2.5 Key habitat attributes

2.5.1 Introduction

"Selecting appropriate and measurable attributes forms the basis of the monitoring prescriptions and the monitoring methodology itself"

A number of attributes are appropriate to HRM in a range of habitats. These are presented below together with a brief scientific justification for their inclusion, a proposed methodology for their recording and details of any site-specific considerations which should help when preparing site-specific monitoring prescriptions. These attributes are relevant to a number of habitats, e.g. grasslands of all types, heathlands and field margins. Attributes relating to the remaining habitats, e.g. woodland, hedgerows and aquatic habitats, tend to be very habitat specific and are not included here. However, lists of these are included in the relevant habitat prescriptions included in Burch *et al* (1999; Appendices) and these should be consulted when drawing up prescription for such habitats.

2.5.2 Key habitat attribute: vegetation height

Justification

- Promoting floral diversity - tall vegetation will tend to shade out less competitive species and reduce species diversity, e.g. limestone grassland.
- Promoting faunal diversity – sward height may be critical for certain invertebrate species providing structures for resting, feeding and breeding, e.g. butterflies.
- Providing nesting sites for birds and protection from predators, e.g. in field margins - heights of at least 25-35 cm can be critical for nesting grey partridges, while in more open habitats heights of greater than 50cm may deter skylarks from nesting.

Methodology

- Sward height can be assessed visually, e.g. patches of short sward (<15 cm) at least occasional, this may be assessed for a site as a whole (M1 methodology, Fig 2) or for sampling positions (M2 methodology, Fig 3) using a metre rule.
- Where sward height is critical for target species, e.g. butterflies, a more specific target height may be stipulated, especially for later stages of restoration. Here sward height may be recorded using a sward stick or dropped disc could be adopted if preferred.

Habitat/Site specific variation

- Favourable sward height varies between habitats, e.g. for limestone grassland optimal sward height will be shorter than for hay meadows/neutral grassland.
- Favourable sward height will vary with management, e.g. an optimal sward height for grazed sites is likely to be shorter than for mown sites.

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- Favourable sward height may be determined by target species, e.g. birds or butterflies with specific sward height requirements.
- Sward height varies with soil fertility. Taller vegetation will develop on richer soils than on poorer soils in the early stages of restoration but this may decline in later stages if the fertility of the soil declines through leaching or through appropriate management, e.g. cutting and removal of hay.
- Sward height may be expected to decline more quickly on lighter soils (e.g. sands, where leaching is more rapid) than on heavier soils (e.g. clays).

2.5.3 Key habitat attribute: open sward

Justification

- An open structure provides an optimal light climate for the germination, establishment and vegetative spread of plant species, for example in grassland and heathland habitats.
- An open sward provides optimal microclimatic conditions for many warmth-loving invertebrate species.

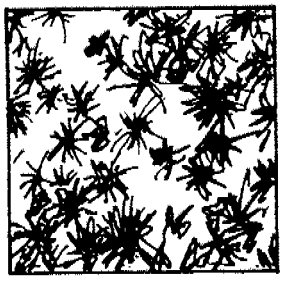
Methodology

- Visual assessment for the site as a whole (M1 methodology, Fig 2) or for sampling positions (M2 methodology, Fig 3).
- The critical aspect is to distinguish dense, closed swards from sparser, open swards, see Fig 4.
- It can be helpful to imagine that an object such as a pencil is lying on the soil surface and to ask yourself whether it could be seen from above. If it would be completely obscured by vegetation, then the sward is closed, if it could be at least partially seen, then the sward is moderately open and if it could be seen almost entirely, then the sward is open.

Habitat/Site specific variation

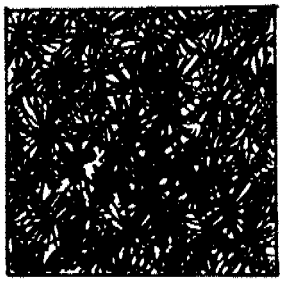
- Sward openness is related to the soil conditions. Sites on rich soils will tend to develop a dense closed sward with little visible bare ground even when the vegetation is parted. However, the sward may open up in subsequent years if nutrient levels become depleted through leaching or cutting and removal of hay.
- Sites on thinner soils may develop a more open sward, with frequent patches of bare ground, providing, potentially good conditions for the subsequent development of a species-rich sward.
- Sward openness is related to species composition. Some grasses such as creeping bent or creeping red fescue (*Festuca rubra*) form dense swards while more tussocky or solitary species, e.g. crested dog's tail (*Cynosurus cristatus*), form more open swards.

