The
UK Terrestrial Biodiversity Surveillance Strategy

Vegetation Sampling Workshop

Vegetation Sampling Workshop

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Throughout the workshop vegetation sampling was discussed in a broad sense; including species surveillance, habitat sampling, and vegetation responses to environmental change. The degree to which these broad groupings overlapped was also discussed. Targetted survey of rare plant species was not included in the workshop discussions.

Problem areas agreed by participants at start of workshop:

Understanding and assessing techniques for suitability and effectiveness

- Understanding the most effective approaches to vegetation sampling when targetting new investment or re-negotiating current investments
- Development of protocols for sampling that give good measurability and consistency (at least adequate for reporting requirements)
- How to assess the effectiveness of any single component of plant sampling or vegetation survey
- Improving data access and ability to use common analysis techniques

Linking vegetation data from multiple surveys, and linking with other datasets

- Linking the results of surveys carried out at different scales
- Analysis and interpretation of large data sets, including linked data sets from multiple surveys
- Understanding the fit between vegetation sampling and other sampling activities within the UK Surveillance Strategy

Improving the use of vegetation sampling in understanding habitats and ecosystems

- The use of vegetation sampling to understand habitat quality and change
- Can vegetation sampling provide some of the measures of ecosystem services?
- The use of vegetation sampling to measure drivers of environmental change

Improving the profile of vegetation sampling results

- Low profile of the results of vegetation sampling – do we need to promote these data to policymakers more effectively?

Discussion of problem areas

Understanding and assessing techniques for suitability and effectiveness

Discussion focussed around two distinct aspects of this problem area: understanding methods for vegetation sampling, and providing a strategic hierarchy of sampling need against which investment decisions could be made.

Methods were particularly discussed in relation to some of the current vegetation sampling schemes that were represented at the workshop, some of the conclusions of this discussion are presented in Appendix 1. Method issues:

- Frequency vs. cover – How consistent can cover estimates be? How often are either frequency or cover estimates used in the data analysis? What extra analytical power do they provide, and is this justified by the increased difficulty of the survey?
- Quadrat size – In part this will be dictated by the habitat type: woodlands need larger quadrats than grasslands. Small quadrats (10cm) were advocated as a means of reducing interpersonal variability, and possibly making them more enjoyable to carry out. Currently a large range of quadrat sizes are used in different studies.
- Species included in sampling – Can the same information on environmental change be extracted using a subset of more easily recognised species? Since 'difficult' species often have to be excluded from analyses due to data errors, what gains are there from their inclusion in the sampling?
- Random quadrats vs. permanent quadrats – Permanent quadrats also vary in whether they are marked or unmarked. Random quadrats do not have relocation problems, but more are needed to understand changes on a site. Some analysis of the impact of using temporary plots had been included in the woodland survey (Bunce plots), and had shown that true pairs were only slightly more similar than random pairs of plots in a site.

Conclusion: we do not currently have a consistent set of techniques that can be recommended for particular sampling problems.

Solution 1: Publish a manual of methods with recommendations for their use in different situations.

- Does something like this already exist?
- Literature review to find techniques, and earlier reviews.

A lengthy discussion focussed on understanding the hierarchy of sampling required to distinguish and identify environmental problems (including emerging problems) and then assessing these at a site level to inform management. The broad-scale schemes were identified as Countryside Survey and repeat Atlases of species distribution. It was noted that although Atlases are possibly only necessary every 50 years, the context for surveys needs to be updated more frequently, and hence a sampled approach will be needed to complement the Atlases. These broad-scale schemes, possibly supplemented by schemes such as Local Change and Common Plants Survey, should be used to identify environmental problems and to identify large-scale changes in habitats and species. This can then be used to design smaller time-limited surveys to understand the impact of a problem more thoroughly, utilising sites that run across the gradient of the problem. These will help at a site level to assess whether management needs to be changed.

Conclusion: our current sampling framework gives moderately good coverage, but we have poor understanding on how to supplement it in a strategic manner.

Solution 2: Produce a strategic hierarchy that can be used in scheme design and in investment decisions.

- First draft included in Appendix 2.

Linking vegetation data from multiple surveys, and linking with other datasets

A theme of the day's discussions was an urgent need to link the results from different surveys, to produce integrated analyses, and to interpret the evidence at different scales. All participants agreed that too few survey analyses make use of data from other sources. It was

further agreed that currently, apparently opposing results from different surveys are perceived as making the results unreliable. However this is possibly due to a lack of interpretation that could link the surveys and explain the overall results. The theme of integrated analysis is picked up in the discussion on improving the profile of vegetation sampling.

