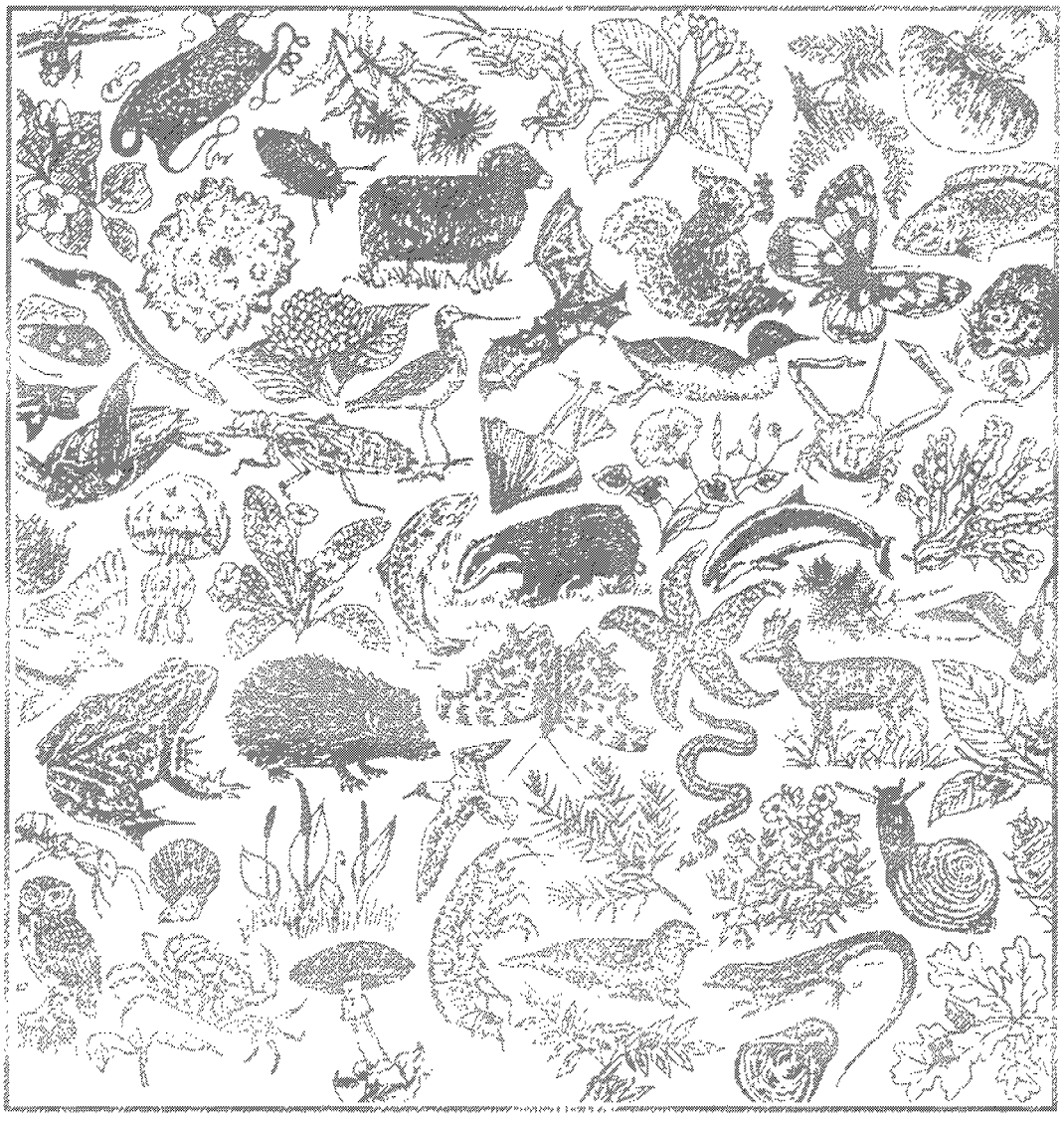
ENGLISH NATURE

Habitat restoration monitoring handbook

No. 378 - English Nature Research Reports



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English Nature Research Reports

Number 378

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ISSN 0967-876X

Preface

English Nature's Habitat Restoration Project ran from 1996 to 2000 to demonstrate the extent to which fragmentation could be reversed using the available mechanisms; to identify which policies and procedures were most effective in achieving habitat recovery and what new policies, funding or procedures were needed; and finally to disseminate the experience to influence partners to adopt those policies or procedures to achieve the reversal of habitat fragmentation.

