25. Science-based Conservation and Management in Wetland Archaeology: The Example of Sutton Common, UK

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Introduction: Sutton Common

Sutton Common comprises the remains of two Iron Age enclosures, which straddle the palaeochannel of the Hampole Beck, which is now completely drained (Figure 25.1). Both enclosures are situated on "islands" of sands and clay of the 25-foot drift/Lake Humber clays within the Humberhead Levels (Van de Noort & Ellis 1997). This is an extensive area of lowlands in eastern England that prior to its drainage in the early seventeenth century was one of the world's great wetlands. Enclosure A is situated on the east side of the former Hampole Beck, enclosure B on the west side. Enclosure A includes two major phases of occupation - the earlier phase is characterized by a timber palisade demarcating the site, the later phase includes multivallete ditch and bank arrangements. Evidence for occupation within enclosure B is limited to the later phase only (Parker Pearson & Sydes 1997). The two enclosures are linked by means of a causeway of sands deposited over the peat of the Hampole Beck palaeochannel and flanked by discontinuous post alignments (Van de Noort & Chapman 1999). Both phases remain poorly dated, but both phases of activity on Sutton Common can be dated after 550 cal BC and before 200 cal BC (Parker Pearson & Sydes 1997).

Until its enclosure in *c.* 1850, the area was wet, with peat forming the main soil on the Common, which was predominantly used as rough pasture. The first drainage ditches were possibly dug as part of the enclosure of the Common, with one ditch clipping the southern tip of enclosure A. Other ditches on the Common provided more effective run-off of precipitation and soil water. However, the site was more effectively drained in 1983, with the installation of plastic underfield drains placed in coarse gravel ditches across the site. Field drains were not installed within enclosure B, but underfield drains were installed within enclosure A, which had been bulldozed in 1980.

A number of archaeological studies and assessments were undertaken between 1987 and 1993, and suggested that desiccation of organic archaeological and palaeoenvironmental remains occurred across the site and with little or no potential for *in situ* preservation (Adams *et al.* 1988, Parker Pearson & Merrony 1993, Sydes 1992, Sydes and Symonds 1987). The failure to protect the site from drainage and desiccation was discussed on several occasions (e.g. Parker Pearson & Sydes 1995).

Nevertheless, after lengthy negotiations, the Carstairs Countryside Trust (CCT) bought Sutton Common in 1997, with support from English Heritage and the Heritage Lottery Fund. CCT's primary objective for the future management of the Common was to enable the long-term preservation of the archaeological remains. In 1997, a high-resolution digital terrain model of the Common was created using a differential global positioning system (dGPS), which has become the basis for all further research (Chapman & Van de Noort forthcoming). In 1998, English Heritage commissioned the detailed assessment of the hydrology and the preservation of organic remains across the prehistoric site. This study identified the existence of extensive waterlogged archaeological remains and the opportunities for their *in situ* preservation.

Background to wetland conservation and management

The destruction of wetlands across the world, and with it the archaeological sites contained within these wetlands, is well recorded (e.g. Coles and Coles 1996, Bernick 1998). Most wetland archaeological research has been focused on the excavation of sites that were threatened either by the physical destruction of wetlands or by the indirect effect of the de-watering of areas. In the last three or four decades of the twentieth century, the need for wetland conservation and management has been highlighted by many national