Figure 4: Assessment of "open sward": The following diagrams should be used as a reference when recording the attribute "open sward" in the field. The critical aspect is to distinguish dense, closed swards from sparser, open swards. It can be helpful to imagine that an object such as a pencil is lying on the soil surface and to ask yourself whether it could be seen from above; if it would be completely obscured by vegetation, then the sward is **closed**, if it could be at least partially seen, then the sward is **moderately open** and if it could be seen almost entirely, then the sward is **open**.



(a) Open sward

(b) Moderately open sward



(c) Closed sward

2.5.4 Key habitat attribute: bare ground

Justification

- Bare ground is essential to encourage the germination of some plant species.
- Bare ground may also be critical for providing a suitable microclimate for warmth-loving invertebrates and reptiles for example in heathland/acid grassland.

Methodology

- Visual assessment at sampling positions using the DAFOS scale (Fig 3) M2 methodology.
- For taller swards bare ground should be assessed by parting the vegetation, e.g. hay meadows.
- For shorter or more open swards bare ground should be visible from above, e.g. heathland.
- Where bare ground is covered by litter this should **NOT** be recorded as bare ground but noted separately in the space provided for comments.

Habitat/site-specific variation

- Where the attribute target relates to promoting seedling establishment, small patches of bare ground >1 cm diameter are appropriate.
- Where the attribute target relates to providing suitable microclimatic conditions for invertebrates or reptiles larger patches are appropriate.

2.5.5 Key habitat attribute: vegetation mosaic

Justification

- A patchwork of tussock species, such as Yorkshire fog (*Holcus lanatus*), cocksfoot (*Dactylis glomerata*), tall fescue (*Festuca pratensis*), sedges (*Carex* spp) and rushes (*Juncus* spp) is a key requirement for some bird and invertebrate species. For example, in coastal grazing marshes, tussocks of grasses, sedges and rushes provide ideal nesting sites for snipe, redshank, yellow wagtail and meadow pipit.
- A mosaic of vegetation heights with frequent tussock species will usually provide suitable habitat conditions for the widest range of target bird species.

Methodology

- Visual assessment of the whole site (M1 methodology, Fig 2).
- A tussock may be defined as an area of sward more than 5cm above the height of the surrounding sward.

Habitat/site specific variation

- Tussock species vary from habitat to habitat, e.g. field margins compared with grazing marsh
- The optimal frequency of tussocks may vary and should relate to the requirements of the target species.

2.5.6 Key habitat attribute: litter

Justification

- A dense litter mat can be a negative attribute in some habitats, preventing the establishment and diversification of plant species in the sward.
- Litter may also be a positive attribute in other habitats, providing nesting materials and protection for some bird and mammal species and habitat for invertebrates.

Methodology

- Visual assessment using the DAFOS scale for the whole site (M1 methodology, Fig 2) or for individual sampling positions (M2 methodology, Fig 3).
- For taller swards litter should be assessed by parting the vegetation.
- For shorter or more open swards litter will be visible from above.
- Where a dense mat of litter is required, e.g. for nesting cover, assessment can be visual or by seeing whether a handful of litter can be picked up at each sampling position (M2 methodology).

Habitat/site specific variation

- Litter may be a product of establishment treatment e.g. hay strewing and may need to be assessed in the first year of restoration for its potential negative impact on seedling establishment or as a measure of the evenness of strewing.
- Litter production depends on vegetation productivity and will tend to be greater in richer soils, although this will also depend on management, e.g. grazed sites will usually have less litter than ungrazed sites.

2.5.7 Key habitat attribute: forb-rich sward

Justification

- Species-rich vegetation is often a prime restoration target, especially for types of grassland in which the development of a forb-rich sward is a key objective.

Methodology

- Visual assessment of patches of forb-rich sward (defined as a sward in which forbs are at least abundant) using the DAFOS scale for the site as a whole (M1 methodology, Fig 2) in the early stages of restoration (up to 5 years). In the later stages, forb rich sward is assessed at individual sampling positions (M2 methodology, Fig 3).

