Catfield Fen
Notes on the Management of Catfield Fen

1. Introduction

Concern has been expressed by Natural England (NE) regarding the spread of *Sphagnum spp.* on some areas of Catfield Fen, in particular Middle Marsh (see Appendix A), which is part of the Catfield Hall estate.

It is understood that the fens located behind the Commissioners Rond at Catfield were, for many years, managed for commercial reed and sedge production using traditional management techniques (Richard Starling, Broads Reed and Sedge Cutters Association, pers comm.). It is also understood that the majority of the area is now managed for nature conservation rather than commercial production and that this requires a different approach (D. Weaver, NE, pers. comm. during site visit of 11th April 2013).

The most recent change in management on the Catfield Hall estate fens followed the purchase of the estate in 1993 by Mr Harris, from the previous owner, Mr MacDougall (Norfolk and Norwich Naturalists Society, 2008).

1.1 This Note

This note considers the changes in management objectives in the context of their potential contribution to the spread of Sphagnum spp.

The following notes are based on publicly available data for the site, general observations in respect of how site management was believed to have been undertaken prior to the 1990s compared with how it is believed to be undertaken now and notes of discussions in respect of reedbed and site management.

- Catfield Fen Investigation, Final Report (AMEC, 2012);
- Catfield Hydrology Survey, HSI, (2002);
- Catfield Hall Estate fens, Notes of visit June 5th 2013 (Barendregt, 2013a);
- Catfield Fen Comments: Some Ecological and Telmatological Considerations (Wheeler, 2013);
- Discussion with Richard Starling, Chairman of Broads Reed and Sedge Cutters Association (January 27th 2014);
- Ecological and Stratigraphic Review, Catfield Fen (Parmenter, 2013);
- Fen Resource Survey (Parmenter, 1995);
- Fen Management Strategy (Tolhurst, 1997);

- Note of the Site Visit with Mr. Andrew Alston (11 April, 2013);
- Processes for fens and conditions at Catfeld Fen, December 17th 2013 (Barendregt, 2013b);
- Reedbed Management (Hawke and Jose, 1996);
- The Future of Reedbed Management (2009) RSPB Information and Advice Note;
- The Fen Management Handbook (2011), Editors A. McBride *et al.*

The Environment Agency (EA) has requested, from NE, a copy of the Higher Level Stewardship (HLS) Agreement which provides management objectives for the Catfield Hall estate fens. Whilst a copy of this agreement has been provided, the EA does not have permission to reference it or make it publically available and it has therefore not been viewed by AMEC during production of this Note. Additionally, there is a Water Management Agreement which governs the operation of the sluice in the Commissioner's Rond and the control of water levels within the internal fen system. Further details of this agreement have been requested by the EA from NE but these have not been received from NE to date (13/3/14).

2. Historic Management

The history of the North, Middle and South Marsh and Rose Fen (see Appendix A for locations), which are part of Catfield Hall estate has been summarised by Parmenter (1995) and is presented in Box B.1 in Appendix B. The history of Sedge Fen, Fenside and Reed Marshes (Parmenter, 1995) is summarised in Box B.2.

The information in Box B.1 and further site summary information provided by Parmenter (1995) (Box B.3), indicates that these fens have been subject to a range of different management prescriptions over the last 200 years, including management as rough grassland/grazing land, which would have required drainage of the area and subsequently management for commercial reed and sedge cutting. It is now managed for nature conservation purposes (D. Weaver, NE, pers. comm. during site visit of 11th April 2013).

The following sub-sections discuss how the area would have been managed for commercial reed production and draws on the information sources listed in Section 1.1.

2.1 Water Level Management

The water regime (water levels maintained throughout a year) is crucial to the management of a reedbed.

Traditional management of the water regime in reedbeds, as previously practiced on the Catfield internal fen system and still practiced elsewhere in the Broads (e.g. the Thurne Valley, Richard Starling pers. comm.), typically requires water levels to be reduced in the winter to allow access for reed cutting. Once the cutting period is finished, water levels are raised in the spring so that 5-10cm of water are retained on the reedbed, which provides the water for the reeds to grow through the spring and summer and helps to protect the young reed shoots from late frosts (Richard Starling, pers. comm.).

