

Peat depth variability at Machrie North, Arran, and its implications for archaeological survey and conservation in British uplands

Keith Ray* and Andrew T Chamberlain†

ABSTRACT

The results of a series of surveys of an area of peat moorland on the Isle of Arran, Scotland, have been analysed to determine the relationship between surface indications and subsurface cultural features. The study reveals that variation in the depth of peat accounts for much of the apparent areal density of surface features. The paper further demonstrates how the conservation strategy enacted at the survey area, based as it was largely on surface indications, was effective in selecting for preservation those areas with shallow peat cover and not (as was believed at the time of implementation) those with a higher feature density. These findings together crystallize various doubts concerning current survey practices, and the survey and conservation policies which it has been advocated should be based upon them.

INTRODUCTION

A number of recent papers testify to an interest in extending the utility of surface survey for the location of early settlement evidence. The majority of published experiments refer to the practical benefits of intensive surface collections under conditions of arable farming (eg Woodward 1978; Foard 1978). Meanwhile, aerial photography continues to extend appreciation of the scale and of the continuous nature of distributions of early settlement traces, especially under intensive agricultural conditions (Maxwell ed 1983; Wilson 1975). One region where the growth in registration of such traces has been extremely rapid recently is in Scotland, where the demands this increase has placed upon the means of adequate depiction of observed features has provoked a lively debate (Shepherd 1980; Ralston & Shepherd 1983; Maxwell 1983; Macinnes 1983). Concurrently, the response to accelerated rates of destruction of early settlement evidence (cf Crawford 1974) has involved a number of surveys of upland areas where relevant aerial survey has proved less successful, and where ground conditions can be difficult (eg Jackson 1978; Mercer 1980).

Such upland surveys, especially in western Scotland, are hampered by the presence of a blanket surface accumulation of peat which has formed mostly during the last three and a half millennia. A gradual abandonment of previous settlement in these upland areas had paralleled the climatic deterioration and soil exhaustion which were the main precursors of peat formation (cf Piggott 1972).

*Department of Archaeology, University of Cambridge, Downing Street, Cambridge, CB2 3DZ

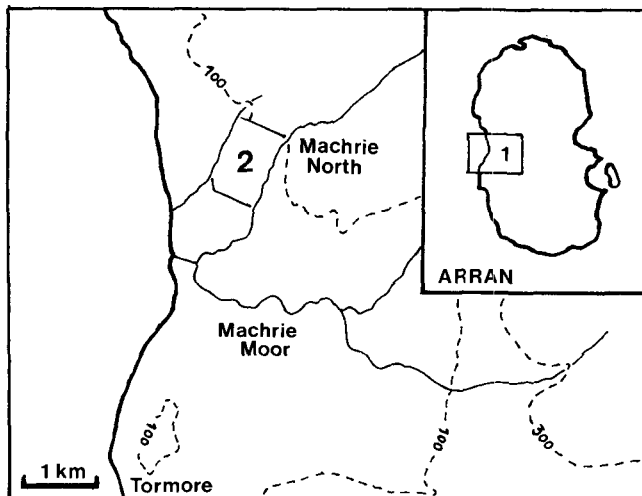
†Department of Human Anatomy and Cell Biology, University of Liverpool, PO Box 147, Liverpool, L69 3BX

The presence of the peat not only impedes survey access seasonally and locally, but itself obscures former land surfaces and covers many former cultural features, making aerial survey often highly unproductive. Where the peat cover is relatively thin, indications of former settlement can be observed. Survey of these indications by the statutory agencies has led to the recognition and definition of a number of classes of field monument. Linear features can often be observed to disappear beneath deeper peat, but there has been no attempt to investigate the consequences of the variability in peat depth to which these disappearances attest.

The present article demonstrates that such variability and the implied disconformity between surface indications and subsurface distributions of cultural features may be characteristic of upland peat moors in Scotland. Additionally, the implications of this disconformity for archaeological survey methods and conservation strategies are outlined.

MACHRIE NORTH: A SURVEY HISTORY 1975–81

During the early 1970s a large-scale afforestation programme was initiated on the Isle of Arran (Strathclyde Region), largely confined to the southern half of the island. The immediate archaeological response to a proposed extension of these operations into areas of moorland immediately adjacent to the Machrie-Blackwaterfoot basin in the west-central sector of Arran (illus 1) was prompted to a large degree by Ordnance Survey records of an abundance of field monuments in these areas. A rapid reconnaissance survey was commissioned from Edinburgh University and was carried out early in 1976 at Machrie North,¹ and at four other localities nearby where negotiations for land for forestry were being conducted (Mercer *nd*). All five zones were examined within a short period, and despite good peat surface visibility, only very prominent features were recorded and these were sketch-located rather than accurately surveyed, to save time and maximize survey coverage. In addition to the primary morphological classes identified by the Ordnance Survey – cairns, hut circles, and traces of former field-walls – a number of other, anomalous, features were recorded and recommended for closer examination.



