

**NE comments on Catfield Hall Estate Fens (Ant Broads, Norwich) report by Dr. Aat Barendregt, Utrecht University 19.7.13**

1. We welcome the insights of non-UK fen specialists.
2. 'Fen' in the UK is used to describe a fairly wide range of vegetation ranging from that supplied by highly basic water through to that supplied by acid water, which may be close to the species composition of 'bog'. It appears from Dr. Barendregt's report that his interpretation of 'fen' is narrower, i.e. restricted to base-rich and neutral fen vegetation, or 'rich fen'. This has implications for attribution of value and setting site management objectives.

Comments on marsh compartments

3. Middle Marsh – pH and EC readings similar to those taken previously. The absence of deep layer of *Sphagnum* remains is consistent with observations from NE/Wheeler visit on 16 May that the dramatic spread of *Sphagnum* is relatively recent. The interpretation of high pH in ditch near boathouse, i.e. ditch dug into the Crag, is consistent with previous interpretations. In my experience, however, *Hottonia palustris*, is not a reliable indicator of groundwater seepage in the UK. It occurs in various open water situations, some entirely surface water fed.

4. It was noted that Dr Barendregt's report found higher pH and EC values in Mill Dyke Marshes (sample 3) and North Marsh (sample 4). Both of these samples contained higher Na and Cl levels than might be expected from the Crag, although Ca levels are also higher. The HSI report (March 2002) noted higher Na and Mg levels and attributed them to the influence of the estuarine clays and silts, into which some of the dykes cut. This layer of clay / silt is likely to be the Upper Clay (Breydon Formation) noted in Parmenter's report, and the Romano – British estuarine clays referred to by Wheeler – deposited during a time of marine incursion and the development of estuarine conditions here. This is important because the clay provides an apparent 'groundwater' influence, but rather than being 'true' groundwater such as that coming from the Crag it is more of a mineral influence on water chemistry – an example of telluric water as used by Wheeler. This influence can occur in the dykes where they cut into clay, but also in old turf ponds if the peat was cut down to the clay

5. Mill Marshes & South Marsh – These observations are largely consistent with previous findings. Dr. Barendregt remarks on the elevation differences between the birch and alder germination, and observes that a 'higher water table' is the reason for the different conditions. Is it not likely that the water table is the same, it is the relative land level that is different? Topographical survey is needed to confirm this.

6. Long Marsh & Rose Fen (not visited by NE so limited comments) – Topographical survey needed to confirm levels. Rose Fen recently deturfed. This may explain the 'higher' water level relative to fen surface? Recent historical records suggest these compartments are characterised by a 'drier' vegetation, and OS 1<sup>st</sup> edition lists as 'land liable to flood' suggesting a history of drainage and disturbance.

7. North Marsh – description is consistent with state on 16 May 2013, following recent digging out.

Fen ecosystem and its processes

8. While the process described on pg 4 appears reasonable, there does not seem to be recognition that most of the Broads fens represent a successional stage in the hydrosere, and that the natural state is for them to accumulate organic material and change from the species-rich S24 type to woodland or bog ultimately. All stages of this succession have groups of particular species associated with them, and all have some nature conservation

value. Some stages are particularly highly valued, including the 'Transition mire' phase and this is recognised in its listing as an Annex 1 habitat in the Habitats Directive. Some of the rarest and most highly threatened species of the Broads, such as *Dryopteris cristata* and *Pyrola rotundifolia*, occur in this habitat.

9. Dr. Barendregt links the presence of *Sphagnum squarrosum* and *S. fimbriatum* to dessication and acidification in the Netherlands. These species are also associated with natural successions from rich fen to mesotrophic bog, and may be the precursors of *Sphagnum* species more characteristic of truly ombrotrophic conditions.

10. NE agrees that 'accelerated succession' as described is not a desirable phenomenon, although we currently lack the evidence to show that the rate of the succession occurring at Catfield is genuinely 'accelerated'.

11. There appears to be an implicit assumption in the report that base-rich fen along the lines of S24 is the 'best' fen, and that deviation or succession from this is undesirable. In addition, there appears to be an assumption that there is site-wide drawdown of groundwater that is responsible for the presence of *Sphagnum* and other 'non-desirables' without consideration of other causal factors, including succession and long-term historic management, as well as variations in hydrological influences across the site.