Habitat/site specific variation

- The presence of a forb-rich sward will depend on establishment treatment, e.g. habitats restored by natural regeneration versus sowing, strewing or planting.
- The presence of forb-rich sward will depend on soil type, e.g. thin, nutrient poor soils will tend to encourage a more forb-rich sward.
- The presence of a forb-rich sward will depend on location. Where there is an adjacent colonising source that will affect colonisation the restoration site will usually require zoning. For example, more demanding targets will be appropriate in the 20m or so adjacent to the colonising source than in the more distant core.

2.5.8 Key habitat attribute: target plant species

Justification

- Presence of certain plant species can provide a good indication that the restoration is proceeding in the right direction, e.g. black knapweed (*Centaurea nigra*) in meadows and heather (*Calluna vulgaris*) in heathland.
- In the early stages of restoration the presence of such target species anywhere on the site is a positive indication, since these species can be expected to spread more widely in subsequent years.
- In later stages the abundance of target species becomes more critical in determining restoration success.

Methodology

- In the early stages of restoration (up to 5 years) the presence of target species is assessed for the site as a whole (M1 methodology).
- In later stages, the presence and abundance of target species is assessed using the DAFOS scale at sampling positions (M2 methodology, Fig 3).
- Lists of target species for some habitats are provided in Appendix 3 and these should be referred to during recording. These lists are not exhaustive and judgements will need to be made as to whether additional species should be included and some inappropriate species removed.
- A guide to the identification of common grass species is included in Appendix 4.

Habitat/site specific variation

- The presence, frequency and abundance of target species will depend on establishment treatment, e.g. target species may take longer to appear in habitats restored by natural regeneration than those established by sowing, strewing or planting.
- Where there is an adjacent colonising source, the restoration site will usually require zoning, and more exacting targets will be appropriate in the 20m or so adjacent to the colonising source than in the more distant core.
- On some sites individual target species may be used as a separate attribute, e.g. the foodplant of target butterfly species.
- The species lists of target species may require adjustment to include locally distributed species of the flora, e.g. round headed rampion (*Phyteuma orbiculare*) in the chalk grasslands of Sussex.

2.5.9 Key habitat attribute: potentially dominant grasses (PDG)

Justification

- Some native grass species have the potential to form very dense swards which can restrict the establishment of other species, these are often stoloniferous or rhizomatous grasses, e.g. creeping bent (*Agrostis stolonifera*), and creeping cultivars of red fescue (*Festuca rubra*).
- Where grassland management is relaxed, some grass species can become dominant, e.g. false oat grass (*Arrhenatherum elatius*), typically forms the dominant grass on calcareous grassland restoration sites, and few other species may co-exist.

Methodology

- A list of possible PDGs for the particular habitat is given in Appendix 3 and judgements will need to be made as to which species should be included for a particular site and these may be listed on the recording form for convenience.
- Visual assessment of PDGs is made at each sampling position and the DAFOS score recorded (M2 methodology, Fig 3).
- A guide to the identification of key PDG species is included in Appendix 3.

Habitat/site specific variation

- Lists of PDGs will be habitat-specific, e.g. creeping bent (*Agrostis stolonifera*) in grazing marsh, and false oat grass (*Arrhenatherum elatius*) in limestone grassland.
- The habitat-specific lists may require revision following a site visit if other PDGs are identified.
- In some habitats PDGs can be a positive attribute, e.g. in field margins where a dense tussocky sward is required to encourage the target fauna.

2.5.10 Key habitat attribute: pernicious weed/problem species (PWS)

Justification

- Habitat restoration on agriculturally improved sites such as arable fields and improved grassland, can result in infestations by PWSs due to disturbance of the weed seed bank, high soil fertility and/or changing management.
- Infestations of perennial PWSs, e.g. creeping thistle (*Cirsium arvense*) and broad-leaved dock (*Rumex obtusifolius*) can reduce the success of restoration by dominating the vegetation and restricting the establishment of other species.
- There is a requirement to control certain pernicious weeds under the Weeds Act to prevent weed problems in adjacent land.

