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An approach to a woodland monitoring framework

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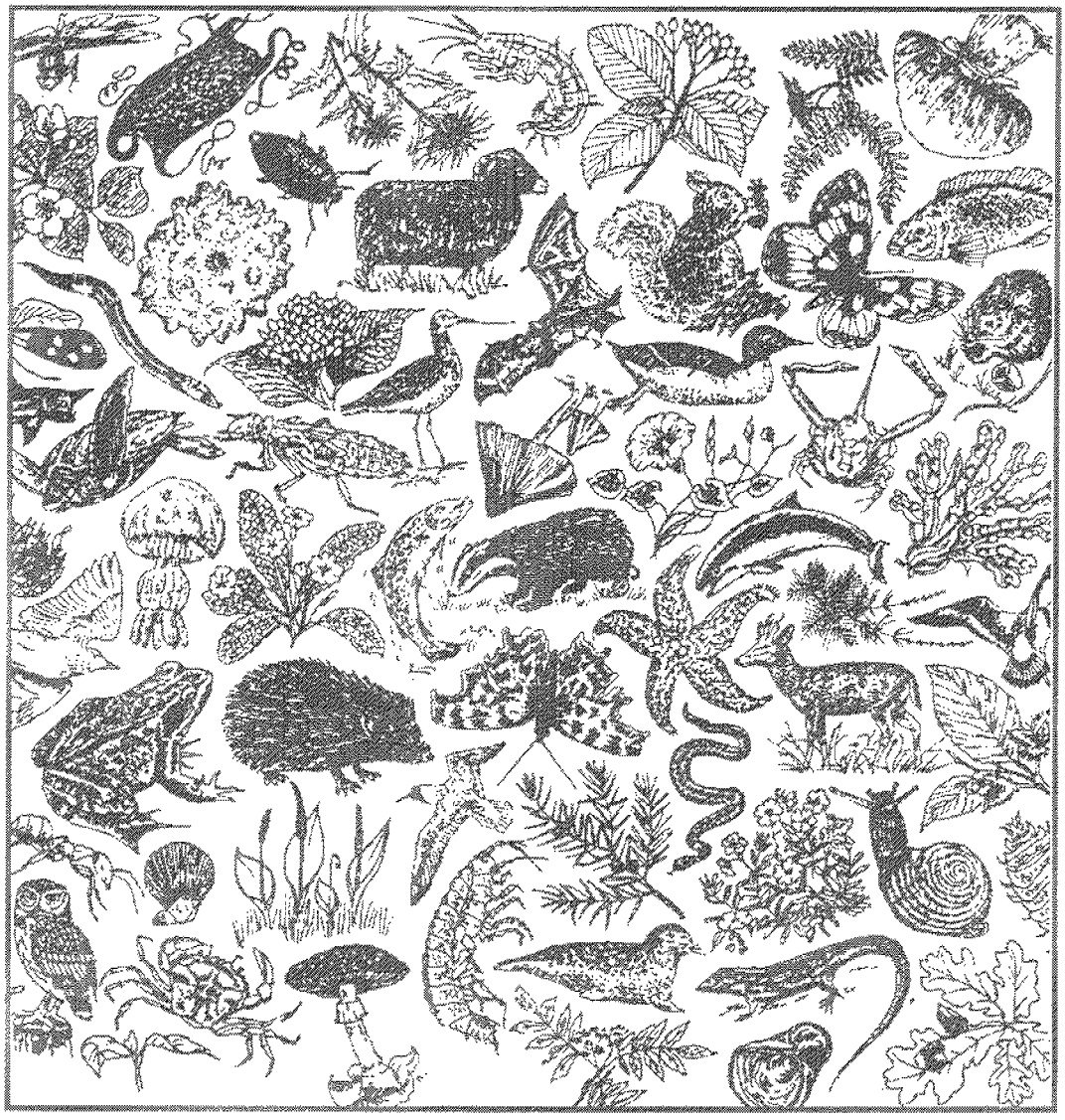

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ENGLISH NATURE RESEARCH REPORT
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AN APPROACH TO A WOODLAND MONITORING FRAMEWORK

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Preface

In the last days of its existence the Nature Conservancy Council was moving towards statements of conservation objectives and frameworks for monitoring for different habitats. A discussion paper (CSD Note 55 issued in March 1991) sets out some ideas for woodland. I hoped that this note would prove useful to the new agencies and generate some feedback. In the event it sank largely without trace. There still seems to be a need for information along these lines however so I have revamped it, expanded some sections and altered others in the light of the changes that have taken place in conservation thinking and structures since then. I hope that this version will receive rather more comment even if only to say that it is of no use at all.

Introduction

1. We cannot say whether woodland conservation is successful or not unless we have a series of targets (what we want to achieve) and a monitoring system (are those targets being met?).

