Broads Authority

BTCV

Living Lakes

Documentation of the Training Course
WETLANDS FOR LIFE
A Training Course in Wetland Management and Restoration

Norwich, Great Britain
19 – 24 April 2004

With the contribution of the LIFE financial instrument of the European Community

Contents

Edited by Julia Masson, Broads Authority, October 2004

1 Introduction

The Broads Authority hosted the second training course in the UK scheduled under the EU Life Project on Sustainable Management of Wetlands and Shallow Lakes from 19th to 24th April 2004. The 4-day course was held in Norwich and attended by 19 participants, 7 from Living Lakes partners in Germany, Greece, Spain, Hungary and Poland, 5 from conservation and other organisations in The Netherlands, Bulgaria, Hungary and 7 from a range of conservation and other organisations in England (Department of Environment Farming and Rural Affairs, Broads Authority, Broadland Environmental Services Limited, Environment Agency, University of Bristol and Whitlingham Charitable Trust).
The course was designed for wetland managers and focused on four key themes: hydrology, water quality, fens and drained marshes, and sustainable tourism for local communities and visitors. Each day was split into presentations during the morning and field visits in the afternoon. In the evenings, each participant was invited to feed back what had been of key significance. This was followed by a lecture from an invited guest.
This document comprises a full record of the training materials used on the course. The course proved to be very successful judging from the positive feedback and evaluation forms completed by participants. The feedback is provided in Section 9.
Full details of the project can be found on its website at: www.livingwetlands.org.

2 Presentations

2.1 Welcome and Introduction to the Broads: A National Park - Dr John Packman, Broads Authority

What is a National Park

- They identify areas of land or sea – usually extensive areas – which are of the very highest value to the nation for their scenery and wildlife, and often for their cultural value
- They provide positive management and additional resources to safeguard the special qualities of these areas long term
- They provide opportunities for the public to enjoy these areas, because theya re usually highly attractive places to visit

National Parks and Access to the Countryside Act 1949

- Preserving and enhancing the natural beauty of the areas specified
- Promoting their enjoyment by the public

Responsibilities of the Broads Authority

- To conserve and enhance the natural beauty of the Broads
- To promote the enjoyment of the Broads by the public
- To protect the interests of navigation

Establishment of the Broads Authority in 1989

- Executive Area 303 sq km
- 200 km of navigable water
- 7,552 ha of sites of national and international importance for nature conservation
- 13 Scheduled Ancient Monuments
- 18 Conservation Areas
- 250 Listed Buildings

Innovation and Change in the Broads

- Halvergate Grazing Marshes Scheme
- Forerunner of ESA
- Restoration of Barton Broad
- Harvesting the Fens

Broads Plan 2004 Themes

- Living Landscapes
- Water, Habitats and Wildlife
- Tourism and Recreation
- Understanding the Broads

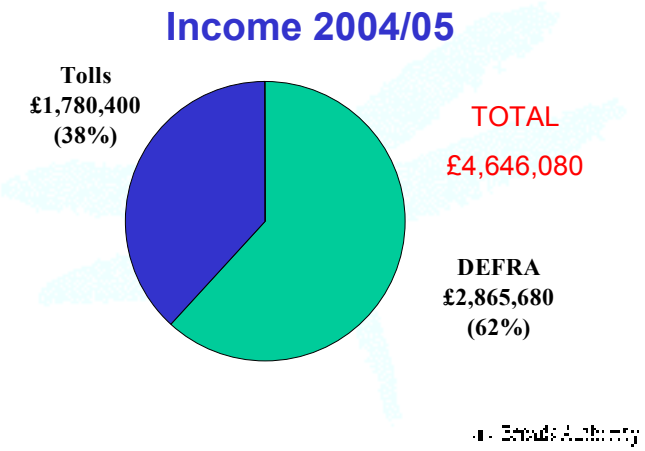
Vision

1. Be well known and in-touch with local people and interested parties.
2. Be respected for its innovative research and projects.
3. Have a close working relationship between a team of informed members and a dedicated staff with clear goals who enjoy working for the Authority.
4. Have an efficient and effective operation which makes good use of public money.
5. Have sufficient resources to have the big impact on the Broads that is required.
6. Demonstrate sustainable practices.

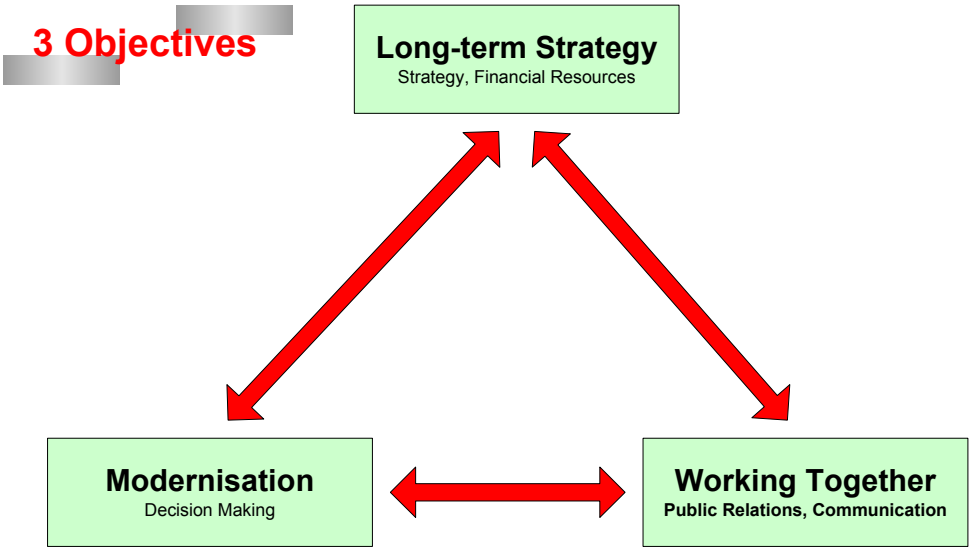
Long Term Issues for The Broads

- Climate Change - high water levels & flooding
- Water quality management
- CAP reform
- Maintenance of the navigation
- Rivers and broads restoration & management
- Quality of the built environment
- Management of the fen areas
- Future of tourism
- Sustainable Tourism

Finances



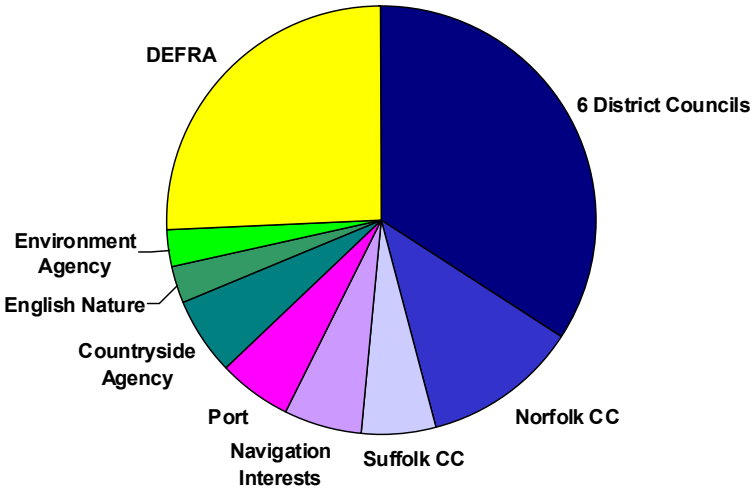
Objectives



Members of Broads Authority

35 Members + 5 Navigation Commitee

Membership representation

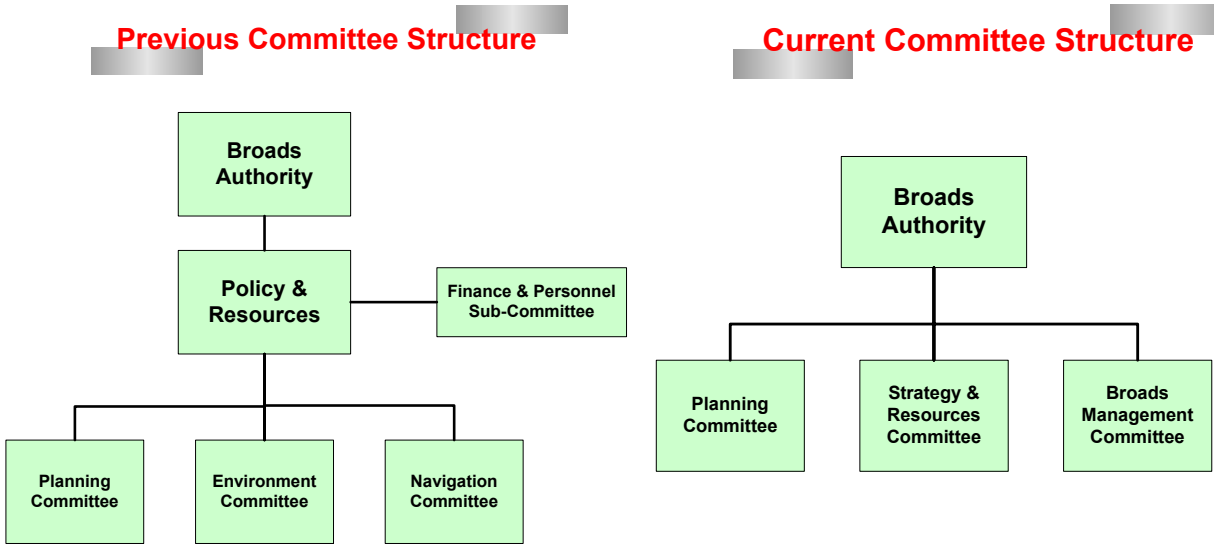


35 members at April 2004

Size compared with other National Parks

Population	Area (ha)	Staff	Budget	Members
42,239 (Lake Dist)	229,198 (Lake Dist)	221 (Peak)	9,194 (Peak)	38 (Peak)
38,100 (Peak)	214,159 (Snowdon	120 (Lake Dist)	6,696 (Lake Dist)	***35 (Broads)***
32,000 (Brecon)	176,869YorkDales)	120 (Snowdonia)	5,005 (York Dales)	26 (Dartmoor)
29,100 (Dartmoor)	143,833 (Peak)	113.7 (York Dales)	4,861 (NYM)	26 (Exmoor)
26,251 (Snowdon)	143,603 (NYM)	110.12 (Pembroke)	4,832 (Snowdonia)	26 (Lake Dist)
25,500 (NYM)	135,144 (Brecon)	98 (Brecon)	4,010 (Pembrokeshire)	26 (NYM)
22,842 (Pembroke)	104,947 Northumb)	***95 (Broads)***	3,812 (Dartmoor)	24 (Brecon)
17,980 (YorkDales)	95,570 (Dartmoor)	93 (NYM)	***3,729 (Broads)***	24 (York Dales)
10,645 (Exmoor)	69,280 (Exmoor)	82 (Dartmoor)	3,453 (Exmoor)	22 (Northumbd)
5,500 Broads	62,000 Pembroke	69.5 (Exmoor)	3,211 Northumbd	18 (Snowdonia)
2,200(Northumbd	***30,292 (Broads)***	42 Northumbd	3,078 (Brecon)	15 (Pembroke)

Structure



Problems that the Broads face

- Eutrophication
- Siltation
- Toxic substances
- Loss of submerged macrophytes
- Loss of littoral margin area
- Loss of biodiversity
- Low river flows
- Climate change – saline incursion
- Invasive species

2.2 Understanding the hydrology of wetlands - Dr Kevin Hiscock, University of East Anglia

Introduction

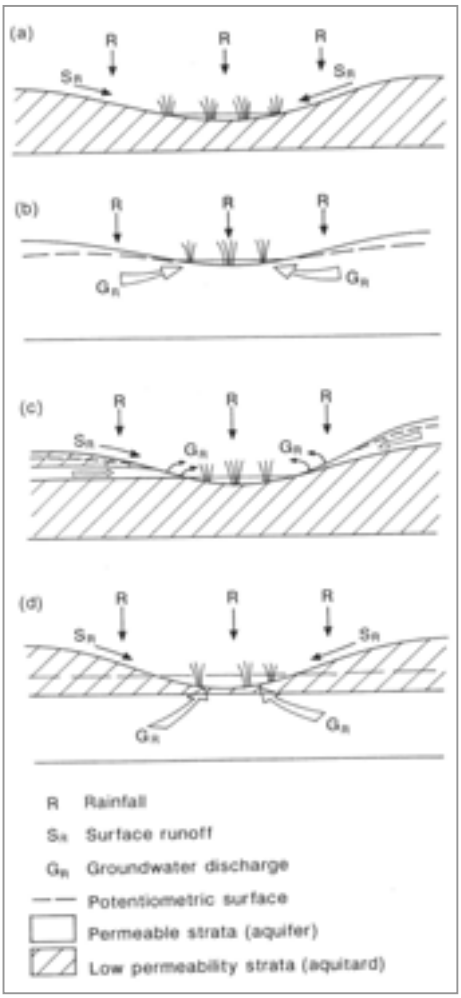
The global extent of wetlands is estimated to be from 7 – 8 x 106 km^2 and, compared to other ecosystems, are an extremely productive part of the landscape with an estimated average annual production of 1.125 kg C m^{-2} a^{-1} (Mitsch et al. 1994). The relatively high productivity and biological diversity of wetlands support an important landscape role in nutrient recycling, species conservation and plant and animal harvest. Although very much smaller in extent compared to marine habitats, inland water habitats exhibit greater variety in their physical and chemical characteristics. Wetlands, with their often abundant and highly conspicuous bird species are protected by national and international agreements and legislation. Notable wetland protected areas include the Moremi Game Reserve in the Okavango Delta, Botswana, the Camargue National Reserve in France, the Keoladeo (Bharatpur) National Park in India, Doñana National Park in Spain and the Everglades National Park in the United States (Groombridge & Jenkins 2000). Inland water ecosystems are unusual in that an international convention, the 1975 Convention of Wetlands of International Importance especially as Waterfowl Habitat (the Ramsar Convention; Navid 1989) is dedicated specifically to them.

Definition of wetlands

Inland water habitats can be divided into running or *lotic* systems (rivers) and standing or *lentic* systems (lakes and ponds). Wetlands are typically heterogeneous habitats of permanent or seasonal shallow water dominated by large aquatic plants and broken into diverse microhabitats occupying transitional areas between terrestrial and aquatic habitats (Groombridge & Jenkins 2000). The four major wetland habitat types are bogs, fens, marshes and swamps. Bogs are peat producing wetlands in moist climates where organic matter has accumulated over long periods. Water and nutrient input is entirely through precipitation. Bogs are typically acid and deficient in nutrients and are often dominated by *Sphagnum* moss. Fens are peat producing wetlands that are influenced by soil nutrients flowing through the system and are typically supplied by mineral-rich groundwater. Grasses and sedges, with mosses, are the dominant vegetation. Marshes are inundated areas with emergent herbaceous vegetation, commonly dominated by grasses, sedges and reeds, that are either permanent or seasonal and are fed by groundwater or river water, or both. Swamps are forested freshwater wetlands on waterlogged or inundated soils where little or no peat accumulation occurs. Like marshes, swamps may be either permanent or seasonal.

Hydrological classification of wetlands

Various attempts have been made to classify wetlands and a variety of subdivisions have been recognised based on broad features such as substratum type, base status, nutrient status and water source, water level and successional stage. The development of the main wetland habitat categories and terms, in relation to the main ecological gradients, has been reviewed by Wheeler & Proctor (2000). Other approaches include a hydrogeological classification based on the main external sources of water and flowpaths (Lloyd et al. 1993) and a hydromorphological (or hydrotopographical) classification based on the shape of the wetland and its situation with respect to apparent sources of water (Goode 1977). A simplification of the hydrogeological classification is shown in Fig. 1 to illustrate the influence of topography, geology and water source in maintaining wetlands.



A change in the factors controlling the source of water to a wetland can have potentially devastating consequences for the fen community, particularly a change in groundwater flow direction. A case study of the impact of groundwater abstraction on the freshwater habitat of a valley fen and the measures taken to restore the fen is given in below.

Fig. 1 Simple hydrogeological classification of wetland types. In (a) surface runoff is fed by rainfall and collects in a topographic hollow (for example, valley bottom, pingo or kettle hole) underlain by a low permeability layer. In (b) rainfall recharge to an unconfined aquifer supports a wetland in a region of low topography and groundwater discharge. In (c) superficial deposits, both unconfined and semi-confined, and underlain by a low permeability layer, contribute groundwater seepage in addition to surface water runoff. In (d) surface water runoff is in addition to artesian groundwater discharge from a semi-confined aquifer.

Case Study:

Impact of groundwater abstraction on Redgrave and Lopham Fen, East Anglia, England

Redgrave and Lopham Fen is an internationally important British calcareous valley fen situated on the Norfolk and Suffolk border in the peat-filled headwaters of the River Waveney.

The fen, covering 123 ha, is the largest fen of its type in lowland Britain and was declared a Ramsar site in 1991. The largest part of the fen is covered by shallow peat supporting a complex mosaic of reed and sedge beds, mixed species fen and spring flushes. The fen is noted for its rare and precarious community of fen raft spiders, the largest spider native to the British Isles. For nearly 40 years, the fen experienced substantial ecological change, principally due to a change in the groundwater flow regime relating to an adjacent water company borehole.

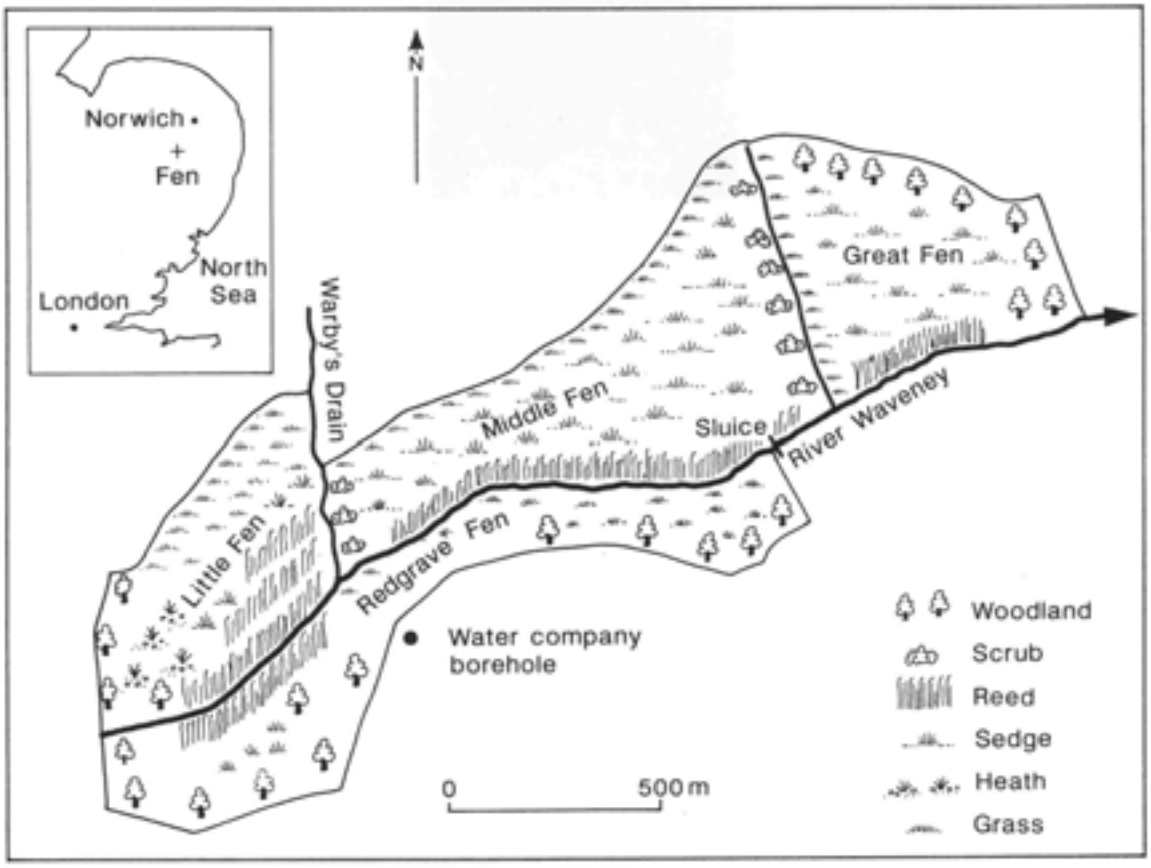


Fig. 2 Location and site map of Redgrave and Lopham fen showing the position of the former operating water company borehole.

The general geology of the fen consists of Cretaceous Chalk covered by glacial till, sands and gravels. The Chalk surface is incised by a deep buried channel which is thought to be about 1 km wide in the vicinity of the fen. With reference to Fig. 1, the fen is a combination of wetland types (c) and (d). Before the late 1950s, calcareous and nutrient-poor water rose under artesian pressure from the semi-confined Chalk aquifer and seeped into the fen both around the fen margins and within the peats. The extreme heterogeneity of the superficial Quaternary deposits resulted in great spatial variation in the quantity of rising Chalk water. The interaction of base-poor water from marginal sands with the calcareous and acid peats produced local variation in soil chemistry that supported a diverse mosaic of fen plant communities of high botanical interest.