Methodology

- A list of PWSs is given in Appendix 3 and examples of possible PWSs for the particular habitat should be included on the recording forms for convenience.
- Judgements will need to be made as to whether additional species should be included in particular circumstances.
- Visual assessment of PWSs is made using the DAFOS scale at each sampling position (M2 methodology, Fig 3) and the DAFOS score recorded in the appropriate box on the form.

Habitat/site specific variation

- Problems with PWSs can depend on establishment method, e.g. natural regeneration can result in colonisation of PWSs by seed while restoration from improved grassland can result in expansion of weed species already localised at the site.
- The habitat-specific lists may require revision following a site visit if other PWSs are identified.
- In some cases, an individual problem species may require a separate attribute if its impact is particularly significant, e.g. bracken in heathlands.
- Occasionally, in some habitats PWSs can form a positive attribute, e.g. patches of stinging nettles (*Urtica dioica*) in riverside margins which encourage the invertebrate fauna.

2.5.11 Key habitat attribute: clonal plants

Methodology

- Visual assessment of the site as a whole using the DAFOS scale (M1 methodology, Fig 2).
- A clonal patch may be defined as a patch of one stoloniferous or rhizomatous species more than 0.5 m in diameter.
- A list of possible clonal species should be included on the recording sheet for convenience.

Justification

- Leguminous species such as creeping white clover (*Trifolium repens*), black medick (*Medicago lupulina*) or common melilot (*Melilotus officinalis*) have been observed to colonise grassland restoration sites rapidly forming large clonal patches which inhibit colonisation by other more desirable species and potentially raise nutrient levels though nitrogen fixation.
- Other clonal species such as creeping buttercup (*Ranunculus repens*) may spread rapidly in developing grassland, particularly on poorly drained sites, and hinder development of a more diverse sward.

Habitat/site specific variation

- Potentially problem clonal species will be somewhat habitat-specific, e.g. creeping white clover (*Trifolium repens*) in limestone grassland and creeping buttercup (*Ranunculus repens*) in grazing marsh.
- The habitat-specific lists may require revision following a site visit if other potentially dominant clonal species is identified.

2.6 A strategy for the preparation of monitoring prescriptions

The following list details the important considerations to be taken into account when preparing monitoring prescriptions. Appendix 5 provides a checklist, derived from this list, which may be photocopied to help you check your completion of this process.

Checklist for the preparation of Monitoring Prescriptions
(Appendix 1a and 2a provides examples of Monitoring Prescriptions)

1. Has the site been visited recently?
Prescriptions developed from memory from a previous site visit may miss critical site specific conditions.
A specific site visit must be made in order to review the site prior to the preparation of monitoring prescriptions.

2. Has restoration management been implemented and has it been documented?
Sites should be checked to ensure that restoration management has been started before embarking on the preparation of the monitoring prescriptions. A complete record of this management - exactly what has been done and when - is also essential for the future interpretation of results.

3. Is the site homogeneous or is it variable over more than 20% of its extent and if so, have monitoring prescriptions been adjusted to account for this?

Zoning of sites should be carried out if they show clear heterogeneity (of 20% or more), for example in terms of hydrology or slope, where this is / or is likely to be reflected in habitat development. Separate monitoring of the zones for all or selected attributes may be required (Section 2.2.3). An individual site may also be zoned into margin and core if there is semi-natural vegetation adjacent which may provide a source of colonising species (Section 2.2.3). In each case the justification for dividing the site should be recorded at the outset when preparing the monitoring prescriptions in order to aid interpretation later on.

4. Have all attributes been considered?

A wide range of attributes may be appropriate for an individual site, drawing both on prescriptions from similar sites, for example as listed in Burch et al (1999 – Appendices), and individual conditions appropriate to the particular site. All of these attributes must be considered while preparing the monitoring prescriptions to ensure that all relevant attributes are included. Section 2.5 presents details of the most commonly used attributes and will help with drawing up prescriptions. If you need to devise new attributes for your site, reference to these attributes as models can also help.

5. Has the appropriate monitoring methodology (M1 or M2) been selected?

There are two main approaches to Habitat Restoration Monitoring, general appraisal (M1) and a combined general appraisal / sample based methodology (M2) and these are recommended for different habitat types (Section 2.3.1 and Table 1). For some attributes (e.g. the occurrence of target species) it is recommended that the M1 methodology is adopted in the initial years (<5) and that the sample based (M2) methodology is adopted from year 5 onwards because species abundance as well as occurrence becomes more critical to the assessment of restoration success (Section 2.3.1).

