

On 28th April 2015, eighteen meadow restorers from around the UK from conservation organisations and commercial practice attended a Meadow Restoration Practitioners Workshop in Worcester arranged by the Coronation Meadows Project. The day consisted of round table discussions of specific elements of meadow restoration, with the discussions recorded. The following notes summarise the discussions.

Attendees

Name	Organisation	Role/Background
Dan Merrett (DM)	Plantlife	Coronation Meadows Project Manager
Claire Cornish (CC)	Cumbria WT	Latterly of Hayday and Cumbria Hay Meadow projects, now Coronation Meadows project officer
Miles King (MK) - chair	Freelance	Ex Conservation Director at Grassland Trust, sits on Coronation Meadows technical group
Keith Datchler (KD)	High Weald Landscape Trust	HWLT founder trustee, private estate manager creating multiple meadows, sits on Coronation Meadows technical group and steering group
Jake Chant (JC)	Somerset WT	Living Landscapes advisor enhancing meadows across the Mendip Hills
Giles Laverack (GL)	Scotia Seeds	Leading producer of wildflower seed in Scotland
Maria Marin (MM)	Scotia Seeds	Undertaking PhD on seed quality
Donald MacIntyre (DMac)	Emorsgate Seeds	Owner of Emorsgate Seeds & Flora Locale director
Ruth Dalton (RD)	Rare Breeds Survival Trust	Field Officer (North), also sits on Coronation Meadows technical group
Matt Sutton (MS)	Wyndrush wild	Ex CCW officer, now SSSI meadow owner and commercially restoring meadows in S Wales from meadow harvested seed
Matt Johnson (MJ)	Beds Cambs and Northants WT	Wildlife Sites Officer including Northants restorations through Inspiring Meadows project
Damian Young (DY)	Landlife	Project Manager undertaking habitat creation work
Rob Allen (RA)	Worcester WT	Reserves Officer undertaking meadow restorations
Lisa Lane (LL)	Berks Bucks & Oxon WT	Living Landscape Manager overseeing Oxfordshire restorations
Tanya St Pierre (TSP)	Yorkshire Dales Millenium Trust	YDMT Hay Time project officer
Sarah Robinson (SR)	Forest of Bowland AONB	Bowland Hay Time and Networks for Nectar Project Officer
Caroline Corsie (CC)	Worcester WT	Grasslands and Agriculture Officer managing Smite Farm
Michael Liley (ML)	Worcester WT	Wildlife Sites Officer

Hilary Kehoe (HK) of Anglesey Grazing Animals Project submitted thoughts by email

Discussion topics

	Topic
1	Natural regeneration through management vs enhancement
2	Nutrient status versus gut
3	Creating bare ground
4	Parameters for green hay
5	Seed ripeness/timing of harvest.
6	Quality of seed
7	Whole field restoration, or inoculator strips
8	Facilitator species
9	Immediate post restoration management and early management of the developing sward
10	How do we ensure appropriate grazing?
11	Hard-to-introduce species
12	Is the standard guidance about seed harvesting intervals from donors correct?
13	Should we be creating headlands for inverts /seedbank/late flowering species as a standard?
14	Basis for judging whether the restoration has been successful
15	What is the most common cause behind failed restorations?
16	Creative methods and unorthodox kit

1. Natural regeneration through management vs enhancement?

Introduction (DM)

Plantlife's seeding policy advocates natural regeneration wherever possible, suggesting sites should be given time to regenerate naturally. Natural England (TIN062) similarly suggests that before looking at other options consideration should first be given to whether changes to the management of the grassland would be sufficient to diversify the sward, while Scottish Natural Heritage concedes natural regeneration is unlikely to be suitable for most situations though may be worth pursuing near to existing semi-natural grassland which can act as a seed source. With meadow restoration often done through fixed term projects however there is rarely the opportunity to amend management for several seasons to see whether natural regeneration may succeed. There are examples of good natural regeneration eg Gwent Wildlife Trust's New Grove Meadows where a study showed that over 12 years semi-improved fields adjacent to the SSSI showed very good results through natural regeneration after changes in management with gates installed to allow movement of stock and machinery between the fields. Species that were frequent in the SSSI fields but remain absent from the naturally regenerated fields are Quaking-grass *Briza media*, Spring-sedge *Carex caryophylla*, Glaucous Sedge *Carex flacca* and Cowslip *Primula veris*.

Where does the balance lie in pressing ahead with enhancement vs giving the site every opportunity to regenerate naturally?



New Grove Meadows natural regeneration after 14 years, 2 fields away from SSSI

Thoughts from the group

MS With sites locked into 10 year agri-environment schemes people expect results. Cited a case where a failed natural regeneration attempt frustrated the farmer, whereas the introduction of some seed would have likely led to the farmer carrying on the management beyond the 10 year agreement. He has found that even if he suggests considering natural regeneration people still typically want seed anyway. Suggested the proportion of seed entering the seed bank for some species was also often very low.

DMac Natural regeneration in any case needs to consider the mobility of the species, with some such as the common spotted orchid coming in fairly easily but not others like cowslip. Reiterated the ephemeral nature of certain species in the seedbank with the community as a whole having a fairly short-lived seedbank

JC Highlighted the experience of fields being under stewardship options but without capital works for oversowing that after years of receiving £200/ha are still showing nothing in terms of increased botanical diversity. Suggest should have local seed added

LL At Chimney meadows did 70 Ha of Arable reversion 10 years ago using green hay from the nearby NNR but left 30x30m plots unsown as controls. The left plots resulted in ruderals and not very interesting grasses whereas surrounding field diversified well. 10 years on the squares are still just about visible despite ingress of species from the surrounding enhancement. Now they have more meadows in the holding there are signs of some natural regeneration with cowslips appearing where they wouldn't expect to be found and other species, presumably through movement of machinery and stock, but it is only a few plants.

KD Highlighted had similar experience of leaving control plots during enhancement (10 m x 10m) which ended up showing little but creeping thistle and the squares are still discernable.

Links

NE TIN 036

<http://adlib.everysite.co.uk/adlib/defra/content.aspx?doc=102905&id=102907>

Plantlife seeding guidance http://www.plantlife.org.uk/uploads/documents/PL_Seeding_14.pdf

SNH advisory note

<http://www.snh.org.uk/publications/on-line/advisorynotes/106/106.htm>

Newgrove meadows study

<http://www.conservationevidence.com/individual-study/4024>

2. Nutrient status versus gut feeling

Introduction (CC)

In Cumbria we have done a lot of restoration and use the NE technical guidance on how to assess fields - through survey, talking to the farmer and getting a lab soil test. However sometimes what the soil test is saying and what can be seen on the ground doesn't marry up at all. In Cumbria they mainly concentrate on phosphorus and pH (as have problems with acidity) but feel that with enough experience you can walk into a meadow and get a good gut feeling of whether it will work or not. Also noted that when the donor meadows have been soil tested some of those have higher phosphorus results than might be expected (P of 3)

Do other people use gut feeling along with/instead of soil tests and what sort of results have they had?