ILLUS 1 Location map: Machrie North survey area within the Machrie Basin

An extensive system of field-walls was the most prominent surface feature recorded in Mercer's survey of the Machrie North location. Unlike adjacent areas, or indeed most of the other surveyed areas in the Machrie Basin,

no monument of even semi-diagnostic type occurs in the area in association with these walls (Mercer *nd*, 11).

The field system was considered worthy of further investigation, if not preservation (*ibid*, 12), but otherwise the area was thus regarded as practically devoid of settlement traces.

In 1978 the onset of forestry ploughing brought into play the second element in the archaeological response to the Machrie Basin afforestation. This was carried out under the aegis of the Scottish Development Department, by the Central Excavation Unit² (henceforward CEU), and involved closer surface survey of upstanding settlement features, limited excavation of field monuments and their immediate environments, and systematic sampling of organic remains with the aim of reconstructing land-use history (Barber 1982). The CEU turned its attention to Machrie North in 1980.

The surface survey at Machrie North, conducted by the present authors, was designed both to supply background information for the CEU excavations, and to test the proposition that observed surface traces were not directly representative of the distribution of features located beneath the peat. The whole of the 71 hectare area at Machrie North was gridded at an interval of 50 m (illus 2) and this grid provided the sampling framework for all further survey. Within each grid square, surface occurrences of stone, any abrupt changes in slope, and the pattern of vegetation cover, were recorded. The resulting microtopographical maps indicated where possible landscape modification had occurred, and located potential cultural features not entirely obscured by the peat cover. The classes of feature most prevalent in the 1976 rapid reconnaissance survey were 'cairns' and 'walls' and numerical increase in these two classes of feature between the 1976 and 1980 surveys was considerable (see table 1).

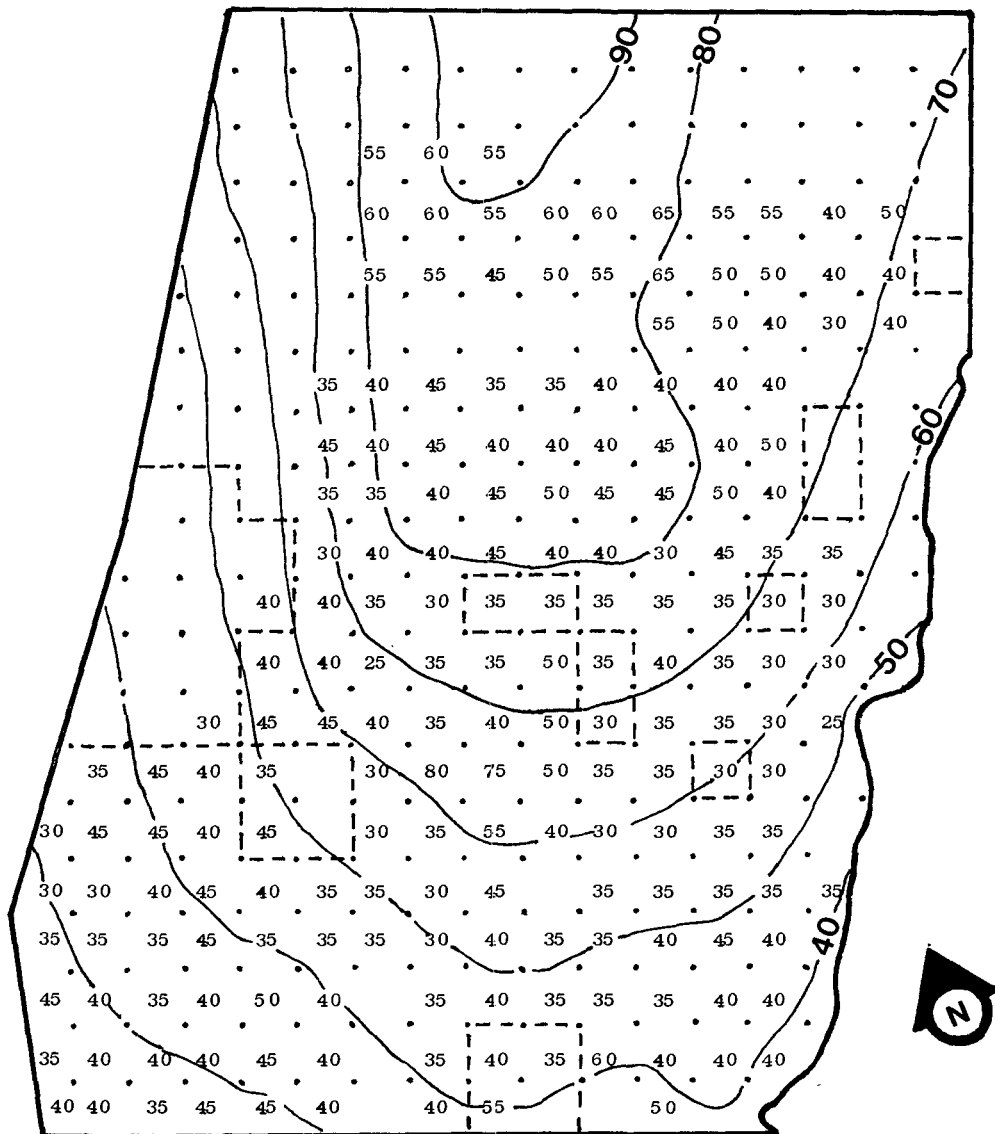
TABLE 1
Total numbers of features found in successive surveys
at Machrie North