6. Is there a long-term commitment to the site?

In choosing sites for restoration monitoring it is critical to ensure that there is a long-term commitment from the owner or manager of the site to maintain restoration management throughout at least the 10 year agreement period. Failure to maintain the management schedule may result in failure of the restoration objectives and make nonsense of the monitoring prescriptions and recording forms designed for the individual site.

7. Have realistic targets been set?

Setting realistic targets for habitat development is a key element in developing the monitoring prescriptions (Section 2.4). If targets are set too high, sites will inevitably fail to meet the criteria and potentially positive restoration developments will not be recognised. Alternatively, setting targets too low may not pick up on positive habitat developments and will fail to highlight problems sufficiently early in the restoration process for remedial action. Note that these targets may require further adjustment in future years if habitat development or management follows a different trajectory to that predicted (Section 2.4.2).

8. Are targets justified for the time series of restoration development?

One of the most difficult aspects in the development of monitoring prescriptions is the adjustment of attribute targets within the restoration time frame of 1-10 years. While some attributes, such as sward height and weed abundance, may be predicted to respond relatively quickly to restoration management, others such as the occurrence and abundance of target species and the development of species richness may be predicted to develop over a longer time frame. Adjusting targets appropriately may thus require a combination of reference to other monitoring prescriptions for similar sites and making allowance for site specific conditions which may influence the speed and direction of habitat development. Further details on adjusting targets are given in Section 2.4.2 and two examples of monitoring prescriptions are provided in Appendix 1a and 2a.

9. Has an independent person checked the form?

Finally, it is important that all monitoring prescriptions and recording forms are checked by at least one other informed individual who is familiar with the methodology and with the sites in question.

3. PREPARING FIELD RECORDING FORMS

3.1 Introduction

"Translating monitoring prescriptions into clear unambiguous attribute condition targets is the basis of preparing effective recording forms"

If the monitoring prescriptions have been prepared as described in Section 2 it should be a relatively straightforward process to translate the prescription into the recording form. However, the process requires care, for example, to ensure that the terminology is clear and unambiguous and relates to the attribute condition targets for the appropriate year of the restoration.

An example of a recording form for a new woodland using the General Appraisal Methodology (M1) is given in Appendix 1b and for a neutral hay meadow using the Sample Based Methodology (M2) in Appendix 2b. These forms are derived from the example monitoring prescriptions in Appendix 1a and 2a. Reference to these example forms should help when preparing recording forms for your own restoration sites.

3.2 A strategy for preparation of recording forms

The following list details the important considerations to be taken into account when preparing recording forms from monitoring prescriptions. Appendix 6 provides a checklist, derived from this list, which may be photocopied to help you check your completion of this process.

Checklist for the preparation of recording forms (Appendix 1b and 2b provide examples of recording forms)
1. Is the restoration site clearly marked on a map?
2. Is the recording form clearly labelled for the correct site?
3. Do the prescriptions and thus the recording form relate to the appropriate year? Separate recording forms must be prepared for each recording period (years 1, 2-3, 5 and 10). Ensuring that attribute conditions selected correspond to the appropriate year is essential.
4. Are all attributes / targets for the specific year included? Care must be taken in translating monitoring prescriptions to recording forms to ensure that all appropriate attributes are included.
5. Is all wording used clear and unambiguous? All wording of attribute conditions must be clear to avoid misinterpretation by the recorder. It is important for the recorder to check the form and question any uncertainties before commencing monitoring.
6. Are all M1 / M2 attributes grouped appropriately? It is advisable to group M1 and M2 attributes on the recording form, this will enable the recorder to distinguish between attributes requiring the M1 methodology and those requiring the M2 methodology.

7. Are positive and negative attributes grouped where possible?
Switching from recording positive attributes (e.g. *at least 5 target species present*) to negative attributes (e.g. *PDG no more than occasional at 80% of sampling positions or less*) can be confusing for the recorder. Where possible, it is helpful to group positive and negative attributes separately on the form.

