My presentation is about creating and restoring species-rich meadows.
We should undertake simple soil chemistry before we start such projects. We should welcome and involve all sorts of volunteers in these projects.
Doing both of these will help to ensure that projects involving grassland creation and restoration have a much greater chance of being successful.
Delivering successful projects which endure for the long-term will ensure that we are seen to be credible by landowners, by regulators, by those giving grants and by other professionals involved in such schemes.
Successful projects are required to deliver John Lawton's vision for the future: More, Bigger, Better and Joined up.

Policy context

The Lawton report 2010
Making Space for Nature: a review of England's wildlife sites and ecological network

Wide-ranging recommendations to achieve a coherent and resilient ecological network of wildlife sites across England to meet future challenges, including climate change, and deliver real benefits to wildlife and people

Applicable in other geographic contexts apart from England

The key message is 'More, Bigger, Better and Joined up'

- John Lawton's report is required reading for anyone involved in ecology and environmental management
- It may be almost 10 years old. It is superbly written in plain English and its recommendations for England can be applied elsewhere
- Our actions and advice must be based on the evidence if we are to deliver high quality habitats for the future and, through doing this well, to maintain our credibility as professionals.

The process of creating habitats

The objectives will drive the quality of the inputs – demanding objectives will require high quality inputs

Simple
Measurable
Achievable
Resourced
Time dependent

Example A Grassland with wildflowers
Example B Lowland hay meadow (MG5) of 1.2 ha with a population of at least 1,000 common spotted orchids by 2030

- You need to have a process to follow and ensure all the steps are taken. Keep it simple. Be realistic about what can be achieved.
- Start by setting clear objectives based on the environmental parameters of the site and the money and the time available for subsequent management and monitoring. Demanding objectives will require high quality inputs.
- Do you want a grassland with wildflowers? Easy to do, ranging from pretty flowers on urban roundabouts to tall perennials like ox-eye daisy, knapweed and buttercups sown into existing grasslands.
- Or do you want a characteristic hay meadow of high nature conservation value? This will require detailed specifications and careful supervision and a long-term commitment of resources (both people and money).

Lowland species-rich grasslands

- **Soil pH <5 for acid grasslands, 5-6.5 for neutral grasslands, 6.5-8.5 for calcareous grasslands**
- **Extractable P (Olsen bicarbonate method) <10 mg/l**
- **Extractable K (ammonium nitrate) <175 mg/l**
- **Total N <10g/kg**

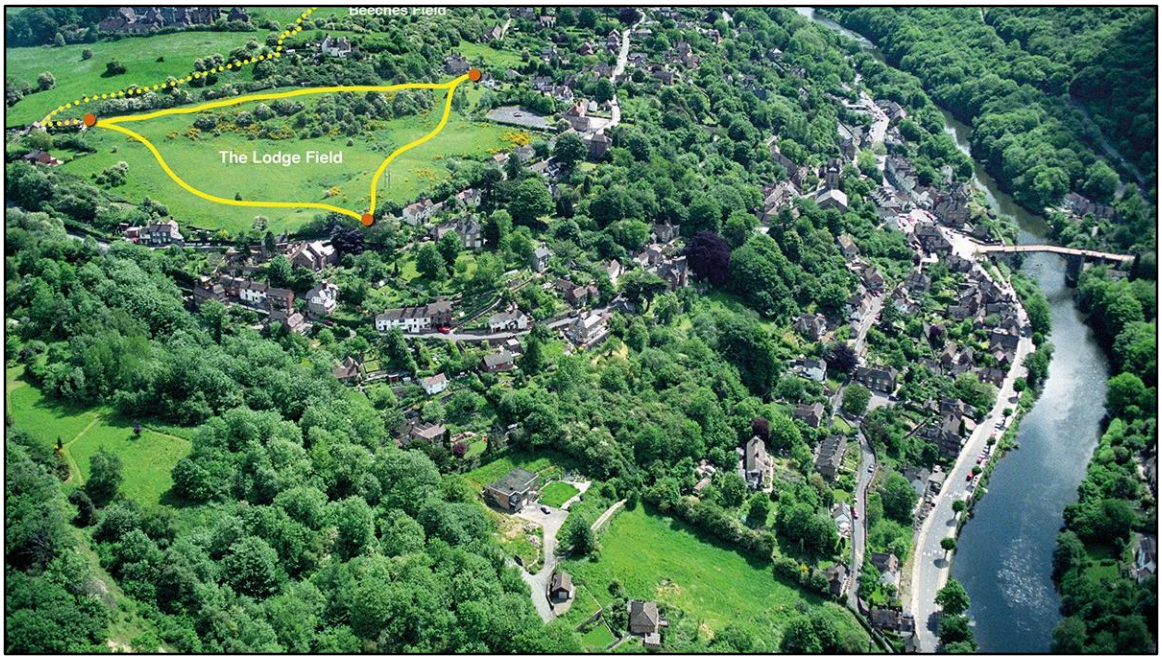
- Soil chemistry (and local hydrology for damp and wet grasslands) is crucial for the successful and sustainable creation and restoration of species-rich grasslands.
- These general guidelines for soil pH and soil nutrients are based on the literature and from experience based on lowland grassland plant communities.
- The extractable phosphorus needs to be <10 mg/l and the extractable potassium needs to be <175 mg/l. There is a good relationship between the phosphorus and potassium available to plants and the analytically determined extractable phosphorus and potassium.
- Soil analyses – the NRM laboratory at Bracknell, Berkshire or Eurofins with labs nationwide. I've used Eurofins where the basic soil analysis for pH, phosphorus and potassium is about £10 per sample and there is a minimum order of £200.
- Low levels of soil phosphorus and potassium are a feature of most botanically valuable unimproved grasslands. The coincidence of low levels of soil phosphorus and potassium in many communities suggests that a combination of both may have a greater influence on the vegetation than low levels of phosphorus alone.
- Soil phosphorus and potassium levels are simple and cheap to measure. They are an effective decision-tool for public and private landowners in determining which