2. The targets must be expressed at a series of levels, namely what we want for the wider countryside, for ancient woods, for woodland SSSIs generally, and for individual sites. The targets should also be related to a timescale. The monitoring system must identify the methods to be used for different circumstances and objectives, the frequency of recording and the action to be taken if targets are not being met.

3. My impression is that there is probably a broad consensus as to what we are trying to achieve. Even so setting out what we want precisely has dangers - others can try to draw us back from that. Also there must inevitably be a great deal of personal opinion and guesswork in setting targets. However I believe that in the 1990s we will be pressed increasingly to define our objectives in quantitative terms so that conservation programmes can be costed properly and so that we can show that what we do does produce the nature conservation goods.

4. In this paper I have tried to set out a series of targets and possible schemes for monitoring them. These are very much personal views for England although similar procedures could be adopted across all three countries. If they are to form the basis for common standards then the outputs need to be agreed by JNCC directly or through the inter-agency working group. Development of the suggestions within this note could be one route towards agreed common monitoring systems.

Outline of my approach

5. Nature conservation objectives are suggested first for broad categories in terms of their total area. For simplicity I have taken the 'standard' breakdown of British woodland into ancient versus recent and semi-natural versus plantation. (For all Scottish figures the inventory category of long-established, semi-natural origin has been included within the ancient category. Semi-natural can generally be equated with native). This breakdown is based on a combination of woodland inventory and FC census data.

6. I have then taken the ancient semi-natural category for England and suggested a second level of objectives in terms of the overall balance of treatment that we should aim for, which will vary from region to region. In practice such targets and objectives are likely to be set in terms of "natural areas". A similar approach could be taken for the other categories. These two levels provide information for use at broad policy levels. For example, has the broadleaves policy been successful at slowing the rate of conversion of semi-natural stands to plantations; is the rate of establishment of plantations in SSSI woodland or in national parks significantly less than in other ancient woods; do management grants lead to more use of coppice in the natural areas where this is a priority? From the results conclusions may be drawn about whether incentives or controls need to be changed.

7. These first two levels of objectives also provide the context for management recommendations for individual sites. The details of site management should be determined by the specific characteristics of that site. However in only a limited number of cases will EN staff be directly involved in providing advice on such management; rather owners/occupiers will be working from guidelines such as those produced by the Forestry Commission (with input from ourselves). A general framework of nature conservation should help to guide others towards appropriate treatments and targets for their sites.

8. We still need to know however whether those targets are being met, both in terms of treatments applied and the nature conservation benefits that are to follow. Therefore we need a series of more detailed site monitoring procedures. EN needs to check on the state of SSSIs but similar types of question are asked by MAFF in relation to woods within ESAs, and increasingly by the Forestry Commission with respect to the effects of the Special Management Grant and in connection with the forthcoming census. If it is possible to gain broad agreement between organisations on the type of data collected then collation and interpretation of countryside statistics would be greatly improved. As a starting point for SSSIs I have set out a series of broad reasons why sites are scheduled which therefore determine the objectives at that level. From these I have derived possible monitoring prescriptions.

9. I would very much welcome comments on this approach.

Objectives for woodland nature conservation at a country level

10. EN aims to conserve wildlife and natural features in England within the wider setting of GB, Europe and our international responsibilities. Within this context woodland nature conservation objectives can be expressed as follows:

- to maintain and enhance the (relatively) natural elements within woodland;
- to maintain and enhance the populations of any rare species that are present;
- to promote a diversity of native woodland species throughout their natural range.

The detail of how these should be achieved and the priorities between objectives vary from site to site and between regions or natural areas and between different stands within one site.

11. Ancient semi-natural woodland comes closest to the natural woods of the past in terms of its composition (both trees and shrubs and other groups); it also has a higher proportion of the rare and vulnerable woodland species and is generally richer in species than any other category.

12. The least valuable woods for nature conservation are recent plantations, particularly of conifers, although even broadleaved woods established on arable or improved grassland tend to be species-poor. The sheer extent of upland conifer plantations means that they will contain high numbers overall of (generally) common woodland species, both plants and animals. Some uncommon species, e.g. siskins and pine martens, have spread directly or indirectly (through reduced persecution) as a result of upland planting. There may also be localised pockets of high nature conservation value within the new forests e.g. Breckland species on rides in Thetford, but these do not alter the general case that the vast majority of these plantations are of relatively low wildlife interest. EN should seek to identify practices and features that can be encouraged or protected, at relatively little expense or with little input from them, so that their limited resources can be directed towards the more valuable sites.

13. Intermediate between these two extremes in nature conservation value are a mixture of woodland types including:

recent semi-natural woods;
plantations (particularly plantations of broadleaved/native species) on ancient sites;
some recent, mature plantations of broadleaved/native species.

(a) Recent semi-natural woods may be quite species-rich for example where they have established on other semi-natural vegetation open); where they incorporate features such as streams, rock ledges, etc; the longer they have been in existence; and where they are adjacent to older woodland. Their structure can also be varied, but for the most part they lack the long-term continuity of habitat conditions that appears to be important for many groups - not just higher plants.