8. Do all M2 attributes also have space for comments?
Where attributes are being assessed using sampling positions (M2 methodology), space must be provided on the form for the recorder to note down comments about each attribute. These comments can assist later on in interpreting why the site failed (or passed) for a particular attribute or can be used to highlight localised site variation.

9. Is the requirement for DAFOS to be recorded specified?
If the recorder is asked to assess a given attribute using the DAFOS scale, each DAFOS score must be recorded in the appropriate box on the form, either for the site as a whole (M1 methodology), or for each sampling position (M2 methodology). Recording the DAFOS score provides useful quantitative information that can aid interpretation of results and may be used for comparison with results in future years.

10. Have appropriate list(s) of positive and negative target plant species been attached?
Where the occurrence of target species forms a positive site attribute, e.g. limestone grassland forbs (LGF), a list should be attached to the form to assist the recorder in recording the appropriate species. Lists of target plant species for several habitat types are provided in Appendix 3. These lists will usually require adjustment for local conditions and for the specific targets for the site. Lists of negative indicator species, e.g. potentially dominant grasses, are provided in Appendix 3 and again these may need to be modified for individual sites.

11. If the site is split or zoned, is this clearly indicated on the form and attributes grouped accordingly?
Where the site has been zoned for some attributes this should be indicated on the recording form using shading or clear demarcation to alert the recorder, see woodland example in Appendix 1b. Where the site has been zoned for all attributes two separate forms should be provided. The zoning should also be clearly indicated on the site map and drawn to the attention of the recorder prior to monitoring (Section 2.2.3).

12. Has the form been checked by another person for clarity, non-ambiguity and adherence to the appropriate monitoring prescriptions?
As with the monitoring prescriptions, prior to carrying out the monitoring, all recording forms should be checked by at least one other person who is familiar with the methodology and the site in question.

13. Is the boundary of the site clear?
The boundary of the site must be indicated clearly to the recorder and should remain clear for subsequent monitoring periods to make sense of the data collected. In many cases this will be a boundary fence or hedge, but where differential management is being carried out over a wide area without relevant boundary structures, some form of permanent markers is required and should be documented to ensure continuity of recording.

14. Has the recorder been informed on location and access to the site?
The recorder must be familiar with the exact location of the restoration site, and appropriate access and parking points should be indicated on the site maps to save fieldwork time.

15. Has the landowner / manager been informed of the monitoring visit?
The landowner or site manager must be informed of any intended monitoring visit.

4. CARRYING OUT HABITAT RESTORATION MONITORING IN THE FIELD

4.1 Introduction

Carrying out Habitat Restoration Monitoring recording in the field should be relatively straightforward if the previous stages have been completed effectively. Any issues or problems that do arise must be recorded to improve the methodology and procedures.

Examples of completed recording forms are given for a new woodland in Appendix 1c and a neutral hay meadow Appendix 2c. Reference to these completed forms should help you complete your own forms appropriately.

4.2 Monitoring methodologies

"Two methods of recording are defined: M1 General Appraisal Methodology and M2 Sample Based Methodology"

M1 - General Appraisal Methodology

For the M1 methodology the recorder carries out a "W" walk of the site (Fig 1) and assesses the condition of the target attributes listed on the recording form for the whole site. If the site meets the required criteria, the appropriate box on the recording form is ticked and additional comments added.

M2 - Sample Based Methodology

For the M2 methodology, the recorder carries out a "W" walk of the site (Fig 1) but this time stops at a number (usually ten) equally spaced "sampling positions" (Section 4.3.3) and assesses the condition of the target attributes on the recording form at each sampling position.

Some habitats are recorded using the M1 methodology alone, e.g. hedgerows and woodland (Table 1) while for other habitats, e.g. grasslands and heathlands, a combined M1/M2 methodology is used and certain attributes are recorded using the M1 methodology and others using M2 methodology (Table 1). It is important to understand which methodology is to be used for each attribute before commencing recording.

4.3 Field methods

4.3.1 Walking the site

"A site walk is the basis of recording each habitat restoration site"

Field recording is carried out through a "W" or linear walk of the site (Figure 1a). The former being appropriate for whole field habitats and the latter for linear habitats such as field margins and hedgerows. For the more awkward shaped sites some provisional planning of the "W" walk and location of sampling position using a large scale site map will be required to ensure representative cover of the site (Figure 1b).