Thoughts from the group

LL Related experience of Chimney Meadow arable reversion where the soil testing for P varied between fields at levels between 1 and 4. They only got the stewardship money for the fields with P levels 1 and 2 but decided to revert the fields of P 3 and 4 anyway as they had the seed. Ten years on one of the best fields is the P3 field which is 'lovely'. The P1 field is very different - it is much thinner and has quaking grass, the 2s are fine while the 4s initially grew very vigorously as expected but they are ridge and furrow and the ridges have nice species, though with nettles and brome occurring in the furrows between. Has taken 10 years but they are coming. The treatment was the same across all fields but now all have very different characters.

CCor suggested that from her background in soil health the wrong things are being measured in meadow soil tests and that if there were only 3 things that could be measured she would suggest pH, organic matter and protozoa to look at soil health and allow insight into things like cation exchange capacity which could affect how phosphate behaves.

LL felt that there is a conversation to be had with Natural England regarding solely following p levels

MS Would go with gut feeling over soil testing and would adjust advice according to view of nutrient status. Regarding soil science, highlighted that the picture can be complicated with for instance pH levels affecting available P, while on the issue of soil health a bacterial dominated system he understands is found more in improved situations with meadows having a more fungal dominated system so suspects there is no quick fix.

JC Nutrient status is one a suite of things that they look at in their attempt to build ecological networks across the Mendips Hills however they are willing to try within reason even on sites with higher nutrient levels where landowners are keen as the result will be something that is better than the current situation. There is an argument for considering, location, connectivity etc rather than just focussing on nutrient status.

SR Agrees but where stewardship is the funding source you are restricted by the decision tree which says yes if the P is 2 or less and no if it is higher and that is their problem. There are sites they have walked away from this year where the gut feeling was yes but the soil test said no (conversely they could put in a site they thought was rubbish if it had a lower test result).

Suggests that yes we should have dialogue with NE about it.

CC Noted that it is often written into higher level stewardship prescriptions that the P index should drop to between 0 and 1 over the 10 years which would be a massive ask if starting off from 2 on the soils they have in Cumbria.

Links

NE TIN 036 <http://adlib.everysite.co.uk/resources/000/245/878/TIN036.pdf>

FEP Manual <http://adlib.everysite.co.uk/resources/000/251/202/NE264.pdf>

3. Creating bare ground

Introduction (TSP)

Outlined a trio of different methods of creating bare ground that the Haytime project had utilised with monitoring case studies

1 Scarifying with an Amazone in 2009 to depth of about 1 inch. Usually used for collecting green hay but turned the blades vertically and scarified plots 2m x 5m and then adding 1.5kg dry seed collected by vacuum harvesting. They were very pleased with the results with new species coming in by the following year (including yellow rattle, eyebright, red clover, common sorrel and pignut) but didn't do again in subsequent years as had been driven by the area being awkward to get bigger machinery in and not wanting to bring in extra equipment. The problem was that it was slow changing round the blades and it was a small scale operation, but still useful for difficult to reach places.

2. Chain Harrowing. They typically recommend to farmers that they do chain harrowing in strips going up and then across as well, as thoroughly as possible within three days or less prior to the arranged seeding date. Have found better results where the seed has subsequently been rolled in. Have problems potentially with chain harrow availability, having to consider any archaeology and that if it is dry weather it is not very effective. Have had good results, 2010 plot survey found two new species (yellow rattle and eyebright) along with increase in rough hawkbit, common knapweed, ribwort plantain, yellow oat-grass and crested dog's-tail.

3. In 2014 tried using a grass harrow with seed box which has metal tines to harrow the soil surface with seed airblown through tubes into channels between the tines. This was done after opening the sward with stock hard grazing (mostly sheep). They are awaiting results, but again was quite neat as only need the one piece of kit and so was a cost and time affective method.

They haven't tried power harrowing



Haytime
Scarifying with Amazone



Haytime
Chain harrowing



Haytime tractor-drawn
grass harrow with seed box

Thoughts from the group

CC We have tried everything from chain harrow to power harrow and tend to go in with heavier bits of kit to get lot of bare ground. In Cumbria they found its most effective to get 50/60% up to 80% bare ground so use a power harrow. It is set very lightly - the top inch of soil - turn over the turf for nice brown earth and put green hay or brush harvested seed on to that and roll. They find that if they just chain harrow or do something too light then the sward just closes too quickly, there aren't enough germination niches and things don't get a chance to come up.

MS asked if they have problems with disturbing the ruderal seed bank in the process

CC We choose our fields quite carefully and so far haven't had problems with rashes of docks, nettles or anything. Have had lesser trefoil come up 'like a rash' but that's about all and we have to be careful with soft brome as well as that is another thing we can disturb. We take quite a

precautionary approach before we get in there but haven't had any problems. There are lots of situations where we can't power harrow and one of those is rushes, you get a big seed bank of rushes, another one is that some of our fields in the lake district tend to be quite shaley and stoney and so we can't do it there, or there is archaeology so there we just do plug plants, so there are quite a lot of constraints but where we can do it we definitely prefer to go in more heavily.

JC At Somerset they too use a power harrow creating basically bare ground which they find bounces unbelievably quickly. Within 6 weeks you can walk back in and it's greening up but there still patches of bare ground even through until the spring where you can see seedlings of yellow rattle, common knapweed etc still with space to thrive.



Power Harrowing at Middledown, Somerset, late summer 2014

Greening up at Middledown 2nd April 2015
Unharrowed (LHS) vs power harrowed (RHS).
See also discussion topic 7

DMac Hit the ground and existing grass species almost as hard as possible directly after a short hay cut and with whatever harrows - disc harrows, chain harrows or grass harrows, not necessarily a power harrow. Aim for 50% bare ground because the more you can reduce competition the greater certain species have of establishing. You can only do this in the autumn not the spring and then after sowing roll back in and continue grazing right until the end of March so you graze the sown seed. All the grasses are competing during the winter and you want to reduce that competition as you go into winter and keep it under control and as the sown species will germinate through the winter and into the spring.

KD We have an expression for creating ground, we say traumatise the receptor site, it doesn't seem to matter how hard you hit it, it doesn't hurt



KD restoration on Triangle field, Beech estate
L to R power harrowing July 2013, grazing Jan 2014, flowering June 2014

TSP One issue we have had raised by farmers is that now the councils cutting has changed we have lots of thistles beside roads and so we have to be careful in advising harrowing because they are worried about the seed so docks and thistles coming in. They are concerned by how deep we do and even chain harrowing sometimes.

MS Has found when dealing with neglected fields that it has been useful to use a flail mower collector that will then scalp the ground as it cuts and then can use the wheels of the tractor to push the seed in or using grazing animals to tread in that way reducing complexities and costs.

DY We sometimes use sprays just to open up some space. A lot of our stuff is new creation sites, but also in existing meadows we will occasionally use something to take out the grasses, especially things like Yorkshire fog. There's a few graminicides and that then opens more space.

LL What about fields that aren't species poor, but are 'alright' do you go over lightly with something or do you go hard in strips?

RD Smaller native breeds of cattle can be quite good unless it is very very dry in which case they won't make much of an impact, but also going through the autumn into the winter what we do is feed them species rich hay from appropriate sites, to leave the stock on those sites over the winter. If you have a good source of hay, that can be really effective for those sort of starter species like hay rattle. Red clover comes really well doing that, I think it even passes through the gut of the cattle and works after that process.

