The Material Component of the Aboriginal Cultural Landscape: Mapping Country Through Predictive Modelling

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This paper reports on work being conducted in the Greater Blue Mountains World Heritage Area (GBMWHA) to map the distribution of Aboriginal archaeological features using predictive modelling. The project combines with other studies being conducted in the region under the banner of 'Mapping Country'. The 'Mapping Country' program was initiated by the Blue Mountains World Heritage Institute (BMWHI), in partnership with the Hawkesbury-Napean CMA, Blue Mountains City Council and the Department of Environment and Conservation, NSW. Knowledge of the distribution of Aboriginal features throughout the landscape is providing a better understanding of the Aboriginal Cultural Landscape. The objective of the Mapping Country program is to generate information that will assist Aboriginal communities and planners develop a more productive working relationship around the development of regional conservation strategies.

Introduction

Aboriginal people experience a very strong sense of connection to the country they and their ancestors are descended from. For them, this attachment to country extends well beyond a sense of belonging, and involves a custodial responsibility to care for country, the successful implementation of which is central to their sense of well being (Waters 2006). For this reason, it is important for Aboriginal people to be fully integrated into land management. For if they are not, there is a very real sense that for them they are letting down their country, their community, and themselves.

However, consideration of cultural heritage as an integral part of land management is only a relatively recent practice in Australia. And indeed, as Sullivan (1992, 172) has argued, the view that the Australian landscape is also an Aboriginal cultural landscape is only a recent realisation for many Australians. Even after 30 years of giving greater emphasis to the importance of Aboriginal cultural heritage (see Kijas 2005), there still remain conceptual conflicts such as with the notion of 'wilderness' and the idea of a traditional Aboriginal cultural landscape (Hooper 2006a; Mowaljarlai 1992). State and Federal Governments are now in the process of developing policy towards productive partnerships with Aboriginal communities focused on the social and cultural benefits of full engagement in land management (e.g. DEC 2006).

However, the issue still to be clearly resolved in setting up such partnerships, is what should be focus of the relationship between Aboriginal communities and government bodies. It has been highlighted for example that the notion of simply 'involving' Aboriginal communities in conservation programs, is in itself rein-

forcing politically that cultural values are still peripheral to core conservation objectives (Birkhead & Smith 1992). A possibly more productive step is to recognise the conservation value of cultural landscapes in their own right, as has recently been done by the Council of Europe (Déjeant-Pons 2002). If this is done, then it shifts the agenda towards focusing on conservation efforts that ensure the persistence of a functioning Aboriginal Cultural Landscape into the future. This is not unlike the corollary objective of ecology, which is to ensure the persistence of biodiversity into the future (Cowling et al. 1999).

Increasingly, it is being realised that such a position involves more than just conserving evidence of cultural features (in a museum sense), and instead requires actively continuing cultural practices that maintain a cultural landscape. This follows the UNESCO view, which is that for a cultural landscape to have integrity, conservation programs must ensure that the behaviour that constitutes that landscape is maintained according to the level of authenticity recognised in that community (see ICOMOS 1994). For example, maintaining historic agricultural landscapes in Europe has meant practising historic farming practises despite the cost this imposes economically (Fairclough 2002). The idea that maintaining a cultural landscape requires cultural practice, comes much closer to the way many Aboriginal people view the importance of cultural practice itself being an approach to conserving cultural heritage (Mowaljarlai 1992).

One of the difficulties with adopting such a framework however, is the difficulty some Aboriginal communities have in articulating their own cultural landscape. This is particularly the case in places like the Blue Mountains, where there has been a long history of Aboriginal people being removed (forcibly) from their land, and has subsequently led to a considerable loss of traditional knowledge and detachment of from country. Projects like 'Mapping Country' (Hooper 2006b), are attempting to help communities organise and synthesise the traditional knowledge they still hold, as well as recognising the social value of the experiences of Aboriginal people during the contact period (see Byrne et al. 2001). These efforts are important for helping Aboriginal communities restore their cultural landscape.

It is also here that anthropology and archaeology can play a supporting role to help re-establish information about how Aboriginal people traditionally utilised the landscape. Archaeology can be useful to Aboriginal communities in providing explanations of long term temporal change, as well as detailed examination of the activities that took place in the past at particular places. A further utility of archaeology lies in the systematic reporting of the distribution of the material remains of Aboriginal behaviour in the past. It is this last application of archaeology that is the focus of this paper. Distribution patterns of Aboriginal features, for instance rock art sites or places with stone tools, are important evidence for reconstructing how Aboriginal people utilised a landscape in the past. Understanding where people situated different activities, how they moved through a landscape and relationships between places with cultural value are important building blocks for reconstructing what the Aboriginal cultural landscape may have been like in the past. The link between a traditional cultural landscape, and its reinterpretation in the present, is important for Aboriginal people trying to reconnect to their country.