4.3.2 The appropriate time of year for monitoring

The time of year during which the monitoring takes place may be an important consideration. In general, monitoring during the period April – September will be appropriate for most habitat Attributes. However, in some cases specific periods of year may be important for certain habitat Attributes, e.g. presence of standing water in grazing marsh restoration requires monitoring by June in any year. Furthermore, where a measure of the abundance of specific species is needed, monitoring during the flowering period will aid species identification, especially for grasses most of which can be difficult to identify in vegetative stages (Appendix 4). If a comparison between sites or over time is required then monitoring must be carried out at an equivalent time each year.

4.3.3 Sampling positions

At each sampling position the recorder will sample the vegetation immediately in front of them; this amounts to a semi-circle of approximately 1-m radius (see Fig 2). The recording form has boxes for noting the habitat elements at each sampling position and the recorder will tick the appropriate box if the habitat criteria are met and record the DAFOS score if required. After completing the monitoring at a site the scores will be added up and a judgement can then be made on the degree to which the site has reached the targets, i.e. a measure of success (Section 4.4.5).

4.3.4 Measures of frequency and abundance (DAFOS)

The DAFOS scale can be used to assess the frequency and abundance of a number of habitat elements. Table 2 provides definitions of the five categories; Dominant, Abundant, Frequent, Occasional and Sparse. The DAFOS scale can be used to assess the frequency and abundance of individual target species, species groups and patches of bare ground. The DAFOS scale may be used to assess attributes for the site as a whole (M1 methodology; Figure 2) or at individual sampling positions (M2 methodology; Figure 3).

4.4 Filling in the habitat restoration recording form

4.4.1 Introduction

"All parts of the recording form must be completed fully"

An example of a completed recording form for a new woodland is provided in Appendix 1c and for a neutral hay meadow in Appendix 2c. These examples show how the example recording forms given in Appendix 1b and 2b might be completed, and, together with the following points, should help to clarify the important elemenst of the field recording procedures.

4.4.2 Site description

Information included here should assist in the overall interpretation of the monitoring results and may provide a brief "thumbnail sketch" of the site. This should be additional information not included in the comments sections for individual attributes (Section 4.4.3) and could include:

- topography, shape of the site, hydrology
- the nature of adjacent habitats
- management information, e.g. evidence of grazing or cutting
- other factors e.g. rabbit grazing, mole activity, evidence of vandalism etc.

4.4.3 Comments section

For each attribute a box is included for comments to assist in the interpretation of results. In particular, these might help to clarify why a particular target condition has not been met. Equally comments may provide suggestions for future management priorities or draw attention to particular aspects of the site.

Appropriate comments may include:

- the localised nature of a particular attribute
- identity of species involved

4.4.4 DAFOS assessment

For a number of attributes, an assessment of abundance is required using the DAFOS scale, e.g. "... *at least frequent*", "... *no more than occasional*". If this is required using an M2 methodology, then a DAFOS assessment should be made for each sampling position and recorded on the form. Crosses or ticks should then be added to indicate whether the particular attribute target condition has been met or not. Care should be taken to note whether the condition target is positive i.e. "...*at least* ", or negative i.e. "...*no more than* ".

4.4.5 Scoring

A scoring system is included on the form to provide a rapid indication of site condition and the conditions of individual attributes:

Scoring

- If a condition target is met (NB for M2 this will require a given number of sampling positions e.g. 8+) then a score of 2 should be recorded.
- If a condition target is almost but not quite met e.g. 7 sampling positions where 8 are required or 3 rather than 4 target species found, then a score of 1 should be recorded.
- If the target is not met at all, then zero should be recorded.

4.5 A strategy for field recording

The following list details the important considerations for completing recording forms. Appendix 7 provides a checklist, derived from this list, which may be photocopied to help you check your completion of this process.

Checklist for carrying out Habitat Restoration Monitoring in the field
(See Appendix 1c and 2c for examples of completed recording forms)

Before setting out to visit the site for recording:

1. Is the site location and boundaries clearly marked on a large scale map?
You must check that each site is covered by a recording form and that zoned sites are clearly indicated as such.

2. Have you planned the sampling route – "W" or linear walk?
Use the large-scale site map to plan the "W" walk and sketch the approximate path and sampling positions (if appropriate) onto the field map prior to the site visit (Figure 1a). This is good practice for all sites but especially important for large and awkward shaped sites (Figure 1b).

