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Archaeological implications of the cultivation of Miscanthus in West
Heslerton (LRC Sites 2 and 81)

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Background

This short report has been written in response to a request from Linda Smith, Rural Archaeologist with the Heritage Section of the NYCC Planning and Countryside Unit to assess the potential impact of the growth of Miscanthus in two fields that have been the subject of English Heritage funded archaeological research by the Landscape Research Centre. Miscanthus, 'Elephant Grass', is a potentially important energy crop, grown as a fuel for power generation. As far as we are aware there has been no research into the impact of this crop on buried archaeology either directly or indirectly, arising from any hydrological impact.

The two fields identified in the proposed planting scheme include Heslerton Parish Project Site 002 (Fig 1) and Site 081 (Fig 3). Although half of Site 002 was excavated during the 1980's, as part of the excavation of an Early Anglo-Saxon Cemetery and associated settlement, the proposed planting arrangements cover the part of the field that has not been excavated with the exception of the Cemetery which lay in the north east corner of the field. In the case of Site 081 the planting scheme covers c.10Ha in the southern portion of the field and does not extend over the dense area of prehistoric and later settlement that remains beneath the northern part of the field.

Both the proposed planting areas have been subject to geophysical survey and sub-surface modelling, designed to map the depth of the buried archaeological features. The extensive research undertaken in and around West Heslerton during more than 25 years has demonstrated that the archaeology of this area is internationally important, particularly on account of the presence of blown sands, which have buried archaeological sites in a way not generally found in Britain securing the preservation of old land-surfaces and floor deposits. The area has been the setting for the largest contiguous geophysical survey in Britain covering nearly 1000Ha in addition to nearly 30Ha of open area excavation. The evidence gathered through excavation and survey in Heslerton have demonstrated a level and complexity of archaeology described by David Miles, formerly Chief Archaeologist for England, as 'every bit as important as Stonehenge'.

Miscanthus ~ General Observations with respect to buried archaeology

Miscanthus is grown from rhizomes with a recommended planting depth of 10-15cm, a depth well within the extant ploughsoil depth in both the selected fields. The archaeological questions regarding its growth relate to the planting, development, harvesting and removal of the crop.

Planting:

The Defra Miscanthus-guide suggests that sub soiling should be used 'when necessary, to remove compaction'. For any site with known archaeology the use of sub-soiling should be avoided, excavations in the Heslerton area have confirmed that whilst sub-soiling does have a devastating effect on buried archaeology, the pans, it was promoted in the past to destroy, either do not exist at all (in the tested environment) or are of such limited nature as to cause no agricultural impact. Even if planted using a potato planter as recommended by Defra, provided that the planting depth is within the 10-15cm range there should be no impact beneath the extant ploughsoil.

Development:

Although the rhizomes develop and mature at a depth of 5-15cm, we have no idea what the impact of the root system may be at greater depths, this should be examined. Since this is a crop that has a long life-cycle, with plantings anticipated to remain in place for 10-15 years, it may assist in securing the future of the archaeological resource as it would suspend plough damage during the growth period. It may also prove helpful in reducing the theft of archaeological material by treasure hunters as it would restrict access to the land and the rhizomes may form a useful barrier discouraging the activity of metal detectorists even after the crop has been cut. Fertiliser requirements are limited and there is no indication that these might contribute to increased desiccation over waterlogged or wet deposits.

Harvesting:

The harvesting of the crop would not have any archaeological impact. Harvesting of the rhizomes themselves, when these represent the primary crop may have archaeological implications. Although sub-soiling has been demonstrated to have an adverse effect on buried archaeology, harvesting of root-crops can be even more devastating. In the current case this is not an issue, however it is essential that research is conducted to determine the depths at which plant needs to operate to lift the rhizomes themselves, if they can be successfully lifted by working the soil to a depth of 20cm then there is no reason to work the soil any deeper and farmers should be actively encouraged not to go any deeper than is necessary.

Crop Removal:

The removal of established Miscanthus crops is achieved through disking, which cuts up the rhizomes effectively killing them off. If, as we believe, the rhizomes thrive at shallow depths within the upper 15cm of the plough soil, the removal of the crop using disking to a depth of <c20cm should make no impact beneath the current plough soil depths and thus pose no particular threat to buried archaeological deposits except where plough soils are exceptionally thin.

Summary:

Whilst it appears, without detailed research and field trials, that the growth, harvesting and removal of Miscanthus should pose no major threat to buried archaeological features, the use of sub-soiling prior to planting should not be undertaken on any site where there are known archaeological features.

Defra should review its advisory notes to reflect the likely impact on archaeological sustainability of widespread sub-soiling associated with Miscanthus growth. Should practical research demonstrate that there is no impact of Miscanthus growth on archaeological evidence at the base of the ploughsoil then, subject to there being no other adverse environmental impact, it should be promoted as a crop which could help protect archaeological sites by reducing the impact and frequency of ploughing.