Improving the use of vegetation sampling in understanding habitats and ecosystems

Much of the discussion of the use of vegetation sampling in understanding habitats focussed on the method used in lowland grassland (which has also been used in lowland heathland), and also the woodland sampling. These were compared to the Y plots in Countryside Survey. The detailed habitat surveys are relatively expensive to complete, and the first aspect of cost will be in improving the habitat inventories. Countryside Survey is not good at priority habitats or rare habitats.

Improving the profile of vegetation sampling results

It was agreed that the profile of vegetation sampling is too low, and does not reflect the current effort or breadth of results. The lack of integrated analyses was seen as key to improving the profile, and in dispelling the impression that there are conflicting results. A suggestion which had good support amongst the participants was to instigate a 'conclusions board' to produce integrated and interpreted analyses of all vegetation sampling utilising different scales and bringing in research results to interpret the sampling. The 'conclusions board' should act as an evidence review panel, and include analysts and researchers. The model of the Intergovernmental Panel on Climate Change was cited as one that could be copied, and which has a respected high profile with policymakers.

Solution 3: Set up an evidence review panel for vegetation sampling with a task to produce integrated analyses of evidence for a range of environmental pressures.

Other conclusions from the workshop

1. The current sampling framework provides a good start, and does not require radical change in order to 'complete' vegetation sampling.
2. Availability of skilled botanists is an issue, training of new botanists will need to be a part of the overall strategy for surveillance.
3. The cost of using volunteers for any particular survey includes the potential for reduced input into other surveys.
4. We need to make best use of the current data and increase our understanding of the gaps in the data.
5. Data and databases need improved accessibility if we are to achieve more integrated analyses.

Appendix 1 Analysis of some current vegetation sampling schemes using information that was available at the workshop. Note that information is incomplete, and does not represent agreed positions on strengths and weaknesses.

Scheme	ECN	'Bunce' plots	Non-statutory grasslands	Common Plants Survey	Countryside Survey	Local Change
Scale	12 terrestrial sites across UK	103 woods in GB	500 sites in England	540 1km squares sampled across UK	591 1km squares sampled across GB	811 tetrads in 400 hectads across GB (761 were actually visited, of which 635 were comparable)
Stratification	Sites vary in habitats etc. but network not stratified	Random plots within broadleaved woodland – woods selected as the 'central' wood within 103 classes	Grassland inventory used to select sites, stratified by priority type, and by whether included in agri-environment, then random selection of sites	Semi-randomised 1km square selection (guaranteed close to surveyors home)	Stratified by 32 land classes, random sampling within these	No stratification, regular grid across GB
Time frame	Fine grain plots sampled every 3 yrs (some annually), coarse grain plots every 9 yrs	First survey 1971, repeated 2000-03	First survey only, intention to repeat at approx. 5-10 years	Annual, 3 visits per year to provide annual statistics	Approx every 6-9 years	First survey was run in 1987-88, second survey in 2003-04. More surveys planned. During survey, approx. 3 visits totalling 10 hours of recording
Quadrat size	Fine grain 10m plots, coarse grain	$200m^2$	Structured walk through site with	5m plots for habitats, 20m by	Range of plot sizes used: $200m^2$,	2km plots (tetrads)

	2m plots		1m radius circles for recording attributes	1m plots for linear features	$4m^2$, 10m x 1m	
Permanent?	Yes	Yes (unmarked)	No	Yes (unmarked)	Yes	Yes
Cover/frequency	Frequency measured by recording presence in smaller subplots	Percentage cover recorded	DAFOR scale used	Cover categories recorded (range of cover percentages in each category)	Percentage cover recorded	Neither – presence data only
Spp coverage	Fine grain all vasculars, bryos and lichens to species level; coarse grain vasculars to species level, bryos and lichens grouped	All vascular plants and bryophytes	All vascular plants (also CSM method)	65 widespread spp, selected to be key indicators of different broad habitats	All vasculars, selected bryos and lichens	3000 vascular plant spp were recorded, but only 700 were sampled sufficiently to be compared
Cost	Whole network costs (much more than vegetation sampling) £2m per annum		£150K (per survey)			£90K plus management costs (per survey, not annual)
Policy questions		Overview for gross changes in broadleaved woodland	UK BAP reporting – condition of grasslands in wider countryside FCS reporting Is priority grassland still being lost in the wider	Possible to group the species trends by broad habitat in order to produce a habitat signal Within-country results	Estimate stock of land cover and characterise change	Scale too coarse? Habitat transformation/eutrophication signal Weak climate change signal

