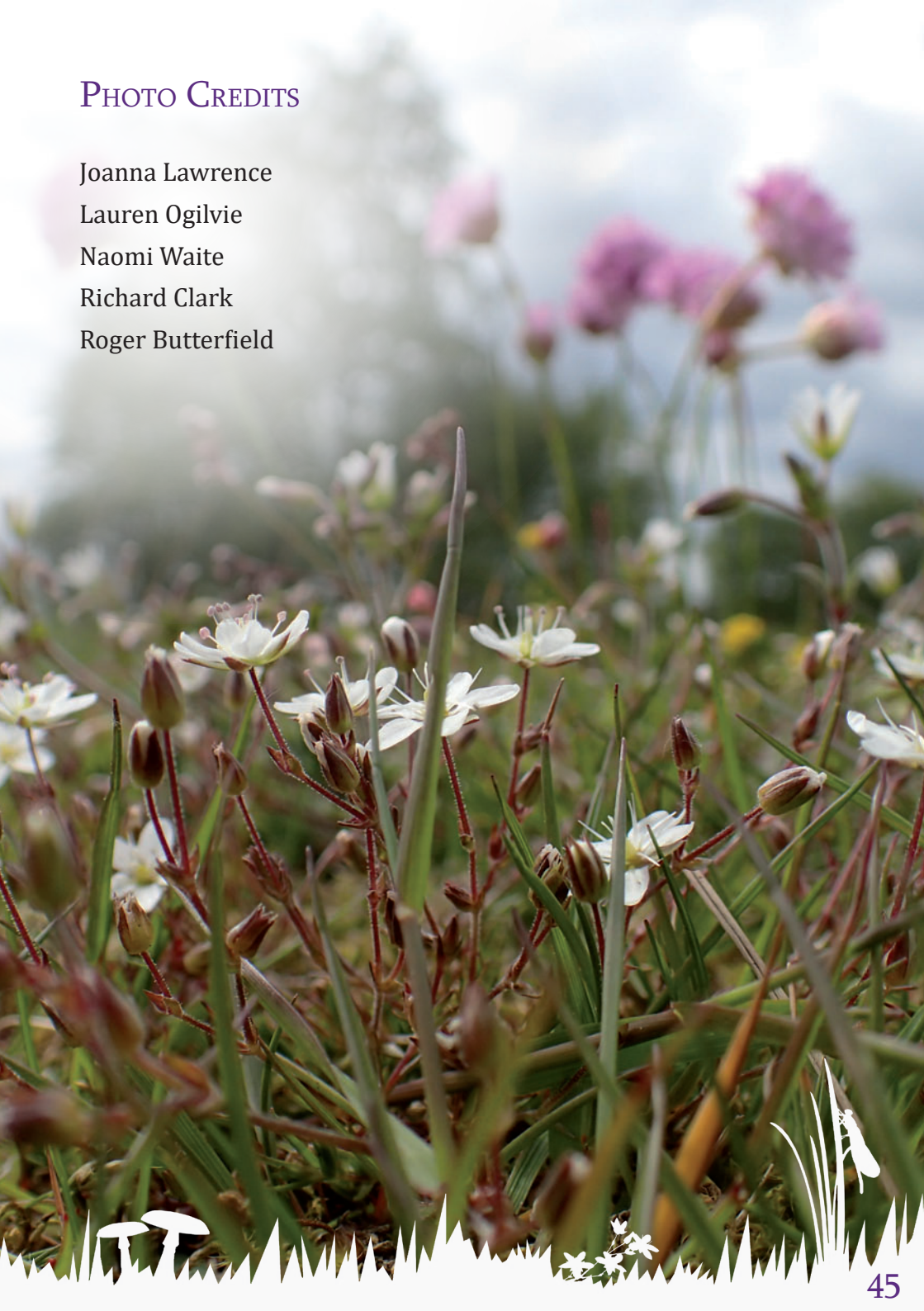

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