Archaeological evidence in the selected areas**Site 2**

Archaeological activity in the unexcavated parts of Site 2 include ring ditches and other burial related features, elements of field systems and part of a droveway entrance in addition to a ditched trackway which ran from east to west across the field and may correlate with 'the Priests Trod' a medieval or earlier trackway which links the two settlements of East and West Heslerton. Auger survey has shown that the soil depths across the northern half of the field (fig. 2) range from 25cm to more than a metre, with the shallowest soils in the western half of the area to be cropped.

The geophysical survey results indicate a number of small anomalies, which may be graves, in the vicinity of one of the ring ditches, a penannular or interrupted ditched monument near the northern field boundary. On present evidence we anticipate no serious impact from growing the crop in this area but propose to use the opportunity to undertake basic research into the impact of the crop in this environment.



Figure 1: Site 2 showing the excavated areas in colour and the geophysical survey data mapped in grey.

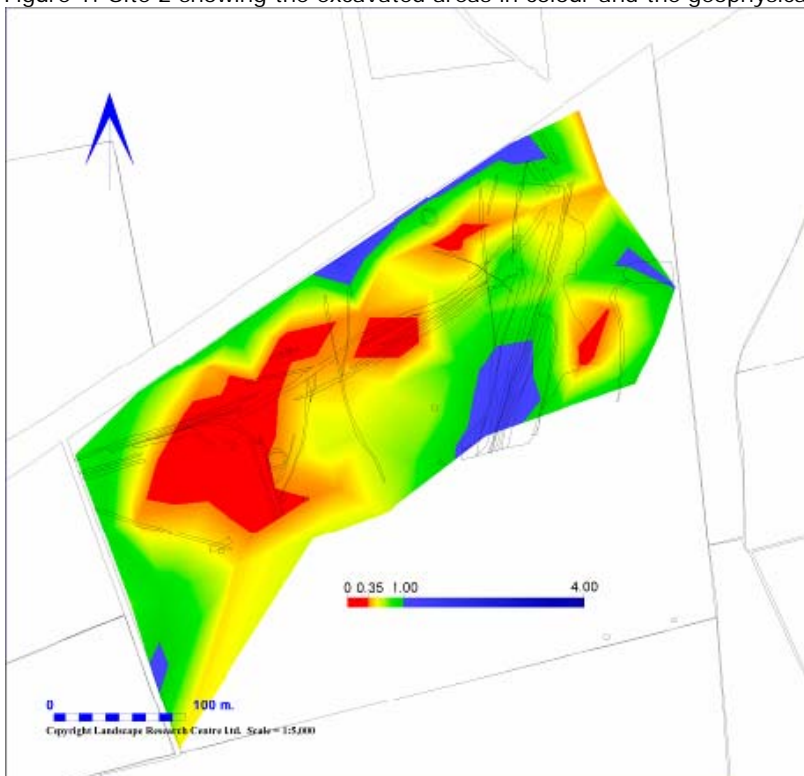


Figure 2: Plot showing the thickness of the combined ploughsoil and blown sands over the northern part of Site 2.



Figure 3: Heslerton Site 081 with geophysical survey results in grey.

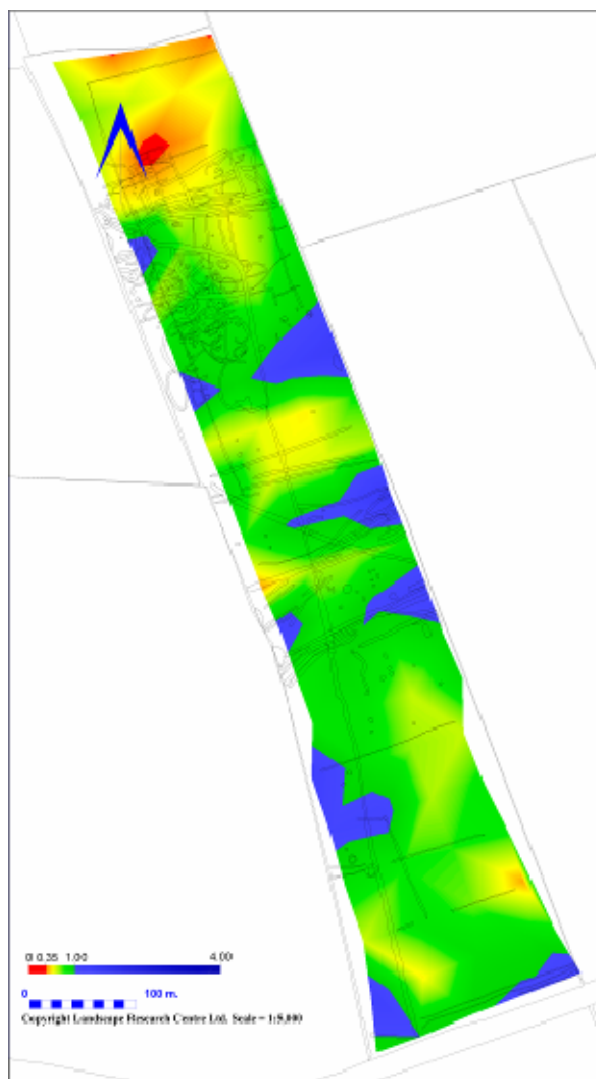


Figure 4: Combined depths of ploughsoil and blown sands observed through auger survey.