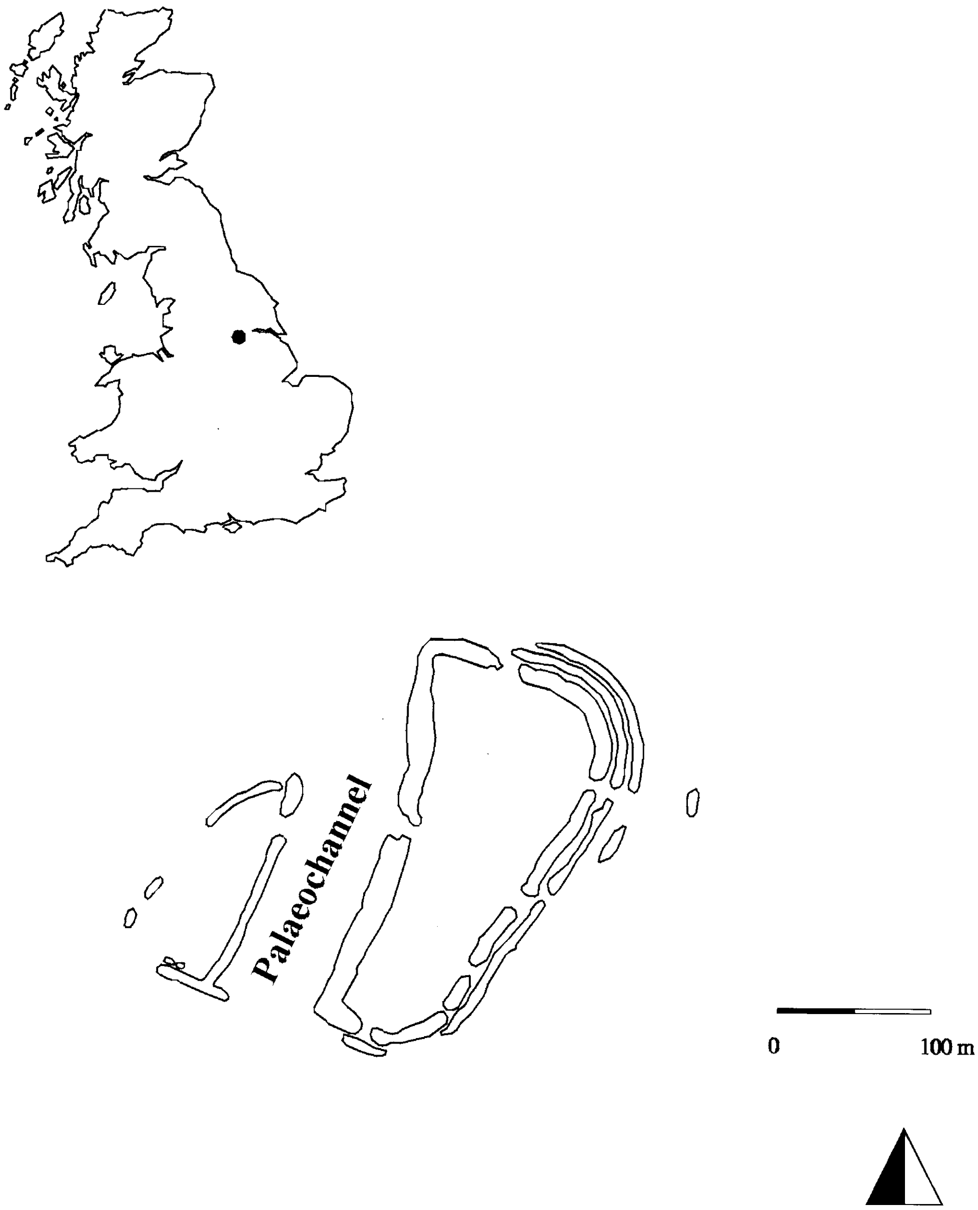

Figure 25.1. Location of the site.

and international bodies, the UN-sponsored 'Ramsar' convention (1971) being the best known (http://www.ramsar.org).

Wetland conservation is now practiced in many countries across the world, by government agencies and voluntary bodies alike (Deny 1995). In all but a few exceptions, the conservation of wetlands is undertaken with the objective of maintaining, creating or recreating wetland habitats that are valued for their contribution to existing faunal and floral communities (e.g., Maltby 1986, Purseglove 1988), for example as an element in biodiversity strategies. Consequently, wetland conservation as nature conservation is a dynamic process, whereby the management of the wetland is adjusted on a regular basis, for example to accommodate changing priorities or changing trends in the weather. Wetland conservation managers boast a considerable experience in controlling this dynamic process, especially on practical matters that include manipulation of the distribution of water, a crucial element in successful wetland management (e.g., Furniss & Lane 1992).

The conservation of wetlands for the protection of wet-preserved archaeological remains is less common throughout the world. Of course, important archaeological sites may be contained within wetlands that are being managed, but examples of archaeology-led wetland conservation, such as the Sweet Track in the Somerset Levels, England (Brunning 1999), remain rare. The main principle of attempts to preserve wetland archaeological remains *in situ* is to maintain a high water table, and thus to saturate the archaeological site. In the case of the Sweet Track, re-hydration or rewetting is achieved by pumping water from the surrounding area to the buffer that surrounds the archaeological monument (Coles 1995). More commonly, for example at the Bronze Age site of Flag Fen in eastern England, or the Corlea (I) trackway in central Ireland, the archaeological remains are surrounded by a "bund," which acts as a water retainer and thus reduces the effects of desiccation (Pryor 1991, O'Donnell 1993).

Important differences within the management of wetlands exist between the archaeology-led and nature conservation instigated projects. Principal among these is the dynamic nature of the wetland management found in nature conservation and the more static approach in archaeological conservation. The scale of operations differs significantly as well, with the archaeologist being essentially concerned with the archaeological monument and possibly a limited buffer area, while nature conservation concerns itself with ever larger areas, sometimes in excess of thousands of hectares (e.g., Ramsar-designated wetlands in the Humber estuary, England). Finally, we note significant differences in the awareness of, and expertise in, wetland management (Coles 1995).

Fundamentally, nature conservation uses the high biomass of wetlands (e.g., Dinnin & Van de Noort 1999) to maximize the variety and quantity of flora and fauna that can be sustained by, or are dependent on, wetlands. The number and abundance of key species, ranging from *Spagnum* to nightjars, can measure the success of this form of wetland management. Archaeological wetland management, on the other hand, aims to create "static" burial environments that minimize further deterioration of the organic archaeological and palaeoenvironmental remains. Its success cannot be expressed in numbers, rather it depends on this absence of change. In certain cases, archaeology-led wetland conservation can successfully adopt nature conservation concerns, and vice versa. Nevertheless, we will concentrate in this paper on wetland conservation work that is instigated with the principal objective of preserving waterlogged archaeological and palaeoenvironmental remains, such as currently practiced at Sutton Common, Yorkshire, UK.

Science-based conservation and management: general concepts

The promotion of the need for science-based wetland management in archaeology rests on several fundamental principles. If our aim is to achieve sustainability of the wet-preserved archaeological resource, or "near-zero" change, and the success of wetland management can only be expressed in those terms, then we must have an approach to wetland management that not only can achieve stability of the burial environment, but that can also demonstrate scientifically the absence of change as an indicator of good management. Furthermore, we cannot progress by "trial and error" but the management must be proactive and informed by empirical findings. After all, the archaeological and palaeoenvironmental resource is limited and non-renewable.