Taking the step from interpreting individual sites to extrapolating regional settlement and land-use patterns has been done with mixed success by archaeolo-

gists in the past. The majority of these attempts have focused on deriving descriptive accounts of the way Aboriginal people utilised a region (eg Stockton 1993). However, actually mapping the pattern of land-use and activity has generally proved to be a much more difficult task (Gaffney & van Leusen 1995), especially when trying to untangle these patterns from issues of archaeological detectability and temporal preservation (Hall & Lomax 1996). For instance, it has tended to be done with landscape units applied over a region, to which qualitative statements about typical behaviour are assigned (eg Purcell 2002).

Otherwise, particularly in a regulatory framework with the protection of registered Aboriginal sites, the emphasis is placed upon the site itself, where it is represented spatially as an isolated point. This has the unfortunate consequence of giving the perception that there is an absence of cultural value between these points, when in fact the density of points really only reflects a combination of preservation potential and archaeological survey effort. The reality of course is that Aboriginal people perceive value in the entire landscape. Consequently the representation and management of this aspect of their cultural heritage, as a set of isolated points, lies in stark contrast to their perception of it as a cultural landscape. One of the challenges for conserving and describing indigenous values is to explore ways of representing a spatially discrete and biased archaeological sample as a cultural landscape.

One way that the cultural landscape (at least its material component) can be described in a spatially continuous way is to model the distribution of archaeological material. Predictive modelling is a technique that, when applied to spatial archaeological data, attempts to describe the likelihood of finding archaeological features occurring at any given location in the landscape (Kvamme 1988, 325). In this way a picture of how the likelihood of archaeological features occurring varies throughout the landscape is built up by calculating the predictions on a grid cell by grid cell basis within a GIS. The result is an image illustrating the spatial pattern of archaeological material throughout the whole region.

Figure 1 illustrates the results of performing the predictive modelling for the GBMWHA using all the available archaeological information recorded in the region. This involved just over 5000 archaeological sites, along with an equivalent number of random points distributed in varying density to reflect variation in archaeological survey intensity across the region (for method see Ridges 2006). The model itself was formed using Generalised Additive Modelling with a binomial family within S-Plus using a custom algorithm called GRASP (Lehmann et al. 2002). The following variables were used to form the model, and build on well-established approaches to modelling hunter-gatherer archaeological sites (Warren & Asch 2000):

- aspect;
- elevation;
- average annual rainfall;
- average annual temperature;
- geology (simplified into key geological units and rock types);
- accumulated visibility (derived by summing how frequently each grid cell is visible from within 25km of 17,000 observation points distributed in a grid

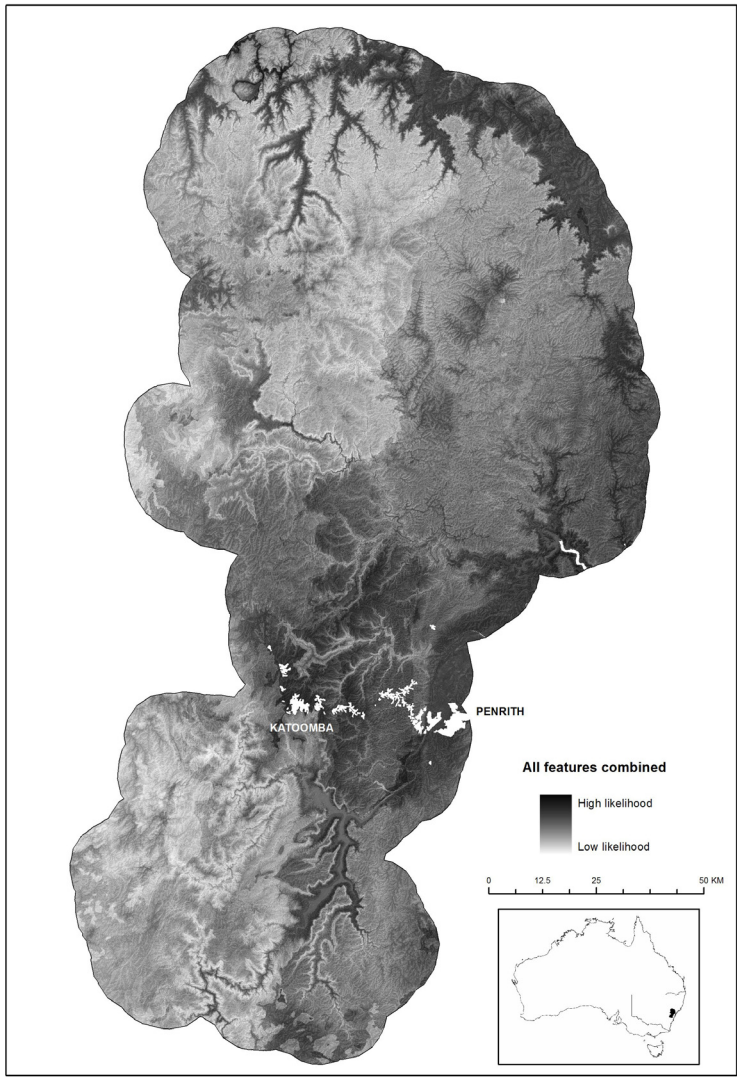

Figure 1 *Predictive model for the GBMWHA. The darker the shading indicates a greater likelihood of finding archaeological features. White areas indicate urban.*

pattern over the region);