CC If we have a field which is half way there which is too good to harrow then we would just plug plant, so we wouldn't disturb it

TSP One of the things we do is we might go in and just do certain blocks, take a strimmer in and cut in so that the strimmer is cutting into the actual soil and then seed that area

And then you can GPS it so you know exactly where that plot is, so you're not disturbing the whole field you're just inoculating certain patches.

KD Asked if anyone had experimented with direct drilling to move away from disturbing the soil. We've been experimenting with trying to do direct drilling but not very successfully. To me the ideal world is that you could go through with a small combine harvester, take green seed out of that harvester, put it into a direct drill, no interference with the surface to liberate noxious weeds or phosphate.

DMac It doesn't reduce the competition, Direct drilling without scarification and without *Rhinanthus* has a much reduced chance of success, though not completely reduced. If you sow onto bare ground with something like *Centaurea* it will produce a big plant within two years. If you sow into existing grass then its growth rate is reduced and its degree of survival is reduced by the competition. The hay itself can be a problem, as you say increasing nutrient status, but it's about the amount of seed you put on.

KD We now put our hay through a multi-chop forage harvester to almost reduce it to dust

Links

Haytime final report <http://www.ydmt.org/assets/x/50613>

4.Parameters for green hay

Introduction (DM)

The Coronation Meadows project get proposals from local partners for using green hay at sites at varying distances from the donor, anything from a field away to 30 miles distant.

Haytime report states that green hay "has to be transported and spread within an hour or so of being collected, which means that the donor and receptor sites have to be within about 40 minutes of each other." The High Weald Landscape Trust video suggests they prefer to have no more than 5 miles between donor and receptor, while in Coronation Meadows we favour sites being within the same or adjacent 10k grid squares as a guide. There is obviously an element of weather dependency but is there any consensus on how far you can take green hay and has anyone tried stretching it further?

Thoughts from the group

KD We have now successfully moved it 14 miles

CC The most we have tried moving it is almost 30 miles which was not ideal

SR If it is chopped then it can heat up more. We chop it using a forage harvester then transport it loose spreading it within an hour. The amount of hay you are moving will also have an impact and to keep it from overheating you may have to do several trips which can be a limiting factor.

Links

Natural England TIN063

<http://adlib.everysite.co.uk/adlib/defra/content.aspx?id=000HK277ZX.0AZNYURWX7E1G4I>

High Weald Landscape Trust video <http://highwealdlandscapetrust.org/>

5. Seed ripeness/timing of harvest

Introduction (CC)

CC outlined that assessing the best time to collect seed from donor meadows was often challenging, mentioning that clover, great burnet and knapweed can be difficult to judge peak ripeness, with great burnet going over quickly and soon going mouldy. Experiences from around the group were sought

Thoughts from the group

SR Found meadow crane's-bill can go 'ping' in an afternoon and recounted that she had watched hawkbit go from being a cut flower to ripe seed on a receptor after transportation and suggested that as several plants were likely to continue ripening after collection it was most important not be too late with collection

MS Suggested Devil's-bit scabious can similarly ripen suddenly

GL Highlighted that for harvesting meadows the problem is exacerbated by the range of species, so you were always looking for a balance.

JC Two collections can help to minimise the issues

DMac Highlighted that historically lowland meadows were typically accustomed to a June cut but ripening in mid-July with hay meadow ecotypes evolving to cutting dates so the collection date should take the history into consideration though some sites would have been less strict and in certain years cuts would have likely been late. With stewardship dictating mid July cutting dates a shift is likely. The weather on the day of collection would also make a significant difference to yield with ideal conditions being cool, dry and windless to retain the maximum seed on the plants. He suggested that a dry and cloudy collection day versus a wet and windy one would see a difference in yield of around 40kg/acre compared to around 10 kg/acre. It was also highlighted that avoiding sunny days made a difference to the amount of invertebrates that would be impacted.

6. Quality of seed

Presentation by GL and MM

GL If you are doing anything at all with seed then the key question is whether they are alive or dead. In most cases I think the seed being produced is not being tested. Unless we are monitoring it then it is hard to tell the quality, whether it is from crops or individual species. I suspect it is more difficult to ensure seed quality, or to test for seed, that is being direct harvested from meadows. We have done a lot of work on seed quality through a series of grants from the Scottish government and are now part of an EU Marie Curie funded project looking at seed quality, which is the subject of MM's PhD at Scotia seeds. And we're also routinely testing seeds that are being produced by ourselves and by other producers. MM has done research on a number of species but we thought we'd show you results for *Rhinanthus minor*

MM The first objective of the research is to assess the quality and performance of native seed from a wide range of European producers, in order to identify a baseline of seed quality and identify the species with poor germination and other causes of low quality. We've selected 12 species. The *Rhinanthus* testing has been done with mostly British producers and one German producer. There are no other producers in Europe as it is not such a common species there.

A Slide was shown for *Rhinanthus minor* showing the germination results for 19 producers though tests are continuing and there will be 23 eventually Results ranged from 0% to around 80% plus.

MM We would like to discover how old is the seed, how has it been held. We keep the seed in a store but we don't know if other people do and if the environment is a controlled environment.

GL To show another common species, the basis of this is that the seed was bought anonymously, though we aren't seeking to embarrass any producers.

(A slide was shown of germination rates for around 12 samples of *Knautia arvensis* with rates ranging from 0% to over 50%)

GL The point of the project is to start a dialogue with producers so that the quality of seed can be improved and we will report back to the producers what we have found.

MM We compared the results of the germination tests and tetrazolium tests giving the viability of the seed. Tetrazolium testing is usually used to test crops so we were trying to see if it can be used for native species seed because the germination tests can take a long time to be done, especially species like *Rhinanthus* that need pre-chilling or dormancy breaking treatment. We found there is a good correlation so it can be used to predict the germination. You can do it in two days and it is not a complex or a difficult test to do.

GL So this makes a lot of seed testing a lot more practical and it is quick as you don't have to wait a long time to break dormancy.

Thoughts from the group

KD With the Weald Meadows Initiative Project when we first moved from green hay to producing seed, the way we stored it was having a massive impact on the viability of the seed, and good but basic advice on how to store the seed changed our germination rates dramatically. It is all about humidity and temperature

DMac As dry as possible, down to 10 percent moisture content, and as cold as possible, below freezing. We don't use any chemicals. Oxygen is the other thing as well. Oxygen does deteriorate it, it loses viability, but it is mainly temperature and water content. The conditions are most easily provided by a fridge.

KD Or a refrigerated lorry bag

TSP Sometimes our farmers buy seed in early if they are going to have seed addition, what's the best advice we should give them? Store in a cool dry place out of the way? Will that suffice?

GL I think that is the right advice. Once you've harvested the seed and dried it then there's not a great deal you can do to enhance its quality, from then on it deteriorates so it's just a question of trying to slow that deterioration and I would say above all keep it dry because our climate is relatively cool anyway so high temperatures are less of a problem. But also keep it as cool as possible. But that doesn't mean putting it in a refrigerated store which some farmers may have for instance if they produce vegetables or fruit. Your standard cold store is cold but is extremely humid, so you may be controlling one factor but the other is disastrous. In a fridge without being sealed is not a good environment for seeds.