In 1957, two Chalk abstraction boreholes were installed adjacent to the fen (Fig. 2) for public water supplies and licensed to abstract 3600 m3 day-1 in 1965. Warby's Drain and the River Waveney were deep-dredged at this time, substantially increasing channel capacity, with a sluice at the downstream end of Redgrave Fen installed to control outputs. As shown schematically in Fig. 3, the operation of the water company source led to the elimination of vertical groundwater seepage and the frequent drying out of Warby's Drain. The normal condition of perennial, high water levels with Chalk groundwater discharging through the fen (Fig. 3a), thus maintaining a soligenous hydrology (where wetness of the site is maintained by water flow from soil) was replaced by a seasonal downward movement of surface water (Fig. 3b). The hydrology of the fen had now become controlled by rainfall patterns and river levels thus producing a topogenous hydrology (where wetness is maintained by the valley

topography). During the summer, the fen dried out more frequently with groundwater heads reduced to a metre below the fen surface. Test pumping and radial flow modelling suggested that about a quarter of the pumped groundwater was at the expense of spring flow into the fen (Burgess 2002).

These hydrogeological changes caused by groundwater abstraction were matched to a deterioration of the flora and fauna at the site (Harding 1993). From a comparative study of botanical records, Harding (1993) showed that great changes had occurred to the ecological character of the fen as a result of the drying out, namely the invasion of scrub. The reduction in the water table altered the balance of competition towards dry fen species and the expansion of *Phragmites* and *Mol*inia, that are to*lerant of low water levels, while previously dominant species such as Cladium and* Schoenus contracted. The loss of calcareous and base-poor seepage water and the increased fertility from the sudden release of large *amounts of stored nitrates through peat wastage under a lower water level also benefited Phragmites*. To reverse the environmental damage, the groundwater pumping was relocated to a borehole 3.5 km east and downstream of the fen and became operational in 1999. The total cost of the replacment supply was of the order of £3.3 million (US$4.8 million), which included the cost of the investigation, source works, pipeline and restoration work on the fen.

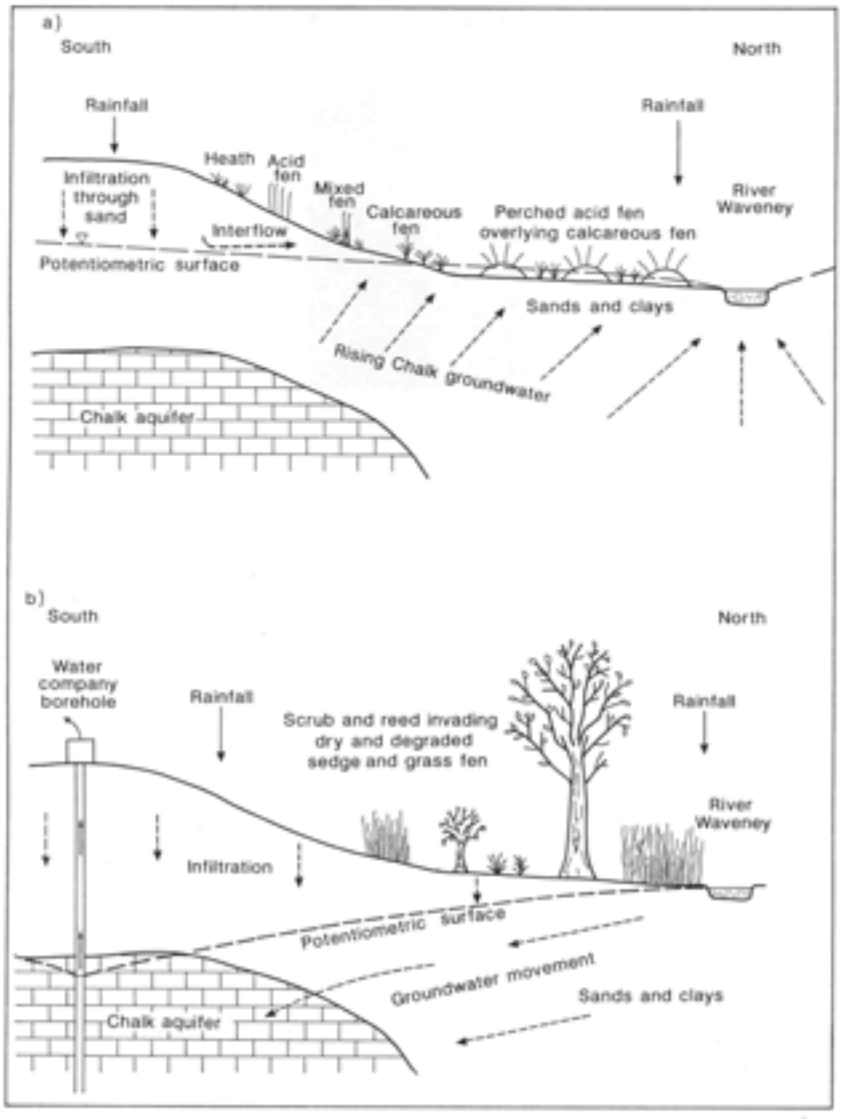


Fig. 3 Schematic cross-section through Redgrave and Lopham Fen illustrating groundwater and ecological conditions (a) before groundwater pumping and (b) after several years of groundwater pumping from the water company borehole (see Fig. 1 for location). After Burgess (2002).

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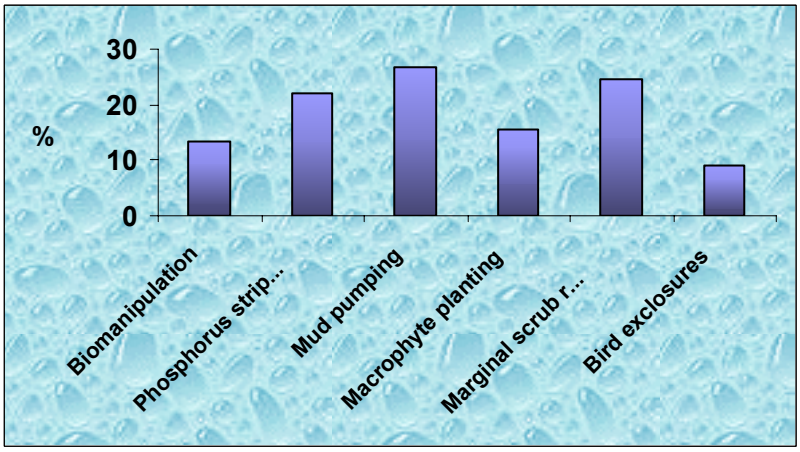
2.3 Water quality and its restoration

2.3.1 Introduction to the Broadland Rivers and Shallow Lakes - Andrea Kelly, Broads Authority

Reasons for Lake Restoration

- Climate change/saline intrusion
- Diffuse pollution
- Toxic substances
- Point source pollution
- Low river flows
- Siltation and dredging
- Biomanipulation

Percentage of the 45 Broads where restoration works have been undertaken



Rivers and Broad Research

EU LIFE project:

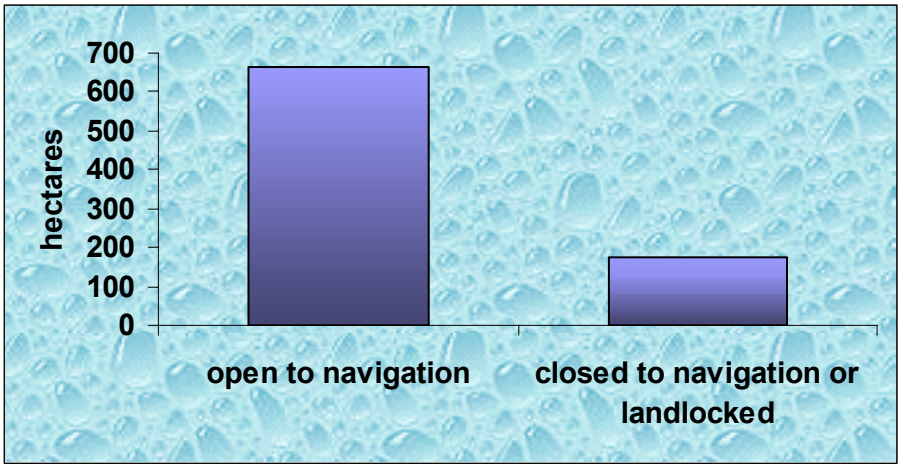
- output: Moss et al (1996) A guide to the restoration of nutrient-enriched shallow lakes

PhD and post doc projects

- Stoneworts and macrophyte recovery
- Phosphorus transport modelling
- Paleoecology
- Toxicity of boat antifouling paints
- Upper Thurne hydrology and ecology

Ongoing research and management at various sites

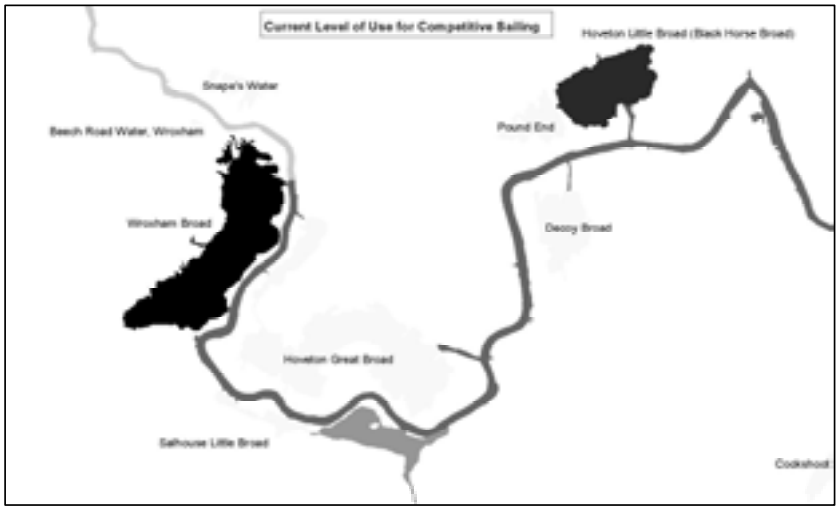
Area of broads open or closed to navigation



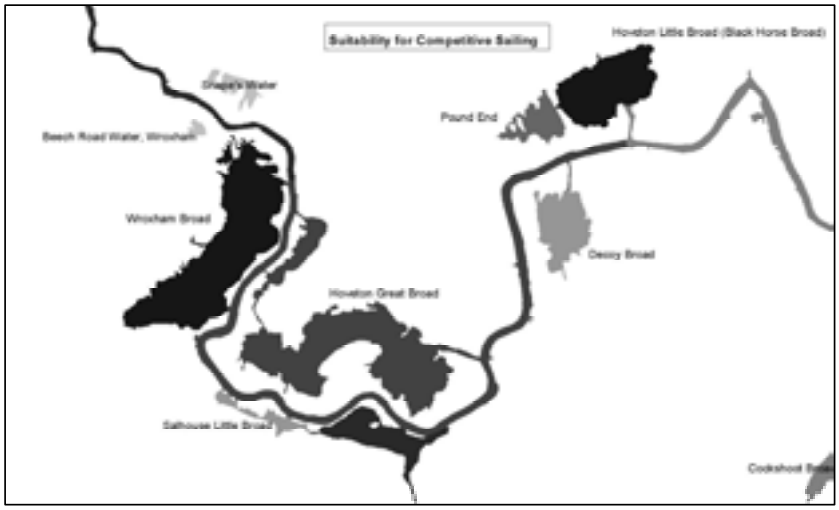
The need for a Rivers and Broad Strategy

- to collate rivers and broads information in a GIS based database
- containing information about the current status and future potential for each of the following activities:
- Conservation
- Water based recreation (eg Sailing and canoeing)
- Land based recreation
- Angling

Current level of use for competitive sailing



Suitability for competitive sailing



Uses of the Rivers and Broad Strategy

- the data base will form the tool for strategic management of the rivers and broads
- it provides opportunity to consult with relevant stake holders
- quality, up-to-date data is required *'the output is only as good as the input'*

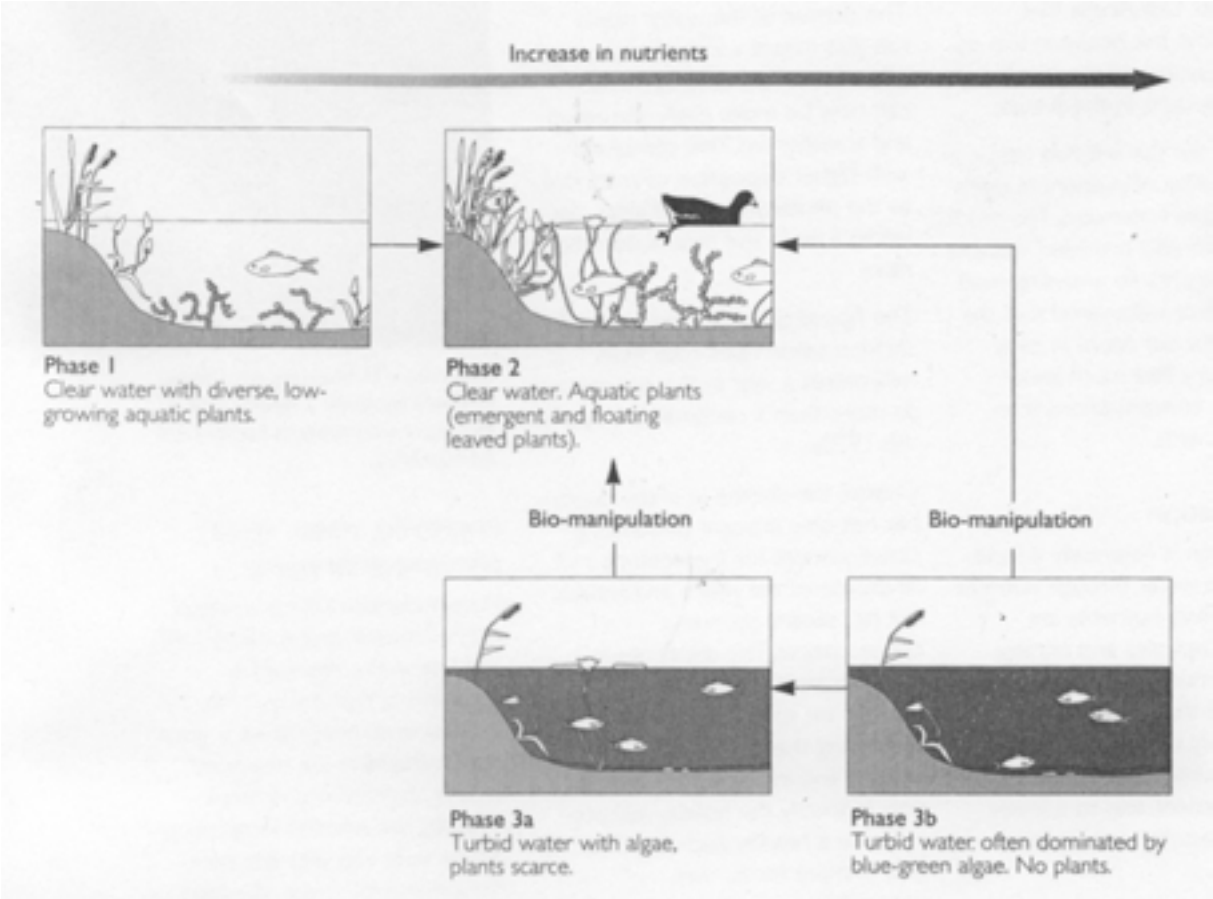
Future consideration of Management and Restoration

- Water Framework Directive assigning achieving good ecological status)
- PSA condition assessment
- Monitoring and data collection
- Biodiversity Action Planning

2.3.2 Cleaning up after nutrient enrichment - Rory Sanderson, Environment Agency

The degradation of open waters in Broadland

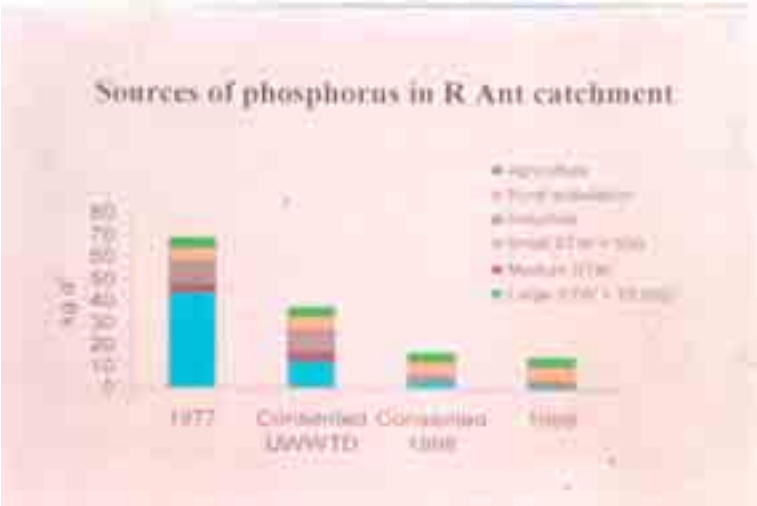
The Norfolk Broads are a series of small shallow lakes formed from flooded medieval peat workings along the three main river valleys of the Bure, Ant and Thurne. Many historic records are available from amateur naturalists that indicate the high conservation value of these 'gin clear' waters.



The picture is somewhat different today. Many of the Broads are in a poor state, and have lost much of their biodiversity as a result. The waters are generally much more cloudy as a result of algal growth, and many of the aquatic plants have been lost because sufficient light cannot penetrate to the shallow bottom to support their growth.
The phases of decline are now understood. The pristine state (phase 1) that was present at the turn of last century is characterised by clear water and by a diverse assemblage of low growing, submerged plants. The next phase of decline (phase 2) occurred during the mid 20th century and was characterised by clear water, but with luxuriant growth of taller 'rank' plant species at the expense of the submerged forms. The third and final phase (phase 3) is the degraded state that occurs in many Broads today. This is characterised by turbid, algae rich waters, with few macrophytes. Blue-green algae may become a nuisance in such Broads.

What cause the decline? - Nutrient enrichment

The change over the last 100 years has resulted from higher concentrations of plant nutrients, namely phosphorus and nitrogen, entering the system. The general decline in water quality and biodiversity associated with such enrichment is widely known as 'cultural eutrophication'. Harper (1982) defines eutrophication as 'the term used to describe the biological effects of an increase in the concentration of plant nutrients, usually nitrogen and phosphorus'. A phosphorus concentration of between 25-85 mg/l can cause eutrophic conditions to persist in still waters.



Plants and algae require nutrients to grow and reproduce. Two important nutrients in particular limit this growth in aquatic systems. Phosphorus is generally considered to be the limiting nutrient for plant growth in freshwaters although nitrogen may limit growth when phosphorus levels are high. Nitrogen is more likely to be limiting in estuarine and marine waters. Identification of the major sources in a particular catchment gives a good indication of where to direct efforts to restore degraded systems. The calculation of phosphorus loading from point sources in Broadland has been influential in directing efforts to reduce the discharge of this nutrient from most large sewage treatment works.

What happened in Broadland? – The effects of enrichment

The productivity of a lake, and ultimately its conservation status, is largely determined by its nutrient supply. A close relationship between algal density (measured as summer mean chlorophyll a concentration) and total phosphorus is evident in the Broads. This indicates that the Broads are indeed phosphorus limited to a degree and that this nutrient may therefore be a good target in any restoration strategy.
Nutrient enrichment had a number of effects on the ecology of the Broads. Direct effects of increased fertility included the excessive growth of rank plant species associated with phase 2, and increased algal productivity associated with phase 3. These changes promoted a

number of indirect effects including the loss of submerged plant species as a result of increased competition and shading. With the loss of plants, the visual refuge needed grazing for zooplankton was lost, and this in turn allowed algae to flourish in a relatively 'un-grazed' environment. All these factors helped to change the Broads from the pristine state to phase 2 and 3. It is estimated that only 4 of a total of 41Broads remain in phase 1, 10 are considered to be in phase 2, and the rest are in phase 3.
Increased nutrients were not solely responsible for the decline. In fact, clear water conditions may prevail over a wide range of nutrient concentrations as long as macrophytes can out competed algae. To complete the degradation to stage 3 requires further factors to remove macrophytes. These have been termed 'forward switches' and include the direct removal of plants by mechanical damage (boats and harvesting), grazing and herbicides. They also include indirect effects which aid algal dominance by reducing the amount and size of zooplankton grazers. Such factors include increased salinity, pesticide pollution and a change in the fish community structure to one dominated by plankivores such as roach and bream.

How can we improve things?