- three dimensions of landscape similarity (as modelled using multi-dimensional scaling). This was achieved by building a matrix compiled from the amount of each of Keith's (2004) vegetation types occurring within the landscapes mapped by Mitchell (2002) that occur within the region;
- A weighted proximity to stream lines where the weight was stream order calculated using the Strahler method. The proximity was measured using cost distance where the cost was slope modified for walking speed using Tobler's formulae (see Ridges 2005, 128).

Although the map shown in Figure 1 indicates the variation in spatial pattern of finding archaeological evidence of any kind throughout the region, what it doesn't show is the variation in different types of behaviour. Different types of Aboriginal behaviour varied throughout the landscape in response to a complex array of resource patterns, social factors, and settlement patterns. Consequently, the pattern seen in Figure 1 needs to be dissected so it is possible to see how that pattern is further composed. This is an issue which is rarely explored in hunter-gatherer predictive models (Kvamme 2005), despite how amenable the data and method of modelling are to doing so (see Ridges 2003). The focus of this study is to pursue this avenue specifically, for it goes to the heart of describing the complexities of past indigenous cultural landscapes.

Figure 2 illustrates the variation that exists throughout the region when different kinds of archaeological features are modelled individually. For these models, the input data, method of modelling and variables were all the same, except that only those archaeological sites that contained the feature of interest were used for input into the model. For the present study, models for stone tools, rock art sites, grinding grooves, stone arrangements, and scarred trees have been derived. The choice of features was driven primarily by the frequency with which these features have been recorded in the region.

There are a variety of other feature-types that also occur within the region. Importantly however, the features that have been modelled reflect a variety of different behaviours. For instance, stone tools reflect primarily economic/subsistence behaviour associated with the places where Aboriginal people undertook activities in the landscape. Art sites reveal aspects of the social/ideological landscape. Grinding grooves again reflect economic behaviour, but quite a different aspect of it- stone axe sharpening. Stone arrangements are variously associated with ceremonial activity and/or Aboriginal burials. And scarred trees are usually associated with economic activity such as canoe or coolamon manufacture, or if they were carved decoratively, with burials. The five models therefore seen in Figure 2 start to show some of the complexity of different kinds of Aboriginal behaviour in the region, not merely variation in the distribution of archaeological features.

The complexity of the material component of the Aboriginal cultural landscape really emerges when these models are used to explore the similarity in combination of features that is predicted to occur in each grid cell. This is illustrated in Figure 3, where similarity in colour reflects similarity in the combination and likelihood of the features occurring. This map was generated using the models in Figure 2 as input for a principal components analysis, calculated on a grid cell by grid cell basis. The first three components of the result were used to assign a colour to each grid cell. Figure 3 begins to display what might be the beginnings of the spatial complexity in the way Aboriginal people utilised the landscape in this region. It also begins to illustrate some of the spatial pattern in the cultural landscape in a behavioural sense. Importantly, this pattern is continuous spatially, and fits much closer to the way Aboriginal people perceive their cultural landscape, and is a positive step away from simply viewing cultural heritage as a set of isolated sites.

Information that describes some of the spatial pattern in the traditional Aboriginal landscape, like that in Figure 3, permits some important possibilities in

