FEN PLANT COMMUNITIES OF BROADLAND

Results of a Comprehensive Survey 2005-2009

Undertaken on behalf of the Broads Authority and Natural England

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SUMMARY

Together with a survey of fen invertebrates, the Broads Authority and Natural England commissioned a comprehensive survey of the herbaceous fen vegetation of Broadland. The main fieldwork was undertaken in 2007-2009, with pilot survey work from 2005 added to the data set. The field methods of the National Vegetation Classification (NVC) were adopted. In total 7038 samples of vegetation were recorded in approximately 1750ha of fen, equating to one sample per 0.25ha.

The *Results* section describes the floristics of all of the vegetation types identified in the survey and their matching with reference NVC types. Four entirely new communities are proposed, dominated by one of *Carex acutiformis, Carex riparia* or *Calamagrostis canescens*. In addition, five new sub-communities of S4 *Phragmites australis* reedbed are identified, five new variants of established S4 sub-communities, and three new sub-communities of S26 *Phragmites-Urtica* fen plus a new variant of an established sub-community. Most notably, a new sub-community of S24 *Phragmites-Peucedanum* fen, the BS(h) *Dryopteris cristata-Sphagnum* spp fen is proposed. Three rather minor variants of the Typical sub-community of M22 *Juncus-Cirsium* fen meadow are also distinguished.

The *Overview of Fen Communities* section summarises aspects of the plant ecology of the vegetation types, and their relationship to environmental and management factors. The different vegetation types are placed in the context of the hydrosere. The findings of this survey are discussed together with those of previous workers, most notably Pallis, Lambert, Wheeler and Parmenter.

In Section 5, the *Conservation Importance* of the fens is described. The distribution of the four Annexe 1 Habitats Directive habitats is mapped for the whole of Broadland. The *Calcareous fens with Cladium mariscus* feature is the most extensive. Nationally and internationally this is very rare, being designated in only 13 SACs in the UK. The Broads holds a very substantial area of this resource, principally in the Ant and Thurne, and to a lesser extent the Bure. The section also describes unique fen types. These include S24 *Phragmites-Peucedanum* fen and its newly proposed BS(h) *Dryopteris cristata-Sphagnum* spp sub-community. Another very special community, *Peucedano-Phragmitetum caricetosum* (Wheeler 1980a) is very species rich, supports a wide range of rare species and is restricted to turf ponds in the Ant and Bure. It was not recorded during this survey, most probably because of habitat change. Its recovery is a conservation concern. The extent of these and all of the major plant communities in Broadland is described.

Other important attributes of conservation value are discussed. These include the very complex physical structure of the fens from the micro- to the habitat scale, and the value added by the juxtaposition of fens with marshes, open water and woodland. An index of diversity is used to map the richness of plant communities. The Ant catchment has the most diverse fens, followed by the Bure. The Thurne, Yare and Waveney fens are generally less rich in fen species although there are notable exceptions, and their fens have other values, such as the extensive stands of *Cladium* vegetation in the Thurne.

A running theme through this report is *Change in the Fens* (Section 6), summarised as:

- An expansion of eutrophic fens.
- An expansion of fens dominated by *Carex riparia* and/or *Carex acutiformis*.

- An increase in *Phragmites australis,* so that it is ubiquitous in almost all fen, swamp and mire communities. Reed-based fen appears to have succeeded a variety of communities including *Cladium* and *Glyceria*.
- A probable increase in the extent and range in communities showing a brackish water influence.
- A decrease in *Glyceria maxima* communities, especially in the Yare, where there appears to have been wholesale change in much of the valley floodplain.
- A reduction in the extent and quality of S24 tall herb fens, partly as a consequence of the expansion of the above vegetation types.
- The truncation of the hydrosere, with the loss of much of the aquatic and pioneer swamp phases, the early secondary swamp communities such as *Carex paniculata* fen and the dryland to floodplain transition mires and fens.
- Autogenic change within fen communities through growth of the peat surface, the succession to drier fen types and the accumulation of surface nutrients.
- A loss of all fen types to scrub and woodland over-growth including the middle hydrosere floodplain tall herb fens.
- Probable loss of structural diversity of the fens consequent upon the above changes.

