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# The Redgrave & Lopham Fens Alleviation Scheme
# Impact of Options Study

Observations on the likely value of the CORINE classification
as a basis for evaluating the impact of borehole relocation options
on the conservation objective of neighbouring wetland sites

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*CONFIDENTIAL*

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# THE REDGRAVE & LOPHAM FENS ALLEVIATION SCHEME – IMPACT OF OPTIONS STUDY

## Background

The Terms of Reference of the Redgrave & Lopham Fens Alleviation Scheme "Impact of Options" study required that "The impact on wetlands is to be considered as the estimated physical impact together with an assessment of the significance of these changes to the conservation objective of each site". Dispute has arisen about the botanical classification system that should be used as basis for the evaluation of the impact of the options with regard to the significance of their impact upon the conservation objective of neighbouring wetland sites. Because of this, independent comment was requested as to whether the CORINE system of classification is likely to provide a "rational, appropriate and acceptable basis for an evaluation methodology" that is likely to achieve this objective.

This Report provides comment on the value of the CORINE system for evaluating the options of the Redgrave & Lopham Fens scheme. Three caveats must be observed:

(i) Access has only been available to the Terms of Reference of the project and the tender stage proposals of the Consultant, not to any reports of the Consultant. Because of this, the comments here about the possible use of the CORINE system are necessarily made "blind", in terms of general principles and perceptions and are not related to any specific issues. However, particular cognisance has been taken of the nature of the vegetation and habitat in East Anglian valleyhead fens when making the assessment.

(ii) No information has been provided about the exact nature and rationale of the dispute. Thus, again these comments must necessarily address general matters.

(iii) The comments made are with specific reference to the CORINE classification of wetland and related "biotopes".

Because of these caveats, and because any such comment requires justification and explanation, this report is divided into three main parts:

(I) a general consideration of some of the problems assessing the likely impact of environmental change in wetlands;

(II) comments on the nature of the CORINE system, its background and character;

(III) conclusions about the likely applicability of the CORINE system to evaluating the impact of the borehole options.

Of these components, parts I and II are not intended to be comprehensive. They are included just to provide some background material and rationale for the conclusions reached in part III.

# I ASSESSMENT OF THE IMPACT OF ENVIRONMENTAL CHANGE UPON WETLAND CONSERVATION SITES

## Introduction

There are two main ways in which it is possible to assess the impact of environmental change upon the biota of wetland sites:

(i) by direct observation and experimentation;
(ii) by prediction, based upon the known response of individual species or assemblages of species ("communities") to changes in the variable(s) in question.

Both of these approaches have their limitations. The first often requires long time periods to obtain meaningful results and can be expensive; it is sometimes largely site-specific and, because of this, may have limited predictive value. It is not very often used.

The second approach is more commonly adopted by ecologists, but its value also is often limited. This is because:

(i) the nature of the response of organisms or assemblages to environmental change is often not at all well known – it is more often assessed by the "judgment" of ecologists (*i.e.* "guessed"). In some, but by no means all, cases such judgments can be surprisingly accurate (*i.e.* "informed guesses").

(ii) where the nature of the response of organisms or assemblages to environmental change *is* quite well known, it is clear that, in many cases, the amplitude of response can be quite broad (*i.e.* individual species or communities can have quite wide "tolerances"); and, moreover, the responses to an individual environmental variable may be strongly modified by other variables (*e.g.* the botanical consequences of a slight reduction of water level seem to be less in a base-rich fen that is of low-fertility and regularly grazed than in some higher fertility, low-management sites).

(iii) a consequence of (ii) is that, as more information becomes available about species–environment inter-relationships, informed ecologists may become more reluctant to make predictive assertions concerning the likely response of organisms to specific environmental changes!

Most attempts to assess the likely impact of environmental change in wetlands often focus upon plants and vegetation rather than animals (unless these are specific target species). This is because plants may have a more immediate dependency on certain environmental conditions than do some animal species; that there is usually a more comprehensive inventory of plants and vegetation than of many animal groups; and because there is a widespread presumption that more is known about the environmental "requirements" of plant species than is the case for many animal species.