Date	Survey	Cairns	Walls
1976	Mercer	5	50
1980	Pre-ploughing	43	142
1981	Post-ploughing	163	222

At the same time as the surface survey was conducted, a systematic soil-sampling programme was begun, based on the sampling grid. This programme, aimed primarily at locating areas of former agricultural activity, was completed in 1981, and provided peat depth data for the majority of the 50 m squares (illus 2). Finally, after primary ploughing operations had been carried out, a watching brief was carried out by CEU staff in 1981, and features containing stone and intercepted by the Clark Trailing Ploughs of the Forestry Commission were rapidly recorded. Although the probability of detection of linear features in particular may have been influenced by the direction of ploughing, and even though there were still large areas between furrows which were left with their covering of peat largely intact, the further increase in observed features is impressive. However, as will be demonstrated below, this increase has greater implications concerning the inadequacy of former survey criteria, than the efficacy of simply more intensive surface survey.

MACHRIE NORTH SURVEY RESULTS: A QUANTITATIVE APPRAISAL

A principal concern in the analysis of the results of the three successive phases of survey at Machrie North (those of 1976, 1980 and 1981) has been to determine the nature as well as to chart simply the fact of increase in the numbers and density of settlement features recorded in the successive surveys. In order to do this the first necessity was to adopt standardized criteria for quantifying settlement feature data. The first step in this process was to restrict our consideration to



ILLUS 2 The gridded survey area. Numbers – peat depth in cm (average per grid square); solid lines – contours in metres, OD; dots – grid intersections/sample points; broken lines – areas recommended for preservation (averaged into grid squares)

features primarily consisting of stone, for three reasons. Firstly, in numerical terms they were far more common than features without stone, such as lynchets. Secondly, their identification and recording was considered to be less subjective than for non-stone features, and thirdly, they were widely and consistently encountered, and were recorded, in all three surveys.⁴

The second step in the standardization process was the quantification itself, carried out on the following basis. All point-located features were designated 'cairns', and the number of such features (recorded variously as burial cairns, clearance cairns and burnt mounds on CEU compilation maps) was calculated as a subtotal for each 50 m grid square. Linear features (recorded as 'field-walls' on CEU maps) were counted once in each 50 m grid square in which they were present. Thus if a linear feature crossed the boundaries of several squares, such a feature was approximately quantified in terms of its linear extent, since it contributed to the subtotals of each of these several squares.

The analysis itself began with an aggregation of these subtotals of 'cairns' and 'walls', and as noted during the survey process itself, the number of features at Machrie North was found to have increased dramatically between the successive survey phases, such an increase being observed for both classes of feature (table 1). Illustration 2 shows the average peat depth recorded for each survey square during the soil-sampling survey. The distribution of the peat depths was found to be log-normal and so five categories of peat-depth were then established in such a way that the distribution of peat depth values approximated a statistically normal distribution.