(b) Continuity of some form of woodland cover has been maintained in plantations on ancient sites, but the tree and shrub community is drastically altered, and, where there is a change to conifers from broadleaves, this has major implications for the associated plant and animal communities. Some of the original ground flora may survive under open-canopied plantations, particularly where the planted species are similar, in terms of canopy and rooting characteristics, to those that were native to the site. Commercial plantation management of semi-natural woods affects stand and woodland structure as much as the types of tree species present. Hence in some circumstances rich open-phase invertebrate communities have actually survived better in commercial plantation woodland with open rides than in neglected semi-natural woods. Equally some new plantations of native species may be very dull.

(c) Recent plantations of broadleaved/native species can be important in areas where other (higher quality) woodland is so sparse that it is the only local habitat available for event the (elsewhere) common woodland species.

14. Whereas ancient semi-natural woodland is valuable across the whole country, there is much more regional variation in the relative value of woods in the other three categories. On the evidence available so far, plantations on ancient sites are more important in the south and east than in the north and west, whereas for recent semi-natural woods the reverse is true.

Objectives for the total area of different classes of woodland at a national level

15. Targets for what would count as 'success' under current or revised policies over the next ten years might be:

(a) clearance of ancient semi-natural woodland to be not more than 0.2% of the total (it is unlikely that all clearance can be prevented, so a zero target is unrealistic) (400ha);

(b) major changes in the composition and structure of ancient semi-natural woods such that they can no longer be classed as semi-natural to affect not more than 1% of the total (2000ha);

(c) at least 3% of plantations on ancient sites to be managed to approach a semi-natural condition (4000ha);

(d) the area of recent semi-natural woodland to be increased by about 15000ha. This would be equivalent to about the annual level of current new planting, and so does not seem excessive to me.

(e) Most plantations will be established primarily for commercial reasons but we believe there should be scope for at least 50,000ha of native species to be included in these.

16. Monitoring whether these targets are being met could be done in various ways. (a) - (c) can be checked by looking at the trend in revisions to the ancient woodland inventories. Initially many revisions may not represent genuine recent change, but correction of errors of which we

are not currently aware. Such changes can be separated off. Loss and damage statistics for SSSIs might also provide some data. Such *ad hoc* recording should be supplemented by a more systematic approach, for example periodic sample check of inventory sites (e.g. every 5 years) to provide a more precise estimate of change in these woods, including both conversion of semi-natural woods to plantations (or complete clearance) and the restoration of semi-natural stands. An alternative is to link the sample check with FA's rolling census programme.

17. For recent semi-natural woodland and recent plantations targets on their location as well as their location and extent are also desirable. Various proposals have been made for ways in which such new woods might in theory benefit the wildlife of existing woods as well as on how to avoid planting on good wildlife habitat. What proportion of new plantations in practice do end up in areas that we consider acceptable? To what extent is recent semi-natural woodland development used to reduce the isolation of ancient sites? We are exploring a method for examining this, initially as a research project, but which could develop as a monitoring device.

Determining the balance of management options within ancient semi-natural woods

18. Woods are more likely to survive where they are valued and hence managed in some way, not that all management is a 'good thing'; nor should we press for management throughout all sites. Nature conservation values can suffer under the wrong treatment. This applies even to 'traditional' management (coppicing and pollarding), but they may suffer as much from a lack of positive management leading to over-grazing in many upland woods or to shading-out of open stage flora and fauna in lowland woods.

19. In general EN's approach to woodland management has been to try to recognise and encourage ways of integrating some production with nature conservation. Undoubtedly in the past there was also a strong element of pragmatism involved. Only by EN accepting some productive management would owners be willing even to consider taking nature conservation on board. The balance has shifted EN's way through the Wildlife and Countryside Act and the Guidelines within the Broadleaves Policy. This enables us to move back towards our 'ideal' position, with more minimum intervention and less planting, but we still depend on convincing many owners that there will still be a value to them, through production, in their woods. (The strength of Project Sylvanus and the like has been in their ability to point farmers towards markets or ways of making some money from their woods).

Options for ancient semi-natural woods

20. The broad options for ancient semi-natural woods (in all cases using species native to the site) are: minimum intervention, coppice (with or without standards), managed high forest, 'traditional' wood pasture, and 'grazed high forest/neglected coppice'. Their relative compatibility with wood production and nature conservation in different circumstances is indicated below.

Minimum intervention No income generated, but allows woods to develop naturally; provides for long-term accumulation of dead wood; soil surfaces and profiles are not disturbed by extraction etc. Not generally suitable where there is a high content of exotics, particularly invasive species (need to control these before minimum intervention starts) or where main interest is open stage species or where grazing levels are very high and uncontrolled.