CC We've had problems with mites with our stored seed, does the cold stop them?

GL Cold will but also low humidity will as well, if you get the humidity down enough it will stop mite activity.

Links

Scotia seeds testing <http://www.nativeseedtechnology.com/>

7. Whole field restoration, or inoculation strips

Introduction (KD)

Managing the expectation of who you are doing it for and doing a small area successfully is the most positive first step you can take with meadow restoration. I think that's where inoculation strips are really useful. The other factors we use them for are if you have weed infestation but you really want to get on then you can put in a strip in a clean area to avoid liberating a noxious seed bed. I think it is a choice to be taken for logistics rather than success if a strip is successful then a whole field restoration would be too but do you have the money for a whole field, the time and do you have the expertise for a whole field, especially if you are just starting. We now also use inoculation strips to do as big an area as possible because we know it will eventually spread.

Thoughts from the group

DMac I agree, but if you have people with experience then the argument comes down to seeding rates. If you have limited seed and a large site, do you want a patch or do you do the whole site at a reduced seeding rate. Ourselves and others have done seeding rate trials. Stewardship is often around 1 or 2g/m², and a gram is 1000 seeds approximately in a mixture. But you can reduce the seed rate down to 0.1 or even 0.01 and still get a fantastic result. It's only when you don't put on any seed at all that you get a disappointing result. So the deduction from that is that with a limited amount of seed it is better to spread it around at a low seeding rate over a large area as you'll get a greater impact on the environment, on the landscape and on the biodiversity from the limited seed source. That's always my recommendation. Another argument is that after 10 -15 years you can get something that looks indistinguishable from unimproved grassland. By the time you get to that stage the plants you are looking at are 3rd, 4th, 5th, 6th generation on from the seed you put on, so the number of plants you end up with after 10 or 15 years is almost no longer based upon your original seed rates. It's based on those few pioneer plants and the management. So the importance of seeding rate, whether it is green hay or pure seed diminishes over time.

KD In terms of managing expectation, if a farmer does 10 acres and he only gets a few plants, it somehow looks more vulnerable

DMac Yes but if you visualise 10 acres with say 10 plants evenly distributed across the field or 100 plants in a clump, that species is going to colonise the field much more quickly if they are dispersed.

MS The other thing you can do if you have complete control over the field and you are doing an inoculation strip is that when you go back to turn the hay for the first time you can spray it around the field, you can play with it a bit more when you're at the ripe seed stage.

KD Elsewhere on the estate we have done these strips and left them un-harvested and then applied the green hay method just by running a forage harvester over them and blown the strips left and right, and where you have started with a narrow strip, within 3 years that strip is everywhere. But the point i keep labouring is that when you get that first dramatic swathe of ox eye daisies it really does hook people, whereas if you look at a 10 acre field with 10 ox eye daisies in it, I totally take your point, but it's not that hook and to a farmer that's not success.

RD Sometimes it's just a necessity to do strips. We did a site last year where you couldn't get any machinery in at all so the cattle went in to try and break up the sward and graze it down but it was really dry so the owners actually did the strimming into the soil but obviously they weren't going to do the whole field. Sometimes you just have to a strip because of manpower or lack of machinery and I think that's when we would use it.

JC Recently we've done strips in Somerset because of practicalities where the hay was cut late and was still lying in rows so we had to avoid it. It's going to be interesting, there's already tons of yellow rattle germinated already.



Power harrowed strips at Middledown, Somerset.
 Late Summer 2014 left June 2015 right



Edge of a Middledown strip June 2015
 LHS cut, harrowed and sown, RHS cut only not sown

TSP We've done loads of patches, and going back looking at the monitoring we've seen movement of yellow rattle out, though not yet across the whole of the field so as you say it can take some time, though hopefully in time it will cover the field. Obviously some plants move more slowly than others. It depends on how long you are prepared to wait.

MJ We've used strips, mainly because of cost so I was wondering how long people have found it's taken before you don't notice the strips.

KD showed two pictures, one of a control strip in the middle of a restored meadow and one showing strips in extensively grazed pasture



8 year old restoration with unseeded control strip in middle now almost indistinguishable. Early June 2014



8 year old enhancement strips in 45 acre lightly grazed field. Bag shows approx right hand edge of strip. Early June 2014

CC I guess if you are doing hard to introduce species as plug plants on fields where we have done green hay then we do those in clumps so like inoculation patches which we are hoping will move out.

KD Listening to what Donald says, if you are going to introduce species from plant plugs then I suppose spread them over 10 acres

DMac - But then there's no visual impact! It's all about taking a long term view.

=====

8. Facilitator species

Introduction (CC)

Roger Smith at Newcastle University worked with Haytime and showed with infield manipulation of the sward that some species prepare the way for other more demanding species to move into meadows. He found specifically on northern meadows things like red clover, yellow rattle, meadow buttercup and sweet vernal grass facilitate the way for more difficult to introduce species later on. I just wondered whether that kind of research has been done anywhere else or anyone recognises that you walk into a field and see ribwort plantain and red clover and common bent and you think it's going to be a good one to restore because with your ecologist head on they are the kind of species you are looking for.

Thoughts from the group

SR I would add eyebright to the list

TSP They are the key species that we try and get in and that's what we suggest in our management plans.

CC So you'll put those into a grassy sward and then wait before you put anything else in?

TSP If we put anything else in it will be *Rhinanthus*, but they are the four key ones that as you say Roger Smith did the study on.

SR What I tend to do is green hay and then according to the ecology of the site either plug plant for specific species or edge species, meadow vetchling, melancholy thistle, whatever fits the site. But those edge species and later flowering plants are put in by plugs or by direct seeding normally from hand picked seed.

MK I don't know that there's been any equivalent research on lowland meadows for this approach. I did hear one contrary view, from Jerry Tallwin at, as was IGER. I don't know

whether he published anything on this, but he wondered whether this particular group of mesophytes, some of which you have mentioned, actually acted as a block on the improvement of less common species, and I wondered whether you had found that at all in your northern meadows?

SR We don't have many sites that have been restored for more than 10 years, in fact I can only think of one, and that is not the case there. But there it has really quite a late cut, it's not cut until September, so maybe that's why those late flowering species have been able to establish. It's also next to a SSSI

TSP The reason why we have the two part process, the restoration and enhancement, is that ground work is what we've worked upon. We are going to go back to look at those meadows that we worked on in 2006 and it will be good to see the results and how diverse they are post restoration and post enhancement

Links

R Smith et al Colts park research <http://onlinelibrary.wiley.com/doi/10.1046/j.1365-2664.2003.00780.x/pdf>

=====

9. Immediate post restoration management and early management of the developing sward experiences of best options for different scenarios

Introduction (KD)

One word -grazing. Once we have established a new meadow then we are quite brutal and graze it as far into the winter, as tight to the ground as we possibly can. But being sensitive with the beast. I wouldn't use cattle, we'd end up with a totally churned site, but with sheep you can graze very, very hard. We have grazed that down to the limit (referring to picture below). And that worked extremely well, it's a brilliant take this year. We're a farming business, we've got a thousand breeding ewes, so we can decide to put 300 sheep in there for 3 days, pull them out, let it refresh, put them back. But that's what we would aim for, a very very hard grazed out site. And I would only do this in year one. I wouldn't be this brutal after that. Keep grazing but not this brutal.