Constant and careful, manipulation of water levels is undertaken on traditionally managed reedbeds to ensure that optimal conditions are maintained for the reed.

There are no measured water levels for the Catfield internal fen system in the 1970s and 1980s, but based on comments provided by Mr Alston and Mr Holburn (AMEC, 2012) and also Richard Starling (pers. comm.), it is known that water levels in the internal system were constantly managed and typically followed the traditional regime. It is believed, in the absence of a review of the sluice management records, that at least some water level management continued until relatively recently, as areas of fen owned by Butterfly Conservation (Sedge Fen, Fenside and Reed Marshes – see Appendix A) continue to be managed for reed and sedge production. However, active water level management now appears to have ceased because of the desire to maintain the highest ditch (and hence fen surface) water level possible. Whilst the water level does fluctuate with this approach (see gaugeboard records in AMEC, 2012), it does so in an unmanaged way, which will typically result in high water levels in the winter and low water levels in the summer – the opposite of that optimally required for good quality reed and that has been undertaken historically.

Elevation of water level is known to help reedbeds in some instances, for example the RSPB (2009) reports that '*Many UK reedbeds were becoming dryer through litter build-up and the associated processes of natural succession. One of the simplest ways of rehabilitating such a degraded site may be to alter the hydrology by raising water levels*'. However, retaining a constantly high water level is also detrimental to reedbeds, as it leads to stagnation of water, anaerobic conditions and reduction in reed vigour, as described by the RSPB (2009).

The RSPB (2009) concluded '*a water regime that follows a natural cycle, with a drawdown in late summer/autumn, is probably better for reedbeds than a regime with constantly deep water, which increases the exposure of reeds to the negative effects of litter accumulation*[1]*. A throughput of water is also beneficial, assisting with the flushing of organic material'*.

Maintaining the highest possible water level and not actively allowing water to leave the system, or indeed allowing water into the system from the river (which is also not currently undertaken at Catfield), is likely to increase the chances of increased water temperatures across the fen surface in the summer. This is likely to lead to stagnation. In traditionally managed reedbeds, the reed cutter would typically release water from a bed if these conditions occur and then manage sluices carefully to allow water from the river onto the fen and ensure that rainfall events are captured to refresh the system (Richard Starling, pers. comm.).

It is possible therefore that the objective of maintaining the highest possible water level, with unmanaged fluctuations and not allowing throughput of water, may be detrimental to the quality of the reed on site. This is not dissimilar to comments made by Mr Alston during the site visit in April 2013. Mr Alston however, is also concerned that the fen ground surface is 250-500mm above the maximum water level height achievable (see further comment on this in Section 2.5).

2.2 Cutting and Burning

Traditional reed cutters aim to cut the reed as low as possible on the stem because this means that the strongest and thickest part of the reed is harvested (Richard Starling, pers comm.). This

[1] RSPB (2009) reportsthat phytotoxins released during the decomposition of reed litter reduce the vitality of the reed. Eutrophication and stagnant water may be a factor in die-back by promoting both litter production and anaerobic conditions.

has the added benefit of minimising the amount of standing reed material left on the fen. As reed cutters are aware of the risk of elevation of the ground surface in the reedbed they also try hard to remove any waste cut material.

Subsequent to cutting, the reedbeds were managed by burning - to remove any remaining litter. The Catfield fens were managed by burning at least in the 1970s (Wheeler, 2013; Alston in AMEC, 2012) and probably more recently (in the 1980s) as part of the traditional reedbed management.

McBride *et al.* (2011) indicate that burning can rapidly remove large amounts of material and is used in commercially managed reedbeds destined for thatching to favour dominance of reeds, to burn unwanted or poor quality reed, and to encourage shoots to grow straight - all of which helps produce a higher quality product.