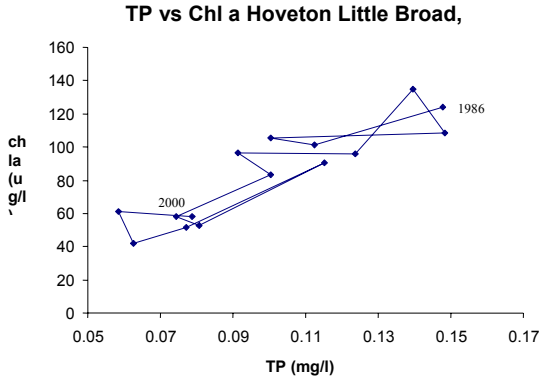
The restoration of eutrophic shallow lakes requires a strategic approach, in which all of the following are addressed:

- Establish the target – this is very important as different user groups may require a different outcome
- Identify and remove any forward switches
- Identify important nutrient sources and reduce loadings
- Biomanipulate
- Re-establish plants to help to stabilise required community changes
- Re-establish an appropriate fish community to aid zooplankton grazer recovery
- Monitor the results and learn from mistakes

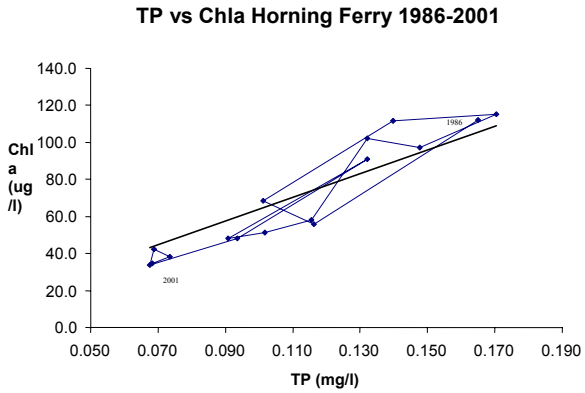
Target establishment is crucial. The aims should not only be achievable, but various user groups should be involved, in deciding the desired outcome of a restoration project. This will help ensure the success of future projects. The targets should also be realistic in terms of the nutrient concentration that may be achieved through nutrient reduction programmes. Certain standards are available, such as those published in the Environment Agency's management strategy for 'Eutrophication in England & Wales' that will aid this decision.

Nutrient reduction in Broadland – a first step towards recovery

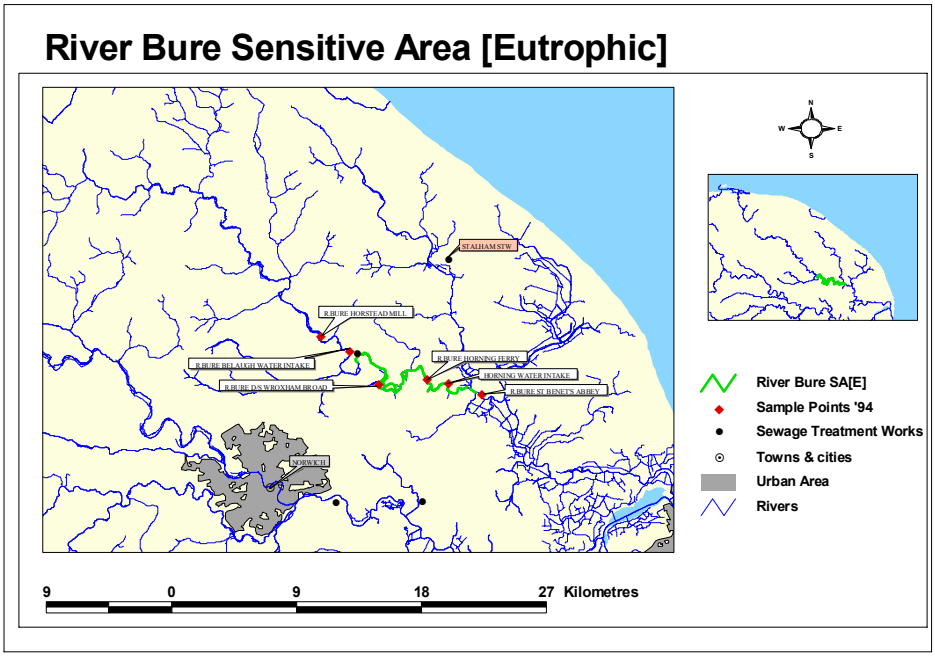
Nutrient control was first introduced in Broadland over 20 years ago. Phosphorus sources from sewage treatment works (STWs) were targeted because nutrient loading work had shown this to be a significant source of the limiting nutrient to Broads rivers. In the early 1980's chemical removal was introduced by the Water Authority at all STWs in the River Ant catchment serving over 100 persons. This was extended to the Bure catchment in 1986. The amount of phosphorus discharged is now set by discharge consents, issued and monitored by the Environment Agency. The initiative has proved successful, with each works now discharging less than 10% of the phosphorus load emitted prior to 1986.

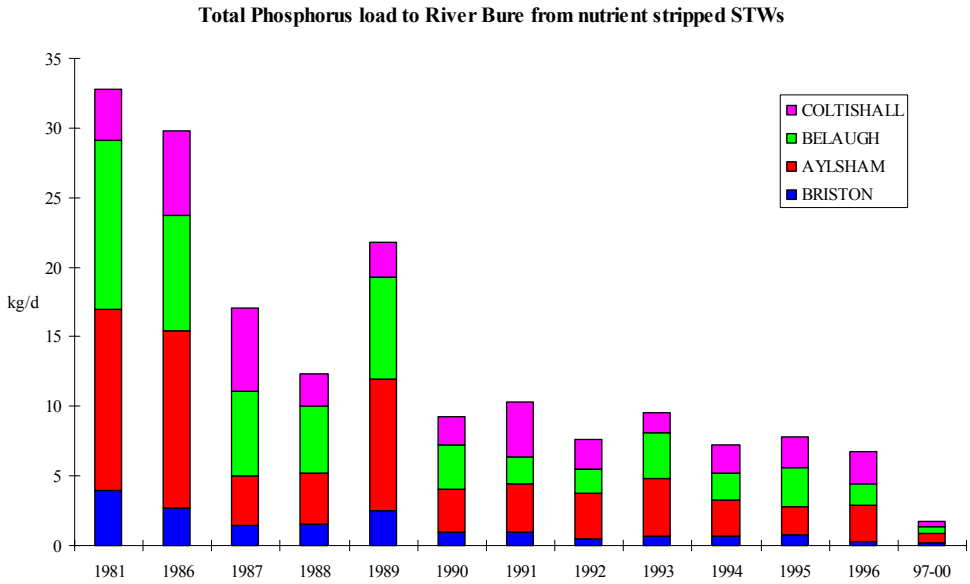


The reduction in loading from STW's is mirrored in the measured phosphorus concentrations in the River Bure. Chlorophyll a (a surrogate measure of algal density) has also declined, indicating a general improvement in water quality as a result of reduced phosphorus. The same pattern is seen within the Broads connected to the Bure, such as Hoveton Little Broad, although there has been little sign of reversion to a macrophyte dominated system. This indicates that simple nutrient reduction is not sufficient to restore these Broads as there are still some forward switches that may be in operation.



One Broad where there has been an indication of reversion to clear water status (phase 2) is Cockshoot Broad. This was one of the first to receive restoration measures, when in 1982 it was isolated from the River Bure and had a large proportion of its sediment removed. The initial results were striking, with dense beds of macrophytes appearing within the first year, and large grazing zooplankton returning to the Broad. Algal abundance has remained lower than the river, indicating that isolation from a nutrient rich source has worked, but the early signs of recovery were short lived. Unfortunately there were still some forward switches in operation such as saline incursions which removed the larger grazing zooplankton (Daphnia sp) and a poor fish community structure. These need to be addressed to promote a self-sustaining restored broad.





How can legislation help the restoration process?

There are a number of legislative tools which may benefit the restoration works of Broadland.

- Discharge consents, issued under the Water Resources Act, 1991, can be used to set limits on the contents of effluents from consented works. Discharge limits are generally set to provide adequate protection to the receiving water on site specific basis, although they may define specific quality standards as set by European Directives.
- Urban Wastewater Treatment Directive. STWs discharging to areas that are susceptible to eutrophication have a prescribed phosphorus limit imposed. STWs involved are only those that serve over 10000 people. The Rivers Bure and Ant are both designated as Sensitive Areas (eutrophic).
- Nitrate Directive. Aims to protect against excessive pollution from agricultural sources. Nitrate Vulnerable Zones (NVZs) are identified within which an Action Plan is established to limit diffuse pollution. The action plan limits fertiliser application and imposes duties on farmers to keep records and store slurry accordingly. The Environment Agency regulates implementation.
- Habitats Directive. This legislation aims to maintain or restore certain habitats to favourable status. Sites are designated according to species or habitats and have conservation objectives associated which could take the form of a target nutrient concentration for example. Environmental quality standards are being developed for phosphorus in waters affecting such designated sites.

2.3.3 Biomanipulation and the way forward - Andrea Kelly, Broads Authority

Biomanipulation in the Broads

'restructuring of the biological community to achieve a desirable response'

- What is the role of biomanipulation in the restoration process
- How can biomanipulation help achieve a a stable healthy ecosystem
- Case study from Broadland

Phased approach to restoration

1. Reduce catchment derived nutrient sources
2. Reduce internal (sediment) sources of nutrients
3. Remove fish (biomanipulate) to get clear water
4. Achieve diverse and stable aquatic community

Clear water feedback mechanisms

Plants can

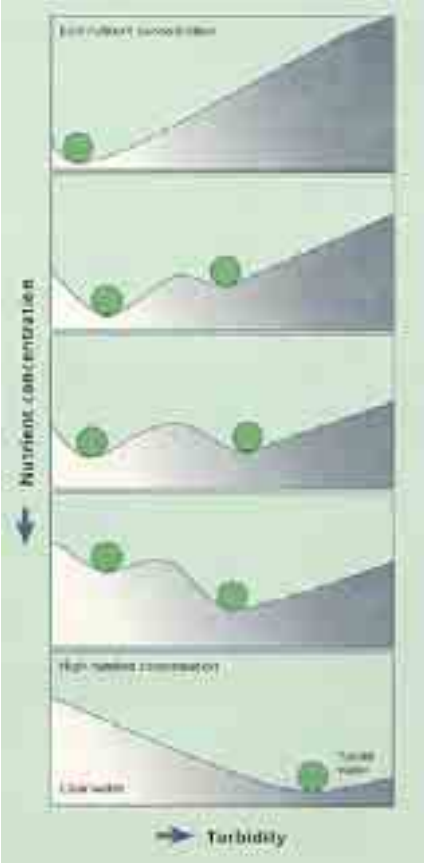
- Absorb wave energy
- Lock up nutrient
- Provide structure and refuge

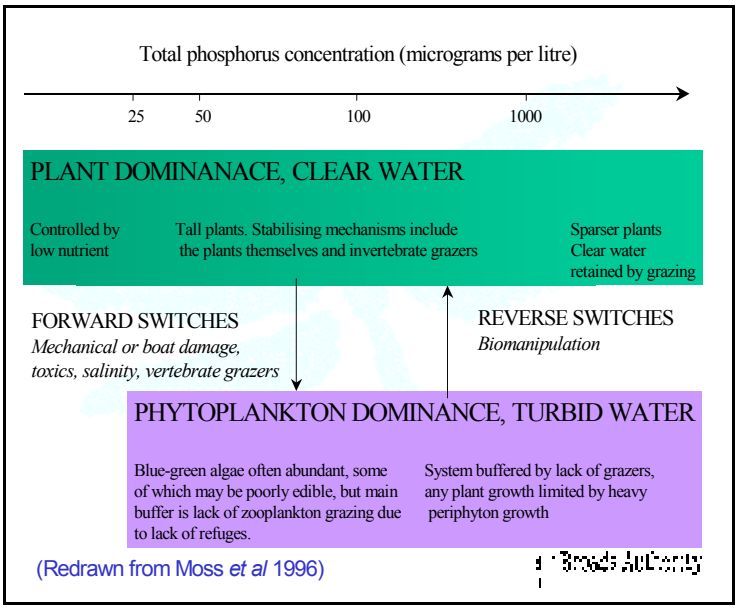
Turbid water feedback mechanisms

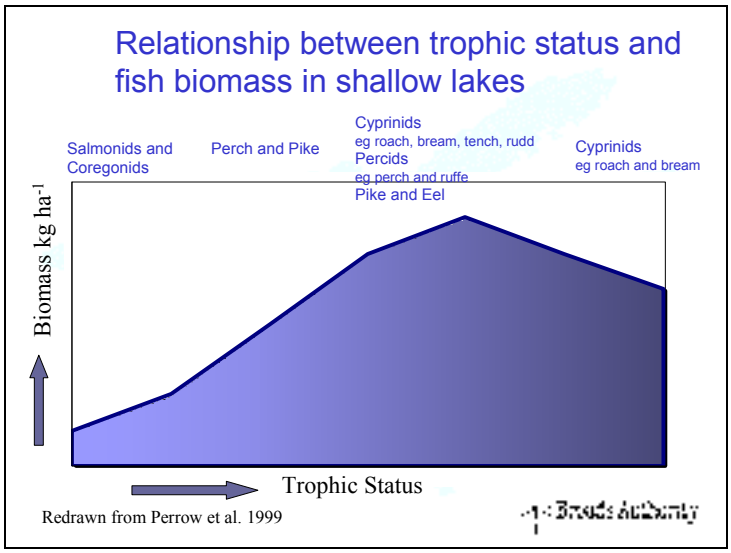
- Algae blocks out light
- Sediments prone to resuspension
- Fine particles clog up zooplankton feeding apparatus

Stable states "marble-in-a-cup" diagram

Representation of stability at five different levels of nutrient concentration and turbidity.
(Redrawn from Scheffer 1990)







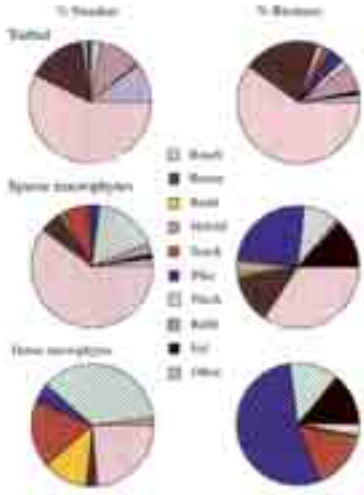
Mean relative composition of fish species in the broads

Changes in the fish composition in the Norfolk Broads with eutrophication

- Smaller fish and young age class structure
- Roach domination (<10cm) and some larger bream (up to 50cm).
- Pike may be present, however cannibalism risk is high due to lack of plants
- High density, low biomass

Have occurred as a result from:

- loss of macrophytes (plants)
- fewer plant associated macro-invertebrates



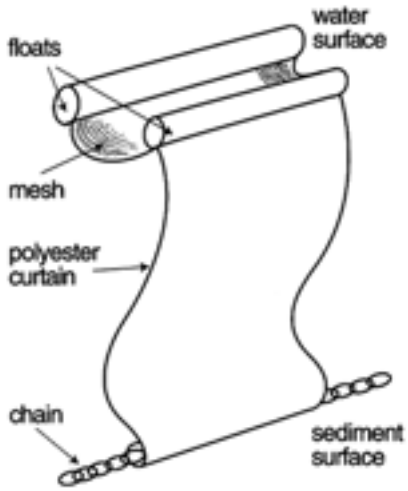
Approaches to biomanipulation

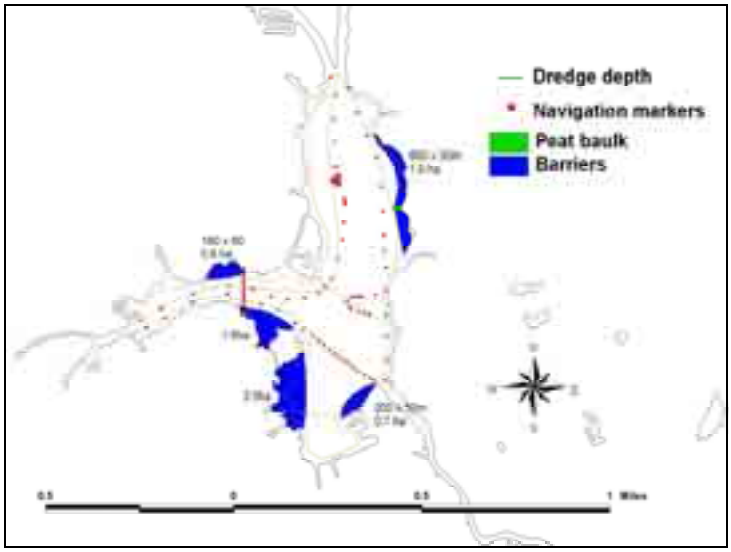
- Removing zooplanktivorous fish
- Enhancing stocks of piscivorous fish

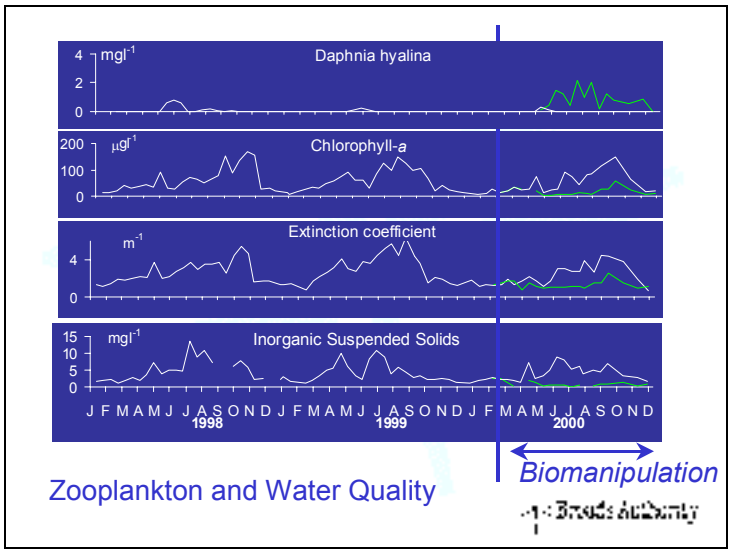
Barton Broad – biomanipulating parts of a lake

- Many shallow lakes in Broadland are hydrologically connected the wetland
- To isolate them is either technically or politically impossible
- Fish proof barriers have been developed that allow biomanipulation of parts of a lake

Diagram of the flexible barrier







Summing up

- a common misconception about biomanipulation is that '*fish are the enemy*' !
- consultation enables lake users to understand why biomanipulation is required
- consultation is recommended at every stage of the projectClear water, macrophyte dominated lakes have different fish populations to algae dominated lakesInitial lower fish populations should - in the long term - result in ecological diversity and productivity.Biomanipulation is part of the restoration packageBiomanipulation is more likely to achieve success if it follows a nutrient reduction programme

2.4 Guest lecture: Managing Water Levels in Broadland - Ben Hornigold, King's Lynn Consortium of Internal Drainage Boards

Legislation under which the KLIDB Operates:

Land Drainage Act 1991 (amended 1994)
Section 12 of this Act states that in discharging its functions with relation to Land Drainage, the Boards must:

'further the conservation and enhancement of the natural beauty and the conservation of flora, fauna and geological features of special interest'

This relates to all our work whether inside or outside of designated wildlife sites.

Section 13 goes on to set out the particular arrangements that must be made for work within legally protected sites such as Sites of Special Scientific Interest (SSSIs).

The Habitats Directive
The Conservation Regulations transposed the European Habitats Directive into UK law in 1994.

The Regulations require Drainage Boards to have regard to the requirements of the Habitats Directive in exercising their functions. This means that IDBs must not cause a deterioration or significant disturbance to any European site when carrying out any of our work.

Countryside and Rights of Way Act 2001

The Act identifies IDBs as a Section 28G Authority and requires IDBs to have regard to the requirements of the CRoW Act in exercising their functions. This means that IDBs have a duty to take reasonable steps, consistent with the proper exercise of their functions, to further the conservation and the enhancement of the flora, fauna or geological or physiological features by reason of which the site is designated. It is a requirement that any such operations are carried out so as to cause as little damage as is reasonably practicable.

Environmentally designated Sites within the Broads Catchments

Water Management Systems

The Board is responsible for maintaining the water courses and pumping stations within the District of responsibility. The works pay due regard for environmental concerns and maintain a close relationship with farmers.

A standard maintenance directive is agreed with English Nature to apply to river SSSIs and watercourses within SSSIs. It is now necessary to register the work with EN on every occasion.

Water Level Management Plans

Consultation is a fundamental part of the WLMP process. All landowners within a plan area are consulted before the plan or review is started and invited to provide information on current water management and aspirations for the future. A draft plan is then drawn up and sent to the statutory consultees. These are English Nature, DEFRA and on the Broads only, The Broads Authority. Consortium staff will also send a draft to other relevant bodies and individuals. For example within the ESA areas the ESA Officers will see a copy.

WLPMs are ‘live’ documents, which need to keep up with what’s happening on the ground, and changing legal requirements. The review is a chance to check that the actions from the last plan have been implemented successfully. Plans will usually be reviewed after five years.

The implementation of WLMPs can range from revision of maintenance regimes, installation of water control structures, enhancing water levels to the promotion of major capital works.

Examples:

- Doles scheme – sluice installed and higher water levels returned, giving the land managers the ability to move water around the system.
- Halvergate Scheme – scheme planned to enable a management system to retain high water levels. This would improve the condition of the SAC.