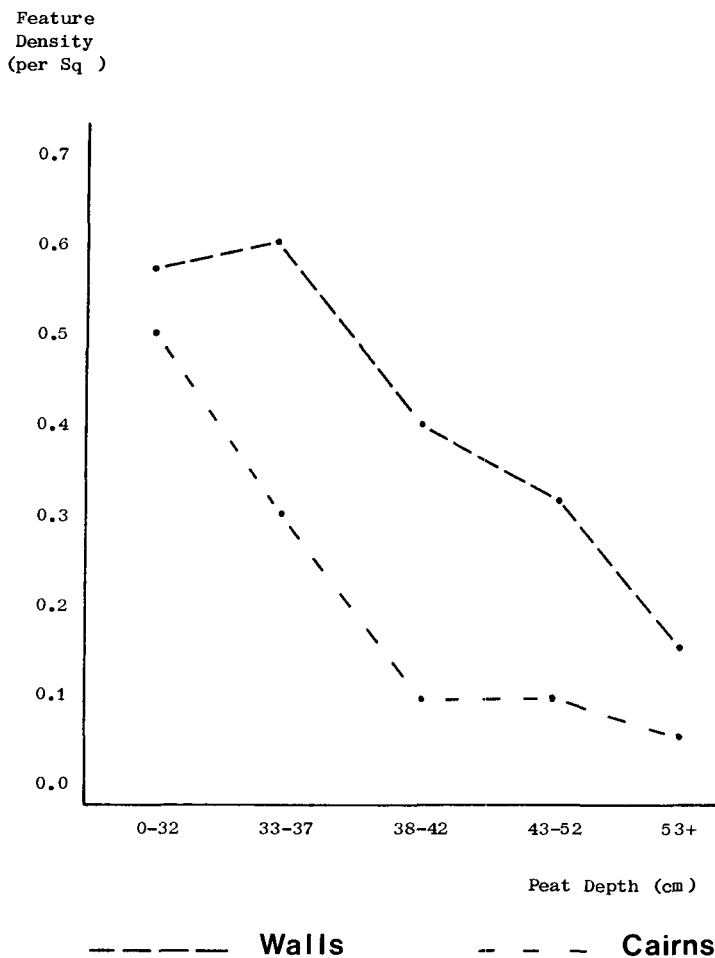
For each category of peat depth the areal density of each of the two classes of feature recorded in the 1980 (pre-ploughing) surface survey was calculated (table 2). The areal density of features recorded in that survey was found to be inversely related to the depth of peat (table 2; illus 3). The same calculations, relating peat depth to numbers of point and linear features recorded, was carried out in reference to the post-ploughing survey results (table 3). It was noted that in this survey no significant decline in feature density was encountered until the deepest peat depth category was reached. Indeed, it was only in this deepest category that feature density remained substantially below the maximum (shallow-peat) values found in the pre-ploughing survey.

TABLE 2
Relation of pre-ploughing survey feature density to peat depth

Peat depth (cm)	No of squares	Feature density	
		Cairns/sq	Walls/sq
0-32	24	0.50	0.58
33-37	52	0.29	0.60
38-42	54	0.09	0.39
43-52	36	0.11	0.33
53+	21	0.05	0.14

TABLE 3
Relation of post-ploughing survey feature density to peat depth

Peat depth (cm)	No of squares	Cairns/sq	Walls/sq
0-32	20	0.75	0.95
33-37	47	1.19	0.89
38-42	52	0.54	0.83
43-52	35	0.77	1.06
53+	20	0.35	0.45



ILLUS 3 Graphed relation of pre-ploughing survey feature density to peat depth

Another pattern evident in the surface survey data was that as peat depth increased the fall-off in the areal density of cairns occurred earlier than did the fall-off in the density of walls (illus 3). Thus increasing peat depth was accompanied by a markedly more rapid decline in the density of cairns observable at surface than of walls. The ratio of cairns to walls in the successive surveys is given in table 4.

MACHRIE NORTH SURVEY RESULTS: AN INTERPRETATION

We infer that the inverse relationship between feature density and peat depth (apparent in the data from the 1980 surface survey) is the result of varying peat cover which influences the visibility at surface of microtopographical modifications of the original land surface. This does not mean that such modifications do not show spatial patterning, but only that the variation in their areal density apparent in the surface survey was a reflection of the overlying peat cover rather than of the underlying distribution of settlement features in the survey area.

As peat depth increases, the visibility of point features immediately declines, whereas linear features appear to be more robust to the obscuring effects of peat. We believe that this phenomenon stems from the nature of surface survey, in which linear features such as field walls may be recognized even if segments are totally obscured by peat, vegetation or by the effects of subsequent land use. Increasing the intensity of surface survey, and the extension of survey to an investigation of subsurface distributions, results in an increase in the cairn to wall ratio (table 4). This occurs, we believe, because proportionally more cairns than walls are identified by such intensifications: in other words, because cairns are more easily obscured, they are more likely to be revealed only when more intensive survey methods are employed.