Triangle field January 2014, six months after power harrowing and seeding. For further pics see Topic 3 'creating bare ground' discussion

Thoughts from the group

RD I would just add that you can also use grazing instead of a hay cut. I've been involved in several sites where you can't get machinery in there and cattle have gone in at fairly low density at the beginning of July. What that gives you is the ability for all the suite of species to drop their seed. Because as the cattle then come off, with maybe the last ones coming off at the start of November, it gives a really good period of time for a range of species to seed. Sheep would struggle to do that because they are not as keen on rank grass, but cattle will do the job really well, and if you don't overstock it there won't be so much trampling and they will just eat their way through it. Cattle are much less selective than sheep as you no doubt know, so sheep in a field that's establishing itself in terms of nice species to eat, they are the ones that go 'ooh that's a nice bit of whatever, I'll just eat that'

DMac Sheep are not good to bring in for your pseudo hay cut, because they reduce biodiversity at that time. You want cattle

RD Sheep won't enjoy it. The farmer wouldn't want to put them in anyway. I do think cattle myself for grazing generally, but for the particular job overwinter on a slightly damp site I can see it needs something like youngstock or really small cattle, not to mess something up too much.

KD And cattle have big feet as we move into the wetter part of the year. They can get quite damaging if you're not careful

DMac Horses are heavy footed as well

RD Yes sometimes they say they cause compaction but a little Shetland can be fine, it can be smaller than a cow

DMac It varies with breed, but broadly horse breeds will prefer grass, sheep prefer broad-leaved species and cattle are fairly indiscriminate, but their preferences are very breed specific. So you can almost select the species you want using the grazing livestock.

MS So if I've got a lot of soft rush in the field then Welsh mountain ponies in March, that kind of thing?

LL We've certainly had Welsh Mountains on ours, so small footed breeds of horse, had light-footed ponies on one of our fields and then we've had sheep go in with mixed grazing. That tends to be how we've done it. We also have dexters. So it's usually Hebridean sheep, Beulah's, we have Welsh Mountains for a bit and then we'll mix up the grazing just to make sure we don't get the problem with sheep selectively eating.

TSP Natural England advise against grazing by horses, as far as I'm aware the way they graze is very different from cattle and sheep and it can be detrimental to the sward and the structure and the damage they actually do to the land

RD I think horses yes, ponies maybe not.

ML The classic thing with horses is that they have dung avoidance areas

DMac They do, but not in meadows, because you can't graze the meadow. Latrines don't develop on meadows but they do on pasture.

RD And horses do have the ability, if you want to take something right down to almost nothing. They are very rarely a productive animal, it's usually the other way, that people are worried about them getting to fat. So in terms of pushing something, if they are unshod, and they're a small breed, and I take the point absolutely about the breeds grazing differently, then they'll do quite a good job. But I wouldn't advise anything that qualifies as a horse rather than a pony.

CC I have seen some really nice meadows near Kendal which are managed almost entirely by horses. She just has them on very extensively over the winter, she has sheep as well, I'm not sure what time she has the sheep grazing, but the main grazers are horses. She's careful and she's got some beautiful meadows. It's to do with timings and how many animals and what type of land it is.

RD I think the absolute key thing to grazing is flexibility, every year is completely different some years we have a winter where the grass grows the whole year through

HK (submitted by email in absentia) It is easiest to use sheep to avoid too much poaching but help things to trample in. At home we have put 50 to 100 sheep per acre just for 24 to 48 hours or moved them around gently with a dog. On someone else's site this could be hard to arrange but may be possible using friendly neighbours or in hand flocks. Mechanically, on restoration sites we

have run back over with the Ryetec (which has a roller behind it) or rolled conventionally. One landowner put his 4 cattle on a 2 acre site for 2 weeks after the Ryetec which seemed to work. The important thing is to keep an eye on ground conditions and the condition of the stock.

RD If a site had been restored the previous year, harrowed with seed put in, would you consider pulse grazing it going into the spring or would you just graze it really short and then leave it. At what time of year would you leave it shut up.

KD I wouldn't graze it beyond February as a general rule

DMac We go on to the end of March

TSP We do suggest cattle go on and hard graze it down and then a mixture of cattle and sheep. With the cattle we have the compaction of seed into the soil and that's what would have happened historically.

MS If you're producing guidance for less experienced practitioners then the key thing is to avoid that prescriptive approach and the thing that worked for me I think as a conservation officer was to say to a farmer 'I don't really mind what you graze it with so long as you are producing something roughly like this' and I think you've got to bow to the farmer's knowledge of the land.

SR I've got a couple of sites I'm working on that have no grazing. They are cut. One is just over a hectare, I cut it by hand this time of year just to take the rushes out. Then there's a hay cut taken middle of July, then nothing after that, no second cut or anything, no muck added, no rabbits.

TSP I had rabbits and the best thing was they just kept it down so after the hay cut all the way through to when it starts growing in April. We still got a hay cut because the growth got away from them.

MS My conclusion, it may not be so successful but there's still herbivory in the field, you've still got slugs, you've still got voles. There's an awful lot of plant matter still gets taken even if you haven't got domesticated farm animals.

ML But we know with established meadows, if you just cut, cut it, cut you end up with *Arrhenatherum*, basically the competitive grasses, so presumably you must want to graze it at some stage, you can't just carry on.

MS It may be but even an *Arrhenatherum* sward can have its interest above that of what was there before

TSP Yes and you can get late flowering species, if the meadow is left uncut, that you wouldn't get with grazing unless you timed it for that

MJ What we do in our Coronation Meadow without grazing, because of dog problems we decided it can't be grazed, is just hay cutting and if it's a growing year we'll hay cut it twice

RD Equines can be very useful if you have a dog issue. Dogs are less likely to worry horses than sheep for instance, so don't rule out small ponies because they can sometimes be quite good.

KD Our Coronation meadow donor site hasn't been grazed by domestic stock in maybe 100 years I would have thought. It is so impoverished that the site doesn't actually produce much growth and its forb-rich not grass-rich

CC Yes if it's a really stressed site environmentally then you won't need so much.

DM Is anyone doing anything different in years 2 and 3 or are they just going straight into a standard hay cut management

DMac You don't necessarily do anything different, but you do expect something different because there is a succession. Once you overseed you get a fairly predictable succession of species, with species diversity increasing over time. There's often an annual short-lived legume flush in years 3 and 4 and maybe a *Rhinanthus* flush in year 2 and 3, *Lotus* and *Lathyrus* in 4/5 and *Primula veris* and *Briza* in 6/7/8, *Bromopsis erecta* in 8/9. So it changes and gets more diverse over time.