Traditionally areas would have been burned to restore reed condition and to control the level of the reedbed surface (i.e. to prevent it terrestrialising/elevating). Establishment of areas of *Sphagnum spp.* would also be expected to cause problems for reed cutters historically, as it can cause deterioration in reed vigour and amount of reed produced. These areas would have traditionally been targeted for burning by traditional reed cutters.

Wheeler (2013) suggests that burning may be inimical to *Sphagnum spp.* and may have been the reason that the species did not expand during the 1980s, when similar low pH conditions were recorded on Middle Marsh. The control of *Sphagnum spp.* on Middle Marsh (and other areas of managed reedbed) could be explained by management using targeted burning, as was likely. Subsequent expansion of *Sphagnum spp.* once this form of management ceased, would therefore also be expected.

It is also noted (Appendix B) that similar issues of *Sphagnum spp.* establishment and spread were reported in the 1990s on the area owned by Butterfly Conservation (Sedge Fen, Fenside and Reed Marshes). This has also been confirmed recently by Natural England (2013a), although the specific areas in which this was observed are not clear. As this area was also managed as a reedbed using traditional approaches when owned by Mr MacDougall, it is possibly not surprising that *Sphagnum* 'boils' were noted in 1993 once this management approach had ceased over much of the Butterfly Conservation area. However, it should also be noted that much of this area (Fenside and Reed Marshes in particular) comprises previously cut peat and therefore the fen surface is likely to be buoyant. In these areas it is more likely that *Sphagnum spp.* would establish and spread, as the buoyancy will allow the species to remain above the influence of base rich water lying underneath or present in the ditches.

2.3 Fen Level Manipulation

Mr Alston reports (AMEC, 2012), that the surface of Catfield Fen (precise location not reported) was reduced by removal of the top peat in 1920. The surface of North Marsh was reduced some 12 years ago. These actions brought the fen surface back into the range of ditch water levels with the aim of improving water circulation and rejuvenating the fen surface. It is possible that the surface of Middle Marsh has become elevated since the 1920s. It is certainly possible that this has occurred since the traditional reedbed management practices (which sought to prevent elevation of the reedbed surface) ceased when the land changed hands in 1993. The information provided by Mr Alston indicating the elevation of the margins of Middle Marsh at least above a high ditch water level, as presented in AMEC (2012), appears

compelling. However, elevation of the fen surface remains to be proved by topographic survey and is refuted by Mr Harris and Mr Riches (AMEC, 2012).

2.4 Management Pre-dating Reed Production

The effect of historic drainage of the Catfield fen area to enable grazing (Parmenter, 1995), is also likely to influence the development and nature of the fens. The Fen Management Strategy (Tolhurst, 1997) states that '*because of the drainage, the surface layers of peat have been oxidised. As a consequence of oxidation, nutrients are released and the soil fertility on these areas is higher than the rest of Catfield which was not drained. When re-wetted oxidised peat is also self-acidifying and the acidic communities which develop are often (mistakenly) attributed to acidic seepage water...'.*

Although it is unclear when this drainage system fell into disuse, it is possible that it was around 1920 when the fen surface of Middle Marsh was reportedly lowered (see Section 2.3). It is however possible that the effects of this historic drainage are, in the absence of the traditional reedbed management practices, now influencing the vegetation.

2.5 Summary of the Effects of Historic Management

The effects of traditional fen management as a productive reedbed would be to reduce the presence of plant litter, reducing the availability of material for peat production and hence reducing the speed of any elevation of the fen surface/terrestrialisation.

Additionally the historic management of the water regime will have provided optimal water levels for reed growth and will have resulted in the throughput of water, rather than water stagnation, which is identified as an important factor assisting with the flushing of organic material (RSPB, 2009).

Sphagnum spp. establishment would also have been suppressed by targeted burning. However, historic drainage of the fen, leading to the oxidation of peat and 'self-acidifying conditions' may have created conditions more suitable for the spread of *Sphagnum spp.* which is spreading in the absence of the traditional reedbed management approaches.