TABLE 4
Feature densities and feature ratios in successive surveys at Machrie North

Date	Survey	Walls/sq	Cairns/sq	Walls:Cairns
1976	Mercer	0.15	0.02	7.6:1
1980	Pre-ploughing	0.47	0.10	4.5:1
1981	Post-ploughing	0.76	0.56	1.4:1

The post-ploughing survey identified additional settlement features of both classes in all peat depth categories. The results of this survey, though quantified in an identical manner to the pre-ploughing surface survey results, are not strictly comparable. In particular, areas designated for preservation on the grounds of earlier survey results, and excavation, were not subjected to ploughing (feature density calculations for the post-ploughing survey were confined to data from grid squares that were predominantly or completely ploughed). None the less it is evident that in the post-ploughing survey only in the deepest peat depth category (ie peat of 55 cm or greater depth) was there a notably lower density of features: in all other peat depth categories feature density, though variable, was in effect randomly distributed. Some of this variability may reflect a partial misclassification of stone structures exposed and perhaps modified by the forestry ploughing process.

We interpret the evidence from the post-ploughing survey as supporting our inferences from the surface survey data. Where the peat cover was 50 cm or less, features on the original land surface were likely to become exposed by the ploughing operation, and variability in peat depth in the 0–50 cm range no longer had a primary influence on feature visibility. In areas where peat depth exceeded 50 cm ploughing exposed some extra features, but the obscuring effect of the peat cover still ensured that feature densities were markedly lower than in the areas with shallower peat.

AN EVALUATION OF THE MACHRIE NORTH CONSERVATION STRATEGY

Although an effective response to the erosion of Scottish archaeological remains by a variety of agencies including government-sponsored afforestation was slow in developing, there has been a significant increase since 1976 in the level of funding and consequently of 'rescue' activity. The principal activity now focuses around the CEU, and since its establishment the practice of rescue archaeology has altered significantly. This change can best be depicted as a shift from purely salvage operations extracting information immediately prior to destruction by development, to a more research-orientated 'environmental' approach, and to a policy encapsulating the preservation of mundane as well as spectacular monuments and in some cases also their immediate environment.

The Machrie North surveys involved a sequence of actions which, although nowhere made explicit, amount to a structured conservation response. As soon as the location of the proposed development had been definitely agreed upon, a survey was carried out to assess the scale and scope

of archaeological traces present. The likely impact of forestry ploughing on the observed surface traces and underlying deposits was known from previous experiments (Mercer 1980), and a series of recommendations were made concerning the appropriate response (Mercer nd). A more detailed appreciation of the scope of settlement traces was sought via the 1980 CEU microtopographical survey and the results were integrated into the strategy of investigation by excavation, the main aim of which was to exploit as fully as possible the opportunity for research into early agricultural and other practices which such threatened destruction afforded. As a by-product of these investigations, areas and monuments were recommended for preservation within the constraint that ploughing and planting operations were not to be made impracticable by the extent of the preserved areas.

Perhaps in part because neither the aims nor the course of this conservation strategy were ever made explicit (except in reference to specific justifications for preservation), such questions as the representiveness of what was preserved of the extant distributions of features were never formally posed. Relatedly the preservation of a 'sample' of areas and monuments could only be made in reference to untested assumptions concerning the effectiveness of survey and investigation at that point in time.

Even then, the preservation strategy appears to have been based neither on the desire to include accurately representative numbers of visible features, nor a fixed proportion of the total area available. Rather, there seems to have been a strong desire to preserve clearly upstanding features, or unusual features such as a ridged cultivation area found fossilised under the peat. These intentions were locally modified in consultation with Forestry Commission officers: the resultant piecemeal pattern of preservation is apparent on the distribution map of the preserved areas (illus 2; the actual areas had irregular outlines, and this analysis is based on the convention that a grid square is recorded as 'preserved' if more than 50% of its contents lie within a preserved area).

Had there been no subsurface sampling it could have been concluded that the enacted preservation strategy had been quite successful, on the grounds of the high percentages of features visible at surface that were included in the preserved areas. An estimated 40% of the cairns and 17% of the walls identified in the 1980 surface survey were preserved, while the sum of the preserved areas constituted only 11% of the total survey area. However, the preserved squares were mostly located in areas of shallow peat: of the 13 preserved squares with measurements of peat depth, 9 were in the first two peat-depth categories, and there was an overall decline in the probability of an area being preserved as average peat depth increased (table 5). It would thus appear that selecting for features, in this preservation strategy, was equivalent to selecting for areas of shallow peat.

TABLE 5
Influence of peat depth on probability of preservation

Peat depth (cm)	No. of squares	No. of squares preserved	% of squares preserved
0-32	24	4	16.7
33-37	52	5	9.6
38-42	54	2	3.7
43-52	36	1	2.8
53+	21	1	4.8

This was to a considerable extent borne out by a related observation that the mean feature densities in the preserved squares (0.53 cairns/sq, 0.75 walls/sq) were similar to those found in the shallow peat areas in the pre-ploughing survey (table 2). The third observation we made was that

these densities and the ratio between them (wall:cairn ratio) were very close to the mean values determined after ploughing in the non-preserved squares (see table 3).