2.5 Fen and drained marshes: their management and restoration

2.5.1 The History of the Broads Drained Marshes - Sandie Tolhurst, Broads Authority

History of the Broads Drained Marshes

Historically the Broads comprised an extensive estuary system. In its lower reaches and close to the river channels, mudflats, saltmarsh and upper saltmarsh grassland would have been present. In the rivers' upper reaches, tributaries and floodplain fringes, where freshwater conditions predominated, reedbeds and various fen vegetation types would have thrived. This historical pattern of vegetation is reflected in the various soil types found within the drained marshes, with clay and silt soils in areas previously under the influence of the brackish river system, and peat soils where freshwater predominated. However, the pattern of freshwater and brackish influence has not been static throughout history, hence in some areas the soil consists of alternate layers of clays, silts or peat. The majority of peat soils have been subject to marine inundation in the past and therefore contain concentrations of iron sulphate. These peats, when drained release sulphuric acid and iron hydroxide, and are consequently referred to as potentially 'acid' sulphate soils.

From the 13th century marsh reclamation started. Sea levels at that time were about a metre below present. Initially sheep grazing predominated, however by the 16th century there was a move to cattle. New areas were claimed and improvement to existing flood banks continued into the 16th century, driven by increases in sea level rise and a wish to increase agricultural production. By the early 18th century, the drained marshes were managed much as they are today, in that all land drainage had been completed and they were predominantly grazed by cattle, although recent agro-economics has produced a shift towards sheep grazing. The clay and silt areas were easiest to drain, the peaty areas were far more difficult, requiring more drains and resulting in smaller field sizes. Very wet spring fed sites and areas of fen and carr woodland along the marsh fringe that were impossible to drain were isolated from the claimed marshes by the cutting of landspring ditches and the use of high water carriers. Examples that exist today include Carleton Beck and the Hassingham Fleet.

Enclosures took place during the early 19th century, and this paid for improvements to the land and drainage infrastructure. Pre-enclosure, transient flooding occurred frequently due to the inefficiency of land drainage pumps, enabling the area to support huge numbers of waders, wildfowl and rare breeding birds such as the spoonbill, now extinct as a breeding species in the Broads. After enclosure, bird populations declined markedly, as drainage was efficiently controlled and flooding became rare. Prior to 1820, ruff had been a common breeding bird on the marshes. However, by 1827 it was becoming increasingly rare and by 1833 was locally extinct. The cause of this decline can be attributed to improvements in drainage and the destruction of the old washland areas with their associated wetland habitats. The plants also declined in this period with some species extinct by 1830, for example marsh fleabane *Senecio congestus*, and many others confined to a few small isolated sites, species such as grass of Parnassus *Parnassia palustris* and adder's tongue *Ophioglossum vulgatum*. Saltmarsh plants and habitat were lost as a result of embankment including plants such as sea clover *Trifolium squamosus*, while others such as the nationally rare pedunculate sea purslane *Halimone pedunculata* survived possibly until the early 20th century.

The 20th century saw further major improvements of the drainage infrastructure driven by the wish to maximise agricultural production and was achieved through technological developments. In 1913, the first diesel pump was installed. During the 1930s, the 18 Internal Drainage Boards within the Broads came into existence and during the late 1930s and 1940s electrical pumps became widespread. The majority of grass marshes were ploughed and reseeded to improve their agricultural productivity. These developments led directly to a decline in bird numbers and the loss of the remaining traditional washes. Between the mid-1960s and the mid-1980s there was a move towards further intensification and arable usage, with the associated lowering of water tables. Until this time the arable crops were grown under a similar water regime to that of the grazing marshes. In the past water tables were kept high throughout the year, and during the winter, flash flooding occurred or washland areas came into use. More effective drainage lead to the lowering of water tables throughout the drained marshes. Lower water tables, rising sea levels and deteriorating floodbanks resulted in many areas in the lower river valleys becoming more saline as the saltwater intruded further up the river system, while in the middle and upper valley ditches become more eutrophic from the influences of nutrient rich river water. This in turn partly accounts for the observed loss in mesotrophic and meso-eutrophic ditch communities, a 50% loss since the early 1970s. Salinity problems have become a serious agricultural issue on some marshes on the lower river valleys, particularly Halvergate and Haddiscoe Island, with drinking water having to be brought in for cattle in 1976 and 1991. The intensification and rationalisation of the marshes have also resulted in a significant loss of ditch habitat in some areas as ditches have been filled in.

Intensification of agriculture and arable farming encouraged deep drainage which has led to acid sulphate soils, peat shrinkage, changes in soil structure and sward types and probably changes in the whole soil invertebrate community. Since the mid 1980s the Broads Grazing Marshes Conservation Scheme and the later Environmentally Sensitive Area have reversed this trend of agricultural intensification, preventing further damage to the drained marshes by providing incentives for grassland management, higher water levels and reduced fertiliser usage. As yet there has not been the wide scale improvement in wildlife hoped for, indeed recent studies indicate that the decline is continuing, possibly for reasons other than land management. It is clear that a more extensive agriculture regime and higher water table are critical to the maintenance and enhancement of wildlife interests on the drained marshes. However other factors, often from outside the catchment, also have a significant influence and these appear in some cases now be the limiting factors. Despite the serious decline of nature conservation interests on the drained marshes, they still represent an outstanding wildlife resource.

Present wildlife values

The Broads Drained Marshes represent a considerable wildlife resource supporting internationally important populations of wintering waterfowl and raptors, internationally important aquatic plant and wet woodland communities, in addition to nationally important populations of breeding waders and waterfowl and other plant and invertebrate communities.

Wintering waterfowl

In winter, the drained marshes of the Broads Natural Area support internationally and nationally important populations of 10 species of waterfowl, two of which are on Annex 1 of the EC Birds Directive – Bewick's swan and whooper swan. The drained marshlands of the Broads are poorly covered by the Wetland Bird Survey (WeBS). A wintering waterfowl survey of the Broads ESA carried out over the winter of 1996/97 is the most accurate and up to date population estimate of the waterfowl populations within the drained marshes.

Internationally important populations

The Broads Natural Area supports internationally important numbers of Bewick's swan, representing 7.1% of the British and 2.9% of the north-west European population. They feed mainly on grazing marshes and arable fields in the Bure and Thurne valleys, with some birds moving between the two valleys during the winter. The Broads Natural Area also supports internationally important numbers of wigeon centred on two main sites – Buckenham & Cantley Marshes and Berney Marshes/Breydon Water. A regular wintering population of pink-footed goose has recently become established in the Broads and now reaches internationally important numbers (10,000 at Heigham Holmes and 5,500 at Berney Marshes/Breydon Water in February 1998).

In addition, internationally important numbers of shoveler and lapwing are present within the Broads Natural Area but only partially dependent upon the drained marshes.

Nationally important populations

Nationally important numbers of whooper swan are found feeding largely on arable fields within the upper Thurne valley. This population occasionally reaches internationally important levels. Bean goose and European white-fronted goose also winter in nationally important numbers. Mute swan, teal, gadwall, ruff and golden plover are all present in nationally important numbers but not entirely dependent upon the drained marshes.

Ditch flora

The drained marshes possess a ditch network of outstanding importance for nature conservation, acting as a 'reservoir' for some of the plant and animal species lost from the broads themselves. Over 80 per cent of the grazing marsh area possesses ditch types of at least national importance. The freshwater types rich in pondweeds (endgroups A1 – A5a) are recognised as being of international importance. The Broads are notable for the wide range of community types, including an acid and base-rich mesotrophic communities (endgroups A1 & A2), meso-eutrophic communities (endgroups A3a & A3b), freshwater eutrophic types (endgroups A4, A5a, A5b & A6) and algal/brackish communities (endgroups A7a & A7b). The Broadland dyke aquatic endgroup classifications are defined in Appendix 1.

Plant communities

The majority of the drained marshland area is of limited botanical interest. The main features of conservation value being the small fragments of remaining fen meadow, wet heath, upper saltmarsh and certain acid and mesotrophic grassland communities.

Three fen meadow communities are recognised as being of international and national importance; black bog-rush – blunt-flowered rush *Schoenus nigricans-Juncus subnodulosus* mire (M13) is confined to just a few small sites. The blunt-flowered rush – marsh thistle *Juncus subnodulosus-Cirsium palustre* (M22c and M22d) and the purple moor-grass – meadow thistle *Molinia caerulea-Cirsium dissectum* (M24) fen meadow communities are more widely distributed with fragmented examples in all the river valleys.

The botanically important cross-leaved heath – bog moss *Erica tetralix-Sphagnum compactum* (M16) wet heath is very limited in extent, the best examples being Potter Heigham fen and the dune slacks behind Winterton dunes. The upper saltmarsh community of interest most frequently encountered is typified by red fescue *Festuca rubra* (SM16), this is restricted to the marshes adjacent to Breydon Water. The acid grassland characterised by sheep's fescue – common bent-grass and sheep's sorrel *Festuca ovina-Agrostis capillaris-Rumex acetosella* (U1) is present in the Upper Thurne area particularly around Calthorpe Broad. This community is recognised as being of high botanical interest. Two further

mesotrophic grassland communities of high botanical interest are present as small fragmentary stands scattered throughout the drained marshes. The crested dog's-tail grass – marsh marigold *Cynosurus cristatus-Caltha palustris* (MG8) community is found in association with fen meadow communities, while the fiorin – marsh foxtail *Agrostis stolonifera-Alopecurus geniculatus* (MG13) community is commonly found in foot drains and periodically inundated areas.

The drained marshes also support stands of wet woodland, most of which is located along the marsh margin. The majority of woodland is dominated by alder *Alnus glutinosa*, (W6 and W7) and these communities are recognised as being of international and national importance within the Broads. The nationally important grey sallow-downy birch-reed *Salix cinerea-Betula pubescens-Phragmites australis* (W2) woodland is also present as small stands. All three woodland types have been identified as priority habitats in the UK Biodiversity Action Plan.

Plant species

The drained marshes support a large number of nationally rare and scarce plants. The ditch system alone supports populations of 108 species of submerged, floating leaved or emergent plants, one of which is nationally rare, while a further 11 are nationally scarce. These are; sharp-leaved pondweed *Potamogeton acutifolius*, rough stonewort *Chara aspera*, floating water-plantain *Luronium natans* (also a UK BAP Priority Species), whorled water milfoil *Myriophyllum verticillatum*, fen pondweed *Potamogeton coloratus*, grass-wrack pondweed *Potamogeton compressus* (also a UK BAP Priority Species), hairlike pondweed *Potamogeton trichoides*, the liverwort *Ricciocarpus natans*, spiral tasselweed *Ruppia cirrhosa*, greater water parsnip *Sium latifolium* (also a UK BAP Priority Species), water soldier, *Stratiotes aloides* and clustered stonewort *Tolypella glomerata*.

The river wall and embankments support populations of one nationally rare and seven nationally scarce species. These are least lettuce *Lactuca saligna*, bulbous foxtail *Alopecurus bulbosus*, marsh mallow *Althaea officinalis*, sea barley *Hordeum marinum*, dittander *Lepidium latifolium*, stiff salt-marsh grass *Puccinellia rupestris,* Borrer's salt-marsh grass *Puccinellia fasiculata* and marsh sow-thistle *Sonchus palustris*.

The brackish grassland communities support four nationally scarce plant species: bulbous foxtail *Alopecurus bulbosus*; slender hare's ear *Bupleurum tenuissimum*; divided sedge *Carex divisa* and stiff salt-marsh grass *Puccinellia rupestris.*

The remnants of fen meadow communities, although small in extent, support important populations of six nationally scarce plant species: fibrous tussock sedge *Carex appropinquata*; narrow-leaved marsh-orchid *Dactylorhiza traunsteineri*; marsh pea *Lathyrus palustris*; round-leaved wintergreen *Pyrola rotundifolia*; greater water parsnip *Sium latifolium* and the marsh fern *Thelypteris palustre.*

Invertebrate communities and species

The drained marshes support about 180 nationally rare or scarce species, 27 of which are characteristic of the Broads grazing marshes. Of these species, six are UK BAP Priority Species while a further 16 are Species of Conservation Concern. Ten more species qualify for but were not included within published national biodiversity lists.

The ditch systems within the grazing marsh areas are of outstanding invertebrate interest with over 40 different invertebrate species having been recorded from some ditches. The range of habitat, from acidic to base rich and fresh to brackish, adds extra diversity to the species and communities present. The grazing marsh ditches of the Waveney Valley are of particular importance due to the presence of what are probably the highest concentrations

nationally of the shiny ramshorn snail *Segmentina nitida* and the snail *Anisus vorticulus*, both UK BAP priority species.

Vertebrates (excluding birds)

The drained marshes remain a key stronghold for the water vole *Arvicola terrestris*, a UK BAP Priority Species. During the 1997 Broads Dyke Survey, water vole presence was recorded on 8.7% of dyke sections surveyed.

Otters are also increasingly found in the drained marshes as they spread in from the main river corridors.

Several rare species of bat listed under Schedule 5 of the Wildlife and Countryside Act may be found feeding over the margins of this open habitat – the whiskered bat *Myotis mystacinus,* Natterer's bat *Myotis nattereri*, Daubenton's bat *Myotis daubentoni***,** noctule *Nyctalus noctula,* pipistrelle *Pipistrellus pipistrellus,* barbastelle *Barbastella barbastellus* (also a BAP Priority Species) and brown long-eared bat *Plecotus auritus.*

The grazing marshes support the most common of the Schedule 5 amphibian species the smooth and palmate newt *Triturus vulgaris* and *Triturus helvaticus,* although the latter is locally rare*,* and the common frog and toad *Rana temporaria* and *Bufo bufo.* The grass snake *Natrix natrix* which is relatively aquatic is the most frequently encountered reptile, although in some areas the adder *Vipera berus* can be locally common.

Breeding wildfowl

Pochard, garganey, gadwall and shoveler all breed in the Broads in nationally important concentrations, representing 22%, 10%, 5.3% and 4.5% of the British breeding population respectively. Garganey are mostly restricted to the drained marshes, whereas the other three species breed in a range of wetland habitats.

Breeding waders

The drained marshes also support substantial but low density populations of breeding waders, notably lapwing, snipe, oystercatcher and redshank. However numbers of breeding waders are well below potential, especially away from nature reserves. A survey of the Broads ESA in 1995 revealed only 1,129 pairs of waders breeding within the Broads Natural Area (Weaver 1995). Between the years 1988 and 1995 on sample grassland sites in the Broads, breeding snipe populations had declined by 40% and lapwing by 14%, redshank numbers remained stable and oystercatcher numbers increased by 37%.

Key issues and threats

Nutrient enrichment / saline intrusion

The intrusion of nutrient enriched or saline water via leaky flood embankments, into freshwater ditches is having an adverse effect upon nationally and internationally important ditch assemblages. Although much has been done in recent years in northern Broadland to improve water quality from polluting point sources, many are still in existence. Several small sewage works discharge their effluent directly in the drained marshes and rely upon the drainage system and pumps to evacuate it to the river. This problem is widespread, affecting a number of important sites. Farm pollution continues to be an issue. Obvious pollution sources have been cleaned up through the co-ordinated efforts of the Environment Agency and DEFRA, however diffuse agricultural runoff continues to be a problem in some areas. In a few sites local water quality problems are associated with old disused waste tips and industrial sites such as those around Great Yarmouth.

Availability of water

Concentrations of freshwater ditch communities are nearly always associated with the upland marsh margin where freshwater from the catchment, in the form of surface seepage and groundwater supply enters the drained marshes. Ditches adjacent to river walls receive much of their water from river bank seepage. Reduction of the freshwater inputs into the marshes can alter the balance in water quality and lead to loss and damage to freshwater habitats. Reduction of freshwater input also reduces the need to pump, consequently less flushing of the ditch system takes place and stagnation of the freshwater becomes more likely. Improvements to the flood embankments, particularly bank strengthening works, will produce a great reduction in seepage. The potential impact of this in terms of the quantity of water entering the marsh is as yet unknown.

On some marshes, the lack of freshwater already requires river water to be deliberately let back into the drained marshland during the summer. Due to nutrient enrichment and increased saline incursion farther up the lower reaches of the rivers, letting river water onto the marshes can lead to a general degradation of their conservation interest and also prove detrimental to grazing animals. This can be a particular problem in the summer when water demand on the marsh is highest and freshwater flows down the rivers are lowest.

Flood defence

The majority of the drained marshes lie at or below sea level. Appropriate standards of flood defence are necessary both to sustain and develop the nature conservation and agricultural objectives within areas of drained marshland. In the short to medium term the Environmental Agency's Flood Alleviation Strategy will bring about a programme of works that will secure valued freshwater habitats within the drained marshes. It will also examine opportunities for managed retreat, washlands and set back. Even within this time frame it is expected that some areas will be removed from drained marshland and be returned to the natural river system. As sea levels rise over time a greater proportion of the drained marshes should be allowed to function more naturally as wetland. The way in which this trend may be managed, the extent of such changes and the timescale requires further consideration and integration of national policy (flood defence, nature conservation, land use planning).

The input of eutrophic or brackish water into the drained marshes via leaky flood defence is responsible for loss and damage to freshwater aquatic habitats. Improvements to the flood embankments would reduce the inputs of poor quality water and in turn lead to an expansion of valued freshwater communities. In areas of brackish ditch habitat, many of which are of national importance for nature conservation, embankment improvements and the consequent reduction in saline influence will damage or destroy this feature. Further upstream where the grazing marshes support ditches containing freshwater mesotrophic and meso-eutrophic communities, isolation from eutrophic riverine influences is usually vital in maintaining their integrity.

The Broadland Flood Alleviation Strategy and the associated massive earthworks will also have a major impact upon the ecology of the river walls and embankments. Although many efforts are being taken to undertake the works sensitively, some loss and damage to wildlife interests are inevitable.

Flood defence works, navigation dredging, low summer flows resulting from water abstraction, drought and relative sea level rise has resulted in the migration of the saline limit further up the river system. Insufficient freshwater availability from the marsh margin during the summer and lack of water conservation measures have resulted in owners/IDBs increasingly having to let river water back into the marshes to maintain ditch levels. Over time as rivers become more saline this may not always prove a viable method of providing water of adequate quality. If grazing agriculture, and indeed some of the important

conservation features of the drained marshes, are to be sustained then alternative sources of water must be secured, possibly by a combination of winter storage and more efficient distribution systems.

Water management

The water management system within most marsh levels has evolved over a long period to take into account changes in agricultural practice. Many marshland blocks now contain a number of land uses including grazing marsh, arable and developed areas, each with its own drainage objectives.

Water level management of the drained marshes is achieved by a mixture of structures under the control of both Internal Drainage Boards and independent land owners and occupiers. There is a clear need to re-examine and further research the water requirements for the drainage levels overall and rationalise the management systems in order to increase their effectiveness to meet all objectives, including those of wildlife.

Within the Broads, Water Level Management Plans (WLMPs) are formal agreements over water management. These are prepared on a whole IDB district basis and will cover the entire Broads area. These plans also fulfil the Broads Authority's requirements under the Norfolk and Suffolk Broads Act 1988, Schedule 3 (33) and DEFRA high level targets. The majority of plans will be produced by Internal Drainage Boards with some minor input from the Environment Agency. DEFRA has the overall responsibility to monitor the process.

The plans intend to balance and integrate the water management needs of different interests, including agriculture, flood defence and conservation. Where agreement is not possible, any differences should be identified. Although the plans are prepared by Operating Authorities, they are agreed with both the Broads Authority and English Nature. Plans are however consulted upon widely and recognise and incorporate the wishes of other interests, including private landowners. Water Level Management Plans to date have been critical in defining the starting management condition, establishing essential communication and identifying the need for modification and improvement to drainage infrastructure. Capital costs for implementing actions identified in WLMPs attract up to 50% funding from DEFRA and some plans have already brought about modification of drainage systems and operations with associated benefits to wildlife. Over time, and with regular review, management systems will be put in place that meet the objectives of all parties and optimise the benefits for wildlife.

Agricultural practices

Agricultural practices largely determine the water level management regimes adopted in the drained marshes and the way in which the grassland is managed.

Arable farming and intensive grass production requires deep drainage.

When peaty type soils, which contain iron sulphide, are drained for the first time, the soil becomes acid. Iron can be mobilized within the soil profile and this, coupled with iron depositing bacteria, leads to the bright orange-red granular ochre deposit, or the oily sheen seen on ditch water surface. Ochre is toxic to aquatic invertebrates and shades out aquatic plants. This effect is not confined to arable land as ochre can impact upon the dyke system in neighbouring land.

With deep drainage of clays and silty clays which were deposited under the influence of salt water as in a saltmarsh, a soil problem of deflocculation can occur. Normally, with sufficient calcium within the profile, soil stability is maintained. However, following drainage, this calcium can be leached out and replaced by sodium ions which can cause the soil to slump and become unstable.

The Common Agricultural Policy (CAP) has encouraged intensification of farming practices and some grazing marshes are intensively managed for silage and dairy regimes. Incentives under the CAP in the 1960s and 70s encouraged the infilling of ditches and foot-drains and the 'improvement' of the grass sward. Today agri-environment schemes, such as the Broads ESA, provide financial incentives to landowners to restore these features and manage the marshes in a way more favourable to wildlife and traditional landscapes.