Coppice Traditional management form; social history interests; benefits open-stage species; may be less damage during extraction than with high forest, because larger baulks of timber

are removed in the latter. Not generally suitable where main interest is in dead wood/over-mature wood fauna, rich bryophyte communities or lichens on big trees, where coppicing long abandoned, where grazing (including deer) high and uncontrolled. Some, but generally small, income.

Managed high forest May enable both some open-phase and some over-mature species to be accommodated on the same site (open rides, retention of old trees); most likely to generate an acceptable forestry income under present circumstances; seen as 'real' forestry by owners/managers. Potentially suitable for many sites but there are many uncertainties about the new balance of species that will develop in these woods and particularly the effects of extraction operations and the scale of felling.

Traditional wood pasture (Parks, wooded commons, old Royal Forests). Traditional management form (social history interest); benefits over-mature wood fauna, lichens, hole-nesting birds. Not suitable where rich but grazing-sensitive flora occurs. Seldom generates income now; problems of maintaining grazing in many sites, restoring pollarding, ensuring new generation of trees (on overgrazed sites).

'Grazed high forest/neglected coppice' The typical state for many woods in upland Britain. benefits some bryophyte communities and creates conditions for typical 'western oakwood birds'. There is a financial benefit to the owners (shelter for stock etc.) but this is difficult to quantify, so seldom recognised. Problems of promoting systems to control grazing and so maintain the woods.

21. All these options are likely to have a place somewhere in British woodland in future. On some sites one may be the ideal whereas the others are very undesirable in nature conservation terms; on other sites two or three may be equally acceptable. What should be the balance between them overall?

22. Steele & Peterken proposed for Great Britain that there should be 22,000ha of deliberate minimum intervention woodland (but were only considering broadleaves, not native pine) and 167,000ha of coppice or coppice with standards. This was re-assessed in 1993 and revised figures with an indication as to where it should be a priority is given in Table 1. It is difficult to estimate the area of traditional wood pastures (many are not normally classed as woods) but 20,000 ha (mainly in the south) is probably of the right order. This needs to be maintained. Grazed high forest may cover about 100,000ha, but this is not necessarily the best long-term nature conservation management for these areas. The remaining woodland is a mixture of managed high forest and what in practice will be minimum - intervention for the foreseeable future because of poor access or the owners wishes, or because the alternative options are too uncertain at present (e.g. managed high forest might be acceptable but not with current extraction techniques).

23. These options should not be spread equally across the regions and woodland types. If we want more coppice the emphasis should be in the south-east, not in oakwoods in North Devon. There should be some minimum intervention sites in East Anglia, but in Northumberland it is the first-choice option for most woods. This regional variation needs to be developed further through the natural areas approach.

24. It is not possible to monitor whether the management of all ancient semi-natural woods is acceptable for nature conservation. However we can use an assessment of the above 'balance' of treatments to see if it is moving in the right direction at a regional level and press for changes in policy or incentives accordingly. In part this will come from the type of anecdotal

survey carried out by Janet May in the early years of the Broadleaves Policy. A sample survey at 5-to-10 year intervals would provide a precise check on these objectives.

TABLE 1. Which woods should get priority for coppice restoration?

Nature conservation is not the only reason for restoring or maintaining coppice. Areas may be cut because it is worth the owner's while to do so or because someone wishes to preserve a coppice system for historical reasons. This may be in association with an open air museum or the remains of mills and furnaces that used the produce from the woods. However, if nature conservation is a major consideration in deciding which woods are restored where should the priorities lie? The following principles may help to make the decision.

a. The wood should have a history of coppicing, should certainly have been cut over this century and preferably have been cut in the last 50 years. If a wood has been treated historically as high forest or wood pasture it is likely to have (or to have had) a different suite of species to woods treated historically as coppice. In addition the longer a wood has been neglected, particularly if there are no open rides or glades within it, the less likely it is that species which need young growth and open stage stands will have survived. Species that prefer mature stands will have colonized (Sterling and Hambler 1988) and after 50 years even the soil seed bank is much depleted (Brown & Warr 1992).

b. Seek to restore coppice in the regions where the treatment was most common in the past and survived best until recently. This is related to the above principle (coppice species should have survived better in these regions because they were more abundant) but in addition there is more chance that there is another worked wood nearby which can act as a source of species for the new cut coppice. The south east and the south of England come out highly in this regard.

c. Look for woods likely to produce a diverse ground flora after cutting, or at least plants which are known food plants for butterflies or other open stage invertebrates. Woods on base-rich or poorly drained soils are more likely to produce a rich response to coppicing than species-poor woods on acid soils. Some acid soils do give interesting results - heather may sometimes appear, while in the Blean (Kent) the occurrence of cow wheat (*Melampyrum pratense)* after coppicing is essential for the survival of the heath fritillary butterfly. More often however bracken, bramble or *Holcus mollis* may rapidly dominate acid sites. These are not without value, but such communities are often widespread under other forestry systems anyway. Bramble is also a hindrance in woods where game shooting is important.