Mr Alston notes the fen surface being 250-500mm above the maximum height achievable, although he also indicates that the limiting factor on water level currently is the top level of the rond at its south western end. He also comments separately (AMEC, 2012) that the water levels are already as high as they should be allowed to get because the Fenside Road is always wet. Considering these comments, it seems that further elevation of water levels would not be desirable or even possible because it seems unlikely that an additional 250-500mm of water height is achievable when the height of the rond was not reduced. Whilst there is no data available for the maximum achievable ditch water levels in the 1970s or 1980s, gaugeboard data from the late 1990s suggests levels of 0.6-0.7mAOD were typical, as is currently the case. Therefore, it is most likely that there has been an increase in fen levels, although this is refuted by Mr Harris and Mr Riches (AMEC, 2012) and the levels require confirmation by topographic survey.

It is therefore quite possible that the presence of the elevated bunds that border Middle Marsh are important constraints on the flow of ditch water on to Middle Marsh, as these will serve to isolate the marsh from the dyke water and also trap rainwater on the fen, which will lead to conditions that are more suitable for *Sphagnum spp.* growth.

3. Current Management

As indicated in Section 1, the HLS Agreement for Catfield Hall estate has not been made available to AMEC, but it is known that Middle Marsh is now managed principally for species rich fen by a process of cutting/mowing (Dave Weaver, NE, pers. comm. during site visit of 11th April 2013). Mowing of fens is typically undertaken through the late summer, autumn and early winter. It is expected that areas of tall herb fen (such as S24) will be mown on a 5 to 6 year rotation in common with other similar fen sites (5-10 years is quoted in the Fen Management Handbook for fens supporting the S24 community, as on Catfield). Areas of predominantly reed and fen meadow may be mown more frequently. However it is not possible to confirm any mowing regime at this time and therefore reference has been made to the requirements for the maintenance of the S24 and S27 NVC communities as indicated in the site Conservation Objectives.

3.1 Management Targets

The target for litter removal presented in the Favourable Condition Tables to be applied to S24 and S27 is that '*More than 25% litter cover indicates insufficient removal of biomass by grazing'*. Although there is no specific litter cover target for traditionally managed reedbeds, the aim is to minimise the litter remaining (Richard Starling, pers. comm.). The fens of Catfield Hall estate are not cut as low as would normally be done by a traditional reed cutter, and the cuttings are bound by the cutting machine (Richard Starling, pers. comm.), which is likely to leave more litter on the fen surface. This will allow a greater potential for elevation of the fen surface over a period of years.

3.2 Water Quantity and Quality

The target for water quantity for S24 in the Favourable Condition Tables is to '*maintain appropriate hydrological regime to support recognised vegetation types'*. There is also a further comment that '*the community is dependent on winter flooding and a high summer water table'*.

The target water quality in the Favourable Condition Tables for S24 is '*maintain groundwater and other base rich-low nutrient water sources to the vegetation*'. This community can be adversely affected by nutrient enrichment and requirements are similar to those for S27.

The potential effects of abstraction on water quantity and quality are presented in the 'Report on the Assessment of Abstraction within the Ludham-Catfield area in the vicinity of Ant Broads and Marshes SSSI' (AMEC, 2014).

3.3 Practical Management Actions

In terms of practical management it seems that based on the comments of Mr Alston (AMEC, 2012), there is currently little or no sluice management – and therefore little or no active manipulation of water levels. However, it is reported by Mr Riches (AMEC, 2012), that the current Water Management Agreement stipulates that the water levels are managed for the benefit of nature conservation. Reed cutters however would reduce the water table at certain times of the year to allow for reed and sedge cutting. These requirements are clearly not

compatible with one another unless water levels fall as a result of natural water table recession. The precise terms of the agreement and how it is implemented requires confirmation to inform this note. However, assuming that there is limited management because the aim is to maintain the highest water levels possible, then the implication of the presence of the rond is the prevention of the input of base-rich river water, as has been reported by HSI (2002) and elsewhere. Additionally, the presence of elevated bunds around the fen edge (of Middle Marsh in particular) acts as a further barrier to inundation by potentially base-rich ditch water.

