I've been involved in creating habitats for a long time - including habitat creation, habitat restoration and habitat translocation.

- This webinar will set out the policy context by reference to John Lawton's report 'Making Space for Nature'.

I will describe a process – a framework – for creating habitats and I will illustrate this by reference to three case studies where I have been directly involved.

- The webinar will last about 35 minutes and there will then be up to 25 minutes for online questions.

Some of the slides are detailed and are really too much to take in at one quick viewing.

- The Notes for the slides contain relevant details and references.

The whole presentation will be available on the CIEEM website together with the detailed Notes for each slide.

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 that can meet future challenges, including climate change, and deliver real benefits to wildlife and people

Applicable in other geographic contexts

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

John Lawton's report 'Making Space for Nature' is required reading for anyone involved in ecology and environmental management. It is superbly written in plain English. Its recommendations for England can be applied elsewhere

- We have a real challenge on our hands as environmental managers and ecologists to be the key players in delivering this vision. 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.

Habitat creation, in the sense of sowing and/or planting often on bare ground, requires time - decades or longer - to develop the flora and fauna associated with such habitats. We need to be honest about this. Unless we are simply creating some colourful grasslands.

- We need to acknowledge that there is an ongoing loss of mature and established habitats as a result of development and infrastructure projects. These mature habitats are usually replaced by young and species-poor habitats as part of habitat creation or landscaping schemes associated with such projects. This is contributing to the ongoing loss of biodiversity, natural capital and the associated ecosystem services.

To put this key point another way, new habitats of the same maturity and quality cannot be developed fast enough to replace the ongoing loss of mature habitats to development and infrastructure projects.

- In my view, both the restoration of degraded habitats, and the translocation of habitats with quality and maturity from sites with development consent, will be required to deliver the land use policies and ecological networks set out in the Lawton report.

‘No net loss’ and ‘Net gain’

EU Biodiversity Strategy to 2020

Target 2 – Maintain and restore ecosystems and their services

Action 7 – Ensure no net loss of biodiversity and ecosystem services

National Planning Policy Framework 2018

Para 170 “…minimising impacts on and providing net gains for biodiversity….”

Highways Agency

HA Biodiversity Plan 2015, Action 3.2 commits to no net loss and net gain wherever possible

Network Rail

Make a net positive contribution to biodiversity in the UK

Objective in 5 year business plan for Network Rail Infrastructure Projects

There is no regulatory requirement for ‘No net loss’ or for ‘Net gain’ in development schemes.

- No net loss of biodiversity is Action 7 of Target 2 of the EU Biodiversity Strategy to 2020. No net loss of biodiversity is a powerful driver

The NPPF in England provides includes a useful reference to net gains.

- It is really encouraging to see that both the Highways Agency in England and Network Rail in the UK have such challenging commitments

It is very clear to me that the delivery of ‘no net loss’ and ‘net gain’ policies will require the restoration of degraded habitats and the translocation of habitats with quality and maturity from sites with development consent. It is no longer sufficient to rely on habitat creation.

NR brochure for Business & Biodiversity Offsetting Programme conference, June 2014

Creating habitats		
Habitat management	**Natural**	**Non-intervention** **Natural processes e.g. disease, death, decay, wind, storm**
	Artificial	**Techniques of intervention in a natural succession e.g. grazing, hay cutting, burning, coppicing, water level management**
Restoration of existing habitats (unaltered soils, remnant vegetation)	**Natural**	**Natural regeneration, colonisation and succession**
	Artificial	**Intervention to mimic natural processes e.g. sowing, planting, hay strewing, using heather brash**
Creation of new habitats (altered soils, no remnant vegetation)	**Natural**	**Natural colonisation and succession**
	Artificial	**Significant intervention to enhance natural processes (as above) - may include translocation of soil, plants, vegetation and animals**
Translocation of existing habitats	**Artificial**	**Significant intervention to move soil, plants, vegetation and animals to a new site**

This table sets out a framework for the three key processes that we use to create habitats: habitat restoration, habitat creation and habitat translocation. The notes to this slide give definitions of these three processes and key references.

