Machair and coastal pasture: managing priority habitats for native plants and the significance of grazing practices

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ABSTRACT
In 2007, Plantlife published a list of 42 Important Plant Areas (IPAs) in Scotland, five of which feature machair and coastal pasture. These sites qualify as IPAs, where they are an outstanding example of a habitat of global or European plant conservation and botanical importance with rich plant diversity and the presence of rare and threatened species. Plantlife’s conservation programme conducts research on priority species within these habitats and devises and tests appropriate management. This paper uses two examples, *Spiranthes romanzoffiana*, Irish lady’s tresses, and *Platanthera bifolia*, lesser butterfly orchid, to illustrate how this approach could be used to inform land management practices and the grant programmes that sustain them in order to conserve wild plant populations. These management recommendations focus on grazing that aim to increase populations of these species and wild vascular plant diversity in these habitats.

INTRODUCTION
Although coastal pasture is only one element of the wider machair landscape, it is a key habitat in Plantlife’s conservation programme and is home to Irish lady’s tresses and also to some populations of lesser butterfly orchid, both of which are priority conservation species for Plantlife Scotland. Other habitats within the machair landscape that are important for plants include traditionally managed flower rich machair and dune slacks within mobile sand dune systems. This paper discusses the management of coastal pasture and machair habitat for two species of flowering plant, with wider ramifications for other rare flowering plants.

Over the last six years, Plantlife has been conducting research and running management trials on two priority species that characterise the coastal pasture element of machair. Results from research at Aberdeen University and ongoing observations of wild plant populations alongside management trials are now set to inform wider land management contract options. Effective land management prescriptions through Scottish Rural Stewardship Scheme (SRDP), enabling land owners to manage for their rare plant populations should aim to result in healthier habitats for these and associated species and should also result, in the longer term, in larger and more robust wild plant populations. This is especially important in view of ongoing environmental change, brought about by climate change and continued decline in traditional land management practices. It is only by enabling current land owners to manage their land sympathetically that these species will be able to expand their populations, thus increasing their resilience in the face of climate change.

Identifying and mapping Important Plant Areas
Important Plant Areas (IPAs) are a key target of the Global Strategy for Plant Conservation (2002). The UK governments endorsed this strategy with the publication of Plant Diversity Challenge in 2005, which detailed the UK’s response to the 16 targets of the global strategy. Meeting targets 4 and 5 are founded on the identification and protection of Important Plant Areas.

In July 2007, Plantlife, with partners, published a list of 150 IPAs across the UK. Plantlife is now working with partners across the UK to map these IPAs so that they can become a relevant consideration in landscape planning. The UK is following the lead of several Central and Eastern European countries who have already identified and mapped their IPAs. These can be seen at [www.plantlife.org.uk](http://www.plantlife.org.uk).

IPAs are selected where sites meet at least one of three internationally agreed criteria:

Criterion A: the presence of species that are of global or European conservation concern. For vascular plants in the UK, these are species listed as critically endangered, endangered, and vulnerable on the UK Red Data List (Cheffings and Farrell 2007). Machair sites in Scotland qualified if *Najas flexilis* or *Euphrasia* species were present for example.

Criterion B: very high species diversity within a Euni level 2 habitat (see European Environment Agency [http://eunis.eea.europa.eu](http://eunis.eea.europa.eu)). For machair habitats these include coastal dune & sand, coastal shingle, rock shores, surface standing waters, littoral zone of inland water bodies, dry grasslands, alpine & sub alpine grasslands, tundra, inland rocky outcrops.
Criterion C: the site is an example of a habitat of global or European plant conservation and botanical importance, as listed in a Special Area of Conservation (www.snh.gov.uk) for plants. These include fixed dunes, alpine and sub alpine calcareous grasslands, alpine and boreal heaths, mesotrophic waters and Atlantic salt meadows for example. Forty two IPAs have been identified in Scotland (see Fig. 1). A list of these sites is available at www.plantlife.org.uk.