Increasing the balance of rainfall compared to groundwater because of the physical features of the fen, would make conditions more suitable for *Sphagnum spp.* Additionally, the implications of climatic changes leading to increased rainfall during the summer months in recent years (since 1987) (Willetts, 2013) would exacerbate this too, by increasing the volume of rainfall on the fen surface in the summer, when groundwater levels would typically be recessing. There are remedies to the physical features of the fen however, such as the creation of foot drains or cuts through the bund at the fen margin which would allow ditch water onto the fen surface when ditch levels are sufficiently high.

It could be argued that this should be done anyway and NE (2013b) has indicated that it would revisit some of the recommendations of Parmenter (2013), which included the following:

- Consider minor changes to rotations: increase frequency of cutting to a minimum of once every 3 years;
- Cut more footdrains to improve circulation of the more calcareous ditch water;
- Consider re-excavating fen dykes which have terrestrialised, so as to restore this open water throughout the site. This could be done slightly offline, so that previously deposited ditch spoil is removed and a new dyke created adjacent to that which is currently 'skimming over';
- Consider extending scrapes and shallow turf ponds. This should not, however, be undertaken in areas of 'virgin' previously uncut peat. Although fen surface reduction across Middle Marsh is unlikely to be acceptable to NE, small scale turf cutting to a depth of 20cm or so would rejuvenate limited areas and re-create appropriate conditions for calcareous fen;
- Avoid cutting Cladium beds outside July-August period.

This suggests that there are measures that can be implemented now to reduce or prevent further change to Middle Marsh in particular.

Raising water levels further may not be desirable because, as indicated earlier by Mr Alston (AMEC, 2012), water levels are already as high as they should get because the Fenside Road is always wet. Based on Mr Alston's observation, if water levels were elevated further the road may become permanently under water.

4. Conclusions

Based on the review described in the previous sections it is considered very likely that the change in management of Catfield Hall estate fens (including Middle Marsh) from the use of

traditional methods for commercial reed production (aimed at minimising litter and terrestrialisation of the reedbed surface, carefully controlled water levels and controlling factors that would adversely affect reed vigour) to the current conservation management practice is a contributory factor in the establishment and spread of *Sphagnum spp.* over the fen. A similar process of expansion of *Sphagnum spp.* may also be taking place on the area owned by Butterfly Conservation, as first reported in 1993 but more recently reported by RSPB. However, the fen surface in this area is likely to be buoyant, which will lift the fen surface above the influence of underlying base rich water and therefore the spread of *Sphagnum spp.* is more likely to occur in this area than on areas of uncut peat (such as Middle Marsh).

Increased rainfall in the summer months, as seen in recent years, is likely to be a further contributory factor to the rapid increase in *Sphagnum spp.* as this could alter the balance of water sources to the fen surface at a time when the groundwater table would typically be reduced.

5. References

AMEC (2012). Catfield Fen Investigation, Final Report. For Environment Agency.

AMEC (2014). Report on the Assessment of Abstraction within the Ludham-Catfield area in the vicinity of Ant Broads and Marshes SSSI. For Environment Agency.

Barendregt, A. (2013a). Catfield Hall Estate fens, Notes of visit June 5th 2013.

Barendregt, A. (2013b). Processes for fens and conditions at Catfield Fen. 17th December 2013.

Giller, K.E. (1992). Aspects of the Plant Ecology of a Flood-Plain Mire in Broadland, Norfolk. Ph.D. Thesis, University of Sheffield.

Hawke, C.J. and Jose, P.V., (1996) Reedbed Management for Commercial and Wildlife Interests, RSPB.

HSI (2002). Catfield Hydrology Survey. Report for English Nature.

McBride, A., I. Diack, N Droy, B. Hamill, P.Jones, J. Schutten, A. Skinner, and M. Street. (Eds) (2011). The Fen Management Handbook. Scottish Natural Heritage, Perth.

Natural England (2013a). Natural England Ecological Report 7. Evidence and Advice to the Environment Agency for Ant Broads and Marshes SSSI (Broadland SPA/Ramsar and The Broads SAC).