sites merit resources for restoration or creation.

- Soil nitrogen is more complicated. I have included a guideline level for total nitrogen to complete the picture. It is not feasible to measure accurately the available nitrogen (i.e. soil mineral nitrogen levels). Soil total nitrogen indicates the pool of potentially mineralisable nitrogen, but much of this would not be readily available to plants as available nitrogen only results from organic matter breakdown and nitrogen mineralisation.

- This slide shows data from 20 meadows and pastures in Telford in Shropshire that are managed by the Severn Gorge Countryside Trust or by Telford & Wrekin Council. Each has been given an Ecovalue based on botanical composition. Ecovalue 5 (pale green) is very high quality species-rich grassland equivalent to a SSSI. Ecovalue 1 (red) is species-poor grassland of very low ecological value.
- The dashed lines define a zone which is 10 mg/l extractable phosphorus and 175 mg/l extractable potassium.
- The highest value grasslands are all within the zone defined by these critical phosphorus and potassium levels with two exceptions which have high soil potassium levels.
- These critical phosphorus and potassium levels give the managers of these grasslands a decision tool for deciding whether to restore grasslands. Those within the defined zone merit the resources involved in restoration to species-rich grassland. Those outside the zone can have other uses.
- For grasslands that you want to restore or create, look at the soil chemistry of equivalent grasslands on SSSIs or LNRs or Local Wildlife Sites in the vicinity and construct your own model. It may cost you some money but it will increase your credibility with those who you need to convince about land ownership or money or resources.

- In my view, any project involving creating or restoring grassland habitats requires local volunteers unless the site is part of a normal agricultural enterprise with access to the types of machinery you will need to manage the grasslands.
- The involvement of local people as volunteers gives landowners, Local Authorities and other public bodies confidence about the commitment of their resources to these sites.
- But volunteers can be very different in their understanding of what is involved and what is important. Some may be interested in wildflowers, some may be interested in butterflies, some may be interested in birds. Some may just like coming along to chop things down.
- Managing and resolving conflicts between the proportion of different habitats for different species can be very complicated. Even apparently simple things like when is the grassland cut each year can lead to intense discussions between those who favour a cut in July or in August or leaving the cut until September or even October to allow the insects and butterflies to complete their life cycles.
- Do not be surprised if volunteers have strong views on what should be done on the site and this does not accord with what you may think is best for nature conservation. But have a least one fundamental aim or principle that you stick to at all costs and are prepared to argue for based on the evidence.