The Broads Environmentally Sensitive Areas (ESA) Scheme enables landowners to enter their grassland into one of three tiers, each of which has prescriptions for water level height, fertiliser and herbicide applications and grazing intensity. Arable land can be entered into a fourth tier – reversion to permanent grassland. ESA Tier 1 has the most flexible management prescriptions and the lowest payment levels and is designed to protect traditional landscapes by encouraging the retention of grazing marsh. ESA Tier 3 and Tier 2 with water level supplement are the wettest of the tiers available, with higher water level management and offer the highest payment levels. These tiers also deliver the most benefits to nature conservation. However, uptake of the wettest tiers has been lower due to the constraints on timing of grazing imposed by the prescriptions, in some cases insufficient water naturally available to meet the prescription requirements and in other cases, land levels preclude entry into higher tiers.

The ESA Scheme has reversed the trend of agricultural intensification and arable conversion and has begun the process of reverting arable land back to grassland. However, large areas of land remain as arable. This appears to be for two main reasons: firstly many arable farmers manage solely arable enterprises and hence are unable to build in grazing management into their business; secondly some see payments under the ESA scheme are as not attractive enough to encourage the arable reversion to grassland when compared with returns from arable farming and are unwilling to change when there is such an uncertain future in the industry.

The economic crisis that has hit the livestock and milk industry also poses a threat the Broads Drained Marshes. A prolonged depression in market prices for livestock could potentially force a large number of graziers out of business leading to an excess of grazing land. Whilst some of the more intensively grazed land may benefit from lower stocking rates, some grassland will be undergrazed and alternative management methods may be needed which will undoubtedly result in changes to the traditional grazing marsh wildlife.

Methods of ditch maintenance have changed significantly during this century. Modern machines are more efficient than the traditional weed cutting methods, and because of their speed and the cost-benefit of systematic ditch clearance programme, ditches can be maintained more intensively. The combination of frequency and intensity of clearance has resulted in changes in plant communities and the local extinction of some species of ditch plants. However, the opposite can also be true with neglect also causing a decline in ditch interest. Ditch maintenance operations can also impact upon rare invertebrates. In recent years progress has been made in encouraging the restoration of neglected ditches and the undertaking of maintenance work with greater sensitivity to wildlife.

Wildlife thrives under a non-intensive grazing regime with a high water table throughout the year. Where traditional grazing is practised, water levels are usually maintained at a level to maximise agricultural productivity rather than to achieve maximum conservation benefit. However a number of farming enterprises on both clay and peat soils have demonstrated the way agricultural and nature conservation objectives can be mutually achieved. However the management of land for dual objectives is not widespread, and there is a general reticence to undertake additional necessary works to achieve conservation goals or to have generally higher water levels, as despite new efficient pumps, there is still a fear of flooding.

Human impacts

Disturbance to wintering bird populations is known to be a significant issue in a few important sites. The majority of the problems have arisen from wildfowling taking place close to large concentrations of birds, such as those in the mid-Yare valley. At present the pattern of shooting is unknown, so to is its significance.

Land take by roads, industrial and recreational development, residential and agricultural dwellings and land raising continues to be a threat. The policies of the Broads Plan and Broads Local Plan have reduced much of this threat within the Authority's area, however around Great Yarmouth development on the drained marshes is seen as the solution to a lack of industrial land.

Introduction of alien/non-native species

The introduction of alien or non-native species is a potential serious threat to the conservation status of some features of the drained marshes.

Three invasive aquatic plant species, commonly sold in garden centres, have already been recorded within the Broads – Australian stonecrop *Crassula helmsii*, water fern *Azolla filiculoides* and parrot's feather *Myriophyllum aquaticum*. A number of other problem species eg floating pennywort *Hydrocotolye ranunculoides* have not yet been recorded from the Broads but are readily available from garden centres. All these species could have a serious impact upon the nationally and internationally important dyke communities in the drained marshes.

Mink are widespread throughout the Broads but in low densities. Mink predation, in combination with other factors such as disturbance and bank erosion, has been implicated in the decline of the water vole *Aricola terrestris* within the Broads. Mink do not appear to have a negative impact on otter populations.

Lack of detailed vision

The Broads Natural Area Profile recognised that Broadland's environment has changed significantly over the past 700 years. With rising sea levels the Broads will continue to change and there are a number of choices that can be made, each with its own advantages and disadvantages, for various nature conservation interests. The preferred option promoted by conservation interests is to develop a more naturally functioning wetland environment as opposed to try to maintain the status quo. However, we are not at present able to answer how and over what timescale changes in the Broads might best be managed. We are however able to develop a common wildlife, and hopefully wildlife/landscape view, of how we value individual areas of floodplain and allocate priority ratings for the potential range of habitats and management regimes they might fulfil in the future.

Nature conservation vision for the drained marshes

A complex network of brimming full ditches dissects the expansive grazing marsh which stretches to the wooded horizon, the flatness is occasionally broken up by wooden gateways, reed-fringed trackways and flood embankments. The ditches are rich with aquatic plants such as water soldier and frogbit and are home to a dazzling array of dragonflies and winged insects that flit across the marshes. Grazing animals drink from the ditch edges, trampling the tall stands of emergent plants at the water margin. The cries of waders and drumming snipe echo across this open landscape. Fen meadows rich in flowers produce a colourful display on the peaty soils along the marsh margins. Where wintry waters over-top their banks and form pools of standing water, flocks of wildfowl and herds of Bewick's swans settle noisily. Progressively there will be a subtle change in the mosaic of vegetation as the tidal influence on drained marshes becomes stronger, as a consequence of the increasing height of relative sea level. Swards rich in salt-tolerant grasses form a tussocked landscape in the lower reaches of the rivers. Saltmarsh plants fringe the water's edge and stretch landward in the lower river valleys where washlands, inundated with stormy waters, are formed.

2.5.2 History of fens and their management - Rob Andrews, Broads Authority

Abstract

The Broadland fens are of national and international importance for nature conservation. This area has been exploited for its natural resources for centuries, but it has been neglected over the last 50 years, leading to a dramatic change in landscape and in the available habitat for characteristic species. The establishment of a National Park has enabled a coordinated approach to their restoration and management. This work includes the continuation of same traditional and commercial practices such as reed harvesting as well as the development of innovative ways of enhancing the nature conservation potential, such as the excavation of turf ponds. The work has been guided by experience of fen workers and the results of detailed surveys, research and monitoring.

There are many modern day threats to the fens in Broadland, including some which are outside the control of the Broads Authority. However, the drawing together of a Fen Conservation and Management Strategy will help to direct resources to achieve the best possible future for this area.

Introduction

The Broads or "Broadland" is a complex of shallow lakes, undrained fen and large expanses of drained marshland in the valleys of three main rivers and their tributaries in coastal East Anglia, in England (see Figure 1). The whole area of approximately 30,000 hectares, was given national protection in 1989, equivalent to National Park status, alongside the creation of the Broads Authority, who coordinate its management (see Broads Authority, 1993).

This paper describes the management of the undrained fen of Broadland. In Britain, reedbeds and other fen habitats are highly valued for nature conservation (Ward, 1992). Virtually, the whole of the Broadland fen area currently has statutory protection, by virtue of national conservation designations and it is proposed to be included in future European designations for Special Protection Areas and Special Areas for Conservation.

History of the fen area

In Roman Britain, a large part of Broadland was an estuary and saltmarsh vegetation and brackish reedbeds were widespread. Fen vegetation was then limited to the margins of the upper valleys. A change to more freshwater conditions occurred as tidal penetration up the valleys progressively decreased from 1610 BP to 1000 BP. At this time, the estuary reduced in size and deep layers of peat were formed in the waterlogged conditions along the length of the valleys. However, the fen communities of the lower valleys wasted away following the embankment of the rivers and the drainage of the adjoining marshland. Only narrow strips of undrained peatland vegetation remain now, between the river and the river embankment, known as “ronds”.

From the medieval period, the peat in the middle and upper sections of the valleys was exploited as a source of fuel, creating large, shallow lakes now known as broads. Peat extraction also took place on the surrounding fens until about 1920 AD. The more recent workings in the fens were very shallow and most have now been colonised by fen vegetation and are hard to locate. The complex network of ditches in the fen areas were dug out to assist removal of the peat and other fen products. For a fuller account of the fen management history, see George (1992).

Types of fen

Most of the undrained peatland In the Broads are “flood plain mires”, since they are primarily influenced by the slow-moving rivers. In addition, there are several “valley mires” along the slopes and floors of smaller valleys, which receive most of their water supply from springs and seepage lines. Most of the fen area receives base-rich water from the catchment, with smaller areas influenced by water passing through calcium-deficient sands and gravels. Research has shown that the distribution of the principal fen communities in the Broads is related primarily to the stratigraphy of the valley deposits (Lambert and Jennings, 1960).

Other important factors include the degree of nutrient enrichment from the river and the history of past management.

The Broadland fens are ecologically diverse and are exceptional in the British context. Wheeler (1980) recognised 21 different fen communities in Broadland out of the 30 which occur in England and Wales. Fen that has developed into woodland is known as carr, and is usually dominated by Alder *(Alnus glutinosa),* with a rich understorey of shrubs and herbaceous vegetation in glades. Fen carr (developed over solid peat) can be distinguished from swamp carr, which has formed more recently over lake sediments and is a relatively unstable formation, usually with an abundance of Tussock sedge *(Carex paniculata).* The wooded area now extends to some 3000 ha. Open, herbaceous fen vegetation (about 2500 hectares), occurs in relatively small parcels amongst the scrub, woodland and alder carr, except in the Thurne valley, where the reinvasion of wooded vegetation has been limited by brackish conditions.

The open fen area is usually dominated by reed *(Phragmites australis),* Saw sedge *(Cladium mariscus),* Fen rush *(Juncus subnodulosus)* or the true sedges *(Carex* species). Pure stands of reed and Saw sedge are still harvested commercially in a few areas but other areas are floristically rich. The *Peucedano-Phragmitetum Caricetosum* community, which is found over some former peat diggings, can support over 50 different species in a ten metre square. The rarest flowering plant within this community is the Fen orchid, *(Liparis loeselii),* which is afforded special protection under national law. The other Red Data Book plant species is Crested Buckler fern *(Dyopteris cristata),* which tends to be associated with more acid communities supporting Downy birch *(Betula pubescens)* and bog moss *(Sphagnum* species).

Fen invertebrates

The invertebrate fauna of Broadland is just as rich and diverse as its flora, although it is less well recorded. Most of the rarities are associated with the open, herbaceous fen communities. The British rate of the Swallowtail *(Papilio machaon)* is now restricted to the herbaceous fen of the Broads. Three moth species are also Broadland specialities - the Small Dotted Footman *(Pelosia obtusa),* Reed Leopard *(Phragmataecia castaneae)* and Fenn's Wainscot *(Photedes brevilinea).* A rich beetle fauna is associated in particular with reed and saw-sedge beds and with moss carpets, small ponds and ditches. Twenty species of Odonata still occur in Broadland, but some, such as the Scarce Chaser *(Libellula fulva),* are less widely distributed than they were in the past, when there was vast stretches of herbaceous fen, intersected by ditches and turf ponds (George, 1992).

Fen birds

The open reed-dominated fens are the preferred summer habitat for a group of small birds, commonly including the Reed warbler *(Acrocephalus scirpaceus*), Sedge warbler *(Acrocephalus schoenomaenus),* and Grasshopper warbler *(Locustella naevia),* with less commonly Savi's warbler *(L.ocustella lusciniodes).* Three well-loved and nationally rare breeding birds also depend on regularly managed reedbeds for breeding - the Bittern *(Botaurus stellaris),* Bearded tit *(Panurus biarmicus)* and Marsh harrier *(Circus aeruginosus).* The latter two bird species are now relatively frequent in the fen areas, the bittern has all but disappeared, probably due to nutrient enrichment of the rivers and deterioration of the open fen habitat, due to neglect (Tyler, in prep.). The alder carr is frequented by more typical woodland birds that occur throughout Britain, such as the Great and Lesser Spotted woodpeckers *(Dendrocopos major* and *D. minor),* the sparrowhawk *(Accipiter nisus)* and a good variety of songbirds.

Fen mammals

Otters *(Lutra lutra)* were common in the Broads up to the 1950's, but now the only animals surviving are ones that have been recently re-introduced. Their loss is probably attributable to bioaccumulating chemicals such as organochlorines (George, 1992). The fens and carr are still rich in small mammals such as voles and shrews. In particular, these fens are thought to be especially important for the Harvest mouse *(Micromys minutus)* and the Water shrew (*Neomys fodiens)* in Britain, due in part to the loss of other habitats (Jowitt and Perrow, 1993). Two notable introductions to the Broads have been the South American Coypu, which became abundant in the Broads from the 1940's and was exterminated by the mid 1980's and the Chinese Water Deer *(Hydropotes inermis),* which has been present since the 1950's and is unlikely to have any significant effect on the ecology of Broadland.

Threats to the Broadland fens

a) Neglect

The Broadland fens have been harvested for centuries for a variety of useful materials. This management has been instrumental in shaping the animal and plant communities that are our heritage in the Broads. The principal crops were reed, sedge and mixed fen litter for roofing material, marsh hay as bedding or food for livestock; bulrushes *(Schoenoplectus* spp.) as a material for weaving mats; various roots such as those of *Typha* spp. for use as animal food; Alder and other tree species for firewood and construction.

During the course of this century, there has been a decline in the market for marsh hay and litter, together with a drastic reduction in the number of marsh workers. Together with changes in farming practice this has led to the gradual decrease of all except the most lucrative of the commercial harvesting, so that now only reed and sedge cutting remains a

regular activity. Natural succession has therefore transformed most of the open fen landscapes into scrub and carr woodland over the last few decades. In the absence of harvesting, the fen surface has risen due to the accumulation of dead plant material and some have been invaded by plant species characteristic of drier habitats.

Today, there is an active programme of fen management to restore the recently lost open, herbaceous fen and to maximise its value for nature conservation. However, financial resources and the labour supply are limited and such management can only be carried out where individual landowners are in agreement. Such agreement is easiest to achieve where there is the potential for a commercial return from reed or sedge. Many areas remain unmanaged or management is sub-optimal due to these constraints.

b) Water Resources

The Broadland fens overly chalk aquifers, which can supply water that is valuable for public consumption and agriculture. Although the regulatory authorities (National Rivers Authority) are now taking steps to restrict abstraction that is likely to cause any significant loss of water to these fens, there are many existing licences which are causing a gradual dehydration of some fen areas, through the decrease of spring flow. In addition, summer river flows have diminished significantly in the Rivers Bure and Ant in the Broads, which may also contribute to changes in fen communities, by allowing the fen surface to dry out more frequently. A related problem is the more frequent inundation by saltwater, caused by extreme high tides during surge conditions in the North Sea.

c) Water Quality

All of the Broadland rivers have suffered from severe nutrient enrichment over the last 50 years. The enrichment has been caused in part by the settlement of people in the valleys, resulting in phosphorus-rich sewage discharges to the river. The intensive cultivation of majority of the catchment of the Broads to produce arable crops, has also resulted in increased nitrogen inputs, which reaches the fen as run-off from higher land and from the river. Together, these nutrients have caused severe eutrophication of the rivers and in turn, this may be changing the nature of the fens.

Conservation Management of the Fens

Commercial management is carried out by a number of self-employed marsh workers, together with landowners. The conservation management of the fens of Broadland is one of the principal tasks of the Broads Authority, who also liaise closely with private cutters. The programme of conservation work is carried out in partnership with English Nature, the national agency for nature conservation, local landowners and voluntary bodies. A range of techniques are currently practised. Most derive from traditional management methods but others have been developed for nature conservation purposes. The main techniques are described briefly below.

Commercial Management

a) Reed Cutting

Reed *(Phragmites australis)* is killed by regular cutting in the summer, so the reed harvest is always carried out in winter when the reed stems are dead, leafless and fully dried out. In this condition, the stems are in a suitable state to go onto the roof. For thatching purposes, reed may be cut every year or every two years. Reed can rarely be used from a reedbed that is more than three years old because the stems become worn and brittle. In general, reedbeds cut every two years (apart from being better for most birds) produce a better growth of reed in their second year. Field observations suggest that the dead stems of standing reed create

a cold frame effect for the young shoots of the following spring, so producing taller, thicker, stronger stems.

If reedbeds are left unmanaged, some of the thick spreading species such as Pond Sedge *(Carex riparia)* or Reed Sweet Grass *(Glyceria maxima)* will shade out young reed shoots and the area will become less attractive for harvest and for its characteristic wildlife. It is also important that cutting machinery cuts low to the ground to remove all of the litter and prevent a build up of dead vegetation, which will dry the fen. Reed that is cut low to the ground tends to last longer on the root since the exposed stems are thicker and tougher.

b) Sedge Cutting

Saw sedge *(Cladium mariscus)* is only used for thatching the ridge of the roof. Although *Cladium* is widespread throughout Europe, East Anglia is the only area where it is commercially harvested. The crop can be cut once every three or four years in fens where it is the dominant plant. Sedge cutting is confined to the growing season so that cut stems may heal and produce new shoots before the winter. *Cladium* can be killed by prolonged flooding of cut stems during the winter months. Freshly cut bunches of sedge are left to dry for several days before being tied and sold for thatching. By the time this sedge is used on a roof, most of the other plants in the bunch should have dried and shrunk to negligible proportions.

Non-commercial Management

c) Marsh Hay Cutting

Rotational cutting and clearing of these mixed fen habitats is now carried out using teams of paid staff and volunteers purely for nature conservation reasons. Various makes and models of reciprocating blade cutters are used according to individual needs and budget. The vegetation is cut in the summer months after most of the flowers have set seed. It is then left to dry for several days before raking into habitat piles or into bonfires constructed in areas of lower botanical interest.

Most of this work is done by hand as the fens are too fragile to support heavy machinery for baling and transporting cut material. This makes the techniques very time consuming and labour intensive, so it is restricted to these areas which have the greatest botanical interest.

d) Ditch and Ride Management

Fen ditches are normally between three and five metres wide. They are important for boating access and as a supply route for water both onto and off the fen, as well as providing a valuable habitat. Ditch edges need to be cut an a regular basis, however, to prevent the overgrowth of scrub and tall vegetation which would eventually shade out aquatic life. Many of Broadland‘s ditch edges are cut back to a width of two or three metres which has the dual effect of management for nature conservation and the creation of a path or “ride“ valuable for access, fen plants and insects. Most of the ditch and ride management is now on land owned by conservation bodies.

e) Burning

Areas of fen are sometimes burnt as a standing crop in winter either to restore them for reed and sedge harvest or as a management technique to maintain open fen conditions. Burning is usually carried out in March after cutting necessary fire breaks and it is only carried out an relatively calm days which allows a greater degree of control of the fire.

Burning is a quick and easy technique that allows many hectares to be managed with the minimum of labour supply. Broadland fens are always very wet at the surface, so much of the dead litter is left unburnt. This will eventually lead to a drying out of the fen unless unburnt

material is raked off and burnt periodically. Conversely, all types of scrub up to about 4 metres tall is killed by burning and will only re-grow from ground level, so burning is very effective as a scrub control technique.

f) Scrub Clearance

Freshwater fens will automatically be invaded by Young Alder, Birch or Sallow *(Salix caprea),* if left unmanaged for more than a few years. Clearance of blocks of scrub is usually done with teams of conservation workers, contractors or volunteers. The majority of the wood is burnt on bonfires although some is left to provide a habitat for insects, fungi and birds. Stumps are cut as low as possible to the ground and treated with a weedkiller such as ammonium sulphamate, to prevent re-growth of the tree. This is vital, since there are insufficient resources to repeatedly cut these areas.

Periodic scrub removal on a long rotation (5-10 years) will maintain open fen but will not produce as diverse a habitat as shorter rotation management. Sites that have been cleared of more established scrub are also very difficult to cut in the future with machinery, due to the large stumps.

g) Water Control

A substantial part of the flood plain rivers of Broadland must be flooded for many weeks each year in order to support the range of unusual plants and animals characteristic of the area. Every fen has a network of ditches and smaller “foot drains” (c. 1 metre wide) which move water both on and off the marsh. These channels must be maintained on a regular basis to give efficient water distribution throughout the fen. This system may be improved by building dams or sluices to prevent areas drying out. Some fens even have an active pumping system that allows water to be maintained at optimum levels throughout the year. The wetter fens are usually the most important both ecologically and from a commercial point of view.

h) Turf Pond Excavation (see Figure 2)

Some of the most valuable areas in the Broadland fens are these that were once cut for peat. Very few of these shallow tuff ponds have been dug this century, so most are in the latter, drier stages of their succession. In order to re-create the wetter, more diverse types of fen the Broads Authority and English Nature have recently begun a programme of large scale turf pond excavation using a 20 ton specialist excavator.

Densely wooded areas are chosen for this type of management, where the wetland plant interest has largely been lost, after years of neglect. The machine is able to up-root scrub and move it away from the fen where it can be used to make raised banks. The surrounding peat is then excavated to varying depths between 0.5 metres and 1.0 metres and this material is used to smooth off the piles of scrub, to facilitate future management of the bank.