			countryside? How effective are AE schemes in delivering favourable condition?			
Strengths	Causes of vegetation change can be interpreted (covariables monitored) Frequency rather than cover Permanently marked plots Extensive QA 15 yrs data Good database Randomised	Wide range of attributes (important for woodland) Standardised Good geographical spread Not just SSSIs Long time period (slow changing system)	Fit for purpose Repeatable, robust statistics Good geographic spread	Annual survey gives rapid update Detailed recording Adaptable Large pool of volunteers (510 currently) Entry point scheme for non-expert surveyors	Quantifies trends in common species in common habitats Changes located precisely in communities and landscape	Low cost (700 volunteers undertake survey) Change statistics for 700 spp Good scale for measuring change in widespread (not common) spp Improved electronic data capture Good training for amateur botanists
Weaknesses	Finding cells can take a lot of time Time intervals are too long Requires skilled botanists Small number of sites Range of methods can be confusing Design of fine grain is unique –	Only 103 woods Not fully representative Wide range of confounding factors Correlation rather than causality Wide gap between surveys Data limited by original survey	SSSIs not included Problems with the inventory CSM method is limited Only England No fauna recorded	Cover categories difficult to use and inconsistent Not enough squares covered currently No targetted coverage Needs a lot of coordination and feedback Plot relocation	Cannot quantify changes in uncommon species Imprecise at small scales (e.g. county) Plot scale variation complicates analysis Seasonal variation	Poor refind rates No habitat information recorded Lack of clarity on causes of change Lack of standardisation Change statistics do not cover dynamic species, rarities, and very

	difficult to link with other studies Not suitable for monitoring rare species			issues Do landowner issues bias the results?	not captured Low explanatory power due to coarse explanatory variables Difficulty finding experienced botanists	common spp
Notes		Possibly 10 years would be optimal for repeat? Trade-off between relocating plots and increasing number of plots		Aim is to increase coverage to 2000 1km squares, would like to link the data with other schemes (CS, Atlas, Local Change), may change the selection of spp covered to help interpret change		Ideas for change: run every 10 yrs? Use 100m plots? Use 100 indicator spp?

Appendix 2 Draft strategic hierarchy.

A model of levels of sampling to drive the evolution of sampling schemes

1. How sophisticated a model do we need to help influence sampling choices?

1.1 The 'Vegetation Sampling Workshop' participants recognised that the several scales of vegetation/plant sampling undertaken in the UK interact, and made several attempts to design a 'hierarchy' that could help the investors/users involved to make good judgements as to what the different scales could deliver, and where to modify, change or put effort in future.

1.2 The expectation of a hierarchy could be that it operates in considerable detail, looking at the actual deployed sampling and uses analytical techniques to see how well it performs at answering different questions, or it could be a logical tidying up of the current sampling to present it as a linked whole.

1.3 The purpose of this paper is to test the hypothesis that we can develop a set of levels that bring together scientific principles, and the experience of sampling so far, to provide a fairly simple tool for testing proposals and the approach to existing sampling to see if modification or addition would help meet need rather than duplicate or prove to be an inefficient way of answering questions.

2. Questions we (collective sum of policy/conservation) are trying to answer

2.1 Which pressures are impacting on biodiversity? how significant is the impact? and what are the most likely drivers of these pressures? This is a horizon scanning task to extract from the observed change in biodiversity the actual impacts of each generation of driver causing pressure in the environment.

2.2 The question following 'detection' becomes: is the link to pressure/driver clear enough for the people best-placed to act, with a scale of policy response best-suited to tackling the driver? *i.e.* have we localised, characterised, quantified the impact enough to allow policy action to occur or be planned?

2.3 For practical land management knowing the general pressures may not be enough; individual land use decisions and people involved in them may still need site-specific evidence to support the decisions. Here the question is: if the desired condition for the land is not being achieved, which pressures are acting, and what specific action should we take?