These conclusions are based on a range of evidence much of which is circumstantial but are corroborated by known environmental changes in the Broads, which include cessation of management, eutrophication of Broadland waters, changes to flow regimes in some rivers and an increase in catchment salinity. While the detail of change is uncertain, the above conclusions are robust in terms of the general direction of change and the overall impact on the fens.

The potential impacts of climate change are outlined. The broad predictions need to be translated more precisely into likely change within the fen compartments, something which requires additional research.

Other *Issues Requiring New Research* are outlined in Section 7. These include:

- Identifying direct evidence of vegetation change, and linking this to changes in environmental factors.
- Improving our understanding of climate change.
- Improving our understanding of fen management and how different management techniques can assist in arresting change and restoring degraded fen types.
- How the vegetation types relate to the national reference communities in the NVC.

In Section 8, the ways in which the vegetation data set can be further developed are discussed. These include:

- Surveillance and monitoring of the fen resource. The importance of monitoring is discussed and some strategies outlined. The fen survey is shown to be central to any new monitoring strategy, including for climate change.
- Linking the vegetation survey through digital GIS to other environmental data sets including elevation, hydrology, water quality, soils, the historic environment, monitoring, other biodiversity data and site management information.
- Using the vegetation data to develop remote sensing techniques for the Broads and nationally, providing cost effective inventory and surveillance monitoring.
- The survey data are shown to be central to the development of key environmental strategies for the management of the fen resource.

In the *Conclusion,* the report suggests that in order to address the various fen conservation issues highlighted by the survey, the following will be required:

- The restoration of the full hydrosere, and in particular the re-establishment of pioneer swamp vegetation at the broad margins.
- The removal of further areas of scrub in areas of critical fen interest and in locations which would restore key parts of the hydrosere.
- Extension of both grazing and cutting to include all of the herbaceous fen resource.
- The continuation of the programme of shallow turf ponding, with the cyclical excavation of peat to a depth of 70cm.
- Ensuring the fen resource is protected against the impacts of climate change. This includes the creation of new fen areas to compensate for the inevitable losses and an adaptation strategy to conserve existing fens.

Achieving these aspirations requires a step change in the management of the fens. The report suggests that a new rural industry, based on economically sustainable fen produce, should be developed. Technological improvements and the pioneering work of the Broads Authority and its partners in the last 15 years mean that products such as compost and soil conditioner, bio-fuels and other green material could be commercially viable. These would provide an economic outlet for fen produce and pave the way for a new partnership to return the Broads to a vibrant economy based on a sustainably managed fen resource.

9. CONCLUSIONS

Over 7000 quantitative and accurately geo-referenced samples, classified according to the national vegetation framework, have been analysed. This report provides a summary of the nature and condition of the fens of Broadland in 2005-9, identifying probable trends and providing a baseline against which to measure future change.

The extraordinary diversity, extent and botanical value represented by the fen resource are described, and the resulting distribution of internationally important habitats have been mapped. The survey demonstrates that the Broads still supports one of the most extensive and diverse suites of fen vegetation types in the UK. These include very species-rich fens, together with a range of plant communities which are rare in the UK and Europe. These include the archetypal Broadland vegetation, S24 *Phragmites australis-Peucedanum palustre* tall herb fen. This is the core vegetation type which lies at the intersection of many plant community successions.

A number of new plant communities not recognised by the national scheme have been described in this survey. They include a range of new reed communities, communities dominated by the pond sedges, and a range of fens of eutrophic habitats. The proposed new sub-community of S24, the *Dryopteris cristata-Sphagnum* spp mixed mire, is of particular importance for conservation.

Despite the prodigious conservation value of the fens today, there is clear evidence of change, and much of this is negative. There is the loss of the pioneer swamps and the early stages of the hydrosere, and also much of the transition habitat from fen to highland. The decline of management of the fens over at least the last 80 years has led to the replacement of rarer and more species-rich fen types with more widespread and less rich habitats, and to the transition to tall, dense and reed-dominated communities. It has also encouraged the development of scrub and woodland at the expense of high quality fen. Autogenic succession of wet fen types to dry fens or non-fen habitats has degraded the more valuable fen types, including some of the most important turf-pond communities. There is strong evidence of an increase in eutrophic fen vegetation, partly due to the foregoing processes and partly as a result of much wider trends toward eutrophication of the Broads and its catchments. The survey provides evidence, too, of increasing salinity on the ronds and in the fen compartments. In the long term, the Broads fens will have to contend with additional pressure for change arising from shifts in climate.