Initial work on an experimental scale has shown that these shallow ponds quickly colonise with aquatic plants followed rapidly by a “wetter type“ of fen community. Large scale ponds of this type are planned to give a variety of successional stages from open water to fen. This represents a very important management technique for the conservation of some of the more threatened Broadland species such as the Bittern, Water Rail *Rallus aquaticus*, and Fen Orchid.

Research, survey and monitoring

The fens have attracted less scientific interest than other habitats in the region but this has begun to change since the Broads was given national park status. Early work (1979-1989) concentrated on understanding some of the factors and processes affecting vegetation and its general response to a limited range of management operations (see Broads Authority 1984 and 1988 for summaries). The impact of management work in the Broads has been

assessed by aerial photographs (Countryside Commission, 1991) and by monitoring permanent plots situated amongst a range of vegetation types (see Kennison, 1991). This monitoring data has been important in guiding the timing and nature of management practice. This monitoring work has also been important in detecting change caused by water abstraction, although detailed hydrological research is necessary to understand the factors affecting the water balance of any particular fen (Gilvear et al 1989). Bird and invertebrate surveys have shown how the vegetation structure, e.g. presence of small ponds, sedge tussocks and isolated bushes, can determine what species will occur.

Work by Wheeler (1983) encouraged the Broads Authority to dig some very small experimental turf ponds. The monitoring of succession in these over 10 years (Kennison, 1992), led to the investment in a large scale programme of works and sufficient experience has been acquired to draw up specific guidelines for turf pond creation. Monitoring data is placed an a computer database so that it can be accessed easily and fed back into the next review of the guidelines.

Only recently we have compiled a map of the Broadland fens showing the distribution, extent and condition of the plant communities present (Parmenter, in prep.). A new classification system (linked to the national one) has had to be constructed to describe Broadland‘s fen vegetation properly. This work will assist in the drawing up of a Fen Conservation and Management Strategy, prioritising works to achieve the best overall conservation benefit for the Broadland fens. Some hard choices will have to be made because resources are always going to be limited. It is intended that we will use a Geographical Information System (GIS) to map fen information and management.

Conclusion

The Broadland fens are of outstanding importance in Britain for nature conservation and they support habitats and species of European significance. Much of the favoured habitat has been lost in recent years to neglect and changes in the catchment threaten the long term security of conservation efforts in these fens. A major programme of fen restoration has been initiated, based on survey and research information and traditional management practice.

The conservation work is coordinated by a partnership of statutory and voluntary agencies and with the cooperation of landowners. Management for commercial gain from fen products is carried out alongside management for nature conservation. To make up for the loss of agricultural labour in the fen areas, conservation staff and volunteers have been employed, together with the use of modern equipment to increase the efficiency of restoration operations.

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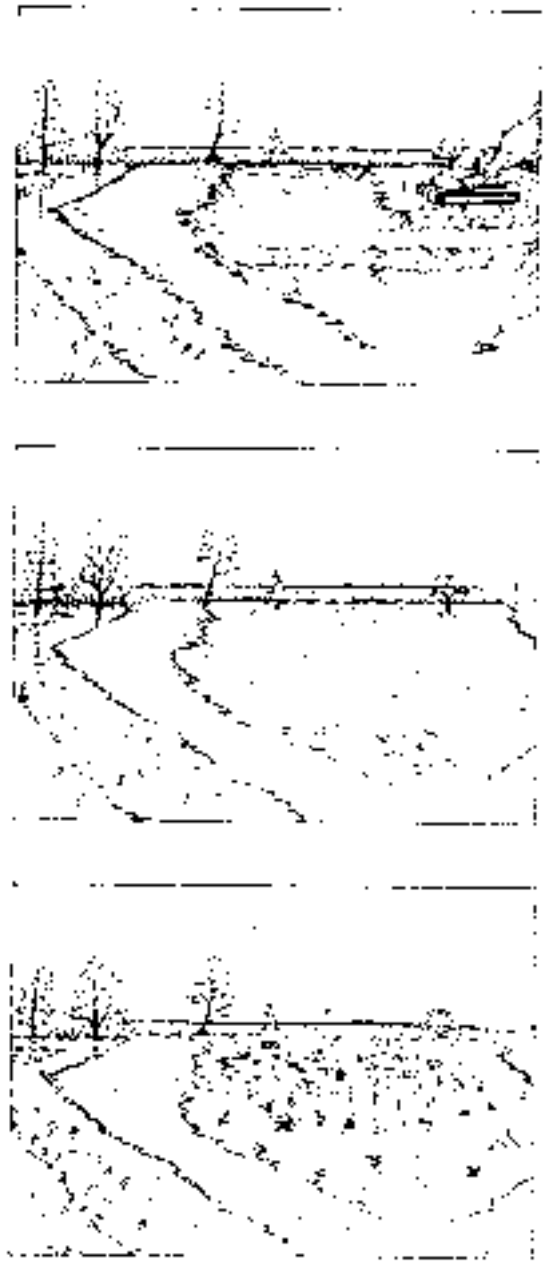
Table 1 Research, survey and monitoring carried out on the Broadland fens between 1979 and 1994.

Reedbed bird survey of England, Wales and Scotland.	Broads Authority (1984)
Factors, processes and management experiments on Broadland fen vegetation.	Broads Authority (1984)
Turf ponds in Broadland.	Wheeler (1983)
Population flux of *Liparis loeselii*	Broads Authority (1984)
Historical ecology of the Broadland fens.	Broads Authority (1988)
Changes in the quality of thatching reed	Boar, Leeming & Moss (1991)
Rollesby Broad Transect Study of fen vegetation.	Kennison (1991a)
Vegetation monitoring of Broads Authority managed fens.	Kennison (1991b)
Habitat conditions of fen vegetation types.	Broads Authority (1988)
Invertebrate survey of East Anglian fens.	Broads Authority (1988)
The effects of reedbed management on fauna and flora.	Broads Authority (1988)
Turf ponds monitoring.	Kennison (1992)
Land use change in National Parks.	Countryside Commission (1991)
Hydro-dynamics of East Anglian fen systems.	Gilvear et al (1989)
Effects of burning in Broadland fens	Sutherland
Small mammals in Broadland fens	Perrow (1993)
Bittern research.	Tyler (in prep)
Fen resource survey of the Broadland fens	Parmenter (in prep)

Figure 2 Stages of turf pond excavation (drawing by Matthew Dane, reproduced with permission of Broads Authority).



The location within the reedbed is also important. To avoid damaging the existing invertebrate interest, it is advisable to create a pond for example, adjacent to or at the edge of the wetland (Kirby 1992), although even here important communities of plants may be present and should be avoided. On large reedbed sites, the addition of open water at the expense of pure reed, which generally has less wildlife diversity than more mixed areas of plants, will add to the wildlife value without damaging the other reedbed habitats present.

For pools, ponds, meres, scrapes and lakes the basic principles are the same. Soil is excavated from reedbed using a mechanical digger to produce a hole, which fills with water. Spreading the spoil on existing reed areas or other valuable habitat should be avoided and it may be pushed into the centre and used to construct islands for example, or as at Far Ings on Humberside, dropped into the edge of deeper water to make it shallower (Case Study 3). At Strumpshaw Fen in Norfolk, the mud pumped to re-open the Old Broad was deposited on a designated, bunded area of low-value scrub. The construction of bunds may be combined with open water creation as was the case at Walberswick in Suffolk where material was scraped from the reedbed to create a sea wall leaving shallow open water areas on either side (Case Study 11).

Similarly, in the Broadland fens, “turf” ponds are dug as part of fen restoration work where the peat spoil is used to consolidate existing bunds or to construct new ones to prevent excessive flooding by the tidally influenced river system. The ponds are profiled, allowing reed and a variety of other plants gradually to recolonise the shallow margins (Figure 18). A similar system but on a smaller scale has been used at Redgrave and Lopham Fen on the Norfolk and Suffolk borders where small pools were dug to mimic traditional peat diggings for the benefit of the endangered great raft spider.

2.5.3 Bring on the animals - Sue Stephenson, Broads Authority

Conservation Grazing

- Use of livestock to manage semi-natural habitats
- Projects in place across UK on range of habitats, e.g. heath, moor, woodland
- Extensive grazing, i.e, large areas & low numbers
- Another potential large-scale fen management technique

Fen Grazing

- Wetland grazing experience in UK & Europe
- New 'experimental' approach in Broads
- Aim to maintain open fen conditions & promote habitat diversity
- Extensive natural systems with minimal interference

Why Graze?

- Range of fen management techniques with range of results
- Notable advantages of extensive fen grazing:
    - Promotion of habitat & structural diversity
    - Creation of ecotones
    - Sensitive technique
    - No product to remove from the fen
    - Large-scale & long term

Stock Selection

- Type - cattle, sheep, ponies
- Breed - traditional .vs. improved
- Animal background
- Own stock or grazier?

Konik Polski

- Conservation grazing background in Holland
- Extremely hardy
- Suitable grazing and browsing ability
- Compensation of growth
- Intelligent and adaptable
- Good health and healing ability
- Strong, slow growing hooves

Welsh Mountain

- Conservation grazing background in Wales
- Small and lightweight
- Thrifty and hardy
- Tolerant of biting insects
- Adventurous, sure footed and adaptable
- Relatively easy to handle

Sutton Fen Grazing Project

- Large fen area of 120ha
- Open fen with scrub, woodland, solid & hover substrate, dry banks within site
- 16ha dry adjacent grassland
- Nine Koniks imported from Holland May ‘00
- Twelve Highland heifers & bull introduced 2001

Sutton Fen Evaluation

Issues:

- Failure of animals to explore the fen
- Over-use of internal banks in autumn/winter
- Over-use of adjacent dry land in summer

Explanation:

- Position of dry adjacent land relative to fen
- Animal background
- Supplementary feeding of cattle

Broad Fen Grazing Project

- Relatively small site of c. 20 ha
- Open fen with scrub, woodland, solid substrate & hover fen over peat diggings
- Dry vegetated bank network within the site & limited adjacent dry land
- Seven Welsh Mountain ponies introduced from Anglesey in Nov ’97

Broad Fen Evaluation

Issues

- Browsing of scrub limited
- Summer grazed only owing to flooding in winter & limited adjacent dry ground

But…… success!

- ponies explored & utilised whole site
- grazing created good structural diversity

Learning From Experience

- Two very different sites:
  - size of site & infrastructure
  - animal management
- Some conclusions:
  - Animal background is key
  - Some breed differences, e.g. browsing
  - Social groups, i.e. sex and age structure
- Importance of monitoring for site and livestock

Conclusions

- Extensive fen grazing can produce favourable results
- Experimental nature in Broads means a certain amount of trial and error
- Importance of monitoring & learning from experience
- A mixture of livestock types may be best for the site, but can cause husbandry issues
- Important to maintain high welfare standards

2.6 Guest Lecture: Needingworth Quarry: From Mineral Extraction to Wetland Haven - Jeff Kew, Royal Society for the Protection of Birds

Creating Britain's Biggest Reedbed – The Hanson – RSPB wetland project

Andy Roberts, MLI. Principal Landscape Architect , Hanson Aggregates, Ashby Road East, Shepshed, Leicestershire, LE12 9BU

Jeff Kew BSc. MIEEM, Projects Development Manager, RSPB, The Lodge, Sandy, Bedfordshire, SG19 2DL

Abstract

The planned development of a new nature reserve incorporating the largest freshwater reedbed in the UK is an ambitious habitat restoration project that is the result of a partnership between Hanson Aggregates and the RSPB. The reedbed wetland reserve will be constructed in phases over the next 30 years at Hanson Aggregates new sand and gravel "super quarry" at Needingworth in Cambridgeshire. The project has benefited from the close involvement of the Minerals Planning Authority, Cambridgeshire County Council, which performed the dual role of facilitator as well as regulator during the planning process. The development of the project has necessitated the satisfactory resolution of a large number of technical and planning issues that have influenced the final design of the new wetland. The project has received a Royal Town Planning Institute National Award For Planning Achievement (2000) for planning and biodiversity, and has been nominated for the 2002 European Planning Awards.

Key Words: Biodiversity, Extraction, Partnership, Planning, Reedbed, Restoration, Water, Wetland.

Planning History

Policy Framework –The Cambridgeshire Aggregates Local Plan (1989)

In the late 1980's Cambridgeshire County Council revised its sand and gravel extraction strategy through a revision of its Minerals Local Plan. This entailed the concentration of production on three large sites in open Fenland – Needingworth, Block Fen (Mepal) and Eye/Thorney (Nr Peterborough).

The Cambridgeshire Aggregates Local Plan (1989) set the policy framework for restoration and while policy presumption for restoration to agricultural or forestry remains on high grade agricultural land, restoration for nature conservation can be considered on lower grade land where the community benefit is greater than that derived from other afteruses.

Proposed Development by Hanson Aggregates

Hanson Aggregates (formerly ARC) secured interests on the majority of land in the Needingworth (Willingham-Over) area of search in the late 1980s. This new mineral reserve provided the opportunity to replace three local Hanson operated quarries producing circa 1 million tonnes of aggregates with one new quarry capable of a similar level of production.

Planning Authority) indicated that they would be minded to consider the unusual step of consenting all the land in the area of search. This was a recognition of the scale of investment that would be required by the operator in terms of infrastructure to develop the

new reserves which involved contributing to a new bypass, and construction of a new river crossing, site access, and processing plant.

Proposed Development and the Potential for Nature Conservation Restoration

The Planning Application was submitted in 1993 with the majority of the area (516 ha) to be restored to agricultural use at existing and low level. The restoration scheme was prepared in the belief that the agricultural land was mostly in the high-grade categories of 3A and 2.

During the formal consultation, soil tests carried out by ADAS on behalf of MAFF revealed the majority of land on Over Fen to be grade 3B, falling outside the policy protection given to Best and Most Versatile Land (Grades 1,2 and 3A). This triggered the nature conservation interests including the RSPB to work together to produce an alternative restoration proposal. The nature conservation interests recognised there was no longer a policy presumption for agricultural restoration, and the potential to produce a nature conservation site of at least national importance. The site was deemed to have a particular strategic location adjacent to the internationally important Ouse Washes (SPA, part c. SAC, Ramsar, and SSSI) and therefore serious consideration should therefore be given to a nature conservation afteruse. The nature conservation bodies suggested that the site was suitable for the development of a large wetland nature reserve capable of supporting populations of at least national importance for wildlife.

Cambridgeshire County Council decided to determine the original application as it was consistent with policy to restore sites to a beneficial afteruse, in this case agriculture, but a proviso was included in the S106 agreement that Hanson Aggregates should produce a feasibility study to further examine the nature conservation restoration idea.

Nature Conservation Restoration Feasibility Study

The study was started in 1996 with RSPB representing the Nature Conservation interests. A combination of species and habitat priorities, arising from Biodiversity Action Plans, and the need to integrate a high degree of public access lent itself to the development of large wetland complex containing a high proportion of reedbed. The feasibility study concluded that subject to water availability a reedbed wetland could be developed and that the original low-level restoration concept at Over Fen should be retained in a modified form to maximize the area of that habitat relative to open water. To achieve the low level restoration a 10km length of low permeability clay perimeter seal would be needed.

Cambridgeshire County Council organised a public consultation exercise, including public meetings, to consider the idea of wetland restoration as an alternative to agricultural restoration. This consultation resulted in an 84% public approval rating for the new concept. Hanson Aggregates subsequently announced that they would progress the alternative restoration scheme with the RSPB as partners. A new planning application was subsequently prepared and submitted in June 1999 to quarry 27.8 million tonnes of sand and gravel and create a 700ha wetland nature reserve.

Key Planning Issues

Some of the key planning issues that needed to be addressed were flight safeguard zones (MOD), restoration and sustainability of the agricultural land (MAFF), water availability and flood bank stability (EA) and the views of the local communities. The proposed wetland lies within the flight safeguard zone of RAF Wyton and it was necessary to demonstrate that the wetland would be no greater risk, in terms of birdstrike, than the approved agricultural restoration scheme. The continued protection of the soil resource of both the 3B and relatively small area of grade 2 was an issue for MAFF. It was agreed to restore a 70cm layer of soils across the main bulk of the reedbed and exclude the 34 Ha of Grade 2 land from the

reedbed scheme. This would retain the long-term option of a return to agricultural use if necessary. Local communities continued to be supportive throughout the planning consultations although reassurances needed to be provided on a range of issues ranging from increases in road traffic due to visitors to malarial risk from mosquitoes.

Development of the Nature Reserve

The nature reserve will be created in phases over the next 30 years and represents a very ambitious habitat creation project, and a major partnership between Hanson Aggregates and the RSPB to develop and implement the project. Indeed this will become one of the largest manmade wetlands in Europe.

The rationale for creating the new reserve is based on restoring habitats that are in serious decline the proposed restoration will create a wetland of at least national importance supporting a characteristic range of reedbed and wetland species. Locally over 95% of original reedbed area has been lost from the Fens. Many of Britain's remaining reedbeds are sited near to the East Anglian coast and are threatened by coastal erosion that will be accelerated by anticipated sea level rise and increased storminess. By establishing this reedbed, it will provide one of the largest non-tidal reedbeds in the UK in a location safe from coastal erosion and future sea level rise. The proximity of the site to the Ouse Washes, (one of the largest examples of internationally important washland and lowland wet grassland in Britain and designated status SSSI, Ramsar site, SPA site and part c.SAC site) could complement their management through a beneficial reduction in summer flooding. This would potentially enhance the success of the nationally important assemblages of waders and waterfowl, which breed on the Ouse Washes. Other benefits of the close proximity to the Ouse Washes include additional nesting and roost sites for wildfowl and additional hunting areas on the washes for marsh harriers.

The establishment of an extensive area of lowland wet grassland was originally considered as an option for the restoration of the site. This could have provided an important area for breeding waders, including black-tailed godwit and wintering waterfowl. However, the key bird species associated with this open habitat are much more prone to disturbance than those of reedbeds and less compatible the scale of public access and informal recreation which was deemed desirable in this location. Reduced levels of public access would have been unlikely to satisfy the important planning consideration of providing a higher level of community benefits than the agricultural scheme. Reedbed species are better able to withstand disturbance due to the dense nature of the reedbed habitat. Therefore on this site reedbed would provide the greatest contribution toward meeting the Governments BAP targets, by supporting many species of conservation priority and concern and providing more extensive informal public access.

The objectives for the new nature reserve are:

- To establish a wetland of at least national importance that makes a substantial contribution to UK Biodiversity Action Plan targets for reedbeds and bitterns and support the characteristic assemblages of plants and animals that were once widespread in the Fens.
- To contribute to the alleviation of Ouse Washes Summer Flooding.
- To enhance the landscape through wetland creation and management.
- To provide informal recreational opportunities for the benefit of local communities and visitors.
- To provide an educational resource which will foster wider interest in, and support for, biodiversity and conservation.
- To provide a best practice example of beneficial conservation after-use following large-scale mineral extraction.

The new wetland will contain 460ha of reedbed created in 20-40 ha. bunded cells serviced by a high-level water carrier. Each cell will contain small meres linked together with ditches and channels. High water quality will be maintained and with it a self sustaining fish population. The reeds will be managed by periodic cutting with some cattle grazing into the edges of the reedbeds. The new nature reserve will incorporate 32 km of dedicated public Rights of Way, including bridle and cycle ways.

The new nature reserve will be managed by the RSPB and eventually will be known as Ouse Fen.

Water Requirements and Abstraction

The new reserve will be created in the driest region in the country with the main wetland area created at low level and isolated from the surrounding water table. Careful assessment of water requirements were made based on MOREX data to accurately predict evapo-transpiration rates with adjustments for climate change predictions. This led to the application for an abstraction licence for annual winter abstraction of up to three million m3. Thorough environmental assessment was undertaken together with an appropriate assessment in accordance with the Habitats Regulations, given the proximity of the Ouse Washes SPA.

The new wetland has been designed to receive water during flood flow conditions with a high intake rate of 5 m3/second and be capable of withstanding future drought. Examination of Great Ouse daily flow data revealed the probability of a one in twenty year inability to abstract water, due to low winter flows. Modifications were made to the design to enable deeper storage of water within the reedbed areas with a target winter water level of 0.6m. The design includes the capability to pump out water into the adjacent IDB system and to recirculate water in mid0-summer to reduce the risk of eutrophication.

RTPI NATIONAL Award For Planning Achievement (2000) – Planning and Biodiversity

This project recently received an award for Planning and Biodiversity from the RTPI in recognition of the quality of the planning work in developing this important project.

The judge's comments are reproduced in full:

"It is not often that a proposal on the scale of that at Needingworth Quarry in Cambridgeshire is enabled to proceed with scarcely a ripple of public discontent or environmental anxiety, and without the heavy hand of the Secretary of State seeking to treat the scheme as a Departure. That is a tribute to those involved and a measure of the achievement in circumstances where nearly 28 million tonnes of sand and gravel from almost 1000 hectares of land either side of the River Great Ouse will be extracted by Hanson Aggregates over the next thirty years.

A nature reserve of some 700 hectare will be progressively created including around 460 hectares of freshwater reed bed which in the process will provide almost 40% of the Government's target for such habitats and help secure the future of the bittern, one of the endangered species within the UK Biodiversity Action Plan.