One of the first IPAs to be mapped in Scotland is the West coast IPA, which stretches from Kinlochbervie to the Mull of Kintyre, identified for its Atlantic woodland communities and Atlantic heath communities. For each key plant community, core areas are identified. Around these core areas, buffer zones of up to 1 km are drawn. Key predictive environmental variables are used to identify zones of opportunity within these buffer zones. These are areas that could be suitable to support the key plant community if land management was appropriate. For west coast Atlantic woodland for example, this may be an area of open habitat or an area of coniferous plantation that could be managed differently to support, in time, key Atlantic bryophyte and lichen woodland species. The approach is similar to Forest Habitat networks, but is applied to every qualifying plant community identified in the IPA selection procedure.

Mapping of machair IPAs has not yet commenced. As an example, on the island of Coll, it is likely that the Site of Special Scientific Interest (SSSI) would be identified as a Core Area, with a 1 km buffer zone around its boundary. Key predictive environmental variables will be tested statistically to find the most appropriate predictive environmental variables to enable identification of Zones of Opportunity. These environmental variables may include the presence of calcareous, wind blown sand, dune pasture, flat relief and / or wet & windy weather patterns.

IPAs are also assessed in terms of their condition and the threats they face. A pro forma IPA information sheet is filled out by a site expert and this is available online at www.plantlife.org.uk. Threats to the coastal pasture and machair IPA sites include year round grazing, the presence of more sheep than cattle, the presence of rabbits, vehicular access, coastal erosion, off shore kelp bed degredation and rubbish dumping. At this point, management advice is needed to mitigate these threats and ensure that management is acting to conserve the IPA qualifying features in the long term.

Managing IPAs for priority species: case study 1: *Spiranthes romanzoffiana*

Irish lady’s tresses is a very rare orchid, confined in the UK to the west coast of the Scottish mainland and its islands and to a small number of sites in Northern Ireland. It also grows in Eire and in Canada, the USA and the Aleutian Islands. It is distinguished by a slender spike of white, scented flowers, from July – August or September. It grows in meadows, pastures and heaths.

Historically, its habitats were managed as extensive grazing. Desk research by Wilson (2009) shows that key sites were subject to winter cattle grazing, with cattle removed to summer pastures from May. Parts of in bye land were cultivated on rotation with poorer areas left fallow. In winter, cattle returned to graze in bye land, when poaching would have occurred alongside possible seasonal inundation.

During the early – mid 19th century changes in land use started to occur when kelp was collected and used to fertilise fields. This was accompanied by an increase in the rabbit population to supplement food sources for the local human population. Further increases in the amount of land used for cultivation came with the introduction of lazy beds. There has been some association made in the past between Irish lady’s tresses and old lazy beds. This does not appear however to be an exclusive association and lazy beds do not appear to be any more or less suitable than other habitats within coastal pasture.

From the mid 19th century onwards, further changes to land use came as the numbers of cattle declined in favour of sheep, as the value of cattle declined. There is a close association between cattle grazing and wild plant diversity. Cattle are generally non selective feeders and are less likely to target flowering plants specifically. They can also break up swards physically, which can benefit some species. A change from cattle to sheep therefore tends to be less advantageous to rare plants. Sheep can have a tendency to target flowers for consumption. These rare species often require non selective grazing, which acts to limit the vigorous growth of competitive species like rushes. Further deterioration in the condition of habitats of rare flowering plants occurred as land was abandoned as a result of emigration or as human populations became increasingly confined to smaller, marginal crofts on coasts. These negative changes in land management and the concomitant impact on plant communities was less apparent or later on islands where crofters retained a mix of cattle, sheep and arable in township systems.

During the early 20th century, as rural human populations continued to decline, arable cultivation also declined and in bye was used increasingly to produce winter fodder. Cattle numbers continued to fall in favour of sheep. These changes continued to contribute to habitat deterioration for Irish lady’s tresses and associated species within the coastal pasture habitat, as competitive grasses and rushes were no longer kept in check by winter grazing or where in bye was converted to fodder production.

From the mid – late 20th century, winter fodder production declined and in bye land was instead increasingly used for summer sheep grazing and was often subject to some improvement. More recently, sheep numbers have declined with the drop in their monetary value and pastures have been abandoned once more. This is leading to even further declines in populations of Irish lady’s tresses. Although long lived,
Irish lady’s tresses populations at most sites in Scotland appear to be in slow and continuing decline.