The science-based conservation developed for Sutton Common is, by the Centre for Wetland Archaeology, referred to as the "3M approach", with the 3 M's standing for *m*onitoring, *m*odelling and *m*anagement. The interactive nature of the 3M approach in operation is illustrated in Figure 25.2. Essentially, in the 3M approach the burial environment is monitored at regular intervals. Monitored indicators include the water table, the reduction-oxidation potential of the burial environment (or REDOX), microbial activity in the burial environment, basic chemistry of the soil water and the wet-preserved archaeology itself. Other sites may receive greater benefit from the monitoring of differing sets of parameters. The data from the monitoring are modelled in a Geographical Information System (GIS) environment, providing interpreted information on the monitored parameters. Finally, the models inform the site managers on the need for proactive changes to the management of the wetland in question. In the case of Sutton Common, the instigation of this approach was preceded by a creation of a high-resolution digital-elevation model (DEM) using a differential Global Positioning System (dGPS), which was designed to act as an objective but manipulatable framework.

For the current purpose, three aspects of the 3M approach at Sutton Common will be discussed in detail: the DEM, the water table and the state of preservation of the archaeological wood. These give a flavor, rather than a comprehensive overview, of the kind of work currently being developed at Sutton Common.

The DEM

An objective but manipulatable base-map of Sutton Common was considered essential for the spatial correlation of the various activities that were planned for the site. The survey of the site was undertaken using a *Geotronics©*

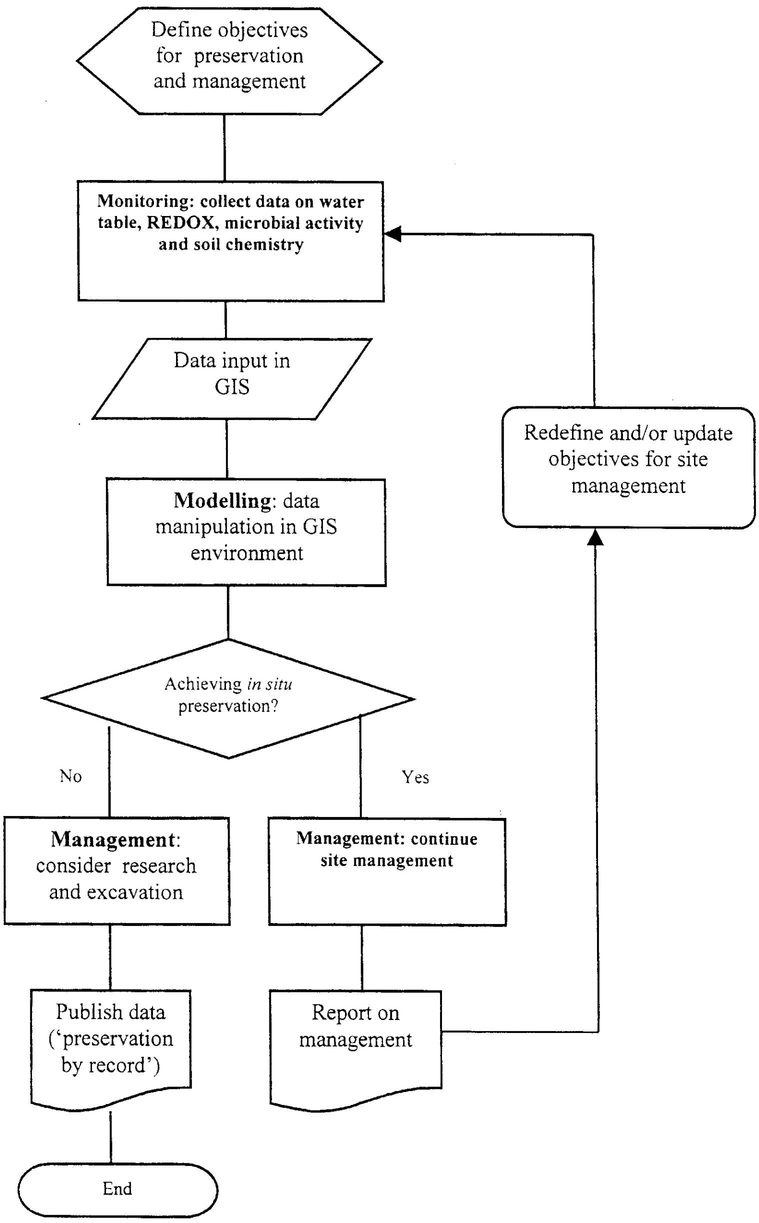

Figure 25.2. 3M approach.

System 2000 L1 – RTK differential GPS. A total of 5,290 points were surveyed, covering an area of approximately 286,754 m², providing a mean density of 0.02 points per m² (184 points per hectare). Points were recorded at between 3 m and 8 m intervals along transects. On areas of high topographic variation, such as across the earthworks within enclosure B, the survey resolution was increased to provide greater detail. The standard deviation error of the GPS was found to be less than 0.054 m for the x-co-ordinate, 0.056 m for the y-co-ordinate and 0.029 m for the z-co-ordinate.

The GPS survey data were recorded in a coded format that was corrected to National Grid values and converted to a comma separated value (CSV) file, consisting of x-co-ordinates, y-co-ordinates and z-co-ordinates, using software developed by Richard Middleton (University of Hull). These data were processed to generate a digital elevation model (DEM) within *ARC/INFO© version 7.2.1* Geographical Information System (GIS) software, run through a UNIX platform.