That the Broads still represents one of the UK's most valuable resources of fens is due largely to the recent investment in restoration and management initiatives. Twenty years ago the fens were in a parlous state. Subsequently, there has been major scrub clearance in the most important fen areas, the development of fen grazing programmes, the introduction of the Fen Harvester to mechanise cutting in some fens, the rejuvenation of the sedge and reed industries, the excavation of shallow turf ponds and a range of individual wetland restoration programmes on private land and nature reserves. This effort, a partnership of national and local conservation organisations, landowners and the reed and sedge cutters, has been an extraordinary success story. The benefits of this partnership are reflected in the results of this survey. If the achievements of the last 20 years are to be sustained, and the fen resource conserved, it is imperative that this effort is maintained.

Although there is a great body of evidence suggesting change in the Broads, corroborated by known changes in key environmental variables, much of the evidence

remains circumstantial. There is an urgent need to set up monitoring programmes which can directly measure future change and inform future management strategies. Further research on a wide range of subjects is required to inform restoration and management of the Broads, and to ensure that future efforts are cost effective. Some priority research areas are identified above. The linking of the vegetation survey to a wide range of other environmental data sets would have very significant benefits to the management of the fen resource. Some of the most important links between data sets are outlined in this report.

Although much has been done to arrest the decline of the fens, more is required to ensure the long term future of the resource. Large areas are still unmanaged, and autogenic change and the accumulation of the peat surface continues. If the fens are to be conserved the following action needs to be undertaken:

- The restoration of the full hydrosere, and in particular the re-establishment of pioneer swamp vegetation at the broad margins.
- The removal of further areas of scrub in areas of critical fen interest and in locations which would restore key parts of the hydrosere.
- Extension of both grazing and cutting to include all of the herbaceous fen resource.
- The continuation of the programme of shallow turf ponding, with the cyclical excavation of peat to a depth of 70cm. This creates some of the most valuable plant communities in Broadland, which do not exist on uncut peat surfaces.
- Ensuring the fen resource is protected against the impacts of climate change. This includes the creation of new fen areas to compensate for the inevitable losses, but also requires research into the precise nature of the likely impacts, and the distribution of such impacts in the Broads. Only then can a strategy for adaptation be fully developed.

Achieving these aspirations will require a step-change in the management of the fens. It calls for a new approach, one which is under-pinned by social and economic sustainability. Habitat management needs to become financially self-sustaining through the identification of new, modern markets for fen produce. The development of composting, which could provide a viable end use for all fen cuttings and the arisings from turf ponding, the development of reed pellets for bio-fuel and other similar products such as biochar and scrub bales, all provide a viable if low-value market for such produce. The technology associated with the cutting, processing and transport of this material has evolved enormously in the last 20 years, and the drive for sustainability now provides the ideal social and political context in which to develop these initiatives.

The development of a new rural industry based on fen produce will require considerable long term investment. It also requires the creation of a new partnership, largely of the same organisations as described above, but broadened to include commercial end-users of and the potential industrial partners who might develop the product. The roles within the partnership might also change. The reed and sedge cutting industry, the last remnant of the workforce that once maintained the fens, could once again be in the vanguard of this new joint enterprise, supported by the array of conservation organisations.

The conclusions presented above are consistent with other initiatives currently being developed by the Broads Authority. These include an investigation into the viability of reed pelleting and composting in the Broads (ELP and Ash 2010), new proposals to support the reed and sedge cutting industry (Broads Authority 2010a) and an outline

for research into assessing hydrological and salinity changes in the Broads fens (Broads Authority 2010b).

If these initiatives are successful, the trends identified through this survey could be reversed, and the full suite of fen vegetation types re-established once again in the Broads. When the fens are re-surveyed fifty years hence, it is hoped that the results might once again demonstrate the full range and richness of the fens originally described by Pallis and Lambert in the last century.