## Environmental indicator value of plant communities

Ecologists have often preferred to use the species assemblages ("plant communities") of vegetation to explore its environmental relationships rather than to focus upon individual species. There are several reasons for this:

(i) there are fewer community-types than there are species;

(ii) it is intuitively evident that distinctive vegetation types are often quite strongly associated with particular habitat-types, to a greater extent than is the case for many individual species.

(iii) in many cases the environmental range of a particular community-type is *much* less than that of its component species, certainly when all of them are considered and very often when each is considered individually.

(iv) a community-type is sometimes considered to provide an integrated representation of the response of its component species to environmental change.

It is possible to question some of these assumptions in specific situations, but in general they are largely valid. However, there are also some difficulties inherent in the use of vegetation types as environmental indictors, most particularly that "plant communities" are not absolute, genetically-determined individuals, but variable entities. Moreover, "community types" have often been identified using various criteria (*e.g.* dominance *versus* species-composition) so that various different classifications can be made (and hence different "communities" recognised) of the same range of vegetation. The value of individual units for environmental prediction is, of course, strongly dependent upon their precise compass and composition and hence upon how "good" is their classification.

### *Plant community–habitat relationships*

The establishment of the indicator value of specific vegetation types for environmental conditions also requires the availability of quite comprehensive base-line data on the environmental conditions associated with particular types, or upon the identity of particular "habitats". Unfortunately, wetland ecologists have had a rather chequered history of assessment of "environmental conditions" and "habitats". A good deal of habitat "assessment" has been done at an intuitive level, sometimes without any measurement at all (*e.g.* in the UK sites have sometimes been called "alkaline fens" or "calcareous fens" without any measurement of their pH or calcium concentration). In consequence, in quite a large number of instances, "habitats" have effectively been defined and recognised just in terms of their general appearance or of the vegetation they support, not by measurements of environmental conditions. Whilst is this may possibly be acceptable for broad descriptive purposes, it is obviously not appropriate for any rigorous assessment of habitat–vegetation relationships.

Some wetland ecologists have made a rigorous attempt to assess habitat conditions within wetlands. Various types of study have been made, of which three can be noted:

(i) *detailed studies of vegetation–environment in specific sites*

Quite a large number of studies of this sort exist, in Britain and (especially) on the European mainland. They are of considerable value in helping to establish vegetation–environment relations, but in many cases are limited by being site specific. This is because it can sometimes be difficult to extrapolate relationships from one site to another (*e.g.* Sjörs, 1950a,b).

(ii) *synoptic surveys of habitat conditions*

A number of studies have been made to examine environmental variation within wetlands and to identify broad habitat types (*e.g.* Succow, 1988). This research has been of great importance for establishment of a framework of habitat variation, but mostly does not explicitly examine the relationships between environmental conditions and specific community-types, except sometimes in very gross terms.

(iii) *synoptic studies of vegetation–environmental relationships*

Very few attempts have been made to examine detailed vegetation–environmental relationships over a large number of wetland sites, not least because there are obvious difficulties and limitations associated with such research. To the best of our knowledge, the only study of this sort available for NW Europe has been made by Wheeler & Shaw (Wheeler & Shaw, 1987; Shaw & Wheeler, 1990, 1991). This study thus provides perhaps the only synoptic statement of base-line conditions associated with the distinctive vegetation-types of fens. This work is still in progress at the University of Sheffield.

# II THE CONTRIBUTION OF THE CORINE SYSTEM

## Introduction

In order to appreciate the contribution of the CORINE system, and some of its characteristics and ramifications, it is necessary first to make a brief examination of approaches to the classification of vegetation in Britain and elsewhere in Europe.

For much of the twentieth century the "British Tradition" of vegetation classification, under the guidance of A.G. Tansley (Tansley, 1939), was to adopt a fairly informal approach to the subject, based around the recognition of 'dominance types', *i.e.* stands were grouped into classes based upon the main "dominant" species. This approach had the benefit of simplicity but also had some considerable limitations. In particular, it ignored the fact that a single dominant species could often preside over a wide range of variation of its floristic associates, and of environmental conditions. It also took no account of the (frequent) situation in which different species could sometimes "dominate" what was effectively the same assemblage of species.