The variably spaced point data were converted to form a triangulated irregular surface (TIN) using the CREATETIN command. The accuracy of surfaces interpolated from a TIN model is dependent upon the function of the triangulation process. ARC/INFO employs a process known as Delaunay Triangulation, which dictates the size and shape of the triangles formed in the generalised surface (Goucher 1997). A cell-based surface was created from the TIN using the TINLATTICE command. This is a vector/raster conversion that interpolates a continuous grid using the TIN as a reference. The function places a grid of cells at a pre-determined density across the area covered by the TIN that are referenced in terms of x- and y-co-ordinates. A height attribute for each cell is then interpolated from the TIN. A number of different ways to convert a TIN to a lattice are allowed by ARC/INFO using this function, and the Quintic interpolation, which applies smoothing to the areas inside the TIN triangles, was used for the DEM of Sutton Common.

Two methods were employed with regard to the representation of the surfaces. The first method involved the basic representation of the surface as contour bands. The second method was to apply a virtual light source to emphasize areas of greater relief. Essentially this technique emphasizes features and slopes, rather than height. A low-positioned light source can highlight the more subtle features. This method can also produce a more realistic-looking surface for comparison with other data sources such as aerial photography.

The resulting DEM of Sutton Common revealed a number of modern and archaeological features despite the intensive agricultural regime of the previous seventeen years. Recent features identified from the survey include the position of the track and drains and, surprisingly, the position of one of the removed drains that was visible on earlier aerial photography of the site. These features were traceable on both models, but were more visible with the application of an assumed light source. However, the hill-shaded model revealed "striping," reflecting the direction of ploughing.

Natural features identified were visible on both models, but the basic contour-banded DEM showed them more clearly (Figure 25.3). The most obvious feature was the relict Hampole Beck (A), which was visible in between the enclosures. Toward the northwestern part of the surveyed area, the braiding channel was visible as identified through previous lithostratigraphical work (Lillie 1997). The two islands occupied by the Iron Age enclosures were highlighted (B and C), as were three smaller islands to the north (D, E and F). Similarly, in the area to the east the sharp shelving of land towards Shirley Wood was visible (G), which marks one of the faults in the Sutton Common area that includes aquifers. Other areas of lowland were also visible, such as to the southeast of enclosure B (H).

The application of a light source from different positions highlighted a number of buried archaeological features that could not be seen on the ground (Figure 25.4). First, and most obviously, the positions of the undamaged earthworks of enclosure B were clearly visible. A comparison between these and the detailed plan made in the 1930s, before ploughing commenced, by Bennett and Hill (Whiting 1936) demonstrates slight details that were missed, perhaps due to vegetation cover. Of these details the most striking is that its northwestern side was more developed, continuous and cohesive than the early plans suggested (J). Similarly, the break in the eastern side of enclosure B was not as distinctive as the plans had suggested, but rather it had a gradual shape to it (K).

The outline of enclosure A was visible on the models. When compared with the natural topography of the area it was notable that its western edge fell away sharply over the Hampole Beck palaeochannel, but that the width of the enclosure was less than the sandy island, which dropped away gradually to the east up to the shelf near Shirley Wood. The main reasons for the visibility of archaeological features in a ploughed-out landscape is the differential shrinkage of sediments in this actively drained area. Peat-filled structures continue to suffer from desiccation and, consequently, continue to compact at a higher rate than drained minerogenic sediments. A quantitative analysis of the effects of differential shrinkage has been presented previously (Chapman & Van de Noort 2000).

The water table

Essential to the future management of Sutton Common, as an archaeological site that includes many wet-preserved remains, was an accurate understanding of the dynamics of the local hydrology. To provide a model of the hydro-stratigraphy, or shape of the water table, a network of 50 piezometers were laid out in a systematic grid set at 50 m intervals covering the southern and southeastern parts of the Common. Its extension to the east up to the edge of Shirley Wood includes the areas of higher potential for the preservation of palaeoenvironmental material. Piezometer pipes, 2 m long, with a diameter of 19 mm were used with 300 mm long screw-on piezometer tips obtained from MGS Ltd. The tips used were self-contained units consisting of a perforated plastic pipe with an internal permeable membrane. The tops of the pipes were sealed using plastic caps to prevent rainwater in-filling and general physical contamination.

The grid of piezometers was planned using the DEM. The piezometers were installed by boring 30 mm diameter holes using a spiral augur from Van Walt Ltd. Boreholes were excavated to a depth of 2.3 m and the piezometers with attached tips were placed within the holes. Once