HK (submitted by email in absentia) Every year is different so again we need to keep an eye on the ground conditions and not be too prescriptive over timing and stocking density. A light cattle graze for around a month with youngstock or quiet cows at around 2 to 4/acre (less if they are cows) in early spring and for a longer period on the aftermath after 6 weeks or so has been effective as long as they're taken off if poaching looks likely. Some landowners have had 2 to 3 rams/acre in for 2 months or so over the winter to graze off any feg. Small ponies would probably be ok as long as the dung is picked off and they don't hang around at the gate waiting for food.

It's probably a good idea to vary the grazing slightly year to year to favour different grasses and plants.

=====

10. How do we ensure appropriate grazing?

RD From a graziers point of view, be very sensitive to what works for them in terms of stock. So, overwintering I assume they are ewe hoggs or wether hoggs, which means they are last year's lambs that they are just growing on over winter. You are not asking the farmer to bring on ewes that are in lamb that have a high nutrient demand, so don't just go them and say "well you've got sheep, can we put your sheep on my field". Think from the farmers point of view. What stock has he got that can take a knock, that can be pushed a little bit. And ask if they have that kind of stock because then he or she will immediately take you more seriously.

MK We're probably now at a situation where any grazing at the right time is to be welcomed and you do anything you can to make friends with the right person.

RD And reassure the farmer, if it's something they haven't done before, you might say well there's the Grazing Animals Project, there people we can put you in touch with. And more and more farmers are catching on to native breeds, more farmers are out wintering cattle they might just need the nudge to do it and think 'Oh I could get some of those Luings I've been reading about in Farmer's Guardian or I could get some Belted Galloways. A lot of farmers are much more open to this sort of thing than they were 10 years ago, because they see it in farming press all the time. Even if they try a few stores, which are cattle they have just brought in to grow for a while, they might overwinter them on a site for you and think 'I'll grow them next summer and sell them and that will work for me'. So asking in the right kind of language and asking for the right sort of animals.

DM What about these sites in the community like Matt's where it would be nice to try and bring stock in but they are nervous about it being grazed

RD Make contact with GAP or RBST because often horned cattle don't get the sort of unwanted attention that other kinds of breeds do, because people are a bit scared of them. So we could put you in touch with maybe your local breeder that might have just a few animals to put on.

HK (submitted by email in absentia) Help with sourcing appropriate stock from neighbours or local conservation graziers/ organisations and setting up grazing licences, then checking that they are being stuck to. We have had a couple of cautionary tales with a pony rescue charity that is less keen to remove stock than put them on and then guilted one landowner into rescuing ponies rather than restoring haymeadows! Explain the principles to the site manager and show examples of well grazed land and what can go wrong. Open days/ farm walks/ haymeadow events/ best practice days offered locally Be available to visit and reassure the landowner/manager or tweak management. Offer plenty of feedback if needed. Secure runback land or other sites for stock so they can be taken off.

=====

11. Hard-to-introduce species Which are the most effective ways to introduce the more challenging species to a sward that has had one pulse of green hay or is already quite herb-rich

Introduction (CC)

We know that we can introduce things like red clover and hawkbits and the annuals, maybe black knapweed, by harrowing and seed sowing, but for us the crane's-bill and the burnet is much harder to get in. We tend to use plug planting once the sward has settled down, a few years after green hay. But I would be interested to hear other peoples experiences.

Thoughts from the group

ML An example of a slow-recruiting species in a hay meadow is pepper saxifrage. It would be interesting to have a list of the species that move slowly.

MK Pepper saxifrage I think probably takes a while to colonise but I don't think it is difficult to establish from seed.

DMac It comes well from seed but it will go easily unrecognised until it flowers. It can take quite a few years to reach maturity.

KD We have Dyers Greenweed in donor meadows and I've never succeeded in transferring it from one. We've left strips and harvested it really late and still that seed won't germinate

DY I've grown it in 7cm pots and planted it out, I don't think we've had problems with germinating it .

KD We've done that successfully, but we've never transferred it successfully with a green hay operation. We've even put the combine through a very dense strip that we've left to seed late in the year and then introducing that seed on a field scale and not had one plant.

GL I think one aspect of seed behaviour that is often overlooked is that many of the species have a very strong dormancy and that means they are not going to germinate quickly when you sow them along with other species. And for some species they might then lose the opportunity because the sward has closed, with the opportunity to germinate lost until dormancy is passed and the sward is disturbed. There are quite a lot of treatments that can be applied to remove or reduce dormancy so that the seed behaviour fits in better with the way we are actually using the seeds and doing the restoration. I think some of the problems we're seeing in establishing particular species might well be dormancy issues with the seed.

TSP Certainly with crane's-bill from my experience it's not necessarily the next year but the year after that so two years it will take to appear in some instances

GL It's quite slow to develop as well actually, even with breaking the dormancy.

TSP One of the things we have done with melancholy thistle is division, pulling off the smaller plant where you've got a group.

CC There can be very little viable seed we're finding on melancholy thistle, it's got such big rhizomes it doesn't rely on it at all.

MK It does beg the question should we be worrying about hard to introduce species. It depends what we're trying to achieve doesn't it.

DMac I think spreading seed is a more wild thing than putting plug plants in which is on the verge of gardening so is less desirable in some ways to interfere.

JC If you go back to what we were saying earlier about this idea of a few plants within a large area after a period of time, you might not be able to see the difference so maybe it's worth investing the time in those plug plants to bring in the seed.

MS I think you need to ask yourself also why you need that species as well. Something like *Succisa* which I've realised perhaps it takes three years, you put the seed in the ground and think that didn't work and then three years later you start seeing plants. You may actively need to encourage that for marsh fritillary conservation purposes but some of the other species - are they 'nice to have' rather than 'need to have' species?

MK And will they arrive on their own given time? And are we happy to have a good enough meadow to satisfy the requirements of the farmer who wants to see some results fairly quickly, or Natural England?

GL Is it not relevant to consider that we might be producing something completely new or meadows for a new use. So bee conservation is not what meadows have been used for before, all meadows have had a purpose for animal feeding, it's just a different species of animal that we're trying to feed. And there's a real incentive for doing that. We've actually been dealing with a project which has created a new community of plants, of grasses and broadleaves, not based around some historic cutting regime or use, but based on a study of how much nectar and pollen they produce for insects throughout the season. There's quite a demand for this meadow.

MK Is this the urban pollinators initiative

GL It's part of that study, although the Edinburgh one has developed a bit further now. But the focus of people in Local Authorities and other landowners in the urban environment that they're dealing with, has recently been on pollinators more than anything else. As well as the amenity value for people. But recreating a type of plant community that never existed in that urban environment, it's not relevant there, so there's a completely different approach in terms of what you'd be trying to do with a meadow type of community.

=====

12. Is the standard guidance about seed harvesting intervals from donors correct?

Introduction (MS)

From my limited period of observations it doesn't seem to matter how much yellow rattle you take off, it comes back twice as strong. I haven't noticed any significant shifts within the fields. The MG5 just progresses from MG5a to c and improves in quality. You drop so much. I'd like to ask Donald with his longer perspective if he's noticed any particular shifts.

Thoughts from the group

DMac No it's a minor effect, overshadowed by other effects, the weather and other conditions, cutting dates and grazing. Taking seed off has no impact on them. If you go round on your hands and knees there's always more seed on the ground afterwards. The method you use effects the invertebrates, if you use a suction machine it's a disaster

DM I think that was the original reasoning for doing the 1/3rd each year - for invertebrates rather than for plants.