The origins of the project lie in Cambridgeshire County Council's 1980s Mineral Development Plan which identified an Area of Search, whilst at that time envisaging agricultural afteruse. The alternative of a restoration scheme based on nature conservation was put forward by the RSPB and others which the Council helped to take forward, initially through a section 106 agreement attached to a 1993 permission requiring a feasibility study of the concept. This study subsequently demonstrated that conservation objectives could be incorporated into the design without compromising the requirements of the operator and that, in returning the land to a reed bed wetland, the historic landscape of the Fens prior to their drainage would in effect be recreated.

To achieve such an outcome in sensitive circumstances has required a constructive Council able to keep a proper distinction between its participatory and its regulatory role and to consult and carry the community with it. It also required a far-sighted approach by the nature conservation bodies concerned, particularly the RSPB, and a flexible response by the operator. The judges have been impressed by the way all parties have sustained this partnership to achieve what will become one of the largest man-made wetlands in Europe. The physical environment will be enhanced, and there will be economic benefits not only for the operator but also on terms of visitor attractions to a remarkable new landscape with access and rights of way created as the phased programme of extraction moves on. The judges have also been impressed by the care the operator has already taken through choice of colour to minimise the impact of machinery on the landscape.

Overall, the project demonstrates the classic but crucial role of the Council as an enabler able successfully to integrate and reconcile major commercial objectives with those of nature conservation, and in the process make a critical contribution to the UK Biodiversity Action Plan".

Next Steps

The project is now moving from the planning stage, with consents having now been obtained together with a £1Million contribution from the Hanson Environment Fund to support the RSPB's long-term management. The first phase of wetland restoration will commence in 2002/03 with further phases added on an annual or bi-annual basis. The site is being progressively opened to local people through the development of the public rights of way network. Development of promoted visitor facilities is scheduled from 2007. There is the prospect of a rapidly increasing population of breeding bitterns from 2010.

2.7 Sustainable Tourism for Local Communities and Visitors

2.7.1 Broads Plan 2004: An integrated and participatory approach to managing the Broads - Maria Conti, Broads Authority

Introduction

- The Broads Authority is bound by statute to review its **Broads Plan** every five years and vary it if appropriate. The Broads Plan 1997 has been reviewed and the Broads Plan 2004 has been completed. The Broads Plan 2004 is accompanied by a **five-year Action Plan** this provides the basis of an **annual Business Plan**.
- The Broads Plan 2004 is a **long-term strategy**, based on a **20-year vision**. This is consistent with the duration of the Broadland Flood Alleviation Project, which commenced in 2002, and provides a sufficiently long-term framework within which to consider major issues such as climate change. Within this timescale, the Authority would need to review the Plan at least every five years and vary it as appropriate.
- The Broads Plan 2004 is based on measurable and achievable objectives, with defined targets, that build on the earlier policies of Broads Plan 1997. Existing policies within the latter were reviewed early on in the process.
- The next **Broads Local Plan** (likely to be called a Local Development Framework) will follow in the wake of Broads Plan 2004. A similar consultation process will be used to identify key issues for informing the development the Local Development Framework as used for the Broads Plan 2004.

- Future **Best Value Performance Plans** (post 2004) will need to be fully integrated with the Broads Plan, demonstrating clearly how and to what extent Broads Plan objectives are being met. As emphasised in the 2002 Best Value Inspectors' Report, the Authority needs to become much more **customer (i.e. public) and outcome focused**. The next Broads Plan and accompanying process provides a major opportunity for establishing mechanisms and structures to address these shortcomings for both now and the future.
- The recent Green Paper on Planning reinforces the role of **community strategies**, which are developed at district level. In the case of national parks, their management plan needs to be incorporated within the relevant communities strategies (six in the case of the Broads).

Key Elements of the Process

Participatory process

- Crucial to securing wide support for preparing and, importantly, implementing the Broads Plan 2004 was to ensure that the process was transparent, participatory and inclusive from the outset. Thus, the process aimed at:
  - bringing together a wide range of organisations and individuals to create a common purpose and collective responsibility for the future of the Broads;
  - generating consensus around a set of objectives, based on a shared vision for the future of the Broads; and
  - engendering a strong sense of ownership amongst organisations and individuals in the objectives of the Plan.
- The three main groups of stakeholders closely involved in the process were:
  - people with information or skills relevant to the Plan and its preparation;
  - people affected by what happens as a consequence of the Plan; and
  - people with authority or resources to help implement the Plan.

  Thus, **stakeholders** comprised the following:
  - those who live or work in the Broads Executive Area;
  - visitors to the Broads;
  - partner organisations (governmental, non-governmental and corporate);
  - local authorities and parish councils; and
  - the wider public.

Forums

- Community forums were established and aimed at:
  - being inclusive (i.e. open to anyone), but with the full range of interest groups (including parish councils) targeted to ensure participation by a representative; and
  - providing a framework for local issues to be identified and potential objectives and actions formulated through workshops.

  Community forums established on a geographic and community sub-catchment area basis as follows:

  Middle Bure and Ant
  Lower Bure, Thurne and Trinities
  Middle Yare (east to Reedham) and Norwich
  Lower Yare (Halvergate/Haddiscoe) and Yarmouth
  Waveney and Lowestoft

It was also planned that **members of the Authority** would participate in each forum.

- The Broads Forum, newly established under the Authority's Development Programme, is representative of a wide range of organisations with an interest in the Broads, other than those already represented on the Broads Authority. It is well placed to contribute to and monitor the development of Broads Plan.

Statutory stakeholders

- Statutory stakeholders, including local authorities, participated in the development of the Broads Plan via their representative members of the Authority, as well as via other mechanisms involving members and officers. Their more local representatives participated via the community forums, as appropriate.

Steering Group

- Its purpose was to manage and pilot the planning process, but NOT to dictate policy. Membership comprised members of the Strategy and Resources Committee (13), officers of the Management Team (5) and the Chairman of the Broads Forum. (4 meetings/year)

Expert Advisory Group

- Its role was to provide external advice on the process, strategies and potential resources for addressing key issues. Members were key national experts and decision-makers (maximum of 6) within sectors relevant to BA's interests, the Chairman and Vice Chairman of the Authority, and officers of the Management Team. (2 meetings/year)

Facilitation

- Members agreed to engage consultants to help design and facilitate the consultation process. A well-designed and successfully implemented consultation process was crucial to the development and implementation of the Broads Plan. Experience from other local authorities with their local plans suggests that the consultation process is best carried out by independent consultants in terms of raising the credibility of the exercise and benefiting from expertise in facilitation. While this has traditionally not been the practice of national parks, a number of them recognise the advantages of such an approach in terms of coherence, independence, effectiveness and quickness.

Progress Design

- The process for the Broads Plan 2004 was designed at a facilitated workshop in July 2003, involving a selection of members of the Broads Plan Steering Group and officers from the Senior Management Group.
- The process is summarised in Appendix 1. By way of explanation, imagine a matrix, with stakeholders as columns along one axis (x) and time as rows along the other (y). The actual cells of the matrix represent the various products (eg process plan, workshops, deposit plan etc) and show when stakeholders are able to engage with them. There is also an additional column (No. 2) that tracks the main actions over time. The matrix also tracks Committee cycles for approvals/guidance at the various stages.

- The process involved the following key steps and elements:
  - Process plan provided to key stakeholders to information and feedback. Also included an invitation to a workshop early in November.
  - Issues brochure prepared and sent to key stakeholders to prepare them for the workshop.
  - Similarly, issues brochure was made available to members of local communities and parish councils, with an invitation to a workshop in their area.
  - Meanwhile, a team of Broads Authority officers was trained in September, ready to help with facilitating workshops in November and December.
  - Wider public sampled and also provided with access to issues brochure to which they were invited to respond in writing.
  - Outputs from workshops and public responses informed drafting of Broads Plan which was deposited by early May for consultation.
  - 3-month consultation of deposited Plan during which a second round of key stakeholder and community workshops was held to consider controversial issues and specific actions for incorporating in the Plan.
  - Consultation ended in July 2003, final preparations, and adoption of plan by members in Sept-November, with launch in January 2004.

Structure of the next Broads Plan

- The Broads Plan 2004 is a concise, strategic and SMART (Specific, Measurable, Achievable, Realistic and Timely) document of about 70 pages, in which issues, objectives and targets are clearly identified in a coherent manner. One model generated by staff that merits further consideration is based on the following: Vision for the Broads, Mission for the Broads Authority, Strategic objectives, and an Action Plan.

- In line with the Authority's more integrated approach to its committee and organisational structures, it was proposed that the first part of the Plan focuses on key themes, rather than statutory functions, and the second part on the community forums areas. Common issues such as sustainable development and social inclusion will need to be mainstreamed across the entire Plan. A possible draft contents list is outlined below.

Broads Plan - A Possible Structure

1. Executive Summary (2pp)
   - Vision for Broads
   - Signatures of partners
   - Acknowledgements
2. Introduction (2pp)
   - About the Broads national park
   - About the Broads Authority
   - About the Broads Plan process
   - About the wider context (e.g. Best Value, Community Plans)
3. Key Themes x 4-6 (12 pp)
   - Background (key features, scale)
   - Key issues, threats and opportunities
   - Overall aims and policies
   - Key objectives, with actions, lead partners, targets and measurable outcomes
   - Resources
4. Community Areas x 5 (2 pp each)
   - Map of area
   - Key issues and possible scenarios over next 20 years, threats and opportunities
   - Possible scenarios and desirable outcomes over next 20 years
   - Key objectives, with actions, lead partners, targets and measurable outcomes
   - Resources

4. Evaluation (1 p)

(27 pp in total)

Summary and schedule of the Broads Plan process (2002-2004)

Committee meetings are in italics.

Target date	Action	Broads Authority Committees			Key stakeholders[1]	Local communities	Public
		Broads Authority	Strategy & Resources[2]	Broads Forum			
16 Aug.	PLAN PROCESS		Review draft process plan and key issues[3]				
30 Aug.					Inform and consult on process plan. Invite to workshop.		
12 Sept.	SCOPE KEY ISSUES			*Inform about process plan and scoping paper on key issues*			
23 Sept.			*Scoping paper on key issues*				
Early Oct.					Provide scoping paper on key issues and questionnaire on special qualities.	Provide[4] and make available[5] scoping paper on key issues and questionnaire on special qualities. Invite to workshops.	Provide[6] and make available[7] scoping paper on key issues and questionnaire on special qualities.
26-27 Sept.	**TRAIN**	15 staff trained in facilitation					
21 Oct.			*Update*				
8 Nov.		*Report on process plan and scoping paper on key issues*					

[1] Key stakeholders include statutory bodies represented on the Authority, non-statutory bodies on the Broads Forum and other organisations with whom the Authority works in partnership.
[2] Note that members of this committee, Management Team and the Chairman of the Broads Forum comprise the Steering Group for the Broads Plan.
[3] Key issues to be arranged under the following 7 themes: Water quality and quantity, Recreation and tourism, The waterways, Landscape, Habitats and wildlife, Built and local heritage, Promoting understanding.
[4] To members of existing BA liaison groups, participants of BA's Annual Public Meeting, parish councils
[5] Via BA website, press releases, local libraries, parish council/community notice boards
[6] To stratified random sample of visitors to Broads and other users (eg tolls payers)
[7] Via websites (eg BA, NATA, EETB)

Target date	Action	Broads Authority Committees			Key stakeholders[1]	Local communities	Public
		Broads Authority	Strategy & Resources[2]	Broads Forum			
6 Nov.	ENGAGE WITH STAKEHOLDERS				STAKEHOLDER WORKSHOP[8] based on 7 themes		
12 Dec.				*Report on stakeholder workshop outputs*			
by 13 Dec.						5 COMMUNITY WORKSHOPS[9]	
20 Jan.	DRAFT DEPOSIT BROADS PLAN		*Report on stakeholder and community workshop outputs*				
7 Feb.		*Report on stakeholder and community workshop outputs*					
6 Mar.				*Early draft of Deposit Plan for Consultation*			
7 Apr.			*Deposit Plan for Consultation*				
25 Apr.		*Deposit Plan for Consultation*					
Early May		**Deposit Broads Plan for consultation**					
May-Jun.	CONSULT ON DEPO				STAKEHOLDER WORKSHOP	5 COMMUNITY WORKSHOPS	

[8] Key stakeholders will be provided with opportunity of follow-up meetings with BA officers as required.
[9] Community workshops based around the following 5 areas: Middle Bure and Ant; Lower Bure, Thurne and Trinities; Middle Yare (east to Reedham) and Norwich; Lower Yare (Halvergate/Haddiscoe) and Yarmouth; Waveney and Lowestoft.

Target date	Action	Broads Authority Committees			Key stakeholders[1]	Local communities	Public
		Broads Authority	**Strategy & Resources[2]**	**Broads Forum**			
29 May				*Deposit Plan for Consultation*			
30 Jun.			*Review responses to Deposit Plan*				
18 July		*Review responses to Deposit Plan*					
25 July		**End of consultation period for deposit Broads Plan**					
Early Sept.	**FINISH PLAN**			*Broads Plan*			
Late Sept.			*Adopt Broads Plan*				
Early Nov.		*Adopt Broads Plan*					
End Nov.		Broads Plan to printers					
Jan.		**Launch Broads Plan**					

2.7.2 Promoting Understanding in the Broads - Jess Tunstall, Broads Authority

Promoting Understanding in the Broads

High quality, effective communication is essential to help people understand and enjoy the Broads in ways that do not damage its natural and cultural features or its sense of space and tranquillity.

Promoting understanding secures public and, therefore, political support for a shared vision of the Broads. Promoting understanding ranges from providing information to visitors about facilities and things to do in the Broads or to local people about the role of the Authority, to describing complex research and management tasks to those interested. It is important to ensure that everyone who wishes can access information appropriate to their needs using a variety of means.

In its recent review of national parks, Government encourages national park authorities to promote greater understanding of national parks among a wider audience, including those from urban areas, ethnic minorities and young people. With this in mind, and in order to clearly identify and promote the national park status of the Broads, the Authority is seeking to change the name of the area to 'The Broads National Park'. As this may require legislative changes, the Authority will change its branding in the meantime to make more explicit its membership of the national park family.

Publications

The Authority produces many high quality publications and other interpretation for local people and visitors. Over one hundred thousand copies of the Broadcaster visitor newspaper are printed annually and delivered to boatyards, pubs and other service providers in the area. It has stories on the Broads and the work of the Authority, it also contains accommodation listings and where to eat in the Broads. It is now a well established and well know document which attracts much local advertisements which fund 95% of the production costs. The Authority also produces many tourist information and interpretation leaflets.

Information Centres

The Authority manages a network of five small information centres. Information and interpretation about the Broads' environment is displayed alongside information on local attractions, accommodation, boating and other activities. Talking face-to-face to a knowledgeable, friendly member of staff is a key part of the Authority's communications. Many people rely on electronic communication, but the opportunity for personal contact with the Authority's information centre staff and also the countryside and navigation rangers, seasonal wardens and other staff is invaluable.

Events

The Authority runs annual events programme attracting approximately 10,000 people. The events are low-key, fun occasions, encouraging people to enjoy the Broads in a sustainable manner. The Wherry Tour is a central part of the programme. The Authority hires three traditional sailing boats and offers visitors short sailings - giving them a taste of the past and getting the boats seen out on the rivers. The Authority also commissions special environmental shows from a local puppet company - aimed at children and adults. The show is also performed in schools.

Besides events for visitors and local people the Authority stages media days to launch particular projects. Newspaper and television coverage means the Authority's message reaches many people nationally as well as locally, and on occasions, internationally, with example, the launch of Britain's first solar powered passenger-carrying boat. Professional seminars and conferences such as the Living Lakes 2003 conference afford the opportunity to share technical information as well as promote the Broads as an internationally important wetland.

Website

The Authority's website was originally designed to be a basic information facility. With over 40,000 hits last year and many web email enquires it is now recognised that the website is primarily used for tourism. The government's 'Implementing Electronic Government' project obliges the Authority to ensure all of the Authority's services and information is available electronically. Work is in progress to develop this next stage.

Access for All

The Authority wishes to make all information and events accessible to everyone. It produces it major publications and reports in large print and on audiotape. The Authority also designs events suitable for people with mobility problems and has assisted hearing equipment on some of its boat trips. From experience it is known that it is not enough to just make these services available but they have to be advertised in magazines and papers aimed at people with disabilities. The Authority has recently produced a prototype Access Pack for the Barton Broad Boardwalk - this includes Braille information and a specially produced CD.

2.7.3 Tourism in the Broads and The Broads Quality Charter - Bruce Hanson, Broads Authority

Introduction

For the greater part of the twentieth century the traditional image of tourism in the Broads has been the boating (or perhaps 'floating') holiday. For the great majority of people this has meant a week, or possibly two weeks, aboard a motor cruiser hired from one of the many boatyards around the river system. Sailing has always been popular, along with other quiet activities such as bird-watching and fishing, but the hire-cruisers for long have been dominant in the Broads.

During the last quarter of the century this pattern began to change, and a steady decline set in. The hire fleet shrank from a high point of approximately 2500 boats to less than 1200 today, bringing serious repercussions for the local economy. The reasons for this are complicated, but they are clearly linked to the relentless growth of the overseas package holiday, which has changed the face of the entire domestic UK holiday industry.

The Role of the Broads Authority

There is an in-built tension in the Broads Authority's role, as with all other UK National Parks, in that the demands of wildlife and nature conservation must be balanced with consideration for the social and economic needs of the local inhabitants. To address this the Authority developed an approach that is today called sustainable tourism – before the term was ever invented. In practice this has meant an almost minimalist technique – providing information and education in a quiet, low-key way so that people hardly realise that they are being

educated. The Authority's expertise has been widely acclaimed and it played a pioneering role in the early stages of the development of the European Charter for Sustainable Tourism in Protected Areas, and it was closely involved in the landmark publication 'Loving Them To Death'.

Information and Fun

The Broads Authority operates a network of small-scale information centres at strategic locations around the Broads. These are valuable to land and water-based tourists alike. Waiting for people to come through your doors is not enough, however, and the Authority has always sought to go out and actively engage people wherever possible.

Education is a serious business, but there is no reason on Earth why learning should not be fun. The Fun in the Broads programme consists of a series of events held throughout the National Park, which enable the Authority to promote its message directly to the public. An example of this is a puppet show, specially commissioned every year on an environmental theme. Another example is the annual Wherry Tour, where traditional Norfolk sailing vessels, crewed by Authority staff, take the public on a series of short sailings around the river system. This provides exceptional opportunities to promote our work almost on a one-to-one basis, as well as a wonderful experience for our visitors.

The Authority operates four electrically powered boats, which again give people the opportunity to experience the natural world in a very intimate and special way. One of these craft, the Ra, is the first solar-powered passenger vessel to sail in Britain.

A network of bike and canoe hire centres has been set up to provide further opportunities for people to get out of their cars and into the loveliest and least accessible places. These are to be developed further to provide 'package' holidays in themselves.

A Future of Quality

There are many excellent places to eat, drink and sleep in the Broads, but sadly there are some establishments that do not meet the standards that most of us expect to day. To address this problem the Broads Authority has launched a quality assurance scheme, known as the Broads Quality Charter. It was launched in the southern area with a publication known as the Secrets of the Southern Broads, and work is now in progress to extend it to cover the whole of the National Park. The aim is to gently nudge standards upwards where they are lacking, and to provide training and marketing assistance. An environmental standard has not yet been applied to this, but a package is being developed with this in mind.

The Broads Authority will shortly be submitting an application to Europarc to become the first UK National Park to be accredited with the European Charter for Sustainable Tourism in Protected Areas. This will provide a valuable framework to develop new and existing initiatives, and it will at the same time provide a focus to help to drive them forward.

2.7.4 Putting Theory into Practice: The Trinity Broads - Cath Johnson, Broads Authority

Trinity Broads

- Located NW of Great Yarmouth
- The Trinity Broads account for 14.1% (250ha) of the 3,640ha of open water space in the Norfolk and Suffolk Broads
- Nutrient gradient exists from the north to the south
- Relatively good existing water quality

Natura 2000 network – Trinity Broads SAC

- Natural eutrophic lakes
- Hard oligo-mesotrophic waters
- Calcareous fens
- Alluvial forests

Restoration of Ormsby Broad:

'To create Clearwater conditions to produce a self-sustaining aquatic macrophyte community'

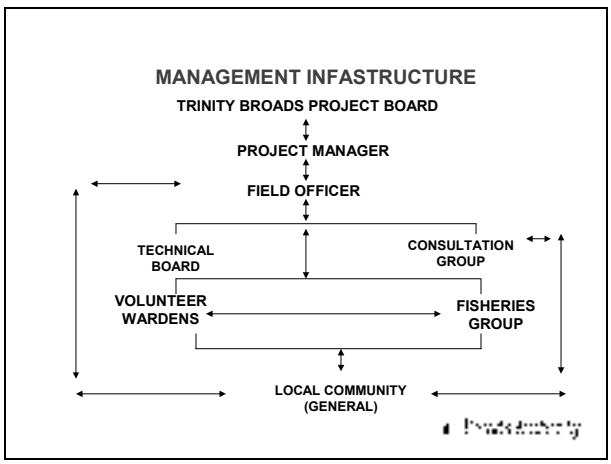
1994 Essex and Suffolk Water Company buy majority of Trinity Broads
Total Ownership 250ha
1995 ESW, BA and EA commence EU LIFE funded project

A Partnership Approach

A partnership was formed with the Broads Authority, Environment Agency, English Nature and Essex and Suffolk Water Company, formalised through a Memorandum of Agreement in November 2001.
The present relationship relies on trust and involvement

- Trinity Broads Consultation Group
- Trinity Broads Voluntary Wardens
- Trinity Broads Fisheries Conservation Group

The partnership brings specific areas of expertise to the project, as well as joint resources and local knowledge and expertise. The partners also have joint responsibility under EU legislation including the Water Framework Directive and Habitats Directive.