12. Dr Barendregt appears to be under the impression that Catfield Fen should contain the same vegetation in each compartment, and that they function in the same way. However, evidence indicates that the site has always presented a variety of vegetation communities. There are indications that there are different hydrological factors influencing different parts of the site, leading to varying hydrochemical environments and influences on water levels. Topographical variations are important influences on hydro-ecology eg influencing duration and depth of seasonal flooding. In addition, management of the site has an important influence on the variety of communities. Past management may still be reflected in present-day vegetation mosaic. These days has a conservation focus and promotes variety, rather than a commercial reedbed focus which would promote a more uniform vegetation type. These factors combine to emphasise the development of a mosaic of vegetation communities.

13. NE agrees with Dr. Barendregt's recommendation that an improved understanding of the role of groundwater in Catfield Fen would add confidence, and that a series of piezometers and dipwells should be installed. We need to ensure that any hydrological monitoring installed is thorough, and is closely linked to any vegetation monitoring plots.

To: NE

According to: NE comments 19.7.2013 Catfield Hall Estate Fens  
July 22th 2013

Today I received your comments on the report of my observations at Catfield Fen, and particularly my interpretation of the consequences of the current levels of groundwater abstraction. It is entirely Natural England's task to evaluate the conditions for nature in England, and NE has to take care for the values for nature/biodiversity. Indeed I can only give my impressions with the eyes from the continent just at the other side of the North Sea (extending to Siberia). However, I also observed the ecological variation in the Broads in 1994 (with Bryan Wheeler) and 1998, and my conclusion was (and is) that the ecological processes in the Broads are not different from elsewhere in Europe. Even more explicit: the conditions in the Broads with former impact of the sea are fully comparable with those in the Netherlands.

For that reason I came with my observations. Many (if not all) fens in the Netherlands suffer from external (hydrologic and chemical) impact so that biodiversity and original succession are interrupted. We have lost much of our fen diversity over the past 50 years and I observe the same processes in UK. My interpretation of the system "fen" is not narrower than you apply in UK because there is always variation in an ecosystem with locally acid conditions. The main message to NE is that if the variation only points to acidic development, species like *Dryopteris cristata* will be stimulated with the result that the real fen species (*Carex*, *Cicuta*, *Cladium*, *Eleocharis*, *Schoenoplectus*, etcetc) will disappear and in turn will become highly threatened in 10-20 years. The presence of many ha of a *Sphagnum* layer is a bad indicator of what will happen in the near future.

It is important to preserve biodiversity and to do this by maintaining essential landscape ecological processes. In the fens these processes maintain non-acid conditions 1) by groundwater input, or 2) by flooding with clean river water. The consequences for removing these processes are known from research on the continent: the fen-system becomes isolated from the input of buffered water and becomes an ecosystem that accumulates rainwater; finally all characteristic fen-species will be replaced by acid species, known from bogs at many other locations. Restoration of acidified and desiccated fens appeared to be extremely difficult (see my report).

The main observation I wish to address is that the changes in vegetation (dominance of *Sphagnum* and acidified conditions) are not aspects of natural succession. Other *Sphagnum* species and many liverworts should be present in the sequence of natural fen succession. I observed species that indicate desiccation and eutrophication (from mineralization of peat).

I disagree for many detailed discussions and consequences from the letter with 13 items. For instance, although I am absolutely not a specialist in the local conditions in the Broads, I completely disagree with your point 4. When these locations are without groundwater input, rainwater can infiltrate the soil and will cause acidification. The fact that the clay layers are a bit saline just give

arguments that this can only be transported to the surface layers by upward seepage. When salinity is absent, there is downward transport of water, leading to infiltration and inevitably to acidification.

In conclusion, by focussing on the presence of ombrotrophic conditions, you miss the typical variation in fen ecosystems. When the Middle Marsh, Mill Marshes and South Marsh becomes overgrown with *Sphagnum*, there are serious problems for variation in fen biodiversity at Catfield Fens. That is what was observed. The fact that a real understanding of the landscape processes is needed by research in groundwater flow is a suggestion from NE that I fully support. If you wish information from the continent, I am available.

Sincerely,  
Aat Barendregt