MS With that in mind let's face it there aren't so many meadows out there that you can maintain a supply from just cutting a quarter of the fields every four years or something. There's a certain amount of compromise I think that has to be factored in and it's my experience that perhaps the guidance is a little over cautious at times.

KD I think so, we've harvested quite aggressively year in year out on some areas and I can't see, apart from what you'd expect from seasonal differences, we've never detected any depletion of the donor site.

SR So is that another subject that needs a bit more discussion with Natural England then? Because they are 'one third, no more' in terms of harvesting on SSSI's

DM Does anyone know of any studies that looked on effects of invertebrates in terms of collections?

MK Yes it was done in the late 1980s wasn't it? Keith Porter? I think it was him? It was suction harvesting?

MS There's a point on invertebrates that relates to Donald's point about timing of harvesting - overcast days when perhaps there isn't so much bee activity in the field and maybe a little bit later in the day. Before then there's a bit more moisture in the air, but afterwards, that's when I try and do it.

SR I do too, late afternoons if I'm using a leaf blower.

MS And yet inevitably there will be the odd grasshopper that you've got crawling away afterwards but it's surprising how little in a site that you know to be invertebrate rich seems to get swept up.

=====

13. Should we be creating headlands for invertebrates /seedbank/late flowering species as a standard?

Introduction (KD)

We farm on quite a large scale but we also try to be traditional. We can mow 60,100 acres if the weathers right because we have modern kit. Having mowed one meadow and stopped for bad weather I was staggered by the increase in insects seen the following morning in an adjacent uncut meadow. The insects had migrated back into the uncut meadow, which made me really stop and think about what we were doing across the wider estate, and the scale we were doing it on. I think that problem is compounded when you are dealing with fragments. So when you are dealing with a 6 acre surviving fragment I think it is important for the invertebrates to have somewhere to go. The insect numbers when we've done that in fragments is incredible and if you leave them constantly then they do become late flowering because you are harvesting them later. So you end up with those strips becoming late-flowering and extending the flowering season as well. It seems to me a good practice but I don't know what everyone else thinks.

Thoughts from the group

MS I agree. Personally a patch like that makes more sense than a headland. A headland from an agricultural perspective is the bit you want to drive on. I've already got brambles coming out 20 foot I don't really want them coming out any further and leaving a headland would encourage that.

KD But you'd top them, I'd put that proviso in. We top them as late as possible. Or stock will start to graze them.

LL At Chimney meadow with a site of over 200 Ha with 110 Ha of hay meadows we've found that over the years we'll end up with a staggered fields, just on the basis of weather. What we've been doing is leaving some meadow margins and then when we are doing the aftermath graze they'll get grazed off as part of that process. We've also tried to end up with hay meadows here next to pasture there so we've got a bit of a mosaic. What we're going to try and do more of is rotate the margin that we leave, so cutting it back at some point so you don't have the brambles but you've got it there for a few years and also it will accommodate your later flowering species.

MS We can talk about meadows being great for bees but it's the edges that are all important, it's the bramble, it's the things that people are trashing now because they can't get any money on it.

DM Richard Jefferson pointed me to a paper he's done with Keith Porter where they conclude such changes to the management like late cut headlands have the potential to cause adverse changes to the botanical composition so they instead favour creating additional habitat in surrounding countryside rather than risking botanical interest in meadows.

MS If you're a purist botanist only bothered with the things in the middle of the field then fine but as we've already recognised with invertebrate interest, and perhaps the fungal interest towards the edges as well, there's more to it. It depends on the size of the site.

LL I think it depends on your particular field as well. On the NNR I'm not going to be fiddling around with my edges and things, the important bit of that is those fields, but on our newly created meadows I think there is more scope to mow around bits.

Links

Jefferson and Porter paper

<http://www.floodplainmeadows.org.uk/files/floodplain/Insects%20and%20Meadows.compressed.pdf>

=====

14. Basis for judging whether the restoration has been successful

Introduction (SR)



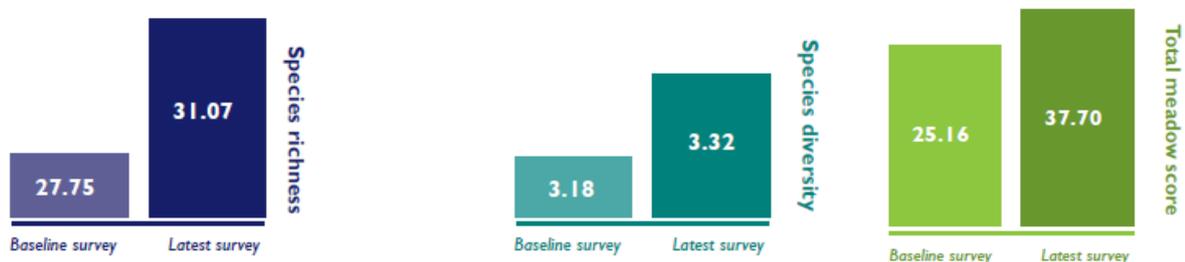
The two pictures are of a 2 year old restoration from our Lancashire Coronation Meadow. I was quite pleased. Previously there was meadow buttercup in the receptor site but there was no red clover, there was no eyebright, no yellow rattle. But I was also very pleased with the effect the yellow rattle was having it has really thinned out the structure of the sward so I would see this as a very pleasing work in progress.

Thoughts from the group

MS When do 'we' judge it a success? 'We' should really be the person who is looking after it directly I suppose, like the farmer. I think it's judged a success when you're confident that it's going to go forward from there as a viable meadow. So when you've got it secure because the owner has appreciated it. I would say that's as much of a measure of success as you need rather than how much percentage of *Lotus corniculatus* is in here or more obscure arguments like that. But if you take the counterargument at what point does it become indistinguishable from the MG5c 100 year old meadow, well its 100 years later.

SR I think it's also about their expectations. This completely meets their expectations. I've got another owner and it's going to take decades because of what is in their head

DM The slide also shows Haytime's final report results from three different methods they tried to use - species richness, species diversity, and their own scoring system to try to show, their funder I suspect, there had been movement in the right direction. When do people judge that their sites haven't been a success? Or do pictures tell you all you need to know



KD The picture below is a one year old restoration, our Coronation Meadows receptor site with a headland the other side of a footpath. We wanted just to see the difference between the two. But we've had years which we've thought to be total failures and thought that was a waste of time, a waste of money, but two years later they've started to suddenly start to show diversity. Even if you're getting no apparent result don't give up too quick



MS That comes back to my point, success is a direction of travel

DMac Well in the first year you can't see anything, the first full year you can't see anything but rattle, maybe some other species but it's really just rattle and then years 2, 3 4 you see the other flowering species coming through. But it can be delayed. And something like *Ranunculus acris* under conditions of competition can take ten years to appear

LL I concur, with the field restorations at Chimney Meadows, if you'd asked me after the first year, I'd have said those ones a brilliant success, that one a complete disaster we'll never see anything but grass, but not now after 10 years. It started after 2 or 3 years, the odd one or two of this that and the other.