Management framework
The overall aim of this partnership is to restore the ecological status of the Trinity Broads for the benefit of nature conservation, public water supply and recreation.
The Management Plan provides a framework to ensure that:

- Wildlife and habitats are protected and enhanced
- Recreation activities are managed at an appropriate level

Management Objectives:

- To maintain and improve the water quality
- To maintain and improve the semi-natural reedswamp communities
- To maintain the alder carr woodland
- To maintain appropriate levels of recreation
- To maintain landscape value
- To maintain a sufficiently large habitat to ensure the long term recovery of the bittern population
- To help maintain undisturbed habitat to support nationally important numbers of wildfowl

Community involvement:

- Building relationships with local communities
- Involving local people in the management and monitoring
- Implementing community led projects
- Employment and training local people

Some examples of community involvement:

- Management of broad-shore habitats
- Construction of fishing platforms, disabled access and landscaping Rollesby car park
- Provision of a 'Wheely Boat' at the Eels Foot Inn
- Filby First School Wildlife area
- Improvements in interpretation
- Filby Parish Staithe

Future Projects:

- Filby broad-shore enhancement scheme – partnership with the Parish Council
- Monitoring water voles and otter populations in relation to mink
- New volunteer structure with new opportunities
- Review of Management Plan

Conclusion:

- The importance of partnerships projects
- Links to the New Broad Plan
- Template for a 'good working model'

2.8 Guest Speaker: Engaging Stakeholders across Society - Kate Mackenzie, British Trust for Conservation Volunteers

The Changing Face of BTCV

Environments for All
www.btcv.org

BTCV work involves:

Not just:
Countryside, landscape and wildlife

But also:
- opportunities to volunteer
- improving towns and cities
- building communities
- developing skills
- helping people into work

Our future:

- Products: healthy communities. Life skills, green spaces management
- People
- Measuring success
- Governance
- Vision and values

Environmental Governance
- Whose voice
- Define the stakeholders
- The end goal – for whom? At what cost?
- Valuing outcomes

Who are our stakeholders?
- Community groups, schools and individuals
- Landowners and land managers
- National parks/protected areas
- Business and industry
- Central and local government
- International partners

Vision and Values
- We see a better environment where people feel valued
- We value people, the communities in which they live and the quality of their environment

Establishing values
- Inclusiveness and choice
- Support
- Empowerment
- Environment
- Impact
- Corporate responsibility

Inspiring people, improving paces
- Diversity and equality
- Celebrate cultures
- Outreach work
- Quality of Life

To promote good practice
- Training on cultural diversity and equal opportunities to staff and trustees
- Producing a community and diversity toolkit
- Involving communities in determining future policy
- Encouraged staff to visit and learn form the pilot projects
- Local diversity action plans

3 Feedback

3.1 Feedback from participants at the end of each day's training

At the end of each day the participants, in small groups were asked to address two questions and then feedback to the rest of the group:

- What was most useful for my work
- What didn't I understand

The usefulness of each day was summarised. Where issues or details were not understood these were either answered or sources for finding out further information presented.

Tuesday 20th April
Understanding the Hydrology of Wetlands

What was most useful for my work?

- Model for collaboration between government and non-government organisations to convince local communities, accept and collaborate for the implementation of Management Plans and environmental measures
- Involvement of public, information and interpretation
- Examples of different types of marshes especially English
- Use of simple methods by Non-Governmental Organisations (NGOs) such as Suffolk Wildlife Trust to extend knowledge – environmental education
- Precise water management
- Project as demonstration of restoration of a wetland – the whole package of good practice
- Hydrology and hydrogeology is very important to wetland function
- Sustainable management of vegetation ie people to machines to grazing animals

What didn't I understand?

Question	Some ways of finding out
Some English terms	Check through papers Glossary in Kevin's papers
Sources of references in Kevin's lecture	Speak to Kevin
What is the function of Redgrave and Lopham Fen eg in Balaton the wetland is used for the removal of N and P	R&L is a wetland in its own right. Look through leaflets/papers for European designation
Where were we on the map?	Show people a map Produce a map showing where we will be each day.
More clarification of landownership, compensation for landowners	Ask Broads Flood Alleviation Project ie Cath on Friday or participants on course Ask SWT – Andrew Excell about R&L Fen
How was information collected from stakeholders at R&L fen? eg meetings and questionnaires?	Find out from Andrew Excell - email
Observation – why have Suffolk Wildlife Trust not made water balance when they have been collecting so much information? Why no gauge on the fen?	
How was the location of the borehole decided on? What is the long-term impact?	Email Andrew Excell. BA to email Andrew with questions and email response to participants.

Wednesday 21st April
Rivers and Broads: Research, Management and Restoration

What was most useful for my work?

- Biomanipulation technology
- Sewage Treatment
- Cobweb brushes as artificial refuge
- Sediment removal techniques
- Public awareness, and use of different boats to raise awareness eg: Ra
- Floating island
- Perception of Broads Authority and the integration with other organisations. Politics compromising over restoration
- Car park, picnic area and boardwalk, interesting and useful information. Broads very different from Bulgarian wetlands
- Promotion of eco-friendly boats and limits to boat numbers

What didn't I understand?

Question	Way of finding out
More information about Suffolk Wildlife Trust	Look at the web site www.wildlifetrust.org.uk/suffolk
Control of invasive species eg Candian and Egyptian Geese. What is the Broads Authority perception?	In order to manage the important habitats and species in the Broads, the control of invasive, non-native species is part of the strategy. The key is using the method which brings the most return for effort.
Sediment technology – volume, lagoons, chemistry	Start with the Broads Authority web site www.broads-authority.gov.uk, and follow path to Barton Project. There are options under research to follow up on some of the references (particularly the BARS reports – some were handed out on the Rivers and Broads day)
Why can't people swim in the Broads? Is it banned?	People can swim, but it is not encouraged/promoted because of safety. There are a lot of boats on the river in the summer.

Thursday 22nd April
Fens and Drained Marshes: Their Restoration and Management

What was most useful for my work?

- Seeing the livestock farm and the technology
- Good relations between the farmers and Broads Authority
- Seeing how agri-environment schemes are implemented on the farm
- Discussion on how far to look back in the past – what is traditional?
- Different types of grazing. It was interesting to hear about grazing projects

What didn't I understand?

Questions	Where to find out more/answer
Why wasn't the livestock farmer producing organic cattle?	• The farmer cannot routinely worm in an organic system • The whole farming system would need to change to become organic with less inputs • The organic subsidy has been removed

Friday 23rd April
Sustainable Tourism for Local Communities and Visitors

What have I learnt today for my work?

- Collaboration between private/ state agencies and NGOs
- Well-organised and complex tourism products
- Broads Quality Charter – the booklet highlighting quality, which included those not making the mark
- Information about the region
- Canoeing for the first time
- Not alone in developing tourism
- Seeing people's backyards

What didn't I understand?

Questions	Where to find out more/answers
Are targets self-imposed or from Government?	Some targets are linked to legislation eg: 95% SSSIs must be in favourable condition by 2010 (Habitats Directive); other targets are Broads specific eg: The Broads Boating Holidays Project action plan
Is the Broads Plan co-ordinated with Local Plans from the Local Authorities?	The Broads has its own Local Plan (for Planning) which is complementary with adjacent Local Authorities Local Plans. It is also important that they refer to and take up the Broads Plan.
How joined up is the Broads Plan?	It is joins up partners working in the broads including local community, and the work of the Broads Authority staff.
Did the Broads Authority consult visitors? Was there a visitor evaluation for the Broads Plan?	We did not directly, but made visitors aware of it through the web site and Broadcaster magazine. The tourism agencies carry out their own evaluations, which contributed to the Plan.

On the final evening participants were invited to identify**:**

The one activity I've enjoyed most from the course

- Sutton Fen was a privilege to visit
- Visiting Beckhithe Farm at Halvergate
- All the field visits
- Trip on the solar boat 'Ra'
- Feedback sessions
- Biomanipulation
- Listening to people who are committed to the Broads
- Living Lakes concept – networking
- Making new friends and contacts
- The mix of theoretical information backed up with practical examples and field visits
- Learning about tourism in protected areas
- Speaking English
- Meeting people who believe they can save nature
- Collaboration of bodies to protect nature
- Walking at Sutton Fen to see the grazing
- Inspiration to organise a course in my own country

3.2 Evaluation at the end of the Training Course – Course Evaluation Form

EVALUATION FORM

Training Course in Wetland Management and Restoration carried out by the Broads Authority, 30th September to 5th October 2002, Norwich, UK

1. What do you think about Topic 1 on 'Understanding the Hydrology of Wetlands'?

☐ *very interesting*
☐ *interesting*
☐ *satisfactory*
☐ *less interesting*
☐ *not interesting*

Was it useful for your work at home?
☐ *very useful*
☐ *useful*
☐ *satisfactory*
☐ *less useful*
☐ *not useful*

2. What do you think about Topic 2 on 'Rivers and Broads: The Research, Management and Restoration'?

☐ *very interesting*
☐ *interesting*
☐ *satisfactory*
☐ *less interesting*
☐ *not interesting*

Was it useful for your work at home?
☐ *very useful*
☐ *useful*
☐ *satisfactory*
☐ *less useful*
☐ *not useful*

3. What do you think about Topic 3 on 'Fens and Drained Marshes: Their Management and Restoration'?

   ☐ *very interesting*
   ☐ *interesting*
   ☐ *satisfactory*
   ☐ *less interesting*
   ☐ *not interesting*

   Was it useful for your work at home?
   ☐ *very useful*
   ☐ *useful*
   ☐ *satisfactory*
   ☐ *less useful*
   ☐ *not useful*

4. What do you think about Topic 4 on 'Working with Local Communities and Visitors'?

   ☐ *very interesting*
   ☐ *interesting*
   ☐ *satisfactory*
   ☐ *less interesting*
   ☐ *not interesting*

   Was it useful for your work at home?
   ☐ *very useful*
   ☐ *useful*
   ☐ *satisfactory*
   ☐ *less useful*
   ☐ *not useful*

5. Which of the topics did you like best? Why?

   _____
   _____
   _____

6. What would you have liked more of or less of?

   _____
   _____

7. What do you think of the timetable of the Training Course?

   ☐ *very good*
   ☐ *satisfactory*
   ☐ *less satisfactory*
   ☐ *not satisfactory*

8. Were you happy with the general organisation of the course?

- ☐ *very happy*
- ☐ *happy*
- ☐ *less happy*
- ☐ *not happy*

9. Were you happy with the accommodation and the catering?

- ☐ *very happy*
- ☐ *happy*
- ☐ *less happy*
- ☐ *not happy*

10. How did you find the Training Course on the whole?

- ☐ *very good*
- ☐ *good*
- ☐ *satisfactory*
- ☐ *less satisfactory*
- ☐ *not satisfactory*

11. Could you describe your expectations in applying for the Training Course?
Which of your expectations did we meet?

_____
_____
_____

12. Do you have any suggestions for improvements?

_____
_____
_____

13. Further comments:

_____
_____
_____

First Name and Surname: _____

Organisation: _____

Street or Postbox: _____

Postal Code, City: _____

Country: _____

Telephone: _____

Fax: _____

E-mail: _____

Please hand in the Evaluation Form after the course or send it to the following address:

Lesley Sayer
Secretary/Administrative Assistant
Broads Authority
18 Colegate
Norwich
Norfolk NR3 1BQ
UK

Fax: +44 (0)1603 765710

Thank you

3.3 Responses from Course Evaluation Form

Note: The responses are summarised in the tables below. They are based on a total of 14 completed and returned evaluation forms. (The total number of participants was 19).

N/A = Not Applicable

Question 1		Very Interesting	Interesting	Satisfactory	Less Interesting	Not Interesting
(a)	*What do you think about Topic 1 on 'Understanding the Hydrology of Wetlands'?*	**12**	**2**			
		Very Useful	Useful	Satisfactory	Less Useful	Not Useful
(b)	*Was it useful for your work at home?*	**7**	**7**			

Question 2		Very Interesting	Interesting	Satisfactory	Less Interesting	Not Interesting
(a)	*What do you think about Topic 2 on 'Rivers and Broads': The Research, Management and Restoration?*	**12**	**2**			
		Very Useful	Useful	Satisfactory	Less Useful	Not Useful
(b)	*Was it useful for your work at home?*	**7**	**6**			

Question 3		Very Interesting	Interesting	Satisfactory	Less Interesting	Not Interesting
(a)	*What do you think about Topic 3 on 'Fens and Drained Marshes: Their Management and Restoration'?*	**11**	**2**	1		
		Very Useful	Useful	Satisfactory	Less Useful	Not Useful
(b)	*Was it useful for your work at home?*	**7**	**4**	**3**		

Question 4		Very Interesting	Interesting	Satisfactory	Less Interesting	Not Interesting
(a)	*What do you think about Topic 4 on 'Working with Local Communities and Visitors'?*	**8**	**4**	**1**	**1**	
		Very Useful	Useful	Satisfactory	Less Useful	Not Useful
(b)	*Was it useful for your work at home?*	**4**	**5**	**4**		**1**

Question 5

Which of the topics did you like best? Why?

Comments

- I enjoyed topic 2 most. The presentations were very good, the topic most interesting. Linked well with Trinity Broads and work of ESW
- I like most topics 2 and 3, as they gave me an example for the restoration techniques used. The habitats I saw differ from what we have in Bulgaria and this experience broadened my 'restoration' horizons
- The three are very interesting, but I do like best topics about management and restoration because are most useful in my work and are topics in which I am personally interested
- All topics were relevant and interesting, but sustainable tourism for local communities and visitors was more directly relevant to me.
- Topic 2 for me as a hydrologist (quantitative) was a new aspect of my work
- Sustainable tourism for Local Communities and visitors because in my country now they are preparing a programme for the sustainable development of tourism
- Hydrology of Wetlands. It might be most useful for my work
- Hydrology of wetlands – this is my area of research at Bristol
- All of them were very good, nevertheless, the idea to organise a similar training course in my own country is the best for me. It is a good activity to increase the environmental awareness of different ages of people from children to adults
- Visiting the environmentally friendly farm. It was new for me (especially as in Hungary keeping cattle is not encouraged).
- Topic 2 after having learned lots about wetland restoration/function/management in theory at university it was useful to see and get to know more about practical examples
- I enjoyed the walk around Sutton fen to see environmental management in action
- Topic 2 because out wetland in Greece includes a large river delta and experiences are transferable

Question 6
What would you have liked more of or less of? Comments • There needs to be a balance of topics across the range of factors that influence management of the Broads. The balance of the course was right, covering those factors • Most of all I liked the practical operation of the course. Eacg course was backed with a on-site visit. • Understanding the Hydrology of Wetlands is a complex topic, for that I wanted to learn more about it. • The role of staff and especially volunteers was not given sufficient emphasis. The BTCV presentation was in some way a missed opportunity here. More case studies and discussion of experiences needed. • More about embankment restoration (natural embankments) • Everything was more useful and interesting. I have liked more and more canoeing. • More technical discussions including case studies, problems encountered, how solved, practical work undertaken, results, conclusions and a field visit. Less sustainable tourism. • The training course was a well organised course with a lot of interesting programmes, presentations and practices (field trips). • More walking during excursions would have been great to balance the nutrient – nice food at the hotel! • I thought the course was about right, for foreign visitors there could have been a trip to Norwich • More practical restoration measures with technical guidelines. More contact with NGOs exchanging experiences about habitat management and visitor guidance.

Question 7		Very Good	Satisfactory	Less Satisfactory	Not Satisfactory
	What do you think of the timetable of the Training Course?	**12**	**2**		

Question 8		Very Happy	Happy	Less Happy	Not Happy
	Were you happy with the general organisation of the course?	**13**	**1**		

Question 9		Very Happy	Happy	Less Happy	Not Happy
	Were you happy with the accommodation and the catering?	**13**		**1 (catering)**	

Question 10		Very Good	Good	Satisfactory	Less Satisfactory	Not Satisfactory
	How did you find the Training Course on the whole?	**12**	**2**			

Question 11

Could you describe your expectations in applying for the Training Course? Which of your expectations did we meet?

Comments

- I wanted to set a conservation perspective of environmental management
- All!
- Field trips were very nice. I liked them.
- I would have liked to know international experience in connection with wetland restoration to later adopt and implement the different technologies and methods.
- I wanted a background into wetlands, their management problems etc. My expectations have been met.
- You met all my expectations
- I expected lots about nature conservation and this aspect was well covered, also in the discussions I had with the other participants of the course.
- A professional and challenging approach to wetland management and restoration. All expectations were met fully.
- My expectations have been completed because my intention was to learn the last techniques of management and wetlands restoration and I think that this has been completed satisfactorily.
- My expectations were to see and be explained others experience in wetlands restoration and management and they were met.
- I haven't got any expectations
- I was unsure if I would find the workshop interesting and enjoyable. I was extremely glad to go and found it a useful insight into the background of the work I do.
- The programme was detailed and the expectations accordingly high! The Broads as a partner in the Life Environment programme where known and of great interest for us.

Question 12
Do you have any suggestions for improvements? Comments • Perhaps you could ask candidates to prepare an A4 page with pictures of their own roles in their countries • One dinner at some restaurant in Norwich would be nice! To see something of the city • I would be more interested in technical details like hydraulic, hydrological details, modelling and water balance • When we visit places outside it would be useful to be given earphones to cut out the noise of wind and other outdoor noise • All slides must be readable. On the bus trip it would be helpful to have a map showing us where we are going • No! • Perhaps some further focus on the funding mechanisms and experiences of such work • The course and organisation were perfect. No suggestions, or maybe one, let participants have some time of their own in Norwich to enjoy it as we could not. • I was unable to attend the evening lectures as I was eating at home. I think this was the case for most local delegates. Could they be made earlier next time. • Include cultural and traditional affairs in topics and visits, especially in relation to Sustainable Tourism - Visitors

Question 13
Further comments: • Presentation skills of most of the speakers were high, but some need reminding that the use of idioms (forms of expression peculiar to English) are not helpful to a multi-lingual audience. • I enjoyed the course very much. The feedback sessions at the end of each day were very well guided by the course staff • To organise more and more training courses such as this and have many successes • I enjoyed very much the training course, especially the field visits. I will try to use lots of things for my work that I saw here. • A good ice-breaker might be to have a map of Europe and each delegate stand up and tell us where they live • Thank you very much for the opportunity to take part in this training course • It was wonderfully organised by thinking about the smallest details like cleaning hands and spare Wellington Boots • Thanks you Lesley and Julia for running the event their enthusiasm helped make it a very useful and enjoyable event. 'DE-stress' the programme a bit.

4 List of Participants

Name	Country	Institution
Cornelis de Wijs	NL	Freelance Water Resources Specialist
Antonio Guillem Avivar	ES	Fundacion Global Nature, Project Partner
Sabine Jantschke	D	Fundacion Global Nature
Eleni Daroglou	GK	Living Lakes Partner (EPO Greece)
Evangelos Tsompanopoulos	GK	Living Lakes Partner (Hrysoupolis Town Council)
Zita Egerszegi	HUN	Living Lakes Partner (Lake Balaton Agency)
Barbara Kuborczik	HUN	Living Lakes Partner (Lake Balaton Agency)
Sabina Lubaczewska	POL	Living Lakes partner (Pro-Natura)
Ivaylo Zafirov	BUL	Ministry of Environment and Water, National Nature Protection Service
Stoyan Mihov	BUL	Ministry of Environment and Water, National Nature Protection Service
Svetlana Ivanova	BUL	Regional Inspectorate of Environment and Water - Rousse
Emese Horvath	HUN	VitukiConsult Rt.
Stephen Cordel	UK	Broads Authority
Julia Corsar	UK	Broads Authority Volunteer
Paul Rao	UK	Broadland Environmental Services Limited
Jeremy Halls	UK	Broadland Environmental Services Limited
Christian Whiting	UK	Broadland Environmental Services Limited
Tanja Hoffman	UK	Broadland Environmental Services Limited
Kim DeBlock	UK	DEFRA Rural Development Service
Katherine Trehane	UK	DEFRA Rural Development Service
Michael Mack	UK	DEFRA Rural Development Service
Nicholas Johnson	UK	Environment Agency
Rebecca Christian	UK	University of Bristol
Roger Smith	UK	Whitlingham Charitable Trust

5 Contact details for the Training Course

Speaker(s) and Job Title	Country	Institution	Address	Phone Fax E-Mail
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