2.4 Focussing on managing the impacts of change in the environment is accompanied by needing to know if we get the conservation outcomes we are aiming for – retaining semi-natural habitats in reasonable quality, both as patches, and at landscape scales, and retaining species (allowing for a range change under climate change). This requires a

broader scale of sampling than site-specific management decisions, and hence the requirements will sit at a higher point within the sampling hierarchy.

3. A suggestion for a model

3.1 *Level 1* Discovering what is happening at the habitat patch and landscape levels. Gross change related to questions under sect. 2.1.

- As a context to species and habitat sampling we need to know if the impact of any drivers is either gross land use conversion or changes in patch size, connectivity needs, densities of different habitats at different scales *etc.*
- The first level of sampling is to pick out this habitat land cover change signal, preferably across the land surface as it would give great flexibility for sub-sampling at other levels.
- The test is whether we are getting a repeatable reasonable resolution (*e.g.* 25m accuracy) picture of habitat land cover (at reasonable habitat class level), including mosaics, transitions, whether through sampled or more extensive (*e.g.* satellite techniques).

3.2 *Level 2* Change discovery and first-cut attribution level. This relates to a finer level of detail within the sect. 2.1 questions.

- The job of this level is to find the cheapest effective way of getting reasonable correlations across pressure gradients, within habitat types, and to pick up and eliminate seasonal/year differences. Its purpose is discovery or confirmation of predicted change (given prediction will build up as a tool).
- It is the level at which you try and build in the sampling replicates for habitat, and environmental gradients to have something very likely to provide evidence whatever the change.
- This may be best done by high numbers of sample locations, based on cheap repeatable samples, with a high frequency (annual to 5 yearly), using a broad basket of species but optimised by identification reliability/repeatability, time in field cost.
- The discovery level aims to sample things that do not yet have any known indicator value, *i.e.* a basket of species, so that we do not miss effects that have not been anticipated (*e.g.* bramble in woodlands *etc.*).
- The discovery level may need the ability to pick up the surprise effects of combinations of pressures on the environment – *i.e.* some element of many variable sampling, but unless this can be significantly cheapened many variable sampling can never be representative of the multiple habitat/pressure combination likely to occur.

3.3 *Level 3* 'The condition assessment level'. This relates to the questions posed within sect. 2.4.

- The next most pressing need for information after ensuring we can pick up change is knowing the condition of semi-natural habitats and how this changes,

similarly some condition and change is needed in intensive landscapes as we need them to retain some biodiversity.

- At this level the state of biodiversity is closely related to questions about priorities in action and whether responses (*e.g.* SSSI , agri-environment, BAP) are having an impact.
- The third level is mainly about stratified repeatable sampling of habitat groupings ensuring appropriate representation of land affected by the different responses (SSSI, agri-environment, *etc*.)
- The third level does not have to take into account being able to pick up widespread pressures as the first level is doing that.
- So the third level can focus on cut down sampling more targeted at picking up useful ecological states of the sampled habitat – *i.e.* closer to the idea of the small number of sensitive species, and frequency in the sampled surveys.

3.4 *Level 4* Confirming pressure/driver/biodiversity relationships to back or obtain a policy response. This level aims to answer the questions within sect. 2.2, and depends on the requirements of a particular policy.

- Providing better evidence of the scale and impact of a particular pressure to support a policy (excluding specific site-based response).
- The first step looks like a synthesis of available evidence, and if necessary a re-analysis, or combined analysis of any sampling (biodiversity and pressure) data sets that could help provide evidence.
- If the first step does not provide sufficient evidence the next step is to consider how to get the evidence and options include the following. The decision is informed by the nature of the question/evidence so far, and the cost of these alternatives.

    1. Looking at an obvious gradient for the pressure and doing short duration surveys to pick up variation along the gradient and use this to understand relationships. We can consider using Europe *i.e.* not just UK to find a gradient along which we can measure.
    2. Experimentation.
    3. Supplementing the first two levels of sampling for a short time.

3.5 *Level 5* Supporting site level decisions. This supports answering the questions within sect. 2.3.

- Providing evidence to support action at a site level *i.e.* proving that a particular pressure, or set of pressures (management actions *etc*.) are the ones driving change at that place.
- This is deploying the most cost effective sampling to pick apart the problem at the site and should rely heavily on indicator species – things closely associated with the way each pressure might be expressed.
- The key point is that site level proof is not a long term sampling problem.