Site 81

Site 81, the western boundary of which forms the parish boundary, is nearly 1000m long, in the northern half of the field geophysical survey and air photography have revealed part of a fen edge 'ladder settlement' dating to the Late Iron Age and Roman period. This settlement which follows a well defined trackway is a feature of the landscape on the southern side of the Vale of Pickering. Within this field a junction in the trackway opens out into a second settlement complex, which is not paralleled in the c.1000Ha of survey undertaken along the Vale edge by the LRC. This settlement complex, characterised by large curved enclosures, containing probable round-houses, is likely to be Bronze Age or Middle Iron Age, perhaps related to a square barrow cemetery in the field to the west. Sub-surface modelling of the overburden shows that this complex is relatively well sealed whilst the features of the 'ladder settlement' are under more active threat from plough damage, a factor confirmed through an observation trench dug in 2003. The proposal to plant Miscanthus in this field covers the southern half of the field where soil

depths are greatest and the principal known evidence relates prehistoric trackways and major landscape boundaries. We anticipate no particular impact from growing the crop in this area.

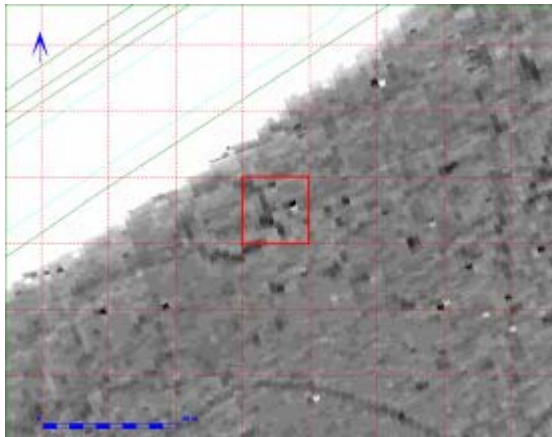
Conclusions

We can see no grounds for objecting to the growing of this crop in the two areas proposed, and feel that on present evidence, the reduction of ploughing resulting from the 10 year lifespan of the crop offers a positive archaeological advantage. Sub-soiling will not be undertaken ahead of planting. The proposal provides a splendid opportunity to undertake detailed research into the archaeological impact of this important crop. We have approached the landowners, the Dawnay estate, with a request for permission to undertake research on the impact of the crop on Site 2; research which should inform all concerned with the impact of this potentially important energy crop.

Proposed Research

A small interrupted or penannular ditched feature, a probable Round Barrow, situated on the northern edge of the area to be planted, a series of small anomalies which may be graves around it, provides a suitable test location. The choice of location satisfies archaeological objectives and minimises impact on the field as a whole. In order to test the impact of the crop it is proposed to excavate a series of adjacent trenches covering the eastern half of this monument and the area around it, at different stages during the growing cycle. The total area to be covered would be a 10 metre square examined through a series of adjacent 10x2m trenches. The first would be excavated prior to planting, the second after 1 year, the third after 5 years, the fourth prior to crop removal and the last following the crop removal. The data recovered should give us a complete picture of the impact of the crop on the buried archaeology at all stages during the planting, growth and removal. Although the trial would be undertaken over a long period, the initial archaeological impact of growing the crop should be clear at the end of the first year when a detailed report should be prepared for distribution to English Heritage, the Forestry Commission, Defra and the local authority. The initial report would then be updated with new information as the experiment progresses.

The first stage of the process would comprise a higher resolution 30m square geophysical survey over the proposed area; the survey and each trench would be tied in using Kinematic GPS measurements, allowing the exact location to be revisited without the need for permanent grid pegs or other survey markers. Following the survey the first trench would be opened and the plough soil removed by machine, any plough furrows or extant blown sand deposits would then be recorded and removed by hand. The ring ditch and any other features would be excavated and recorded and the trench backfilled prior to planting. The trenches



would be excavated aligned east to west and progress from south to north. Once the field is under crop excavation could only be undertaken after harvest, care would be taken to replant the rhizomes during backfilling by separating the upper part of the ploughsoil containing the rhizomes during stripping. Excavation of each trench should take no longer than one week.

Figure 5: Proposed research area bounded in red