Current land management at the best sites for Irish lady’s tresses are built around complex but flexible grazing regimes, which can include erratic grazing regimes for cattle and sheep. At one site in Scotland, the timing of grazing does not seem to be as important as the impact of some grazing at some point in the year. The species is long lived so that it can survive grazing, although if flower spikes survive to flower and set seed, its populations are strengthened.

At other sites in Scotland, a wide range of grazing regimes, often with sheep and cattle are employed. Some sites are used for intensive cattle rearing with semi improved swards. On more traditional crofts, cattle graze in bye in winter with a grazing break over the summer. On other sites on partially drained peat bog, light occasional grazing appears to maintain conditions for Irish lady’s tresses. On the mainland, sites are part of rough hill grazing. These sites rarely flower however and as such their long term success is under doubt.

Increasing capacity for reproduction of Irish lady’s tresses orchid populations

Until recently very little was known about the reproductive capacity of Irish lady’s tresses in the UK. The species has probably been lost from its single site in England and has not been seen there for several years. In Scotland, populations on the Outer Hebrides have been tracked for over 12 years by Dr J Roberts and on the Inner Hebrides by Dr R Gulliver (2004), which has shown that plants can persist vegetatively or underground for long periods of time. However, there had been no evidence that the plants were reproducing sexually until Andrew Scobie (2007) found apparently viable seed from a Scottish population. In addition, research by Gulliver (unpub), using Spiranthes cernua as an analogue species has demonstrated vegetative reproduction. Gulliver et al (2007) have shown that vegetative reproduction in S. cernua occurs through the production of rosettes, the production of new plantlets at root tips and the production of new plantlets at rosette centres. Further research is required to determine which, if any, of these processes occur in S. romanzoffiana in the field.

Scobie (2007) notes the existence of seed in Irish lady’s tresses and has recorded low but consistent levels of seed production on Colonsay since 2003. Seed production is, however, far more limited than in other orchids. In larger flowering populations, natural pollination levels are high but result in very low levels of capsule production. Within these capsules, the quantity of viable seed is also low and consequently the annual seed output from these populations will be very limited. Forrest et al (2004) found very low genetic diversity in populations on Colonsay and in Ireland but higher diversity in populations from Coll and the Outer Hebrides. Experimental cross pollination studies within and between populations in Scotland suggest that seed production may be constrained by self-incompatibility and/or inbreeding depression (Scobie pers. comm.), which was also noted in North American S. romanzoffiana by Catling (1982).

With consistent, although low levels of seed production, it is essential to maintain flowering populations through the provision of summer grazing breaks to maximise the opportunity for pollination and seed production, however limited that may be. These small populations remain however extremely vulnerable to stochastic events. For example, in the summer of 2007, flowering population sizes were considerably reduced by rabbit grazing, resulting in significantly lower pollination levels and no seed production that year.

Ongoing management trials, supported by evidence from research, have enabled Plantlife to devise some guidelines for management designed to maximise the size of flowering populations of Irish lady’s tresses. Gulliver et al (2004, 2007) provides details of exclosures used to manage grazing by cattle and sheep to increase Irish lady’s tresses populations. These experiments have shown that a return to a more traditional management regime for machair that removes grazing by sheep and/or cattle in May or June, and reinstates grazing in September, maximises the potential for populations to flower, set seed and expand. Full effectiveness of this regime however can only be attained where rabbit populations are controlled. Sites must also be managed to avoid artificial improvement through the application of artificial fertilisers or drainage for example. Seasonal inundation should be retained, as this also helps to reduce competition from other plant species. Irish lady’s tresses populations show some resistance to grazing over time (Gulliver et al 2005), although for long term population growth, contiguous summer flowering within large populations is required.

Monitoring of Irish lady’s tresses populations has been crucial in assessing population change over time. To this end, volunteer Flora Guardians are recruited to count flower spikes every year to track the potential of populations to expand. Plantlife is looking for more Flora Guardians to complete this type of work on the Inner and Outer Hebrides. Please contact Plantlife Scotland if you can help.