As part of the project, a monitoring programme was developed to chart the establishment and development of restored habitats in the context of the Biodiversity Action Plan and to assess the extent to which restored habitats contributed towards improving the wildlife and biodiversity of agricultural landscapes more generally (Mitchley, Burch and Lawson 1998; Burch, Mitchley, Buckley and Watt 1999). The method is in keeping with standard procedures for monitoring on SSSI, advocated by English Nature. Habitat Restoration Monitoring was not designed to pass or fail sites but to identify successes and highlight management problems.

This handbook is designed to highlight the critical considerations at each of the main stages of the monitoring methodology as follows:

- Preparing habitat restoration monitoring prescriptions
- Preparing field recording forms
- Carrying out habitat restoration monitoring.

The Habitat Restoration Project continues to use this method in conjunction with more traditional techniques to explore the ecological changes taking place over 10 years on the sample sites within each of the four HRP trial areas. The results of this work will emerge over the coming years. In the mean time, the method described here is recommended as part of long term trials of habitat restoration and creation.

Rachel Thomas, Habitat Restoration Project Manager
April 2000

CONTENTS

1. HABITAT RESTORATION MONITORING (HRM)

"The aim of HRM is to provide simple techniques for monitoring habitat restoration to assess the contribution that restored habitats are likely to make to enhancing biodiversity"

This methodology for monitoring the development of habitat restoration sites was derived as part of English Nature's Habitat Restoration Project (Mitchley, Burch & Lawson, 1998; Burch, Mitchley, Buckley & Watt, 1999; Thomas & Isaacs, 1999). The aim of the methodology is to provide a simple technique to:

- Chart the success of the establishment and development of restored habitats in the context of the UK Biodiversity Action Plan (HMSO, 1995)

- Assess the extent to which restored habitats are likely to contribute towards improving the wildlife and biodiversity of agricultural landscapes more generally

Please note: The use of the words ***restoration*** and ***restored*** are used throughout the handbook to include both the 'creation' of habitats (from scratch) and the restoration of habitats (where a fragment of the habitat exists or a seedbank is present on the site).

"HRM is not designed to pass or fail sites but to identify success and highlight management problems"

The objective of the HRM methodology is not so much to pass or fail restoration sites but to identify key issues and to highlight problems in order to prioritise action, for example, to improve site management in response to issues identified by the monitoring.

"This handbook is intended to facilitate the whole HRM process – from designing prescriptions to field recording"

The HRM handbook is designed to highlight the critical considerations at each of the main stages of the monitoring methodology to enable appropriate and efficient monitoring. The starting point is the habitat prescriptions provided by Burch *et al* (1999, Appendices) and the three main stages described in this handbook are:

- Preparing Habitat Restoration Monitoring prescriptions (***Section 2***)
- Preparing field recording forms (***Section 3***)
- Carrying out Habitat Restoration Monitoring (***Section 4***)

ACKNOWLEDGEMENTS

Many people assisted directly or indirectly with the production of this handbook and the authors would like to thank the following in particular for their help and encouragement:

Phil Horton, Rachel Thomas and James Trueman (English Nature), Nicky Wheeler (HRP Ouse Valley), Brenda Williamson (HRP Alde Estuary), Karen Eppey (HRP Blackmore Vale), Gordon Hewston (HRP Sherwood Forest), Phil Wilson, Marian Reed, Sue Clark and Clive Bealey (Wessex Environmental Associates), Jim Connor (Wye College).

2. PREPARING HABITAT RESTORATION MONITORING PRESCRIPTIONS

2.1 Habitat Restoration Prescriptions

2.1.1. Introduction

"Habitat restoration prescriptions are the basis of the HRM methodology"

Burch *et al* (1999 - Appendices) provide HRM prescriptions for a range of habitats and these prescriptions are based on general features of the target habitat as well as ecological requirements of target species, such as key Biodiversity Action Plan (BAP) species for each habitat (HMSO 1995). These prescriptions have been field tested at a number of sites in four pilot areas (Ouse, Alde, Blackmore Vale and Sherwood Forest) and represent the current standards for HRM.

An example of a monitoring prescription for woodland is given in Appendix 1a and for neutral hay meadows in Appendix 1b. Familiarisation with the structure of HRM prescriptions for relevant habitats should help with the development of site-specific prescriptions for your own restoration sites.