Natural England (2013b). Ecological Report of Evidence and Advice to the Environment Agency for Ant Broads and Marshes SSSI Part 3 (June 13).

Norfolk and Norwich Naturalists Society (2008). A Natural History of the Catfield Hall Estate. Occasional Publication 11.

Parmenter, J. (1995). Fen Resource Survey. For Broads Authority.

Parmenter, J. (2013). Ecological and Stratigraphic Review, Catfield Fen. Report for Mr and Mrs Tim Harris.

RSPB (2009). The Future of Reedbed Management. Version 7. RSPB Information and Advice Note.

Tolhurst, S. (1997). Fen Management Strategy. For Broads Authority and English Nature.

Wheeler, B.D.W. (2013). Catfield Fen Comments: Some Ecological and Telmatological Considerations.

Willetts, P. (2013). Recent Trends in Rainfall Patterns – Ant Broads and Marshes, North East Norfolk. File Note. Environment Agency.

Author: Andy Brooks

.....

Reviewer: Tim Haines

.....

Appendix A
Map of the Catfield & Irstead Fens, Showing the Compartments and other Subdivisions (from Giller, 1982)

1 Page

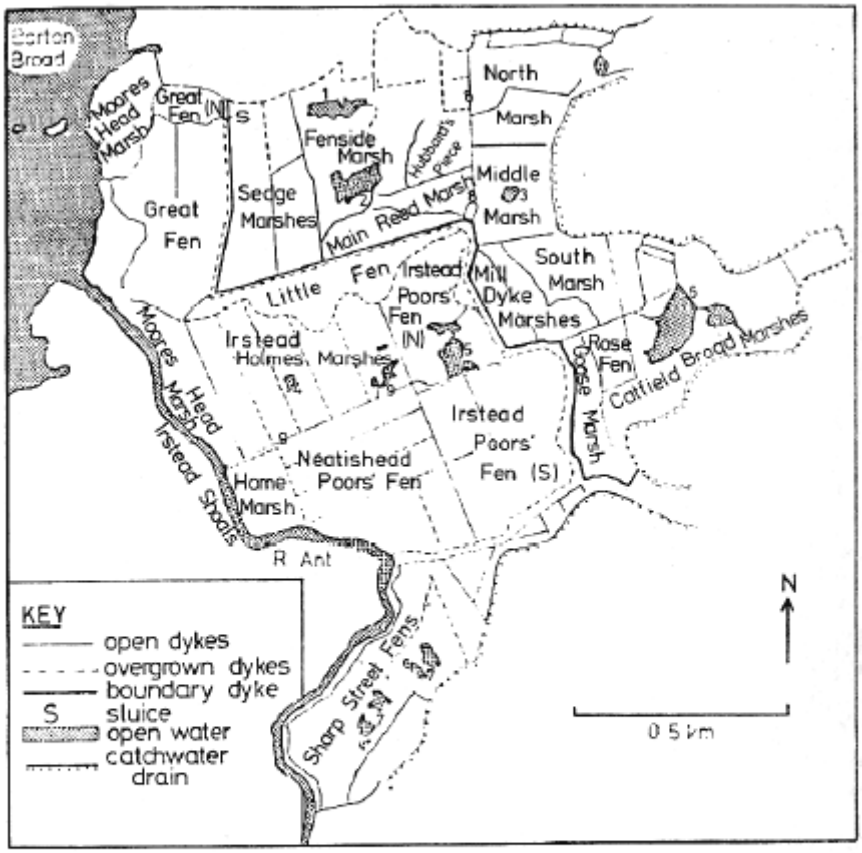

Fig. 1. Names of fen compartments in the study area (1, Fenside Outer Broad; 2, Fenside Inner Broad; 3, Middle Marsh decoy; 4, Monsey's Decoy; 5, Irstead Holmes Broad; 6, Catfield Broad; 7, Sharp Street turf ponds; 8, Commissioners Drain; 9, East-West dyke).