Managing IPAs for priority species: case study 2 Lesser butterfly orchid

Lesser butterfly orchid Platanthera bifolia produces white / greenish white flowers from May to July. It is distinguished from greater butterfly orchid Platanthera chlorantha by the shape of the flower, the angle of its pollinia and by its height.

Lesser butterfly orchid is pollinated by night flying moths and achieves a generally high rate of seed set. Vegetative propagation, if it occurs at all is very rare. It grows throughout Europe to the Himalayas and in North Africa. In the UK, it grows on heathland,
grassland, scrub margins and open woodland; it has suffered a 33% decline between 1964 and 2002 across the UK (Preston et al 2002). This decline is why the species is now listed as a priority species on the Scottish Biodiversity List and in SNH’s Species Action Framework. Its key threat is the continuing loss of its habitat.

**Land management at lesser butterfly orchid sites**

In 2008, Plantlife Scotland and the Farming Wildlife Advisory Group (FWAG) and Scottish Natural Heritage conducted a field assessment of management at 22 sites for lesser butterfly orchid across Scotland. Interviews with land managers illustrated that in general, higher numbers of cattle had been kept on site in the past and sometimes also higher numbers of sheep. Overwintering cattle seemed to support larger populations and light summer grazing seemed to benefit lesser butterfly orchid populations by reducing competitive grasses. In contrast, silage making in the past had limited orchid numbers. One site on Skye was regularly burnt, which was believed to help maintain orchid numbers, presumably by reducing competition from other species.

At sites where lesser butterfly orchid numbers remained high, all sites had been lightly grazed by cattle at some time during the year. Where cattle grazing had been more intense in autumn / winter, orchid population numbers appeared to increase.

**Management recommendations for flowering plants in coastal pastures**

1. **Grazing patterns and timings for cattle; sheep; deer:**

   Optimal grazing regimes to maximise orchid numbers focus on maintaining grazing by cattle and / or sheep in winter with short exclusions during flowering periods in the summer. Grazing breaks are ideally as short as the flowering season only, roughly three months for these species, resulting in fairly short swards. Currently, sites with large populations are all managed as part of a farm grazing regime that removes rank vegetation in autumn and winter. During flowering periods in June, July and August, many good sites have moderate levels of grazing. Other nearby species may be more palatable, which means that orchids are not necessarily targeted by grazers.

2. **Choice of livestock**

   Both sheep and cattle are grazed on good orchid sites: as long as animals are used to remove large quantities of coarse grasses, then any grazing animals could be used. Heavy grazing pressure must however be released in summer to allow flowering. Some good mainland sites are winter grazed by deer, which has a similar effect.

3. **Rabbit control**

   Grazing control during flowering periods must include rabbit control in order to be effective. The potential for seed production in Irish lady’s tresses is being severely curtailed by rabbits removing flowering spikes and is having a significant impact on seed production.

4. **Conservation management agreements**

   Of five sites visited with conservation management agreements in place that specified grazing levels and exclusion periods, only one site was being managed successfully for lesser butterfly orchid. This success was linked to three factors:

   - Grazing exclusion period was short enough to cover flowering of this species only
   - Grazing levels were high enough to maintain a short sward
   - Management regime was specifically targeted at this species

   Problems occur where conservation agreements are targeted at other species that require lower levels of grazing. This is resulting in problems when summer growth is not removed and then becomes unpalatable in autumn. Equally, the desire to meet cross compliance measures (the requirement to meet certain environmental standards under agri environment schemes) means that winter cattle grazing is restricted to limit poaching of the soil. This means that suitable habitat conditions for these orchid species are not maintained. Winter sheep grazing tends to trample vegetation but not remove it.

   These observations suggest that summer stock levels should be maintained to manage competitive grasses or sites should be stocked heavily in late summer before grasses become unpalatable. Grazing exclusions should be kept short and restricted to small sites to manage and concentrate grazing on key sites.