d. Use coppice to help maintain diverse tree and shrub communities. Almost all British broadleaf species coppice to some degree and this can help to maintain a greater variety of woody species on a small site than under high forest. If coppice is allowed to become overstood the taller growing species shade out some of the lower growing ones; any gaps that occur are generally small so regeneration tends only to be of the more shade-tolerant species. In worked coppice all species are set back to ground level when the coupe is cut and so the regrowth of all species competes on more-or-less equal terms. The gaps are relatively large so light demanding species as well as shade-tolerators may be able to regenerate. Therefore in woods where there is wide variety of trees and shrubs or distinct patterns in their distribution and abundance this may be better maintained by restoring coppice than by allowing high forest development to proceed. The complex mixtures of woody species found in many East Anglian woods (Rackham 1980) are, for example, probably best conserved by coppicing. There is less case for more or less pure stands of oak and beech which are often difficult to restore anyway.

e. Use coppice restoration to maintain large old stools (large equals more than 1-2m across or about 75cm high although this varies with the species). Such stools are usually indicative of a long history of coppicing, may harbour species of moss or insect of interest in their own

right and are probably the old individual organisms in the wood. They will not necessarily be killed if the stand is left alone or actively encouraged to develop a high forest structure, but it is more difficult to maintain them.

f. Use coppicing to maintain elements of open grassland, scrub or heath communities where these have largely been lost from the surrounding landscapes (see Peterken 1992).

g. Avoid 'restoring' coppice in woods which have species or features that will not benefit from the process. This includes many epiphytic lichens and Atlantic bryophytes which may not tolerate the sudden changes in the light and humidity regimes that follow with a coppice cut (Edwards 1986). It also includes those stands long neglected that have accumulated much dead wood that is now decaying in moist conditions. If this wood is suddenly exposed the decomposers may be killed by the rise in temperature and loss of humidity. Future production of large dead wood and continuity of this resource is limited because most of it is harvested before it reaches such a size.

Estimate of area that it would be desirable to restore to active coppice working in England 60-70,000ha.

The above comes from Kirby, K.J. (1993) Coppice restoration for nature conservation - how much and where? in *Proceedings of a Coppice Restoration Seminar* edited by R. Lightbown & A. Seale, Institute of Chartered Foresters, pp 15-24.

Objectives and management at site level

Assumptions

25. EN will rarely be able to monitor in detail the conditions of sites other than SSSIs. Hence the following is written as a framework for special site monitoring, although the methods could be applied more generally, given unlimited resources.

26. Priorities must be set. It would be nice to look at change in butterfly populations, dead wood beetles and the ground flora at all woodland SSSIs but this is not practicable. Hence there is a need to identify certain key points about an SSSI, usually those for which it is scheduled, and keep a check on them.

27. There are circumstances where EN also needs to follow up a particular management operation to check that it has achieved its objectives. This monitoring may be applied to only part of the site and may or may not be related to the main interest of the site. There are also projects that employ techniques that may act as a monitoring system but are primarily set up as research projects. These last may command a much higher level of resources and hence use more detailed methods than can be justified for general site monitoring because (a) only a few sites are involved in research projects and (b) the data has to be of a higher quality and precision if generalisations are to be made from the research. Site monitoring will not become widespread if "research procedures" are proposed rather than simpler, quicker and cheaper approaches.

    It is not necessary to check in detail the success or otherwise of every single application of a standard management procedure, if the general principle of its effects has been established and there is a coarser check for potential change in the site as a whole. Therefore just as the idea of levels of survey have been helpful so it may be helpful to have levels of monitoring that will be applied to different sites. Only a small number of sites should receive the most detailed level of monitoring on a regular basis as reference points, on other sites detailed methods would be instigated only if the coarser methods indicate a potentially unacceptable change that needs a further check before initiating action.

What should be monitored?

28. The area of woodland should be checked regularly on all woodland SSSIs and, on most, the vegetation communities as well, because most sites are selected as examples of particular types. However, monitoring the NVC type over the whole of Bernwood Forest SSSI (largely replanted, but with rich butterfly rides) or in a park where the grassland has been improved would be of little interest. On an 'average' woodland SSSI checking that some open ground (rides, glades etc.) is maintained is worthwhile because we know there are many species that can benefit from this, but the extra effort needed to set up a butterfly transect would not be justified. Even in Bernwood Forest there is no need to monitor the butterfly populations on every ride (let alone monitor other invertebrate groups).

29. The accompanying pages develop this approach to monitoring. Initially eight broad reasons for selecting a site as an SSSI are proposed:

    - as an example of a particular woodland vegetation type
    - as good for woodland vascular plants

- as good for open-stage species such as butterflies
- as good for dead wood/veteran tree habitats
- as good for lower plants (other than epiphytic lichen already covered in (d))
- as good for woodland birds
- as the site of a particular rare species, feature or community
- as a minimum intervention area

There are other possibilities, and if you find this approach acceptable and useful additional pages may be added (all contributions welcome).