Thus the preservation strategy has selected areas of apparently rather than actually greater density of features, the true (subsurface) density of features probably being similar in preserved and non-preserved areas. However, the strategy was enacted as if it were possible to preserve more than an 'average' density of features by delineating areas of greater surface concentration of underlying structures.

SOME IMPLICATIONS FOR SURFACE SURVEY

The microtopographical survey work conducted by the authors in 1980 as part of the CEU programme at Machrie North was designed in part to overcome some of the perceived limitations of a 'site morphological category' approach to surface survey (see Ray forthcoming). Such an approach has also been criticised in relation to the registration of aerial photographic findings (Ralston & Shepherd 1983). The possibility was entertained that microtopographical recording might be more sensitive to subsurface features than such categorizing survey work. At the same time, it was thought possible that *all* surface survey on upland peat involved some distortion of our perceptions of subsurface configurations.

We interpret our analytical findings as supporting both contentions, but believe that because the most considerable disconformities between surface and subsurface evidence appeared to stem from the presence of a variable peat cover, the analysis of this variability was a more pressing requirement than simply advocating an increase in surface survey intensity. The demonstration of the presence and nature of these disconformities has a number of implications for the practice of surface survey, and for the evaluation of survey results, in areas where peat is present. Variations in areal density of features observable at surface do not necessarily represent foci of former settlement: such apparent foci may simply represent fragments of a denser, continuous distribution of settlement evidence, the surface visibility of which is modulated by variations in peat cover.

An illustration of how this may alter our perception of surface survey evidence is given by the findings of a recent survey of an adjacent area of Machrie Moor (Barnatt & Pierpoint 1981). This survey of settlement traces was used to support the hypothesis that both 'domestic' structures and 'ritual' monuments were sited in topographically commanding areas: in particular, along a ridge orientated NW-SE above Machrie Water. Several categories of peat depth were identified, but their relation to topography was not made explicit. The fact that the survey only revealed traces in the shallowest peat areas was used not as an indication that peat was obscuring features elsewhere, but that settlement was located only in this area. In the light of the Machrie North results, the settlement feature distribution map for Machrie Moor (Barnatt & Pierpoint 1981, Map 1) amounts to little more than an index of shallow peat locations: the potential presence of settlement evidence under deeper peat cannot be excluded.

It is important to note that surface survey can approach the question of identification of cultural features from two directions. If the principle is adopted (cf Mercer 1982) that careful field mapping of clearly identifiable surface features should provide the basis for monumental classifications which themselves permit the formulation of research designs for further fieldwork, then only a percentage of observable traces will be recorded as contributive to the further production of knowledge about settlement. On the other hand, we may keep the experience of situations such as we have documented for Machrie North clearly in mind during surface survey. This may enable us to predict trends in the disconformity between surface and subsurface distributions, and to use all available surface indications not as a means of identification of monument types present but rather as a clue to the true nature

of the subsurface distribution of features. Such an approach gives no *a priori* primacy to the results of surface survey as a means of framing research problems. Rather it sees surface and subsurface investigations as simply interdependent parts of the processes of field survey and resource assessment which themselves are the prerequisites of the formulation of a conservation response to the potential erosion of archaeological traces.

Three principles emerge which summarize the most general implications of this study for surface survey in upland areas. Without some means of gauging subsurface distributions:

- (i) Areas devoid of settlement evidence cannot be deemed to have been devoid of former settlement.
- (ii) Surface survey cannot be regarded as providing a representative sample of settlement evidence, since some classes of feature are more obscured than others.
- (iii) Intensification of surface survey coverage may increase the yield of settlement features in a given area⁵ but may not bring about a correspondingly more complete knowledge of settlement feature distribution.

IMPLICATIONS FOR CONSERVATION

If the logic and principles upon which surface survey in moorland are based have rarely been enunciated, those from which conservation strategies have stemmed have hardly ever been more than cursorily mentioned. For the most part they have been relegated to recommendations' memoranda, and so have not been available for scrutiny beyond the orbit of the statutory agencies. From the foregoing study, we can conclude that the disconformity between surface and subsurface evidence has considerable implications for any structured conservation response to the erosion of the archaeological resource base.

Archaeologists in the service of statutory agencies have in passing used the argument of proceeding from the known to the unknown in justification for 'monument-orientated' preservation strategies. However, 'the known' is synonymous in this context with 'clearly visible at surface', and may be unrepresentative of distributions that are present but obscured by constraints on surface visibility. Any preservation policy that embodies the assumption that localized concentrations of features exist and can be identified (by surface survey, for example), is liable, on execution, to reduce a potentially continuous distribution to just such a pattern of 'isolated' concentrations. A corollary of this is that in the absence of typologically diagnostic monuments such 'concentrations' become, by default, the focus of investigation, thereby further reducing the likelihood of continuous distributions being perceived.