3. Are the access arrangements confirmed?
The parking/access route must be clearly indicated and the landowners informed of the intended visit.

4. Have you read and understood the recording form?
All recording forms should have been checked for structure and clarity by at least one independent person prior to monitoring but problems can still arise and so a further check by the recorder prior to the site visit is needed. Some recording forms are very straightforward others are more complex and so it is important to understand what is required to complete the recording form for each site. Any ambiguous or unclear wording should be questioned before monitoring commences.

5. Have you checked the identification of any key species?
This is especially important if you are visiting an unfamiliar site or habitat type. Where specific plant species e.g. target species, are listed on the recording form, check that you are familiar with these.

6. Have you assembled any equipment required?
Metre rule and dropped-disc (if appropriate) as well as clipboard and other essentials for monitoring but also protective and safety clothing as appropriate to the site.

7. Have you left your contact details?
For health and safety in the field it is essential to leave details of your intended movements following your organisation's fieldwork safety system. In addition take a mobile phone with contact numbers for health and safety but also for a contact who compiled the forms to help with specific problems with field recording.

During recording

8. Is the boundary of the site clear in the field?
Take some time to ensure that the boundaries marked on the map correspond to true boundaries in the field and note any discrepancies on the recording form. Any useful boundary or other landscape markers should be added to the map for future users.

9. If site is split or zoned is this obvious in the field?
Where the site has been zoned for all or some attributes check that this is clear in the field and note any additional areas on the map to be queried later. If you encounter serious difficulties with interpreting the field site and recording form in the field, contact your advisor.

10. Do you understand the approach to recording M1 vs M2 attributes?
Some habitats are recorded using M1 methodology only, e.g. hedgerows and woods (Table 1). For other habitats e.g. grassland and heathland, some attributes are recorded using the M1 methodology while others are recorded using the M2 methodology (Tab 2). For these habitats it is important to appreciate that the M1 type attributes refer to general aspects of the and are usually best recorded after the "W" walk of the site. M2 type attributes refer to quantified aspects recorded at each of the sampling positions during the "W" walk.

11. Have your recorded DAFOS scores where required?
The DAFOS score can be used to assess frequency and abundance of attributes, e.g. of target species or of potentially dominating species, for the site as whole (M1 methodology, Figure 2) or for individual sampling positions (M2 methodology, Figure 3). It is important to record the DAFOS score in the appropriate box on the recording form since this provides additional quantitative information and allows checking of target scores later if required as well as for comparison with previous or subsequent recording periods.

12. Have you calculated the score for each attribute correctly for positive or negative indicators?
Calculating target scores from positive or negative indicators can be confusing (Section 4.4.5). For example, in the case of the negative indicator *"PDG no more than Occasional"* records of **F**requent, **A**bundant or **D**ominant ***DO NOT*** meet the target and the score recorded is zero (although records of **F**requent may score 1 if considered appropriate). However, records of **O**ccasional or **S**parse **DO** meet the target and score 2. After recording the DAFOS scores at each sampling position these scores can be converted to ticks (=meets the target) or crosses (=fails to meet the target). Summing the ticks then provides the overall score for the attribute at that site. To avoid potential confusion, the positive and negative indicators should be grouped together on the recording form (Section 3.2), if they are not grouped in this way, make a note of this on the form for future revisions.

13. Have you provided comments as required?
Use the spaces provided on the recording forms for any comments that relate to particular attributes. Additional comments can be very helpful in interpreting the results of monitoring and may be especially valuable in assessing further management practices or in clarifying potentially conflicting or irregular results.

14. Have you completed all sections of the form?
Check the recording form methodically before leaving the site. Fill in any blanks, re-walking the site if you are at all unclear about any aspects. Check the comments boxes and add additional comments as appropriate

5. REFERENCES

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Thomas R, Isaacs J P. 1999. A habitat restoration trial in farmland in lowland England. In *Heterogenity in Landscape Ecology: Pattern and Scale.* Proceedings of the 1999 IALE(UK) Conference, pp 179-188. Eds M.J. Maudsley & E.J.P. Marshall (eds), Bristol: IACR- Long Ashton Research Station.