- The definitions in the Notes of this presentation are based on whether the structure, drainage and/or nutrient status of the soils of the project site have been significantly altered by human intervention, and whether there are remnants of the original semi-natural vegetation present either as degenerate vegetation or as seeds, rhizomes or roots.

In this table, natural regeneration, colonisation and succession are separated from artificial processes such as sowing and planting.

- Creating any habitat successfully in the long-term needs management & monitoring. This should be kept in mind from the beginning.

Non-intervention is a method of management that requires a clear rationale that is recorded for future site managers. Grazing, hay cutting, burning, coppicing, managing water levels all need financial and human resources year after year. Such active methods of managing habitats are hard work to continue year after year but are critical to providing high-quality habitats and their associated species for the future.

- Habitat restoration and habitat creation need to make more of the powerful processes of natural regeneration, colonisation and succession. There are many advantages such as species being appropriate to the local area. Ecological function, structure and diversity will be established more quickly and cheaply than by using seeds or planting tree & shrub whips.

Creating habitats from scratch has greater risks of failure than we will often admit. The soil and/or hydrology may not be appropriate for the planted or sown species. Colonisation by other plant species and animals may be slow.

- Some created habitats seem to go well e.g. woodlands in a general sense (although creating the ground flora is a real art), scrub, hedges, simple wetlands and watercourses, coastal habitats. We struggle with creating hay meadows although we are fascinated by them. Heathlands are a challenge to create or to restore as soil pH and nutrient levels may have altered to such a degree that heathlands are now not the appropriate habitat for the soils in question.

Habitats with maturity and quality should be translocated from sites with development consent. Established hedges, species-rich vegetation and ponds are valuable wildlife habitats and it can take years for newly created, planted and sown habitats to attain the same degree of maturity and complexity.

Ecological restoration

The process of increasing the semi-natural vegetation at any site where the structure, drainage and/or nutrient status of the soils have not been significantly altered by human intervention and where there are remnants of the previous semi-natural vegetation, either as degenerate vegetation or as seeds, rhizomes or roots.

Good reference book: Oliver Gilbert & Penny Anderson (1998) *Habitat creation and repair*, OUP.

Habitat creation

The process of establishing a semi-natural vegetation community at any site where there has been a land-use which has significantly altered the structure, drainage and/or nutrient-status of the soil and where there are no remnants of the previous semi-natural vegetation.

Good reference book: Oliver Gilbert & Penny Anderson (1998) *Habitat creation and repair*, OUP.

Habitat translocation

The process of moving soils or substrates with their vegetation and any animals that remain associated with them in order to rescue or salvage habitats that would be lost due to changes in land use, or to restore biodiversity to sites that have been damaged or degraded, or to newly created sites.

Good references:

- Penny Anderson & Peter Groutage (2003) *Habitat translocation - a best practice guide.* C600, CIRIA, London
- John Box (2003) Critical factors and evaluation criteria for habitat translocation. *Journal of Environmental Planning and Management* 46: 839-856.
- John Box & Kat Stanhope (2010) Translocating wildlife habitats: a guide for civil engineers. *Proceedings of the Institution of Civil Engineers - Civil Engineering* **163**: 123-130.
- John Box (2014) Habitat translocation, rebuilding biodiversity and no net loss of biodiversity. *Water and Environment Journal* **28**: 540-546.

Habitat Restoration at Lodge Field in Telford in Shropshire

The following slides describe a small urban site with a hay meadow restoration project.

- Lodge Field was grazed by cattle in the past. It was then let for grazing by a few horses from 1974 onwards, but this was not going to maintain a grassland community as the grazing pressure was too low. This horse grazing was stopped in 2003 when the dog walkers complained and there was then no grassland management.

In 2004, the grassland was recognizable as a derelict hay meadow. But brambles were present in the open grassland well away from the edges of the fields due to the low grazing pressure.

- Natural succession was driving the habitat towards scrub.

There were very few orchids and yellow rattle was only recorded in one very small area.

A hay meadow regime of cut & collect in mid to late August was imposed from 2005 The cut&collect regime uses a tractor towing a mower which blows the grass into the trailer.

- There is no aftermath grazing because this is not compatible on this urban site with dog walking and general recreational use.