2.1.2 The structure of HRM prescriptions

"HRM prescriptions are composed of site characteristics, attributes, overall targets for these attributes and condition targets projected over a 10 year time period"

Site characteristics

"Site characteristics are the important features of potentially successful restoration sites"

A number of key attributes are listed at the outset (i.e. year 0) which are considered essential to identify a potentially successful restoration site. These attributes will be highlighted on the recording form and might include physical attributes such as soil type or local topography or biological attributes such as presence of large mature trees or proximity to a propagule source to enable colonisation. In some cases these site characteristics will need to be resurveyed at each monitoring visit (year 1/2, year 5 and year 10), e.g. presence of mature trees, while others may be unchanged after the first visit (e.g. soil type).

Attributes

"Attributes are measurable qualities or properties of the target habitat, including permanent or transitory qualities, both positive and negative, which are associated with the successful development of the restoration site"

Attributes may include bare ground, target plant species or pernicious weed species, or the structure of the vegetation, e.g. tussock grassland. It is the definition and monitoring of these attributes which forms the basis of the HRM methodology and it is thus referred to as *attributes monitoring*. Details of some key attributes frequently used for HRM are given in Section 2.5.

Overall targets for these attributes

"The overall targets represent the condition of each attribute which will meet the requirements of the target species, plant or animal, for which the habitat is being restored"

Overall targets are the desirable outcome of habitat restoration in the medium or longer term (i.e. 10 years). For example the desired quantity of bare ground or frequency and abundance of target plant species, the maximum acceptable frequency or abundance of pernicious weed species or the nature of vegetation structures required by target species (e.g. frequency of tussock grasses).

Condition targets for attributes throughout a 10 year period

"Condition targets are the desired targets defined for each attribute at each recording period – usually 0/1, 2/3, 5 and 10 years after commencement of habitat restoration"

Most attributes will change in quality or quantity through time, reflecting the successional nature of the restoration process. Therefore, to derive target conditions for the attributes to be recorded during the habitat restoration process, the overall condition target will be sub-divided into targets for each of the monitoring periods (0/1, 2/3, 5 and 10 years) after the start of restoration. For example, in a successful restoration site, the occurrence of target plant species should increase over time both in terms of species number and abundance, while under appropriate management conditions, pernicious weed species should decline.

2.2 Site-specific monitoring prescriptions

2.2.1 Introduction

"A site visit is the critical first step in preparing the site-specific prescription"

It is essential that monitoring prescriptions and thus recording forms should be tailored to individual sites. Therefore, a site visit is essential in order to prepare a monitoring prescription which will take account of the individual characteristics and peculiarities of the site in question. The preparation of monitoring prescriptions for individual sites requires the greatest input of time and expertise in the restoration monitoring process. If adequate time is spent in preparing these accurately and realistically for the site in question, then the preparation of recording forms and the monitoring process itself should proceed smoothly.

2.2.2 Site-specific variation

Outlined below are some of the conditions that may vary between individual sites.

Site history

Whether the site supported the target habitat in recent years or has had a long history of intensive agricultural production will have a significant effect on the speed of habitat regeneration, (particularly from the seed bank) and thus the time in which certain target species may be expected to reappear. Equally, past management may have an impact on residual levels of fertility on the site and the likely occurrence and impact of some problem species. These factors should be reflected in the targets set for certain attributes, both in terms of the time over which changes may be expected and the level of success predicted.

Site location

The location of the site in relation to likely sources of colonisation and to other habitat types will also have a significant effect on species colonisation. Sites with adjacent sources of colonisation may be expected to gain target species more rapidly and may be zoned for certain attributes to reflect colonisation distance over time, see Section 2.2.3.

Restoration method

The methods of restoration establishment and management used on individual sites will have an effect on the speed and direction of habitat development. For example, targets and attributes appropriate to grassland creation sites on arable land will vary according to whether natural regeneration, sown brush-harvested seed, strewn hay or a sown mix of non-competitive grasses is used as an initial establishment method. If the site is being restored from improved grassland quite different considerations may be required. Care must thus be taken in translating targets from other site specific prescriptions if different restoration methods have been used.