Appendix B
The History of the Marshes of Catfield Fen

3 Pages

Box B.1 Extract from Fen Resource Survey (Parmenter, 1995) on the history of North, Middle and South Marsh and Rose Fen

SITE HISTORY

Synopsis: A large proportion of this area was formerly drained for use as grazing land by means of a windpump situated on the bank which separates the internal and external parts of Catfield fen. When the windpump fell into disuse the marsh became progressively wetter until it reverted to fen. There is unfortunately very little documentary evidence relating to the history of this part of Catfield Fen.

1797	Faden's map shows the entire area as marshland, labelled Catfield Marsh.
1826	Bryant's map shows the entire area as marshland, labelled Wood Fens.
1840	The O.S. 1st edition 1": 1 mile map seems to indicate that this part of Catfield Fen was drained at that time.
1885	The O.S. 1st edition 6": 1 mile map shows this area as marsh except for a narrow strip of rough grassland along the eastern margin. There are areas of peat cutting indicated in Mill Dyke Marsh and Rose Fen, in the southern part of this area.
1907	The O.S. 2nd edition 6": 1 mile map indicates that North Marsh had been converted to rough grassland by this time. The remainder of the site appears to have been unchanged since 1885.
1909	"Catfield Fen, where there are a number of shallow pools which owe their origin to the digging of peat." (E Gurney & R Gurney, 1909)
1972	"... it was very striking when looking across his marshes, that the latter had now been entirely cleared of scrub and bushes ... when he [*assume this refers to Mr MacDougall - AMEC*] purchased the estate some 20 years ago, some considerable bush growth had already begun and this continued until he started actively managing the marshes a few years ago ... the whole area was originally grazing marsh ... on the tithe map the area is shown as allotments." (M George, 1972)
1977	Quadrat data. (B D Wheeler, 1977)
1978	"... since the exceptional drought 2 years ago the spread and growth of scrub has been exceptional ..." (K A McDougall, 1978)
1978	"... deterioration in the quality of some reed ... marshes with consequent abandonment of regular mowing and scrub invasion ... [in] ... parts of North and South Marsh and Rose Fen." (P A Wright, 1978)
1993	"Middle Marsh was the boggiest of this group supporting a wet poor fen vegetation with *Eriophorum, Potentilla palustris, Juncus* & *Cladium* grading up into a fen grassland with *Cirsium dissectum*. The owners regularly burnt this off which in the following spring encouraged the *Eriophorum* but also increased regeneration of *Myrica* from the burnt shoots. The traditional practice of sedge cutting was to hand pull *Myrica* when cutting a bed - this seems to be no longer practiced so *Myrica* is increasing despite management. North Fen was cleared of scrub some years ago and *Phragmites* quickly re-established to form a rather uniform vegetation, valuable as a crop. South Marsh has mixed *Phragmites* and fen meadow species with quite a lot of *Calamagrostis*. There are high water levels in winter but becoming quite dry in the summer. Burning management encourages the proliferation of *Calamagrostis*; otherwise attempts to control cyclic water fluctuation, plus turf cutting and grazing should be attempted on areas which are not floristically rich." (P A Wright, 1993)

Box B.2 Extract from Fen Resource Survey (Parmenter, 1995) on the history of Sedge Fen, Fenside and Reed Marshes

SITE HISTORY

Synopsis: There is little historical information about this site other than that given by cartographic sources. Large areas of peat were cut in the late 19th century and the resulting turf ponds rapidly became terrestrialised. Presumably the areas of reed and sedge harvest were much more extensive than today; as these areas have been abandoned, scrub has invaded some of the botanically more interesting areas and the parts of the site which are not managed for reed and sedge are generally very overgrown.