The grassland has been harrowed roughly 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 2018 onwards, harrowing every year rather than every three years 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.

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.

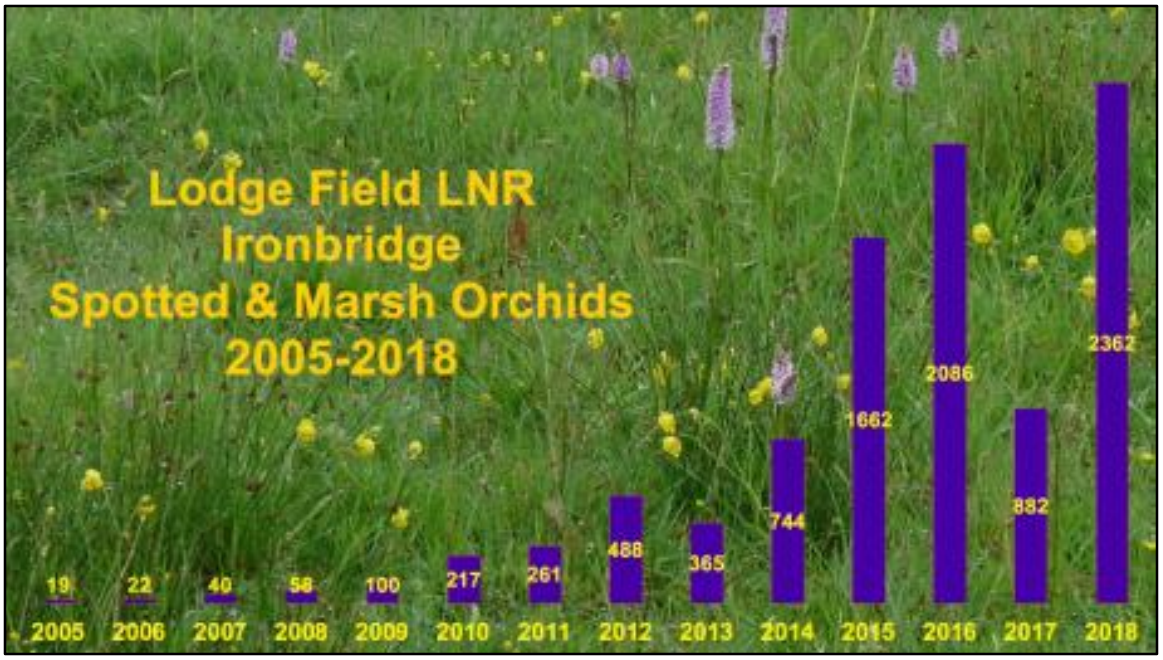
At Lodge Field, we use annual orchid counts as the principal method of monitoring the grassland together with occasional NVC and condition monitoring based on the English Nature rapid assessment method for monitoring the condition of lowland grassland SSSIs (ENRR 315, 2000).

- Orchids are iconic species and are easy to count with local volunteers and members of the public.

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.