Problem species

While certain pernicious weed species may be common to many restoration sites e.g. thistles (*Cirsium* spp) or docks (*Rumex* spp), individual sites may have specific problem species which reflect local conditions or past management history, e.g. bracken (*Pteridium aquilinum*) in heathland restoration sites. These may require treatment as a separate attribute in themselves or inclusion in the list given for a particular negative attribute. For example, a site where scrub has been cleared to promote grassland restoration would require a specific attribute to monitor control of scrub regrowth.

2.2.3 Zoning a site

There may be significant variation within a site in relation to site history, topography/ soils/hydrology or method of restoration. As a general rule if the site visit shows obvious variability in terms of topography and/or vegetation over 20% of its area or greater then consideration should be given to dividing the site into two or more zones. For example, where the site is on a slope and the upper slope is clearly different to the lower two separate zones may be

appropriate. Separate sections of the recording form will be required for the different zones and different targets for attributes likely to differ between the zones as appropriate. For example, if the soil on the upper slope is shallow a more open sward and rapid colonisation by target species may be expected than on the deeper soils down slope.

Another case for zoning a site can be made where the restoration method is through natural regeneration to establish vegetation within a whole field site and where colonisation is expected from an adjacent site, the field should be stratified into a "margin" and a "core". The margin is the outer 20m adjacent to any source of colonisation, and the core is the centre of the field more than 20m from a known source of colonisation. Monitoring of some or all attributes will be carried out separately in the margin and the core. Recording forms need to be designed accordingly, i.e. separate parts of the form, or separate forms entirely if considered appropriate, for recording the margin and the core.

2.3 Monitoring methodologies

2.3.1 General Appraisal Methodology (M1) and Sample Based Methodology (M2)

"There are two field recording methods for HRM: General Appraisal Methodology (M1) and Sample Based Methodology (M2)"

For some relatively straightforward habitats (e.g. hedgerows, new woodland and field margins) it is recommended that monitoring be carried out using a general appraisal of the site. For more complex habitats, where restoration is more difficult to assess, e.g. grassland and heathland, a combination of general appraisal and more detailed quantitative recording is recommended. Table 1 indicates those habitats that may be monitored using the M1 methodology alone and those which require a combination of M1 and M2 methodologies.

Table 1: **The recommended monitoring methodology for different habitats (see text for further information)**

General appraisal methodology (M1)	**Combined sample-based (M2) and general appraisal methodology (M1)**
Coastal grazing marsh	Alluvial grassland
Field margins	Restored neutral grassland
Hedgerows (new and restored)	Restored neural hay meadow
New woodlands	Restored limestone grassland
River margins	Restored damp grassland
Ditches	Neutral grassland creation
Ponds	Limestone grassland creation
	Acid grassland creation
	Heathland recreation

For those habitats monitored using a combined M1/M2 methodology, the M1 approach is recommended for those attributes which can be assessed relatively easily through a general appraisal, e.g. vegetation mosaic (see Section 2.5.5). While for attributes that require more quantitative data, e.g. pernicious weed/problem species (see Section 2.5.10), the M2 approach is recommended.

For some attributes, e.g. the occurrence of target plant species, it is recommended that the M1 methodology is adopted in the initial years (<5 years) and that the sample based (M2) methodology is adopted from year 5 onwards. This change in monitoring methodology with time is appropriate for attributes such as target plant species since successful restoration should result in colonisation and spread of target species with time so that frequency and abundance as well as simply presence at the site need to be recorded.

General appraisal methodology (M1)

The M1 method provides a general appraisal of the site as a whole. For this methodology the recorder carries out a "W" walk of the site (Fig 1 and Section 4.3.1) 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.

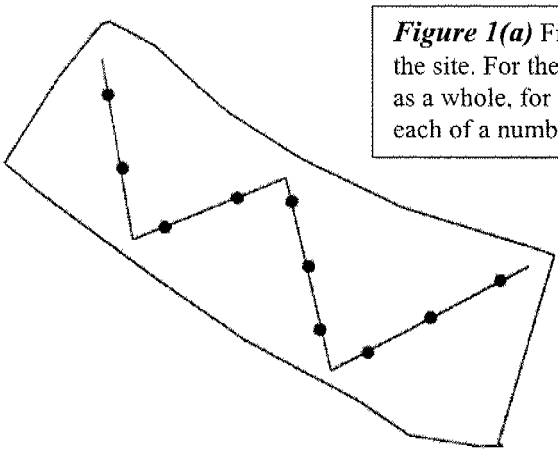


Figure 1(a) Field recording is carried out through a "W" walk of the site. For the M1 methodology, attributes are assessed for the site as a whole, for the M2 methodology, attributes may be assessed at each of a number of sampling positions (usually 10)