In much of Central Europe and France, the development of vegetation classification early in the twentieth century was strongly influenced by such workers as Rübel and J. Braun-Blanquet to form a tradition often known as the "Zürich-Montpellier School of Phytosociology" (ZM). This was ostensibly "eine pflanzensoziologische System auf floristicher Grundlage"[1], with a concern for the overall species composition of vegetation as the basis for classification, rather than the dominance of one species. It developed a quite elaborate and formal protocol for vegetation classification.

The attitude of contemporary British ecologists to the ZM tradition was variously one of luke-warm acceptance, indifference, incomprehension or rejection. However, there can be little doubt that "full floristic composition" is, for many purposes, the "best" available basis for vegetation classification. It is also one of the most difficult. Fortunately, increasing availability of computational power since the early 1960s has meant that it has become possible to apply multivariate methods to the classification of floristic data and to link such numerical

[1] "a phytosociological approach with a floristic foundation"

procedures to the syntaxonomy[2] of the ZM protocol. This approach was welcomed by many British ecologists and is, for example, the basic approach of the *National Vegetation Classification*, though without recourse to the full syntaxonomic hierarchy of the ZM system.

Again with the benefit of hindsight, it is also possible to see that some of the differences between the dominance tradition of Tansley and that of the early ZM workers were sometimes more apparent than real. This is not least because, despite their apparent floristic basis, a number of ZM units were (and, in some cases, still are) little more than dominance-types.

Although much of NW Europe has had a long history of vegetation study, there has been a tendency for most studies to be carried out independently and over comparatively small regions, and the development of an overall, rigorous, synopsis is long overdue. One of the few attempts to provide such an overview of wetland vegetation was made by Dierssen (1982), using ZM methodology. However, this often-quoted study had considerable limitations. Because of the scale of his venture, probably coupled to the technology then available to him, Dierssen was unable to make a rigorous floristic comparison of stands or communities and the resultant community-types of his synthesis seem to be more a collection of intuitive units than objectively-defensible floristic categories. Indeed, scrutiny of his units reveals that in many cases they are little more than dominance-types of broad floristic and ecological amplitude (*e.g.* Moen, 1990).

Consequences of this lack of a proper pan-European synthesis of vegetation-types are:

(a) that very often no real comparison can be made between vegetation-types say, in Britain, with those elsewhere in NW Europe;
(b) that the same community-name is sometimes given to different vegetation-types in different parts of Europe; and
(c) that the same vegetation-type may be given different names in different parts of Europe. Thus a community-type which may appear to be localised may (in some cases) actually be rather widespread, though masquerading under several aliases.

Such comments suggest that, in the present state of development, on a pan-European scale vegetation classification sometimes serves more to obscure the relationships between vegetation-types in different regions than to clarify them.

## CORINE "Biotopes"

The comments made above indicate the difficulty of synthesizing a pan-European classification of vegetation and "habitats" and it must be recognised that the task of the CORINE project – to produce a classification of biotopes – was an invidious one, especially in view of the patchy and disparate nature of the data on habitats and vegetation-types that was readily available. The authors of CORINE have attempted, albeit in a simplified way, to produce a pan-European conspectus of "habitats" and vegetation. However, whilst there can be no doubt that such a conspectus is most necessary – and, in that sense, CORINE attempts to fill a big gap – it must also be recognised that there are weaknesses within the CORINE system, which reduce its value both as a scientific procedure and as a generally-acceptable classification system. Limitations include:

(a) *lack of consistency* Different higher order categories for wetlands are defined (or appear to be defined) by different criteria, in some cases "habitat", in others "vegetation-type" and in yet others "mire type". As these different criteria are not coterminous, such inconsistency not only gives lack of scientific credibility, it also

[2] *i.e.* the "naming of community-types"

has the practical consequence of generating confusion, especially as it leads to overlap. Thus, on the one hand the term *Rhynchosporion* is used to refer to a distinctive, separate "type", whilst on the other hand it is also cited as a component of some other "types" (*e.g. transition mire*).