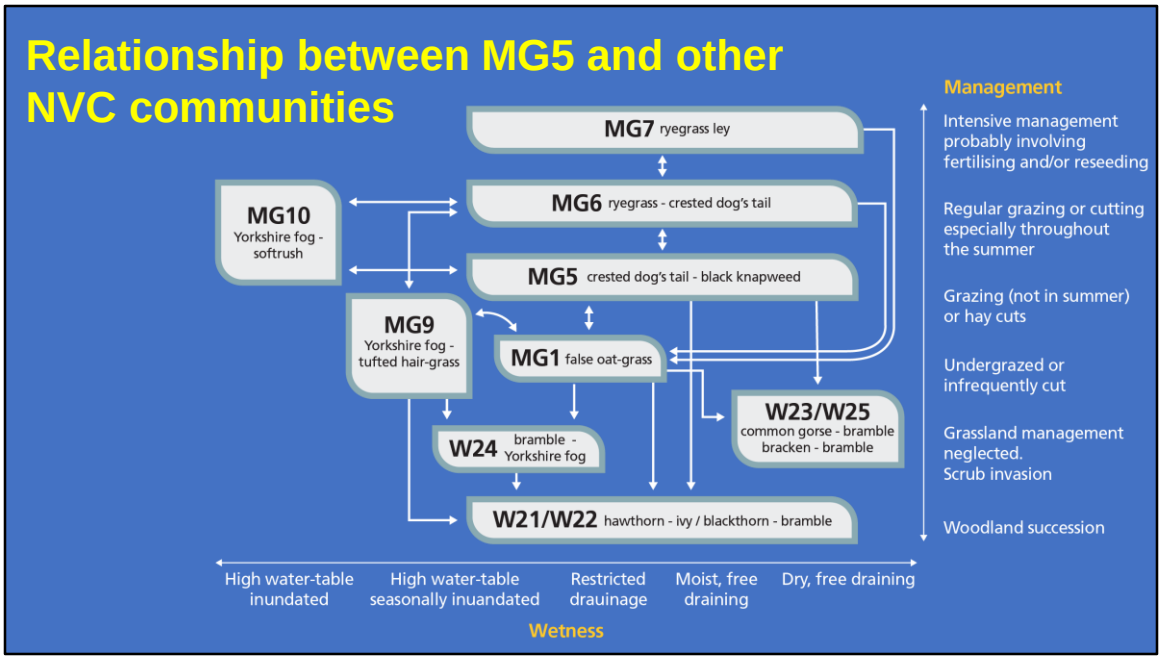
Trying to keep a group of committed and willing but opinionated people in a rough straight line on a Sunday morning is very hard.



The numbers of common spotted orchid, southern marsh orchid and their much more abundant hybrid have increased from 19 in 2005 to 2,362 in 2018 in an area of about one ha. The growth over this period fits an exponential curve.

- The reduction in 2017 is undoubtedly a reflection of the prevailing weather conditions that year and this was the case in other grassland sites in Telford.

The NVC coefficient for MG5a was 60% in 2016 which is a very good fit with this typical hay meadow community.



Habitat restoration requires a good understanding of the potential for changing NVC communities through changes in habitat management or the water regime.

- This slide use the MG5 grassland community – the classic lowland hay meadow – to illustrate this point.

On this slide, the vertical axis goes from no grassland management at the bottom to intensive management at the top. The horizontal axis runs from very wet on the left to dry & free-draining on the right.

- Start with the MG5 grassland in the middle of the slide. Increasing the intensity of the management by fertiliser application and frequent cutting will change the species-rich MG5 grassland to MG6 grassland which is of less nature conservation value. Greater intensity of management can further change the grassland to MG7 ryegrass of low or negligible nature conservation value. On the other hand, lack of management allows the MG5 grassland to become MG1 grassland typical of roadside verges and on its way to scrub.

A species-rich MG1 grassland or a MG6 grassland can be restored to MG5 grassland by changing the management regime as long as the soil chemistry is appropriate.

- This diagram was constructed by Mike Webb and myself many years ago for the MG5 grassland community. This diagram has been looked over and revised in light of comments from John Rodwell who is the architect of the NVC.

Similar diagrams can be constructed for other NVC communities.

Habitat Creation at Stirchley Grange in Telford

The slide shows a surface water balancing pond constructed in the 1970s on boulder clay.

- There was only a little emergent vegetation by 1983.

In 1984, rhizomes of common reed were excavated from a local reedbed to create more open water and stop the incursion of willows into the drier edge of the reedbed.

A clump of rhizomes of common reed. People do enjoy getting involved and muddy!

The rhizomes of common reed were planted into the clay bottom in shallow areas.

By 2005, a superb and extensive reedbed had developed. Wetland ecosystems are often relatively easy to create

Habitat Translocation at Lightmoor Village in Telford.

There was a length of species-rich hedge which was hundreds of years old and had evidence of being laid many years ago. Its retention on the site but in a different location was proposed by the Project Manager.

- This slide shows the preparation of a receptor trench for hedgerow translocation in 2007. Each receptor trench was excavated on the same day as sections of hedgerow were dug up and translocated. This is crucial to prevent soils drying out and injuring the root hairs which absorb water and nutrients from the soil.

Sections of hedgerow were dug up using a 360 excavator

Translocating the excavated sections of the hedgerow. Once the 360 driver had got the hang of the process, he started to enjoy himself and to demonstrate the skill and precision of an experienced excavator operator.