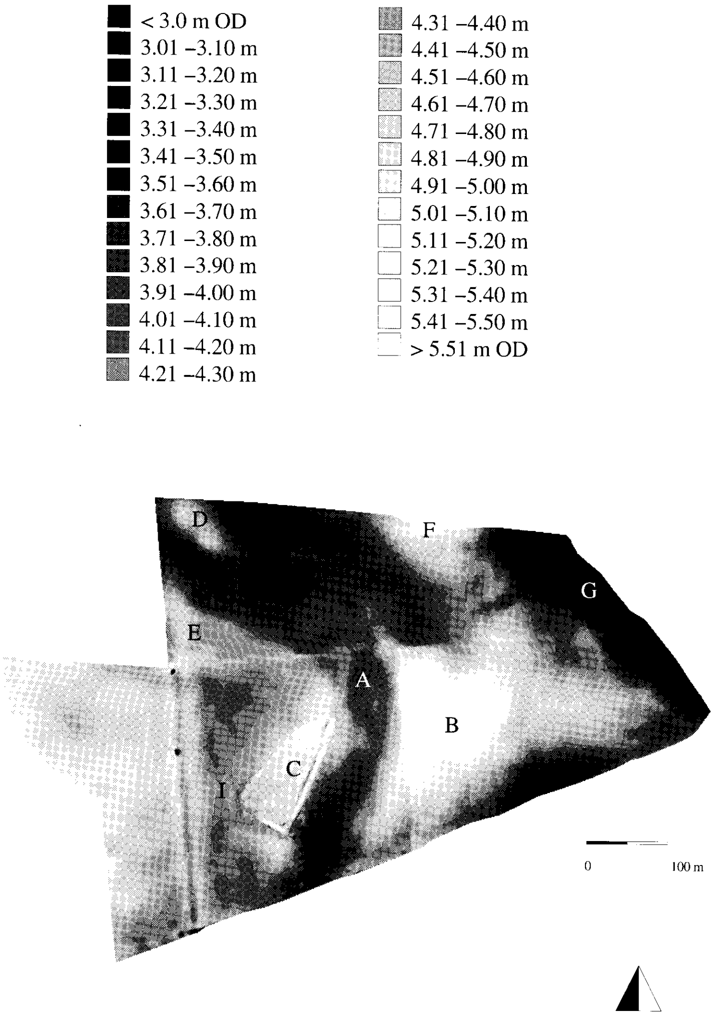

Figure 25.3. Contour band DEM with features mentioned in the text.

installed, the piezometers were left to settle for approximately a week before any readings were taken. After this time the level of water within each piezometer was measured using Van Walt Ltd. sounding apparatus. Measurements were taken on approximately a two-weekly basis following installation and were recorded on pro forma sheets. To provide both relative and absolute levels for the groundwater readings, the positions of the tops of the piezometers were surveyed in three dimensions using dGPS with its accuracy set to a 0.02 m standard deviation. From this the depth of water in each piezometer from the top of the pipe could be subtracted from the absolute height of its top. The series of water table surfaces was generated in the same manner as the contour bands of the DEM, for which the readings taken in September 1998, January 1999 and June 1999 are shown (Figure 25.5).

Readings have demonstrated an overall increasing water level, which was influenced by the oncoming of winter that was also reflected by the water in the open drains surrounding the site. When modelled the ground water table can be seen to have a dome-shape beneath enclosure A, a wholly natural phenomenon related to precipitation, permeability, through-flow and topography (*e.g.*, Ward and Robinson 1990). The hydromorphic dome became more pronounced in the last months of 1998, when prolonged rainfall had added to the soil and ground water storage. The pronounced character of the dome was enhanced by the size of enclosure A, relative to enclosure B, and the infilling of the ditches surrounding enclosure A in 1980. This rendered these ditches ineffective in drawing down the water table Furthermore, the track to the north of enclosure A acts as a hydrological barrier.

This close relationship between hydrology and topography is not so well defined beneath enclosure B. This may