30. The site management should normally be geared to maintaining and enhancing the value of the site in terms of the reasons for which the site was scheduled, so targets need to be set that can be used to judge whether the management is succeeding or not. Methods for monitoring can then be defined to say whether the targets are met. Many sites may have been selected for more than one of the above reasons and some of the simpler monitoring operations might be combined on one visit. Decisions are however needed (a) within a site as to what aspect is most important and (b) between sites in a given category (e.g. all dead wood sites) as to which should receive regular detailed surveys.

The following pages have been set in this standard form:

Monitoring procedures

Category of site - the reason for which it is scheduled/important

Target or objective	-	what should the monitoring be able to tell you about the site; what level of difference counts as likely to be a significant change (mostly guesses!);
Method	-	this is only outlined but standard references or examples can be provided for most;
Action required if targets not met	-	change may be acceptable or further survey or management may be required;
Frequency of repeat recordings	-	these are what I would regard as being reasonable; whether they are realistic in terms of the resources required is another matter.

31. No attempt has been made to provide standardised monitoring forms since these are the subject of debates elsewhere. Nor can one specify methodology too precisely: even standardised methods may not produce useful comparable results when applied to a series of sites that differ widely in their characteristics.

32. In most instances both simple and more complicated, time-consuming procedures are specified. In most cases this latter should be applied regularly to one or two reference sites as well as occasionally as necessary elsewhere.

Application of the system

Appendix 1 illustrates how the system might be applied to Shropshire's woodland SSSIs.

33. For Shropshire (see Appendix) 3-4 weeks work might be needed each year. What are the consequences if this is too high an input? The methods might be made simpler and quicker, but this is difficult if the results are still to be relevant to the particular interest of the site. There is a risk that the methods will come to dictate what can be monitored rather than starting from what change we need to detect. Alternatively less frequent monitoring may have to be accepted.

34. Relatively little site monitoring takes place in a structured way at present. Therefore, even if the frequency was less than the ideal, a structured programme could still improve our knowledge of the way sites and species were changing in response to management-induced or natural factors. The choice of sites would, however, need to be done more carefully to achieve the most representative sample possible in any one year.

35. There may however be a further constraint on choice of site, since some priority must be given to checking the condition and integrity of Section 15 Agreement sites, or those where there is a high level of threat or vulnerability. The Habitats and Species Directive will place a duty on us to monitor SACs. This flexibility is essential, but reinforces the need for a core programme which provides a representative sample of the whole.

How does this fit with the SSSI sample monitoring system?

A programme of random sampling of SSSIs is being planned and woodland sites will eventually fit into this system. These ideas fit into this system by providing the means for determining whether or not the interest of a site is being maintained. In other words depending on the site different sections of these methodologies would be applied at the appropriate point in the sample survey process.

36. I would stress that these are ideas for discussion. They cover the subjects that I believe need to be covered, but there may be other ways this can be done; some of the information or something very like it may already be being recorded (casework returns, loss and damage returns). If these are useful then they should not be overturned. What I am trying to provide is the overall framework for woodland monitoring, which I hope will then make it easier to argue for the necessary resources.

MONITORING FRAMEWORK

(1) (a) Wider countryside: ancient woodland extent

Target	(i)	Loss of ancient woodland should not be more than 0.2% over the next 10 years.
	(ii)	Less than 1% of ancient semi-natural woods converted to plantations.
	(iii)	3% of plantations should be restored to a semi-natural state.
Monitoring	(i)	Use inventory revision as an indication of what's going on. Produce annual statement of changes recorded.
	(ii)	Institute a 5-yearly check on a representative sample of sites through air photographs and selected site visits. (There are possibilities for linking this either to FC's census, to NCMS, to the ITE land class sampling system, to Phase I surveys etc).
Action required if targets are not met	(i)	Identify major reasons for failure to meet targets.
	(ii)	Press for changes in policy, grants or the implementation of these OR Decide that targets were unrealistic/unimportant and set new ones. (This would probably be an admission of failure. Nevertheless it is important that monitoring programmes are periodically reviewed).
Frequency of recording	(i)	Periodic statements on inventory changes (JNCC, Country Headquarters).
	(ii)	3-6 month contract to carry out 5-yearly review.