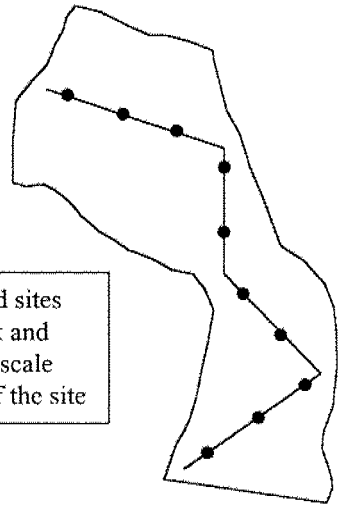


Figure 1(b) For the more awkward shaped sites some provisional planning of the "W" walk and location of sampling position using a large scale site map will ensure representative cover of the site

Sample based methodology (M2)

The M2 methodology provides a quantitative assessment of the attributes at a number of sampling positions. For most sites ten sampling positions is considered adequate however in particularly large or complex sites a larger number may be recorded, in which case the recording form should be adjusted.

For the M2 methodology the recorder carries out a "W walk" of the site and assesses the condition of the target attributes listed on the recording form at each of ten more or less equally spaced sampling positions. At each sampling position the recorder samples the vegetation immediately in front of them and encompassed in a semi-circle of approximately 1-m radius. The use of a metre rule can assist in defining the sampling position (see illustration on front cover). In addition, the recorder also records some more general attributes of the site in the M1 style, and so the M2 methodology represents a hybrid method for gathering a range of information about the attributes of a site.

2.4 Defining target conditions for attributes

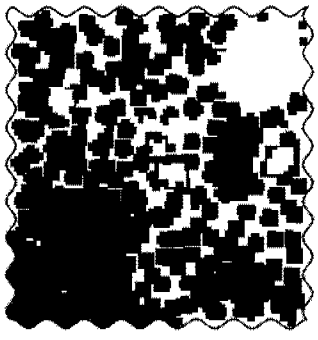
2.4.1 Measures of abundance (DAFOS)

To assess the abundance of a number of habitat elements, including individual species, species groups and patches of bare ground, a modified DAFOR scale (DAFOS) is described below. This system can be used to assess frequency and abundance across the site as a whole as in the M1 method (Fig 2) or for an individual sampling position as in the M2 method (Fig 3). Thus, the system does not require the use of frame quadrats in the traditional sense.

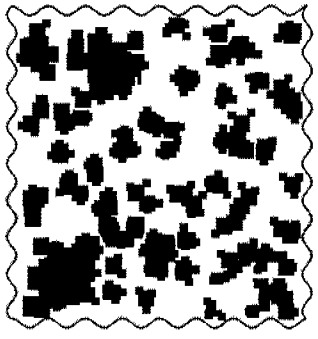
Table 2: **The DAFOS scale for assessing frequency and abundance for the site as a whole (M1 methodology) or for individual sampling positions (M2 methodology)**

DAFOS Score	M1 methodology	M2 methodology
Dominant	Present at high abundance across the site, highly visible, usually more than 50% cover.	The dominant vegetation/species at an individual sampling position, highly visible, usually more than 50% cover.
Abundant	Present and visible over most of the site, but usually not more than 50% cover.	Abundant individuals at a sampling position, but usually not more than 50% cover.
Frequent	Regularly observed across the site, cover variable.	A number of individuals at a sampling position, cover variable.
Occasional	Present at the site but have to hunt to find it, cover variable.	Scattered individuals at a sampling position.
Sparse	Present at the site but have to hunt hard to find it, cover low.	Single or very scattered individuals at a sampling position.

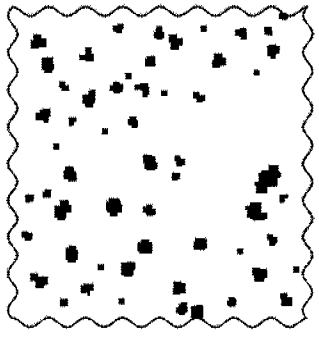
Figure 2: The DAFOS scale for assessing the site as a whole using the M1 methodology:
The DAFOS scale can be used to assess frequency and abundance across the site as a whole in the M1 methodology as shown below. (Figure 3 shows the DAFOS scale applied to individual sampling positions).