Lack of consistency is expressed in other ways too. For example, *Large Sedge Communities* (*Magnocaricion*) are recognised at the same hierarchical level as *Fen Sedge Beds (Cladietum marisci).* Yet throughout the phytosociological literature, the *Cladietum* is normally considered to be a subdivision of the *Magnocaricion*.

(b) *terminological inexactitude* In their attempt to provide a terminology for some of their higher-order categories, the CORINE system has variously (i) used terms in a way that is, strictly speaking incorrect (*e.g. alkaline fen* – which may include sites which are, by most definitions, not "alkaline"); (ii) given terms a specificity of meaning which, in normal use, they do not possess (*e.g. transition mire*); and (iii) hi-jacked well-established terms in widespread use by practitioners and redefined them (*e.g. rich fen*).

(c) *use of dominance types* Insofar as it possible to judge from the CORINE manual, many of the lower-order units are essentially dominance-types ("black bog-rush fens *etc.*) rather than floristic units. Of course, a number of the published Associations for wetlands were essentially dominance-types anyway, but even when they were not, splits have been made by CORINE. Thus the cohesive unit of *Pinguicula–Carex dioica* mire has been split into "Scottish brown bog-rush fens" and "British dioiecious–yellow sedge fens", even though the presence or absence of *Schoenus ferrugineus* (Scottish brown bog rush) does not conform to any sensible floristic subdivision of this community-type. Given the traditions involved, it is singularly ironic for UK floristic units to be reduced to dominance-types by continental workers. It is also a regrettable reversion to *ad hoc* intuitive units rather than clear floristic categories with "real" ecological meaning.

(d) *lack of clear definition* The problems of terminological revision have been compounded by lack of clear definition. It is clear that some terms and concepts used by CORINE are not being used in their well-established sense, but it is often quite unclear in just what sense they are being used.

Some of these problems are particularly acute for British ecologists, partly because some types of British wetland vegetation are not really covered by CORINE and, in the absence of coherent definitions, it is difficult even to guess where they might be expected to fit within the system, if indeed they fit within it at all. It is, of course, always possible, to regard the CORINE categories as labeled containers within which any habitat which seems vaguely appropriate can be placed. However, such an approach has the scientific credibility of a farmer deciding that, for the purposes of accounting, carrots can be called a fruit!

## CORINE units, resource assessment and vegetation–habitat relationships

As is evident from the above discussion, various flaws within the CORINE system considerably reduce its credibility and its usefulness as a general purpose classification. They are especially severe with regard to the scope the classification offers for exploration of vegetation–habitat relationships, but also apply to its use for resource assessment. Nonetheless, CORINE does provide the basis for the EU "Habitats Directive", though how consistently or logically it can be implemented for this purpose remains to be seen.

There are several limitations in any use of the CORINE system for an assessment of plant–environment relationships:

(i) although the units are ostensibly "biotopes", their habitat characteristics are usually described in very nebulous terms and for some units they are scarcely described at all. Hence the "indicator value" of such units is at best ill-defined.

(ii) since many of the basic units are essentially dominance-types, there is no real reason why they should be expected to circumscribe a very discrete range of habitat variation, as the habitat range of many species (as dominants) is much broader than that associated with many floristically-defined community-types.

Some of the limitations of the CORINE classification can be illustrated by reference to habitats present in the East Anglian valleyhead mires. To take but one example, many of these sites support (or once supported) species-rich vegetation of the CARICION DAVALLIANAE Alliance. Some stands of this vegetation are dominated by *Cladium mariscus*, others are not, but, apart from the dominance of *Cladium*, both those examples with *Cladium* and those without are very similar floristically. This led Wheeler (1980) to classify them all within a single, well-defined and cohesive, floristic unit (the *Schoeno-Juncetum subnodulosi*) and this unit has since been incorporated into the *National Vegetation Classification* (Rodwell, 1991). Subsequent research (Shaw & Wheeler, 1991) has shown that not only are the *Cladium* and non-*Cladium* examples both part of the same vegetation-type, but also that both versions occur within the same range of environmental conditions – *i.e.* they occupy the same (distinctive) habitat; it has not been possible to find any consistent environmental differences to separate stands with *Cladium* from those without this species (see also Wheeler & Shaw, 1990).