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(1) (b) Wider countryside: regional balance of woodland management

Target	-	A balance to be maintained in England between coppice, wood pasture, high forest and minimum intervention treatments (all with native species) in ancient woodland.
	-	Regional variations in treatment to be maintained and promoted.
Monitoring	(i)	Collate anecdotal evidence/feelings from Regional staff on whether targets being met. Review forestry grant applications and special management grant proposals.
	(ii)	5-10 yearly review of sample squares/sites partly through aerial photographs, but mainly site visits. (Can be linked to monitoring of extent of ancient woodland (1a).
Action required if targets not met	(i)	Identify major reasons why targets have not been met.
	(ii)	Press for changes in policy, grants or the implementation of these, nationally or locally. OR Decide that targets were unrealistic/unimportant and set new ones.
Frequency of recording	(i)	Collation of anecdotal information should occur as part of the normal feedback on how woodland policy is operating.
	(ii)	3-6 month contract to carry out 5-yearly review.

2 SSSIs: is the woodland still there?

Target	-	Area of semi-natural woodland on current site at least maintained (in some cases the target may be to increase the woodland area, for example in many upland sites).
Monitoring	-	Recent aerial photograph check if no full site check by a field visit in the last 2 years. Identify any change affecting more than 2% or 1 ha of the area or more than 1% (or 0.5ha) if the change at previous recording was in the same direction.
Action required if target not met	(i)	Identify cause of change, which may require further survey.
	(ii)	Accept change either because it is cyclical, benefits other aspects of the site or is part of (acceptable) natural processes. (On some sites natural expansion or reduction in woodland cover would not be acceptable if it threatened the survival of important species/features on the site). OR Change the management. OR Consider denotifying the site.
Frequency	(i)	20% of woodland SSSIs each year in a rolling programme. (I hope most SSSIs would be visited at least once each year for some purpose or other but it is seldom possible on such visits to check the whole site. Hence the once-every-five-years target).
	(ii)	Annual report detailing sites checked and level of change found.

Notes

1. Details of the extent of woodland on SSSIs are held on CORDATA (but this is incomplete) derived from Phase I surveys and for all ancient woodland (on the inventories). Both of these sources need updating as site conditions change.

2. Woodland area is likely to change suddenly only as a consequence of positive action by the owner, e.g. clearance or planting. Hence on most sites we ought to know that a change is likely because we have been consulted over the owners intentions. However occasional major events (violent storms) might have a similar effect. In addition gradual changes and expansion through natural colonisation or contraction in heavy grazed woods, may not be apparent except through this sort of survey.

3. Other bodies (local authorities, Forestry Commission) may be a source of photographs and in future boundaries should be put on GIS.

3. **Site quality: sites selected as examples of particular woodland types**

Target	-	Area of selected types is maintained on the site.
Monitoring	-	Prepare baseline map of types (1:10,000) and check this by field re-survey at 10-year intervals. Changes of less than 10% of area are unlikely to be significant unless they are part of a longer-term trend. Something similar to the Phase II woodland survey maps but prepared with a bit more time and care should be an adequate base for this.
Action required if target not met	(i)	Identify cause. Some changes may be natural and acceptable. Some management-induced changes are cyclical and acceptable.
	(ii)	If not acceptable change the management or consider denotifying the site.
Frequency of recording	(i)	10% of sites to be checked each year on a 10-year rolling programme. ½-1 day per 50ha depending on terrain.
	(ii)	Annual report on sites visited and change found.

Notes

1. Woodland type is generally fairly robust such that it is unlikely to change much. However some NVC sub-communities in upland woods may change if the grazing pressure alters drastically (although over a 5 yr period the change is more likely to be in the structure of the community rather than its detailed composition). The communities of post-felling or post-coppicing stands (tending to grassland or scrub) may also differ from those under closed canopy. We presume that usually this will be a cyclical change although this may not always be the case.

2. Stands might be altered by selective felling or replanting, and will change in broad composition according to differential regeneration.

3. Over longer periods both stand and ground flora types may be altered by climate and pollution.

4. Except for sudden changes brought about by management (which should be detectable/predictable from discussions with owners over the treatment of the site) changes in woodland type are likely to be slow and the mapping procedures are not very precise. Hence a long interval between type boundary resurveys is proposed.

5. Prior to gross changes in type boundaries there are likely to be changes to the "quality" of woodland vegetation, the loss of certain sensitive species or increase in abundance of others. If quadrats are recorded at random in the type area these changes in quality should be picked up. This is comparable to the monitoring discussed in the next section.

4. Site quality: sites selected for woodland vascular plants or vegetation quality

Target 1	-	Maintain diversity of species present on site.
Monitoring	-	Use the number of woodland species that can be expected to be found on a systematic ½ day walk through the site. Carry out walk at appropriate time of year. Identify (say) 5 'interesting' species to be checked as present (local species typical of habitat etc.).
	-	Changes of more than 20% in the species richness or failure to pick up the interesting species count as significant change or more than 10% change in the same direction in consecutive recordings.
Action required if not met	(i)	Institute more detailed survey.
	(ii)	Accept change as natural.
	(iii)	Alter management if possible/desirable.
	(iv)	Consider de-notifying the site.
Frequency of recording	(i)	10% of sites in this category to be checked each year in a rolling programme. (This can be linked to assessing change in vegetation type). ½-1 day per 30ha required depending on terrain.
	(ii)	Annual report on changes found.