- Habitats should be translocated in large pieces to minimise damage and edge effects. Grassland turves, for example, should be around 2-3m long by 1-2m wide by at least 600mm in depth to capture the deep roots of perennials.

The excavated sections of hedgerow were carefully placed into the receptor trench.

The contractors took great care with the newly translocated hedge

One year later in 2008, all the tree and shrub species had survived the translocation, even holly which is a difficult plant to move.

By 2014, it was clear that the hedge had not been managed as a hedge, but had turned into a linear woodland with similar ecological functions to a hedge.

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**

So what have I learnt over the years in creating habitats?

- You must have a process to follow and you must 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.

The process of creating habitats

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

- **Environmental factors are critical – soil type, soil chemistry and hydrology**

Creating habitats needs a process. The objectives will drive the quality of the inputs.

- Be realistic and keep it simple. Soil chemistry and hydrology are critical factors.

Lowland 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

Lowland heathlands

- Soil pH 3–4.5
- Extractable Ca (ammonium nitrate) <150 mg/l
- Extractable P (Olsen bicarbonate method) <5 mg/l
- [Extractable ammonium nitrogen <3 mg/kg]
- [Extractable nitrate/nitrite nitrogen <I mg/kg]

The creation, restoration and translocation of grasslands and heathlands should consider these guide levels for soil pHs and soil nutrients taken from the literature and from experience. The Notes to this slide have full references.

- pH measurements taken in the field can give a good idea of whether it is worth doing soil chemistry. This is particularly valuable for heathland restoration in that soils with pH levels of greater than 4.5 are unlikely to generate sustainable heathland.

For grasslands, the extractable phosphorus should be <10 mg/l and the extractable potassium should be <175 mg/l

- Soil analyses can be done by NRM at Bracknell in Berkshire or Eurofins with laboratories nationwide. There are other commercial laboratories that do soil analyses. 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.

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 grassland restoration or creation.

- Low concentrations of soil extractable phosphorus may be a prerequisite for the

maintenance and restoration of the most highly valued grasslands. Reducing soil phosphorus is difficult in practice and the restoration of species-rich grassland in the presence of elevated soil extractable phosphorus levels merits serious re-assessment.

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 together in many communities suggests that a combination of both may have a greater influence on the vegetation than low levels of phosphorus alone.

- The creation of woodlands with a typical woodland ground flora on agriculturally rich soils should be undertaken with great care and forethought. High levels of soil nutrients may encourage competitive species such as rosebay willowherb, bramble, nettle and goose-grass. Planting or seeding of woodland ground flora species should take the existing soil nutrient levels into account.

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.

- For heathlands, extractable nitrogen fractions are useful guides in relation to heathland soils but only if there is a suitable analytical laboratory available as these are not standard analyses.

Additional notes

The exception to these general guidelines is the U1 *Festuca ovina-Agrostis capillaris-Rumex acetosella* grassland – see the paper by Nigel Critchley and colleagues in the references in the notes to this slide.

- Only a small proportion of the total P/K/Mg/Ca is available to plants. Soil analyses use chemical extractants to provide an estimate of the nutrient available under field conditions. Soil analysis methods have been developed to correlate with the response of agricultural crops and can be used for semi-natural vegetation. In terms of soil analyses, ‘extractable’ – ‘exchangeable’ – ‘plant available’ – all seem to mean more or less the same thing; the distinction is in the analytical methodology. Extractable is exchangeable + soil solution and this is the form of the nutrient available to the plants.

'Available' K & Ca for plants and ‘Extractable/Exchangeable' K & Ca as analysed are closely related.

- This is not necessarily the case for P where the soil and the extractant may correlate to P that is taken up by plant roots, but acid soils behave differently to neutral and

alkaline soils depending on the extractant that is used.

Experiments with different extractants for P suggest that the Olsen bicarbonate extraction method gives the best result compared to bioassays. The Olsen method is the standard agricultural method in England and Wales.

Key lowland grassland references

Critchley, CNR *et al*. (2002a) Association between lowland grassland plant communities and soil properties. *Biological Conservation* **105**: 199-215.