In our view, the results of archaeological survey should provide one element of the corpus of evidence on which conservation responses are formulated, rather than be relegated to the role of modulating existing (monument-orientated) preservation strategies. Conservation decisions should be framed with reference to the purpose of preservation: this will often encompass both present-day considerations (for example, amenity value) and the demands of maintaining a resource base for future archaeological investigation. In relation to upland areas, if continuous distributions of settlement evidence are indicated (and preservation can be justified) then spatially contiguous blocks of land, rather than isolated features, should be retained.

Consideration should also be given to the preservation potential of areas designated for conservation. It is not difficult to appreciate that the highly visible features identified by one generation of archaeologists can eventually become the actively-eroded resources prompting rescue attention from a subsequent generation. In upland areas, shallow peat may reflect attenuated peat growth, but may also result from the active ablation of a previously intact blanket peat coverage. In

such a situation the requirements of amenity value, especially those of visibility, may be in direct conflict with the optimal conditions of preservation for future archaeological research.

CONCLUSIONS

The findings reported in this paper must be evaluated within the general context of a debate concerning the determinants of survey efficacy and the policy founded upon perceptions of it, which first found a forum in Stevenson's 1975 article 'Survival and Discovery', and one of the most recent contributions to which has been Mercer's 1982 article 'Field Survey: A Route to Research Strategies'.

Briefly, the conclusion of the present paper with respect to survey is an extension of Stevenson's observations and a considerable qualification of Mercer's. With reference to surface surveys in Perthshire, Stevenson noted that the survival or destruction of archaeological features depended on their location and morphology with respect to predominating land-use patterns and exploitation practices. He thus sought to illustrate how some sites in marginal land-use settings had high survival prospects but low discovery potential, while other sites within this zone might be more easily identifiable – for instance due to their proximity to head-dykes, or by virtue of having upstanding earthworks. In this context, he mentions short cists as having a particularly low discovery potential (Stevenson 1975, 106).

We have shown that disparities in visibility (discovery potential) may indeed be in some measure attributable to feature morphology, but that this is in a sense inseparable both from the survey parameters (particularly the intensity of survey), and more importantly from ground surface conditions, predominant among which is (in many cases) peat depth. Mercer argues that surface survey involving 'analytical field survey' of monuments can enable archaeologists to isolate and specify significant research questions. If (as has been argued here) however, distributions of visible monuments compiled from surface survey (Mercer's 'total inventory': Mercer 1982, 24) are to an inconvenient degree an artefact of peat depth variability, then they cannot be used as a reliable sample, let alone a direct index, of the range of examples of cultural features existing below the peat.

The study presented here then is intended as a preliminary contribution to the documentation of the effects of visibility factors upon perceptions of the extent of the archaeological resource-base. Within our survey area we have shown that the variation in peat-depth is an important factor affecting the visibility at surface of cultural features. The further suggestion that some kinds of feature have a greater propensity for being masked by variable peat cover than others is one aspect that will certainly require careful attention in subsequent studies. This study has also introduced the need to examine closely the efficacy (and rationale) of specific enacted conservation strategies: at Machrie North, variability in peat-depth may have had a direct effect on the choice of areas for preservation.

We should also briefly consider the possibilities for future research into survey and conservation methods that the reported findings present us with. For instance, the lack of representation of surface observations for subsurface features has highlighted the problem of bias introduced as a result of variability in surface visibility. Much more work needs to be done in the direction of structured assessment of the effect of such biasing factors. In the intensive surface survey at Machrie North we recorded the relationship between vegetational distributions and variable ground surface visibility. The obscuring effect of heather was registered as a more permanent limitation than bracken in this respect, while the presence of bog grasses in certain areas defined seasonally inaccessible places. The strategy for overcoming problems of representation under upland peat conditions also needs to evolve from our simple demonstration of the nonviability of purely surface assessments. Here, extensive experimentation with subsurface sampling schemes needs to be made, including combinations of area stripping and point sampling, according to both systematic and randomized designs.

Only such schemes will enable us to formulate contrasting strategies for the elucidation either of basic presence/absence of cultural features, or of further spatial configurations of distributions.