Notes

1. The aim is simply to get a broad idea as to what is happening to the flora in a qualitative way over a much of the site as possible. More quantitative data can be collected through use of quadrats but they are very inefficient as a means of detecting species and there is a high standard error attached to small samples. Hence they are not recommended where the aim is to look at the total species list.

2. Factors that affect the list produced (survey method, surveyor, season) are discussed in:

KIRBY, K.J., BINES, T., BURN, A., MACKINTOSH, J. PITKIN, P. & SMITH, I. 1986. Seasonal and observer differences in vascular plant records from British woodlands. *Journal of Ecology* 74, 123-13.

3. A wide variety of changes may lead to changes in the list recorded, particularly the relative proportion of open to closed stands. It may be possible to analyse these effects by looking at the proportion of species of different "strategy" or "indicator" types as for quadrat records (see below). Indicators of eutrophication or increased nitrogen might be particularly of interest where long-term pollution and soil changes are believed to be a problem.

Target 2	-	Maintain/increase the abundance of most species over the whole site.

Monitoring	-	Take series of temporary quadrats at random throughout site. Assess frequency of species and mean cover.
	-	A minimum of 20-30 5x5m plots per site is likely to be required.
	-	A change of 10% in species populations or two consecutive changes of 5% should be regarded as significant.
Action required if target not met	(i)	Identify nature of change and its causes.
		and
	(ii)	Accept as natural.
		or
	(iii)	Alter management.
		or
	(iv)	Institute further survey.
		or
	(v)	Consider de-notifying site.
Frequency of recording	-	One/two sites per natural area as reference site. Recorded every 2 or 3 years. Shorter runs of annual recordings elsewhere if walkabout survey suggests change, or change expected because there is a need to assess impact of new management.
	-	1-2 days required per site.
Target 3	-	Maintain/increase populations of common woodland species in particular areas (eg in response to management).
Monitoring	-	As previous page but in limited area (with control) or in some circumstances only selected permanent plots.
Action required if target not met	-	Alter management.
Frequency of recording	-	Institute this form of monitoring only as necessary. It should normally be linked to wider research programmes on change (natural and induced) on sites.

Notes

1. The Countryside Survey in 1990 provided information on changes in woodland species richness as well as in total area of woodland. However the sampling system is too coarse to use to assess changes in SSSIs. Nevertheless the basic approach - a random sample of plots from a stratified sample of sites - is worth considering. (Indeed the CS1990 results should provide a context for changes within SSSIs - hopefully SSSIs show less deleterious change).

2. The aim is to provide a quantitative assessment of whether the SSSI series as a whole is changing in plant diversity, using natural areas as the strata. Within these ideally sites, as well as sampling positions should be chosen at random although practical considerations would point to using NNRs where possible. Once sites were picked they would remain in the sample thereafter but the sampling points within them would change each time.

3. Changes on individual sites need to be interpreted in terms of the management going on within them, but over the series as a whole these should even out, or at least show a consistent trend.

4. 5x5m plots are proposed for convenience for woodland ground flora. The precise size in the range 4x4 to 10x10m is unimportant as long as it is consistent across a particular site or survey.

5. Although on a smaller scale and using permanent plots the results in the following reference illustrate how data may be analysed.

   KIRBY, K.J. & MAY, J. 1989. The effects of enclosure, conifer planting and subsequent removal of conifers in Dalavich Oakwood (Argyll). *Scottish Forestry* 43, 280-288.

6. The following may help in interpreting changes in the composition of the ground flora:

   "Environmental Indicator Values". ELLENBERG, H. 1988. *Vegetation ecology of central Europe*. Cambridge, Cambridge University Press.

   "Plant Strategies". GRIME, J.P. HODGSON, J.G., & HUNT, R. 1988. *Comparative plant ecology*. London, Unwin-Hyman.

   "Ancient woodland indicator lists". MARREN, P. 1990. *Woodland Heritage*. Newton Abbot, David & Charles.

   "Community Associations". RODWELL, J. 1991. *British plant communities I. Woodland & scrub*. Cambridge, Cambridge University Press.

7. Permanent plot systems can be used as an alternative to random, temporary samples. Because of the extra effort involved in marking and relocating permanent plots there is a tendency to use less (= poorer replication) and consequently they are more likely to be subjectively placed. If the hope is to be able to extrapolate to a wider area e.g. other areas similarly treated, the rest of the wood etc. then the drawbacks of a few, poorly positioned plots may outweigh the benefits of more precise measures of change. The following reference (and further work in preparation) illustrates the types of result that can be obtained from a well-designed permanent plot system.

   THOMAS, R.C. & KIRBY, K.J. 1992. Seventeen years of change in the structure and composition of Wytham Woods, Oxfordshire. *Aspects of Applied Biology* 29, 49-55.