Critchley, CNR *et al.* (2002b) Plant species richness, functional type and soil properties of grasslands and allied vegetation in English Environmentally Sensitive Areas. *Grass and Forage Science* **57**: 82-92.

Defra (2010) Fertiliser Manual (RB209), 8th edition, pages 35 & 36 and Appendix 4, page 227. The Stationery Office. Transferred from Defra website to Agriculture & Horticulture Development Board website www.ahdb.org.uk/cropnutrition

Gilbert, J *et al*. (2009). Available soil phosphorus in semi-natural grasslands: assessment methods and community tolerances. *Biological Conservation* **142**: 1074-1083.

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Gough, MW & Marrs, RH (1990) A comparison of soil fertility between semi-natural and agricultural plant communities: implications for the creation of species-rich grassland on abandoned agricultural land. *Biological Conservation* **51**: 83-96.

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The Potash Development Association (2011). Soil Analysis – key to nutrient management planning. PDA Guidance Leaflet No. 24. http://adlib.everysite.co.uk/adlib/defra/content.aspx?id=000IL3890W.16NTBZXC9EW2DK
http://www.ahdb.org.uk/projects/documents/SoilAnalysis_000.pdf

Walker, KJ *et al*. (2004) The restoration and re-creation of species-rich lowland grassland on land formerly managed for intensive agriculture in the UK. *Biological Conservation* **119**: 1-18.

Key lowland heathland references

Clarke, CT (1997) Role of soils in determining sites for lowland heathland reconstruction in England. *Restoration Ecology* **5**:256-264

Mitchell, RJ *et al.* (1997) A study of succession on lowland heaths in Dorset, southern England: changes in vegetation and soil chemical properties. *Journal of Applied Ecology* **34**:1426-1444

Mitchell, RJ *et al.* (1999) A study of the restoration of heathland on successional sites:

changes in vegetation and soil chemical properties. *Journal of Applied Ecology* **36**: 770-783
Oliver Gilbert & Penny Anderson (1998) *Habitat Creation and Repair*, OUP

This slide shows data from 20 meadows and pastures in Telford.

- Each has been given an Ecovalue based on botanical composition and experience. Ecovalue 5 is very high quality species-rich grassland equivalent to a SSSI. Ecovalue 1 is species-poor grassland of very low ecological value.

The dashed lines define a zone which is 10 mg/l extractable phosphorus (phosphorus is the vertical axis) and 175 mg/l extractable potassium (potassium is the horizontal axis).

- The highest value grasslands (Ecovalues 3 to 5) are all within the zone defined by the critical phosphorus and potassium levels with two exceptions. The two green dots of Ecovalue 4 grasslands outside the defined zone have low levels of phosphorus but high potassium levels for reasons that are not yet known but may be due to previous intensive livestock use and manuring.

You can see Lodge Field down in the left-hand corner of this zone as a pale green dot for Ecovalue 5 and a code of L:F. Lodge Field was the earlier restoration case study with the orchids.

- 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.

The process of creating habitats

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

- **Environmental factors are critical – soil type, soil chemistry & hydrology**
- **Biological materials from the local area through good suppliers**
- **Natural regeneration, colonisation and succession**

Moving on through the process of creating habitats.

- Use good suppliers from your local area for your biological materials, whether seeds or plug plants or whips for shrub and tree species.

Even cheaper is using natural regeneration, colonization and succession. This process is so much more exciting as you do not know what interesting species may turn up on your site.

Natural regeneration, colonisation and succession

Advantages

- Species appropriate to the local area & local genetic stock
- Natural development of field, shrub and canopy layers
- Ecological function, structure & diversity come more quickly than habitat creation using seeds or nursery materials
- Development of unusual plant communities as part of the natural succession on bare or disturbed ground

Disadvantages

- Visual appearance of vegetation is slow to develop suggesting lack of management or interest that can lead to undesirable activities (e.g. fly-tipping)

One lesson that I have learnt over many years is that natural regeneration, colonization and succession are powerful tools that we should seek to use as much as possible in creating habitats.

- The advantages are clear in ecological and nature conservation terms.