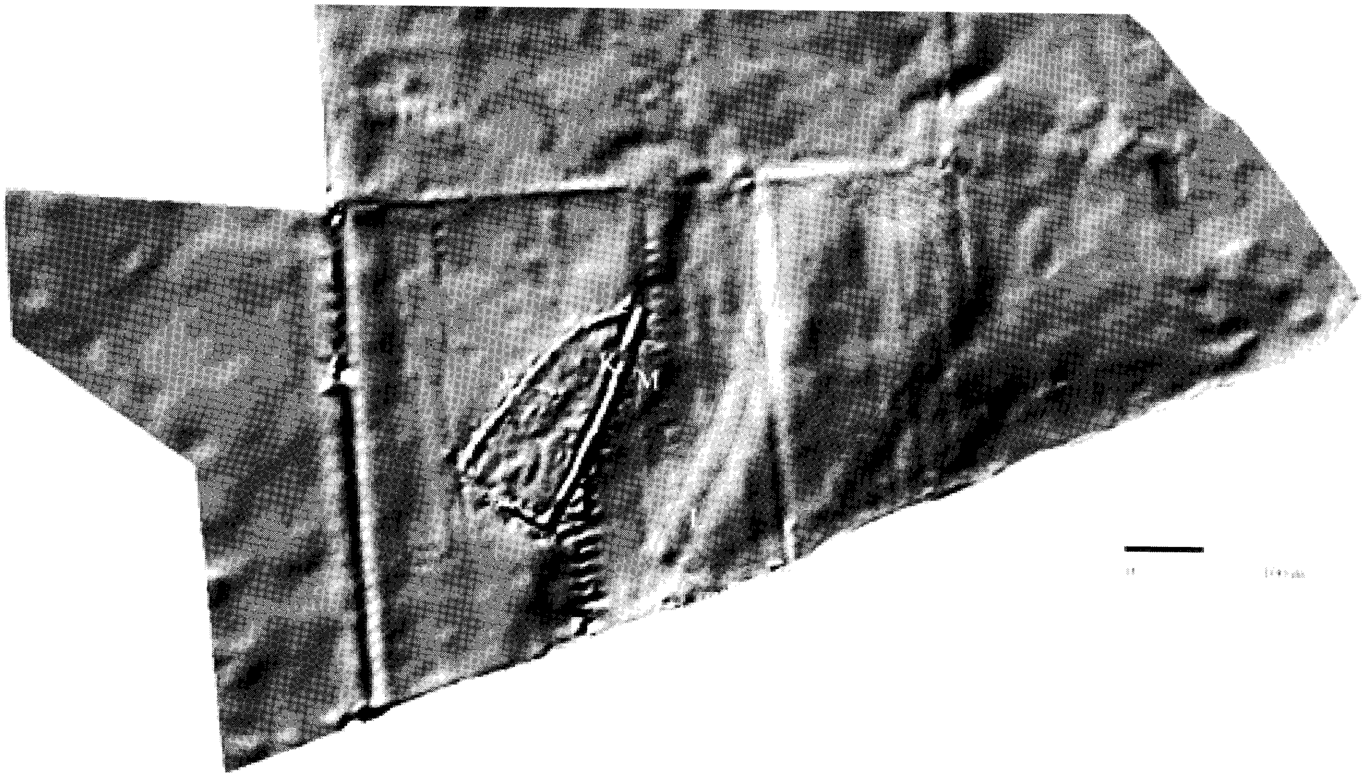

Figure 25.4. Hill-shaded model with features mentioned in the text.

be explained in terms of frustrated soil and ground water storage, which is disturbed through the presence of ditches around enclosure B which draw the water table down, and its relatively small size. Nevertheless, a faint dome-shape was observed in periods of prolonged rainfall, which added to the soil and ground water storage. The soil characteristics of the palaeochannel, which comprises in the upper layers mostly degraded peat with very large pores and therefore high levels of permeability and through flow, are not conducive to hydromorphic domes.

Archaeological wood

Excavations were undertaken in 1998 and 1999 commissioned by English Heritage. In all, sixteen trenches were excavated, ranging in size from 2 × 2 m to 30 × 30 m. Archaeological wood, dated to the Iron Age, was found to survive across the archaeological site. In many places, timber uprights were found to be poor quality and desiccated at the top, but well preserved further down (Figure 25.6). All but a few timbers were found to be *Quercus* (oak).

The preservation of archaeological wood is dependent on a broad range of factors. These factors operate on different scales, ranging from the feature-specific (e.g. wood species, treatment of timber prior to deposition), to the site itself (function, method of deposition) and beyond (water table, drainage). In order to assess the state of preservation of the organic archaeological resource across the site, the highest point of each surviving timber was three-dimensionally recorded by dGPS. On the one hand, this data set represents the hydrology of the last 2500 years, as timbers that would have been exposed to oxygenated environments for any length of time since the Iron Age would not have survived. On the other hand, the data set epitomizes also the effects of the drainage and change in land use of the last two decades of the twentieth century. Nevertheless, the interpolated continuous surface of surviving archaeological wood, which was created in the same manner as the interpolated continuous surface water table,

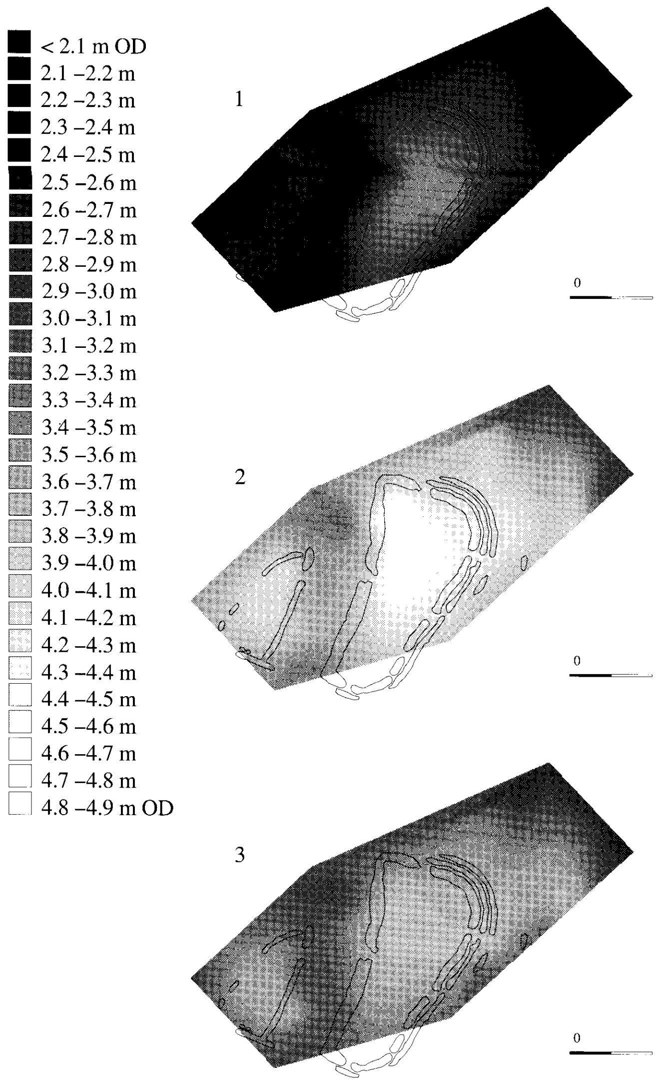

Figure 25.5. Water table in September 1998, January 1999, June 1999.

provides a model of survival of organic archaeological remains that can form the basis for analysis.