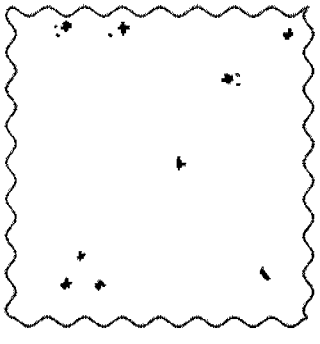
Dominant: present at high abundance across the site, highly visible, >50% cover



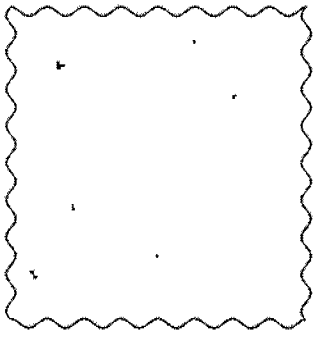
Abundant: present and visible over most of the site, <50% cover



Frequent: regularly observed across the site, cover variable



Occasional: present at the site but have to hunt to find it



Sparse: present at the site but have to hunt hard to find it

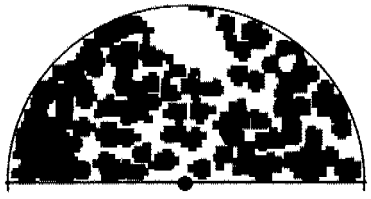
2.4.2 Adjusting target conditions

The number of individual species required or their abundance of occurrence (using the DAFOS scale) can be adjusted to account for individual conditions. For example in a grassland restoration site sown with a brush harvested seed mixture one may expect to find more target plant species and at a greater frequency and abundance early in the restoration, in comparison to a site under natural regeneration. Equally, for both sites, the number of species would be expected to rise over time as the sward develops, although at different rates.

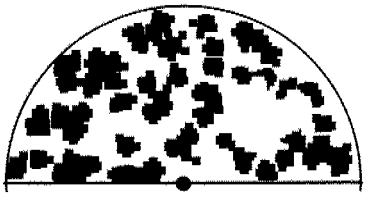
For sites with an adjacent colonisation source, zoning may be employed and the number of species adjusted to reflect conditions close to and distant from the colonisation source. As the restoration proceeds, the evenness of occurrence of representative species may be seen as an appropriate target and thus DAFOS assessment may then be used to monitor species occurrence.

For negative indicators such as pernicious weeds, DAFOS assessment may be the most appropriate form of assessment from the beginning of the restoration process.

Figure 3: The DAFOS scale for assessing sampling positions using the M2 methodology: To assess the abundance of a number of habitat elements, including individual species, species groups and patches of bare ground, the DAFOS scale is used. This scale can be used to assess frequency for individual sampling positions (semi-circles of approx 1 m radius) in the M2 methodology (Fig 2 shows the DAFOS scale applied to the site as a whole).

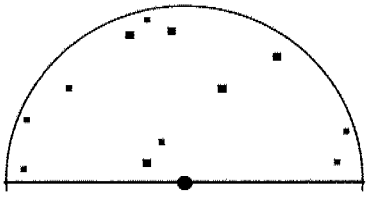


Dominant: the dominant vegetation/species, highly visible, usually >50% cover

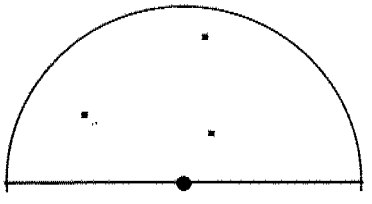


Abundant: abundant individuals, usually <50% cover

Frequent: a number of individuals present, cover variable



Occasional: scattered individuals



Sparse: single or very scattered individuals

For attributes monitored using the M2 sampling position methodology, individual site conditions can also be reflected in the target number of sampling positions set to meet a given attribute condition.

It is generally not recommended to require 100% compliance (all 10) of sampling positions to meet a given attribute condition, since all sites inevitably show some variation. However, for a number of attributes which are considered critical and where the restoration establishment and management method are appropriate, high levels of 70-90% compliance may be set.

For other attributes which may, at the start or throughout the restoration, be more patchy (e.g. the occurrence of target species) lower targets of 50% or less may be appropriate and may be set at higher levels in later monitoring periods as the restoration progresses.