But the disadvantages of the lack of rapid greening and the initial poor visual appearance of bare ground need to be taken into account depending on the location of the project.

- Use the power of nature to reduce costs and reduce the risk of failure associated with sowing and planting schemes.

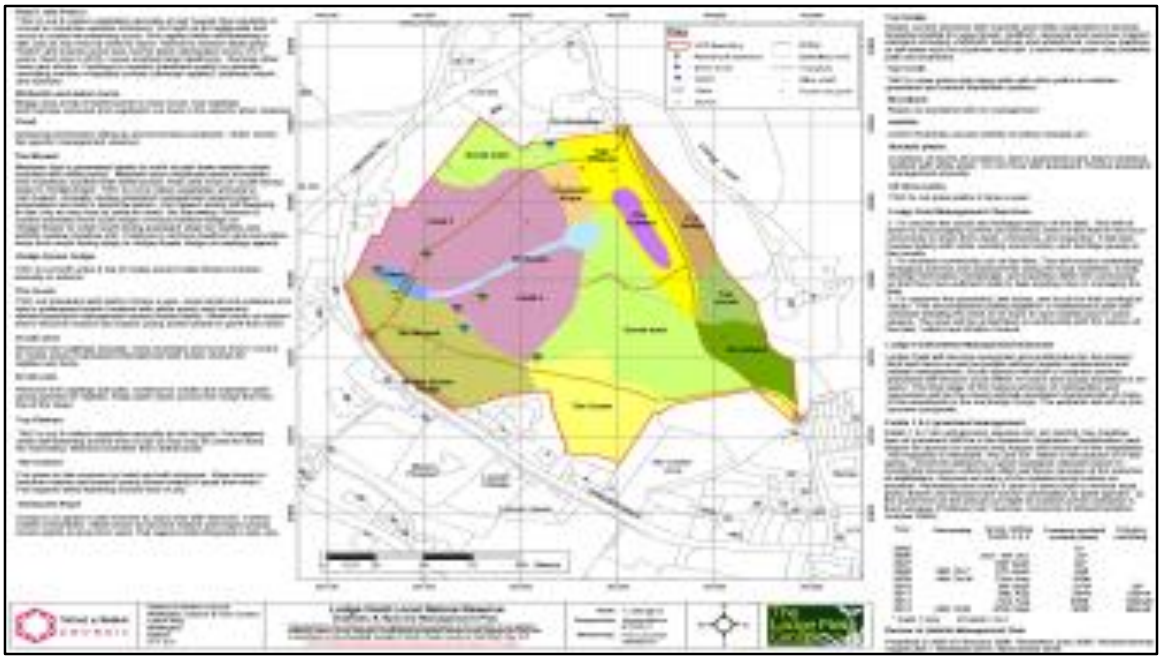
The process of creating habitats

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

- **Environmental factors are critical – soil type, soil chemistry & hydrology**
- **Biological materials from the local area through good suppliers**
- **Natural regeneration, colonisation and succession**
- **Ecological manipulation (e.g. soil preparation, control of water-level, vegetation management)**
- **Manage the habitats year after year**
- **Monitor against original objectives over defined period of time**
- **Implement corrective actions indicated by monitoring**

The final four key actions in the overall process of creating habitats are site preparation, management and monitoring.

- And being able to implement corrective actions if the monitoring data suggests that the process is not following the expected path to the defined target habitat.



Management Pans can be complex and detailed and become thick documents. The questions you need to answer are: Who is your Management Plan for? Who will read this Plan?

- This is the Management Plan for Lodge Field in Telford, the site featured earlier in the habitat restoration slides. It is an A3 document. All the key features needed for a management plan are present. You can zoom in on the slide in your full screen version of the presentation to see the detail.

This Plan includes the objectives and the rationale for grassland management; the management prescriptions for individual compartments and notable species; the key monitoring results over time; the dates of key management operations such as the cut&collect and the harrowing; the dates of revisions of the management plan.

- This A3 management plan can be a stand alone document. Or it can be an appendix to a longer more detailed management plan. It can be printed out at a larger size for an office, the site portacabin, a wall in the house of a local resident, or a public exhibition.