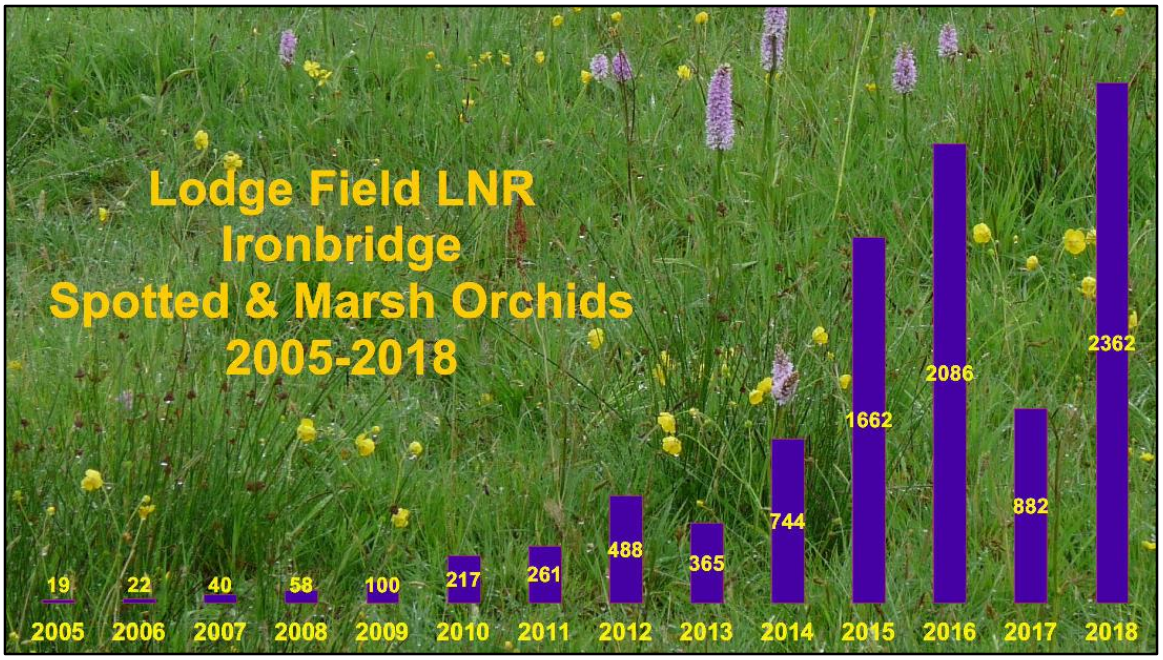


- My case study is Lodge Field on the edge of the Severn Gorge in Shropshire overlooking the famous Iron Bridge over the river Severn.
- Yellow lines show the footpaths and red dots the entrances.

- Lodge Field was grazed by cattle in the past and by a few horses from 1974 onwards.
- The horse grazing was stopped in 2003 when the dog walkers complained and there was then no grassland management.
- Brambles were present in the open grassland rather than just along the edges of the fields due to the low grazing pressure. There were very few orchids and yellow rattle was only recorded in one very small area.
- Natural succession was driving the habitat towards scrub.
- A cut&collect grassland management regime was started in 2004 with a target date of mid August. The results over the past 15 years have been most impressive: restoration of a high quality hay meadow with numerous orchids and widespread yellow rattle.

- The cut&collect regime uses a tractor towing a mower which blows the grass into trailer.
- There is no aftermath grazing because this is not compatible on this urban fringe site with dog walking and general recreational use.
- The grassland has been harrowed every three years using an Opico 3m wide harrow with four rows of spring tines set at the firmest setting. This removes the dead vegetation (the thatch) which can build up and inhibit colonisation and germination. From this year, harrowing every year will be undertaken soon after the cut&collect operation.
- This year there has been a 2nd cut&collect operation in late October to mimic the aftermath grazing by sheep often used on hay meadows. It is hoped to make this part of the regular management regime.

- At Lodge Field, we use annual orchid counts as the principal method of monitoring the grassland together with occasional NVC and condition monitoring based on the English Nature rapid assessment method for monitoring the condition of lowland grassland SSSIs (ENRR 315, 2000).
- Everyone starts off in a nice straight line with one metre between each person and strict instructions to only count the orchids to your right up to the next person.
- The reality is that individuals move at different speeds. They chat to each other. A dense patch of orchids will slow one or more people down. The others may go on ahead.
- Trying to keep a group of committed and willing but opinionated people in a rough straight line on a Sunday morning is very hard.



- The spotted and marsh orchids have increased from 19 in 2005 to 2,362 in 2018 in an area of about one ha. The recent counts suggest the expected plateau in orchid numbers may have been reached.
- Counting orchids is a powerful technique in terms of motivating people and attracting volunteers and monies.
- The NVC coefficient for MG5a was 60% in 2016 which is a very good fit with this typical hay meadow community.

In conclusion, I have a few golden rules for the effective use of resources to restore and to create meadows and grasslands for the future.

- Firstly, the plant species already present will suggest the type of grassland that you can restore or create and the feasibility of doing this.
- Secondly, taking account of simple soil chemistry (and local hydrology for damp and wet grasslands) will ensure a scheme is sustainable in the long term and worth investing resources. Don't push water uphill. In other words, do not try to create a complex MG5 species-rich hay meadow on nutrient-rich topsoil
- Thirdly, the original objectives must include habitat management and monitoring. Decide what is feasible given the resources you have and what can be continued in the future if resources are reduced.
- Finally, try to involve volunteers and the local community. Reward them with feedback, positive results and parties.
- This Powerpoint will be available on the Conference part of the CIEEM website, but without the Notes for each slide. I'm doing a CIEEM webinar about creating habitats for the future using habitat creation, restoration and translocation next Wednesday 28 November starting at 12.30. You can register for this through the CIEEM website. The presentation for this webinar has got very detailed Notes for each slide with full references. I'm hoping there will be a way of making this

available through CIEEM to those who want it.