MK Natural England have a whole long list of indicators of success which apparently they are going to try and revive for stewardship. But if you look at those indicators of success they are a whole rag bag of different measures, some are outcomes, some are process.

MS Then my solution is the best one for you. The direction of travel.

Links

Haytime project Analysis of results <http://www.ydmt.org/assets/x/50620>

=====

15 What is the most common cause behind failed restorations?

Round the table

DY From what we do which is probably more creation rather than restoration, it is being rushed. Say with three years of funding it doesn't kick in until the end of the first year, rushing to get it prepared in the second year, sow it in the third year say, and then walking away and maybe no-one looks at it again. If there's no management put in place, the moneys spent, it can look lovely in the first year but walk away and it can be left to its own devices. I'm not saying that we have many failures, because we will take the time to get it prepared properly in the first place.

Sometimes by quite extreme methods such as our soil inversion method, which on highly fertile ex arable land, in the time scale it really is a short fix for getting the meadow established very quickly. But we have had failures and it's normally because it has had to be rushed

RA We're only in the second year of our restoration so I haven't seen the results yet. But if it is a failure then it will probably be down to not having done aggressive enough ground preparation

DMac There's always good in everything so I don't recognise failure!

CCor I agree with Donald it's more about getting people to recognise the value of what is there and it's hard to paint the picture of what its going to look like over time.

RD Thinking of a site we've been involved with grazing advice for, then though it's early days from what's been said, old badly stored seed that was given to them may have been responsible for nothing coming up

MJ I'd agree with Damian. It's not failures but its often sites that you could have done better if you didn't have to do everything to meet the funding deadlines rather than the weather deadlines. That and sometimes not having long term secured management, if that falls through for any reason, people don't really know what they are taking on.

TSP I'd second that. Management. We've had sites where we've had *Rhinanthus* in the first year and the sheep have not been taken off until post mid may and it's all been grazed off, so that *Rhinanthus* was put in for nothing. And also we've sadly worked with schemes that have come out of stewardship and now have reverted back to rye grass. We would love to be able to invest in the long term, building the relationship with the farmer.

SR I've got a similar one. In the uplands it can be quite common practice for the fields to not be shut up until the end of May by which time the sheep have eaten all the little seedlings. But I went back to the same fields in August (it still hadn't been cut) and it was ablaze with yellow rattle that had come up, flowered and seeded. So perhaps there was another flush that came through, or where they had taken it right down it had then recovered.

MK I think the reason a lot of restorations or creations failed in the past is that the knowledge of the right techniques wasn't there. But thanks to fantastic research work a lot of the questions have been answered and now most of the time they work. But it has to have that continuity and it has to be left for long enough. And we're moving from a ten year stewardship agreement to a five year stewardship agreement which is actually going to work against new creations.

KD Lack of correct preparation is probably the single most common cause, where you're trying to instruct someone else but you aren't actually going to be there. It's 'Oh yes we've power harrowed it' but when you see it you find its been tickled. And everything comes under that umbrella of managing expectation. Steering people through the whole process including post restoration is the secret to getting it as close to right as we can

MS One by my definition of a failure, I did a textbook job for a couple and they were disappointed that they didn't get the Olympic meadow. So they added some 'volcano mix' which failed.

GL We've been out to sites where a nice meadow has established and the landowner has said 'yes but where are all the poppies'. So again its expectation

CC I would say the ground prep, making those germination niches in the first year and onwards and generally the long term management of sites has to be right, don't graze too late in the spring, don't cut too early

LL I've had one where similarly where I've informed the owner about 50% bare earth etc and she's said everything's fine and then when I've got there it's 'oh, that's not what I was expecting', but I'm here and that's what we've got to work with.

JK Follow up management. If situations change for farmers, perhaps they will have lost some of the land they are tenanting and all of a sudden they have more stock on their home land and they don't have the option so they're grazing land that you would really rather they wouldn't.

=====

Creative methods and unorthodox kit show and tell

GL I'd be interested to know what sort of equipment people are using and if over the years they've found better. For ourselves we're using a brush harvester we built ourselves which we use for harvesting meadows or heather and it's very effective

MS I bought a hand held harvester from Canada, it's limited use for specialist sites, not highly recommended for the price, though I've used it for example on a steep slope on a lead mine site, specialist applications like that it can be useful.



Wyndrush Wild using hand held harvester

CC We use standard farm kit, forage harvesters and muck spreaders. We were using a contractor with a brush harvester but it just got too expensive, HLS payment wouldn't cover it. So we just use the biggest farm kit we can find.

SR It depends on the site as well, we use a forage harvester on the cam because it's cheap and it's quick, but it doesn't go up hills very well

TSP We use the vacuum harvester on a few sites that's quite good

KD We've used a sand spreader. We take seed directly out of the combine and literally the same day within the hour put it into the sand spreader which is for spreading sand on municipal football fields, And you can control it to a defined degree. So we chuck it straight into that and then out and onto the field with the sand spreader. It's working really well, it's just like green hay, without the bulk. So you don't get that flush of nutrient from the bulk.



Haytime's vacuum harvester



Agrifactors mini-combine and sand spreader as used by the High Weald Meadows Partnership



TSP And do you roll that afterwards?

KD We don't do a great deal of rolling. The minute its green the stock are back in, so they're treading it in. But when mowing for green hay, don't use a mower conditioner, because the conditioner knocks all of your seed out, so you need to mow without a conditioner. Try and find the most old-fashioned mower you can, so you're mowing it gently.

DMac I have two side mounted tractor brush harvesters, one loader brush harvester, four or five combine harvesters. We're developing a horse drawn brush harvester so they'll be completely green. And in passing we've developed all sorts of different types of harvesters. For small areas you can just use a sweep net, and its possible to just use a loader on the front of a tractor with the bucket a little bit up and just drive real fast and it just goes flat as you go over it. Or you can put an oil drum half on the front of a landrover. And again it has a leading edge which the seed flaps into. Or you can empty out shoes!

KD We used the channel shaped RSJ on the front of a tractor, 15 feet wide and it collected all the ox-eye daisy seed.

MS When we use a brush harvester the more processes you're doing in order to dry out and store it the more seed you are potentially losing whereas if you just empty the brush harvester it's effectively green hay anyway. It's a 'top of the crop' approach which is I would have thought a happy intermediate where you can get the receptor site lined up on the same day.

SR Our brush harvester is actually a paddock sweeper from Newmarket and it goes on the back of the quad and we spread that the same day so we spread that green. We don't bother drying it.

DMac So how do you spread the seed. Because on a large area that's quite an issue

SR Just sit on the back of a flatbed trailer chucking it out, it takes quite a while

JC We use volunteers for it and it's a nice job for them

SR We use barn sweepings from underneath small baled field-dried species-rich hay for little sites

DMac We did small bales, and we were real careful, finger mower once, 2 into 1 and an extra baler and we cleaned out the bales. And the maximum we got was 400grammes per small bale of mixed seed. We couldn't improve on that, it was pretty good.

Links

North Pennines Wildflower seed bank harvester video

<http://www.northpennines.org.uk/Pages/Nectarworks.aspx>

High Weald Landscape Trust video (showing sand spreader) <http://highwealdlandscapetrust.org/>