Discussion – modelling and management

When integrating the data from Sutton Common, it was evident that the preservation of archaeological wood (and other organic remains) reflects closely the winter water table, as illustrated by the hydrological model. It is reasonable to suggest that the water table observed in the winter of 1998–99 must resemble the more static water table at Sutton Common in the period before its active drainage. Otherwise, archaeological wood preservation would not have mirrored the hydrology. This not only explains the absence of structural archaeological wood in enclosure B, where the water table is drawn down, but also the surprising presence of waterlogged wood within enclosure A, where the water table is dome-shaped.

The results of the modelling were used to determine the approach to the management of the site. It was decided that:

- First, the dynamic hydrology could be manipulated
- Second, the maximum height of a permanent water table that would not result in the flooding of neighbours' land was 4.1 m Ordnance Datum as measured in one piezometer set within the ditch of encloure B
- Third, that only remains below the 4.1 m Ordnance Datum could be sustainably preserved *in situ* (this

includes the ditches of the Iron Age enclosures and the palaeochannel of the Hampole Beck, the latter containing the causeway linking the two enclosures)

- Fourth, that the interior of enclosure A could not be sustainably preserved as a wetland site
- Fifth, that where *in situ* preservation was not possible, excavation should be considered the most appropriate solution

To assist the management of the site, a model was created of where the water table would breach the surface when the water table was kept permanently at 4.1 m Ordnance Datum, exaggerated by 0.4 m to account for the higher winter tables (Figure 25.7). This shows that much of the palaeochannel of the Hampole Beck would be wet, with areas of standing water to the north and east of enclosure A, and larger areas of standing water to the east of the site, where Sutton Common adjoins Shirley Pool, a protected wetland. On the basis of this model, the varying concerns of landowner, neighboring landowners, archaeologists and nature conservationists were addressed and discussed, and agreements were made on the management of Sutton Common as a wetland.

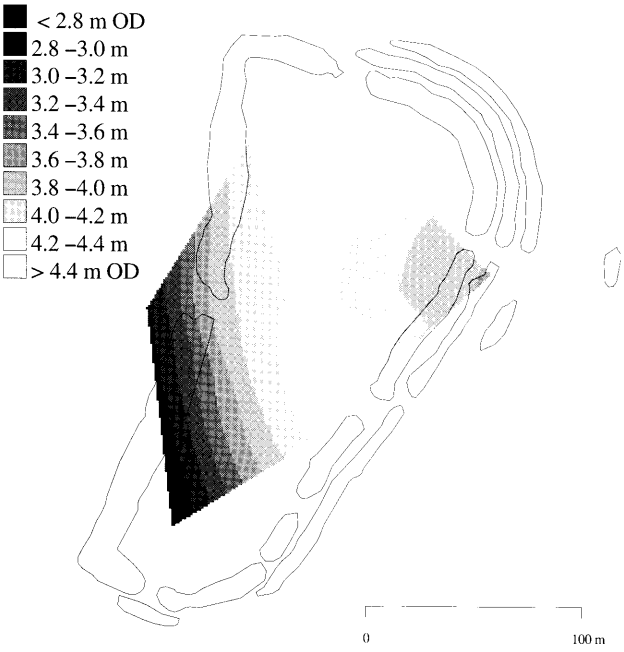

Figure 25.6. Model of surviving archaeological wood.

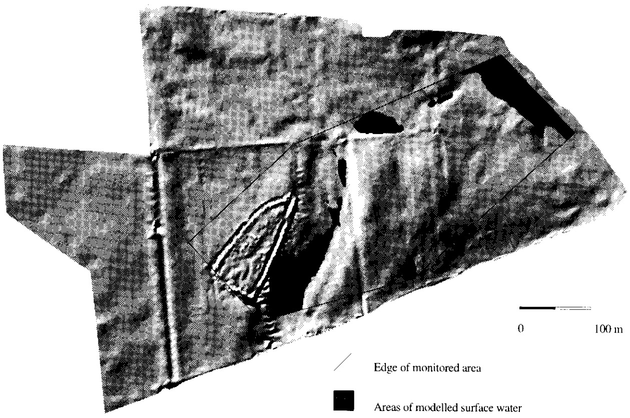

Figure 25.7. Predictions of future situation.

Conclusion

In many instances of wetland conservation, objectives are to be achieved through reactive management. Where nature conservation leads the management of wetlands, such an approach may well be the most cost-effective and appropriate, but where preservation of waterlogged archaeological remains *in situ* is the main objective, such a trial and error approach is unsuited. Rather, a proactive approach must be developed, that must be based on objective parameters. For the case of Sutton Common, this approach has taken the form of monitoring of key parameters, including the water table, the modelling of information and the prediction of the effects of managing the wet-site archaeology. Elsewhere, the science-based management and conservation of wetlands may involve different or additional parameters.

Postscript, January 2000

Following English Heritage's commissioned evaluation of the interior of enclosure A, undertaken in the late summer of 1999, the recommendations are now published. These include the excavation of the full interior of enclosure A, an area of c. 20,000 m^2, and an integrated education programme that will be developed with local schools. The interior of enclosure A is considered unsuitable for long-term *in situ* preservation, and excavation is the only credible course of action here.

The rest of the archaeological site is believed to be suitable for *in situ* preservation following the rewetting of Sutton Common. In the early autumn of 1999, the underfield drain system was modified under supervision of drainage engineers Grantham, Brundell and Farran. Predictions of wetness seem to be justified, with base levels overall higher than in the winter of 1998–99 and the re-creation of a wetland landscape and the *in situ* preservation of much of the wet-preserved archaeology of Sutton Common, are now considered feasible. Monitoring of the burial conditions continues.