Application of the CORINE approach to the classification of this same range of fen vegetation has a very different outcome, in that the *Cladium*-dominated stands of *Schoeno-Juncetum* are allocated to a completely different sector of the classification than are examples without *Cladium* (Table 1).

**Table 1** CORINE classification of *Caricion davallianae* communities of East Anglian fens with and without *Cladium mariscus*

| 5 BOGS AND MARSHES | | | |
|---|---|---|---|
| **53** | **Water-fringe vegetation** | **54** | **Fens, transition mires and springs** |
| 53.3 | LARGE SEDGE BEDS | 54.2 | RICH FENS |
| 53.31 | Fen *Cladium* beds | 54.21 | Black bog-rush fens |

Table 1 suggests that *Fen* Cladium *beds* and *Black bog-rush fens* are strongly different entities, being not just different end units (53.31 *versus* 54.21) but also belonging to quite different broad habitat categories (Water fringe vegetation *versus* Fens, transition mires and springs). It does not at all reflect the reality of the comparison, namely that they are stands of the same floristic vegetation-type, differing only in the presence of *Cladium* (as dominant) and growing in the same habitat. This rather unfortunate outcome of the CORINE approach is a product of its use of crude habitat categories and species dominance as the (apparent) basis for its classification. Whilst such an approach may provide a convenient "pigeon-holing" of the communities it fails to reflect their floristic character and environmental relationships.

## III CONCLUSIONS: THE VALUE OF THE CORINE SYSTEM AS EVALUATION METHODOLOGY FOR THE REDGRAVE & LOPHAM FENS ALLEVIATION SCHEME IMPACT OF OPTIONS STUDY

In addressing this matter, it is necessary first to make the observation that it is not evident from the supplied documentation, in what way it is envisaged that the CORINE classification is to be used as an evaluative tool for the "Impact of Options" study. However, it is presumed that the rationale is along the lines that the CORINE system could be used either to assess the effect of hydrological changes after they have been made or to predict the necessary conditions for the maintenance (or enhancement) or existing wetland conservation interest. Both of these possibilities are based upon the proposition that the CORINE units reflect habitat conditions and vegetational response to these.

However, as the discussion in Part II indicates, there is strong reason to consider that the CORINE system is neither very rational as a system, nor that its end units necessarily have great scientific utility[3]. It is therefore difficult to avoid the view that the CORINE system would *not* provide "a rational, appropriate or acceptable" basis for assessing the impact of shallow groundwater levels upon adjoining wetland conservation sites, particularly in the context of the Redgrave & Lopham fens. The reasons for this view have already been ventilated, but in summary they are:

(i) the basic CORINE units are dominance types; as such on the one hand they bring together examples of vegetation which can be very different from one another; on the other they serve to separate examples of vegetation that are very similar to one another;

(ii) many of the CORINE units neither clearly define, nor correspond to, specific "habitat types", except in very gross terms (and sometimes not even in these). As has been illustrated above, in some instances the classification generates an arbitrary subdivision of a uniform "habitat-type" in a way that obscures vegetation–environment relationships;

(iii) no evident attempt has been made to define the *range* of "habitat conditions" associated with the various CORINE units. Thus, re-inforcing the comments of (ii) they have little practical value as "indicators" of specific conditions, except (perhaps in some cases) in very gross terms.

CORINE units may have some value in assessing *gross* habitat differences. For example, it may be reasonable to use the occurrence of, say, a CORINE biotope for chalk grassland as evidence that the substratum was considerably drier than one which supported, say, *Cladium* fen. But, of course, in such gross comparisons, any such differences would be intuitively obvious without recourse to any formal classification scheme.

However, for assessing the impact of borehole options upon the vegetation and habitat of neighbouring wetland sites, an evaluative strategy based upon CORINE units is likely to be crude, unreliable and misleading.

[3] Note that these comments refer specifically to wetland components of the CORINE classification. I am not in a position to make authoritative comment on dryland units.

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