A one size fits all approach to species rich grassland management clearly does not suit lesser butterfly orchids or Irish lady’s tresses orchids. This causes a conflict at some sites between corncrake (**crex crex**) management and **Spiranthes** management for example. Several of the sites on Coll and the area around Loch Fada on Colonsay are under corncrake management, which requires an extended grazing break during summer months resulting in a much taller sward. This is less than ideal for Irish lady’s tresses, and population numbers are falling under this regime.

5. **Land management supported by SRDP**

   There has been a tendency for SRDP prescriptions to over compartmentalise for environmental management, leading to rigid management regimes that cannot manage a mosaic of habitats and deliver a range of rare species habitat needs. Well managed sites benefit from being part of more extensive grazing regimes, which are more flexible for owners, tenants and neighbours and enable them to move animals from site to site, ensuring that site specific management is appropriate. Increasing flexibility in terms of grazing will make them more economically viable and attractive for farmers to adopt and effectively deliver more environmental benefits.
6. Winter poaching
Winter poaching may be useful in preparing the ground for good spring growing conditions. Observations at sites indicate that both plants can withstand years of very heavy grazing and plants will come back once grazing is reduced to moderate levels. Winter poaching could therefore be used as a management tool to maintain existing populations and encourage expansion.

7. Supplementary feeding to maintain appropriate grazing levels on designated sites
Many sites are relatively poor pastures and farmers do not leave animals out long enough because of loss of condition. Restrictions on supplementary feeding are standard clauses in many prescriptions at designated sites to avoid nutrient increase and introduction of foreign seeds from hay / silage. However, where the lack of winter grazing is limited specifically by this factor, relaxing rules on supplementary feeding would enable farmers to graze for longer which would benefit habitats. Supplementary feeding could be through ‘concentrates only’ systems for example. The use of native breed cattle should also be encouraged as some breeds struggle to maintain body condition on these pastures.

8. Haymaking and cropping times
Only one site visited was being managed successfully for lesser butterfly orchid through hay making. The quality of the hay was poor and does not produce a viable crop. Several sites could have been used to produce hay / silage and if this had been done, the lack of grazing during the hay making period could allow vegetation to become too rank for this species. Haymaking is not therefore recommended as a management tool. There is not enough information on the impact of cultivation on these species, although it would be prudent to presume against cultivation.

9. Protecting sites from new woodland plantings
One site visited has lost orchid populations to woodland regeneration schemes. The presence of lesser butterfly orchid and Irish lady’s tresses (where appropriate) should be a material consideration in planning woodland regeneration schemes.

10. Monitoring
There is an urgent need to continue monitoring how plants react to changing management practices. Plantlife currently has three volunteer Flora guardians for Irish lady’s tresses and 12 for lesser butterfly orchid. Monitoring needs to include sward height measurements in early June and early September and the number of flower spikes produced. Plantlife is always looking for more volunteer Flora Guardians so please get in touch if you can help.

If the conservation of rare species is to be effective through SRDP prescriptions, flexibility needs to be increased. Managing for single species does not automatically result in increased levels of biodiversity and managing for bird species, for example, does not necessarily benefit rare and threatened plants. There is instead a need for flexible schemes that can be adapted to each site, so that land managers can manage smaller parcels of land and move livestock between them as required. This provides land managers with increased flexibility when managing for conservation while at the same time maintaining herd condition. The introduction of supplementary feeding, through concentrates for example, would also enable land managers to use animals more effectively to maintain the mosaic of habitats that these species require and that in the long term provides an ecosystem approach to land use, enabling production and conservation to work side by side. There is an urgent need to devise modern land management prescriptions that are sufficiently flexible to build on the best practices of the past and ensure that crofters and small land managers can afford to continue to manage their land in environmentally and economically sustainable ways. Much is still to be learned from traditional land management, when these species did in fact thrive as a by-product of dynamic and diverse rural land management.

To find out about becoming a Flora Guardian for rare plants and threatened habitats in Scotland, please contact Plantlife Scotland at the address above or go to our web site www.plantlife.org.uk/scotland/get_involved.
Important Plant Areas in Scotland

Fig. 1: Map of the location of Important Plant Areas in Scotland.
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