NOTES

- 1 Mercer and his team surveyed two distinct areas at Machrie Moor North, denoted Machrie Moor North 1 and Machrie Moor North 2. The piece of moorland subsequently examined in more detail in 1980/81 was Machrie Moor North 1, and it is this appreciably smaller, more westerly of the two areas which we mean throughout this paper when referring to Machrie North (see illus 1).
- 2 The Central Excavation Unit's programme was directed by John Barber. The authors would like to take this opportunity to thank him for field support and encouragement for the initial idea behind this experiment, and for access to survey results for our analyses in 1982, in advance of publication of the definitive reports.
- 3 It was found during the excavation of both monuments and of 10 m×10 m sample squares at Machrie North that most groupings or accumulations of stone both within the peat and on the old land surface had some cultural significance, if only in terms of the residue of early field clearance operations.
- 4 It is important to recognize the limitations of restricting future experiments to the use of stone features as an index of archaeological distributions. The extended use of a soil-sampling programme to test for sub-peat and non-stone feature distributions would provide one direction via which the 'stone' results could be qualified.
- 5 We estimate from our surveys and those of Mercer that the rate of discovery of features in any given area will increase roughly as the square root of the person-days spent on survey in that area. This, however, neglects the much wider utility of microtopographical survey data as compared to that derived from a sketch-located rapid reconnaissance inventory.
- 6 He also noted as surprising the fact that highland regions abandoned by agriculture since the Bronze or Iron Ages and containing 'houses, field-systems, clearance cairns. . .' have received so little attention from archaeologists perhaps because, due to these sites' remoteness and good state of preservation, they were regarded as exceptional or otherwise atypical of their period.

REFERENCES

- Barber, J 1982 'Arran', *Curr Archaeol*, 7 (1982), 358–63.
- Barnatt, J & Pierpoint, S J 1981 'Field monuments on Machrie Moor, Arran', *Glasgow Archaeol J*, 8 (1981), 29–31.
- Crawford, I A 1974 'Destruction in the Highlands and Islands of Scotland', in Rahtz, P A (ed), *Rescue Archaeology*, Harmondsworth, 183–212.
- Foard, G 1978 'Systematic fieldwalking and the investigation of Saxon settlement in Northamptonshire', *World Archaeol*, 9(3) (1978), 357–74.
- Jackson, Angela M 1978 *Forestry and Archaeology: A study in survival of field-monuments in south-west Scotland*. Hertford.
- Macinnes, Lesley 1983 'The view from the bird's eye – the dilemma of aerial archaeology', *Scot Archaeol Rev*, 2(1) (1983), 60–2.
- Maxwell, G S 1983 'Cropmark categories observed in recent aerial reconnaissance in Scotland', *Scot Archaeol Rev*, 2(1) (1983), 45–52.
- Maxwell, G S (ed) 1983 *The impact of aerial reconnaissance on archaeology*. London. (= *Counc Brit Archaeol Res Rep*, 49.)
- Mercer, R J nd *Kilpatrick, Corriecravie, Machrie: Arran field surveys*. (Unpublished Report, Central Excavation Unit, Scottish Development Dept, Edinburgh.)
- Mercer, R J 1980 'The evaluation of modern ploughing threats to prehistoric sites', in Hinchcliffe, J & Schadla-Hall, R T (eds), *The past under the plough*, London, 105–8. (= *Dir Anc Mon Hist Bldgs Occas Pap*, 3.)
- Mercer, R J 1982 'Field survey: a route to research strategies', *Scot Archaeol Rev*, 1(2) (1982), 91–7.
- Piggott, S 1972 'A note on climatic deterioration in the first millennium BC in Britain', *Scot Archaeol Forum*, 4 (1972), 109–13.

- Ralston, I B M & Shepherd, I A G 1983 'Archaeological air photography – the classification of the results', *Scot Archaeol Rev*, 2(1) (1983), 53–60.
- Ray, K (forthcoming) 'Missing landscapes: survey and the assessment of Scotland's archaeological resources', *Scot Archaeol Rev*.
- Shepherd, I A G 1980 'Archaeological aerial photography', *Scot Archaeol Forum*, 10 (1980), 75–9.
- Stevenson, J B 1975 'Survival and discovery', in Evans, J G, Limbrey, Susan and Cleere, H (eds), *The effect of man on the landscape: the highland zone*, London, 104–8. (= *Counc Brit Archaeol Res Rep*, 11.)
- Wilson, D R (ed) 1975 *Aerial reconnaissance for archaeology*. London. (= *Counc Brit Archaeol Res Rep*, 12.)
- Woodward, P J 1978 'A problem-oriented approach to the recovery of knapped flint debris: a field walking strategy for answering questions posed by site distributions and excavation', in Cherry, J F, Gamble, C and Shennan, S (eds), *Sampling in contemporary British archaeology*, Oxford, 121–7. (= *Brit Archaeol Rep*, 50.)