Acknowledgments

The "Sutton Common project" is spearheaded by the Trustees of the Carstairs Countryside Trust (CCT), who own the land, in partnership with English Heritage, English Nature, Countryside Agency, the University of Exeter and Hull and Gantham Brundell and Farran.

The project, which includes land acquisitions, wildlife and landscape enhancement, archaeological and paleo-environmental evaluations, research and conservation, and engineering works to raise ground water levels has been made possible through the Sheared Family Trust and financial support from: English Heritage, Heritage Lottery Fund, English Nature, Countryside Agency, Darrington Quarries (Landfill Tax Credits) through WREN – Waste Recycling Environmental, James Goodhart, the Pilgrim Trust, The University of Hull and the Ministry of Agriculture's Countryside Stewardship Scheme. Help has also been given by Doncaster Naturalists Society and Crombie, Wilkinson Solicitors and Carter Jonas, Property Consultants, both of York.

This innovative project forms one of the trial schemes in the Humberhead Levels "Value in Wetness" Land Management Initative. Participation with the Askern Community Partnership over public access and enjoyment of the site seeks to contribute to the environmental and economic regeneration of this Coalfields area in South Yorkshire.

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References Cited

Adams, M., C. Merrony and R.E. Sydes. 1988. Excavations at Sutton Common, South Yorkshire 1988. Sheffield: South Yorkshire Archaeology Unit.

Bernick, K. (ed). 1998. Hidden dimensions. The cultural significance of wetland archaeology. Vancouver: University of British Columbia University Press.

Brunning, R. 1999. The *in situ* preservation of the Sweet Track, In B. Coles, J. Coles and M. Schou Jørgensen (eds). Bog bodies, sacred sites and wetland archaeology: 33–8. Exeter: WARP.

Chapman, H. and R. Van de Noort. 2000. Archaeological wetland prospection using GPS and GIS – studies at Sutton Common, South Yorkshire, and Meare Village East, Somerset. Journal of Archaeological Science.

Coles, B. 1995. Wetland management: a survey for English Heritage. Exeter: Wetland Archaeology Research Project.

Coles, J.M. and B. Coles. 1996. Enlarging the past, the contribution of wetland archaeology. Edinburgh: Society of Antiquaries of Scotland, and Exeter: WARP.

Deny, P. 1995. Benefits and priorities for wetland conservation: the case for national wetland conservation strategies, in M. Cox, V. Straker and D. Taylor (eds.) Wetlands: archaeology and nature conservation. London: HMSO: 249–74.

Dinnin, M. and R. Van de Noort. 1999. Wetland habitats, their resource potential and exploitation; a 'case study from the Humber wetlands', in B. Coles, J. Coles and M. Schou Jørgensen (eds) Bog bodies, sacred sites and wetland archaeology: 69–78. Exeter: WARP

Furniss, P and A. Lane. 1992. Practical conservation water and wetlands. London: Hodder & Stoughton.

Goucher, K. 1997. Hill of Tara topographical survey and mapping, in C. Newman, Tara: an archaeological survey (ed). Dublin: Discovery Programme Monograph 2, pp. 245–52.

Maltby, E. 1986. Waterlogged wealth: why waste the world's wet places? London: Earthscan.

O'Donnell, T. 1993. Conservation of Iron Age roadway and associated peatlands at Corlea, Co. Longford. The engineers Journal 46 (3) pp. 44–7.

Parker Pearson, M. and C. Merrony. 1993. Sutton Common desiccation assessment 1993: interim report. Sheffield: Department of Archaeology and Prehistory, University of Sheffield, South Yorkshire Archaeological Services and Doncaster Museum.

Parker Pearson, M. and R.E. Sydes. 1995. Sutton Common: a South Yorkshire wetland, in M. Cox, V. Straker and D. Taylor (eds) Wetlands: nature conservation and archaeology. London: HMSO: pp. 86–96.

Parker Pearson, M. and R.E. Sydes. 1997. The Iron Age enclosures and prehistoric landscape at Sutton Common, South Yorkshire. Proceedings of the Prehistoric Society 63: pp. 221–59.

Pryor, F. 1991. Flag Fen. London: Batsford.

Purseglove, J. 1988. Taming the Flood. Oxford: University Press

Sydes, R.E. 1992. Report on the re-excavation of trench A/C, Sutton Common, South Yorkshire. Unpublished report, Department of Archaeology and Prehistory, University of Sheffield.

Sydes, R.E. and J. Symonds. 1987. Sutton Common 1987 excavation report – investigations of a northern wetland site. Sheffield: South Yorkshire Archaeology Unit.

Van de Noort, R. and H. Chapman. 1999. An archaeological assessment in preparation of a management plan at Sutton Common, South Yorkshire. Hull: Centre for Wetland Archaeology research report.

Van de Noort, R. and S. Ellis. (eds) 1997. Wetland heritage of the Humberhead Levels, an archaeological survey. Hull: Humber Wetlands Project, University of Hull.

Ward, R.C. and M. Robinson. 1990. Principles of hydrology (3rd edition). London: McGraw-Hill.

Whiting, C.E. 1936. Excavations at Sutton Common 1933, 1934 and 1935. Yorkshire Archaeological Journal 33: pp. 57–80.