1797	Faden's map indicates that this area was marshland at that time, labelled 'Catfield Marsh'.
1826	Bryant labels this area Wood Fens.
1840	The O.S. 1": 1 mile map indicates that this area was at that time marshland.
1885	The O.S. 1st edition 6": 1 mile map shows a large area of peat cuttings.
1902	Marked as "large reed hole" on a map. (R Gurney, 1902)
1906	"The discovery of several coins in Catfield, the latest of which was in the reign of Edward VI proves that there was water when the coins were sunk, and the peat has grown up since." (W A Nicholson, 1906)
1907	The O.S. 2nd edition 6": 1 mile map shows peat cuttings occupying an extensive area of the fen.
1909	"... there are a number of shallow pools which owe their origin to the digging of peat." (E Gurney & R Gurney, 1909)
1933	"... a couple of acres of very boggy ground thickly dotted with *Peucedanum palustre* ... and totally surrounded by sallow and birch bushes." (C Morley, 1933)
1966	"... a large and carefully managed sedge bed which has been recently cut." (J J Sambrook, 1966)
1967	"... a wilderness of hidden pulk holes, narrow reedy channels, bottomless mud and jungles of sedge." (J Wentworth Day, 1967)
1972	"It was very striking, when looking across his marshes, that the latter had now been entirely cleared of scrub and bushes ... when he purchased the estate some twenty years ago considerable bush growth had already begun and this continued until he started actively managing the marshes a few years ago." (M George, 1972)
1978	"... since the exceptional drought 2 years ago the spread and growth of scrub has been exceptional ..." (K A McDougall, 1978)
1978	"Deterioration in the quality of some reed and sedge marshes with consequent abandonment of regular mowing and scrub invasion ... Reduced vigour of reed on the main reed marsh due to difficulty in maintaining a consistently high summer water table. Bryan (Wheeler) suggested that the extensive system of turf ponds which formerly occupied most of the ... sedge marshes were dug in the early part of the century to provide areas of shallow water for reed culture and not for fen peat." (P A Wright, 1978a)
1978	"Hubbards Piece ... shows extensive surface acidification with abundant Birch/*Sphagnum*." (P A Wright, 1978b)
1979	"Both *Cladium* and reed are still cut over large areas of the fen, although large areas are not used ... some areas are dominated by carr." (J Lunn, 1979)
1981	The annual abstraction at Catfield borehole was reduced from 183.3 million gallons per annum to 151 million gallons per annum. (P A Wright, 1981)
1983	"I feel that the turf ponds at Catfield were not more than 80cm deep ... they probably do not indicate an earlier, deeper phase of peat removal." (B D Wheeler, 1983)
1989	"The area known as Hubbards Piece was cleared ... last year and supports open, wet, mossy communities which look suitable for *Liparis."* (P A Wright, 1981)
1990	"Herbaceous vegetation dominated by reed, sedge and pinreed, covers most of the site. Large areas are extensively invaded by birch, alder and sallow ..." Abstractions from the crag may cause a lowering of water levels in parts not underlain by Romano-British Clay. (University of Birmingham, 1990)
1993	"This is a very fragile site which could easily be damaged by insensitive management. The main reed marsh, cut by the McDougalls on a double wale basis is subject to considerable surface acidification and extensive bolsters of *Sphagnum* have developed, locally known as `boils'. The process is of considerable ecological interest but reed will eventually be so reduced in vigour to become uncroppable. It would be conceivable to re-establish a *Phragmites* monoculture by `turfing out' the marsh to restore commercial cropping, although in my opinion the acidification process should be permitted to continue and maintained, to determine if the development of oligotrophic nuclei can occur in Broadland. There are plenty of other degraded sites in Broadland suitable to re-establish *Phragmites* culture." (P A Wright, 1993)

Box B.3 Extract from Catfield Fen Site Summary (Parmenter, 1995)

Large areas of peat were cut at this site in the late 19th century and the resulting turf ponds rapidly became terrestrialised. These areas now support extensive reed and *Cladium mariscus* dominated communities, a large area of which is cut commercially for reed or sedge. A proportion of this site was not cut for peat, but was drained for use as grazing land *[believed to be North, Middle and South marshes and Rose Fen - AMEC]* by means of a windpump situated on the bank which divides the hydrologically separate inner and outer parts of Catfield Fen. When the windpump fell into disuse the grazed marsh became progressively wetter until it reverted to fen.