Any management plan must consider its audience: the Client, the landowner, the contractors doing the habitat management, the Wildlife Trust, the local community group, the local residents, and the general public. One format for a management plan can address more than one audience.

- **Counting orchids** Local volunteers can do annually. Use as a time series. Simple quantitative annual feedback.
- **Condition monitoring** Trained volunteers can do annually. Overall condition (five point scale e.g. favourable maintained, unfavourable recovering) can be used as a time series (e.g. five point traffic light system). Qualitative annual feedback.
- **NVC** Requires good botanists. Use as a time series if data is regularly available. Feedback only at survey intervals.
- **Plant species list** Requires good botanists and more than one visit a year to deal with seasonality. Total species number can be used as a time series if data is regularly available. Feedback only at survey intervals.

Moving onto monitoring.

- There are various alternatives for monitoring the development of the vegetation towards the target habitat set out in the original objectives.

The results need to be gathered over a period of time, for example 10 years, to demonstrate trends and to ensure the regular commitment of resources to the appropriate management of the habitat.

- Discuss the four methods.

Condition monitoring is based on the rapid assessment method for monitoring the condition of lowland grassland SSSIs (ENRR 315, 2000). This actually has seven conditions and includes partially destroyed and destroyed. See pages 8 and 135 & 136 of ENRR 315.

Volunteers

In my view, any project involving creating or restoring habitats requires local volunteers unless the site is part of a normal agricultural enterprise or a commercial operation with access to the types of machinery you will need to manage the habitats.

- 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 want to plant wildflowers or shrubs or trees. Some may just like coming along to cut things down.

- Managing and resolving conflicts between the proportion of different habitats for different species in a site can be very complicated. Even apparently simple things like 'When is the grassland cut each year?' may 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. You may have to give way on various issues to ensure a consensus or to allow some people to own their particular ideas. 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.

Key Questions

- **How to create semi-natural habitats usually associated with low nutrient soils on nutrient-rich agricultural land?**
- **How to create habitats with suitable connections for colonisation by species including slow moving species?**
- **How to replace ongoing losses of mature and diverse habitats?**
- **What are the funding mechanisms to deliver habitat management and monitoring in perpetuity?**

Key Questions for the future that need to be considered in research and policy agendas

The 1st & 2nd questions. These two questions are particularly relevant to biodiversity offsetting and to on-site or off-site compensation for residual impacts after application of the mitigation hierarchy of avoidance, impact reduction and mitigation.

- Soil chemistry and hydrology are fundamental to creating habitats. We must base our proposals for creating habitats on real evidence and not best guesses or a hope that the soil chemistry will be OK.

Created habitats must not become islands in a sea of agricultural land.

- The 3rd question: How to replace ongoing losses of mature and diverse habitats? 'No net loss' and 'Net gain' of biodiversity will be a real challenge for us all to address over the next decade. Habitats will need to be translocated as habitat creation alone cannot replace the maturity and diversity of the habitats being lost to development.

The 4th and final question. Funding is a real issue as the management of created habitats is so often a reason for failure. Habitats should be created that do not need habitat management unless this can be guaranteed through the commitment of the landowner. So, create habitats where management is not necessarily critical – for

example woodlands, hedges that can become linear woodlands, wetlands and rivers, coastal habitats. We should be very careful in trying to create defined grassland communities (such as hay meadows) or heathlands unless the habitat management is assured with appropriate resources into the future.

I have a few golden rules for the effective use of resources to create habitats for the future.

- Firstly, the plant species already present will suggest the type of grassland that you can restore or create.

Secondly, simple soil chemistry 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 and species management and monitoring. Decide what is feasible given the resources you have and what can be easily maintained 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 photo shows the Lodge Field Annual Community Picnic. Creating habitats is enormous fun because it involves working with people and with ecological processes – both of which are dynamic and not always predictable..

- In conclusion, the successful restoration or creation or translocation of habitats will give public and private landowners and those bodies giving grant monies confidence in our advice. Creating habitats successfully over time allows us to demonstrate our abilities as ecologists and environmental managers to produce

more, bigger, better and joined-up wildlife sites. These sites are needed now for the coherent and resilient networks full of wildlife and biodiversity that we all need in the future.