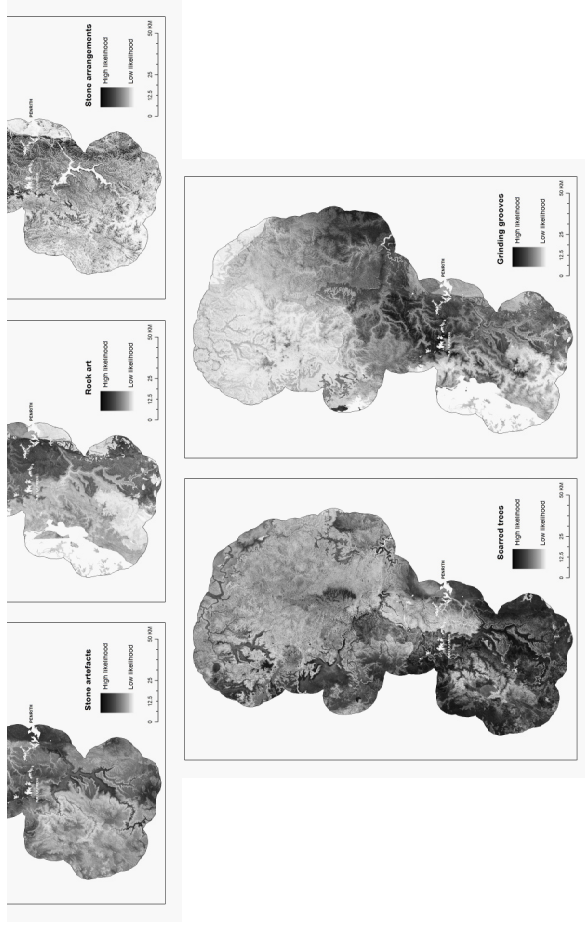

Figure 2 Predictive models for individual feature types. White areas indicate urban

planning and decision making for cultural heritage values. For instance, using the patterns seen in Figure 3, it would be possible to construct a conservation strategy that sought to maximise the representation of all colours (or feature combinations). The idea being that such a representative sample would enable a community to connect with all aspects of their cultural landscape, in so far as it is represented in archaeological sites. This would require much more than just looking at a representative sample of 'sites', and instead require look at planning for an entire landscape using systematic planning principles (Margules & Pressey 2000).

For Aboriginal communities, maps like that in Figure 3, articulate, spatially, some of what they recognise as the way their ancestors utilised and existed in the landscape. Importantly, armed with such information to represent their heritage spatially, Aboriginal communities can potentially use it to engage in a variety of planning contexts. These contexts include:

- connecting to country projects and cultural revival programs;
- site management issues;

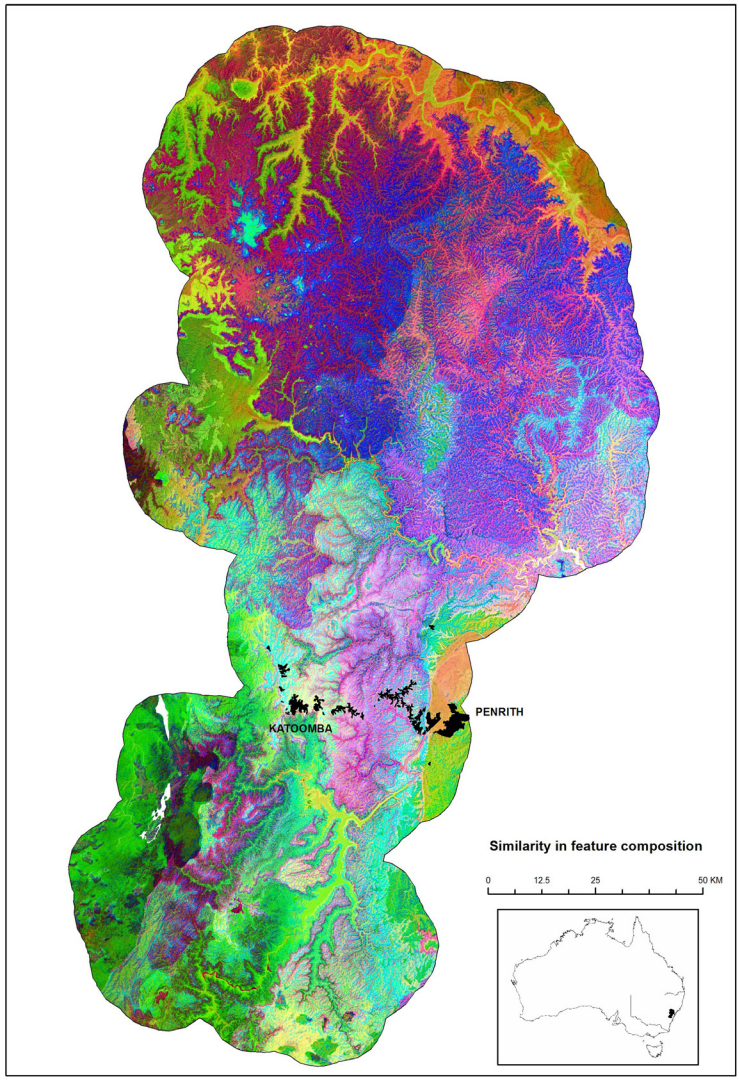

Figure 3 *Models of individual features types combined into a single colour figure. Similarity in colour indicates similarity in the combination of features predicted to occur. Black areas indicate urban*

- directing archaeological surveys, both on-reserve and within the regulatory environment;
- within the local government environment;
- with the management of reserves;
- with a variety of state and federal land-management bodies;
- decision making and conservation priority setting.

However, of most importance, is that these principles can be applied under the control and direction of Aboriginal communities themselves. Potentially this is where empowerment of Aboriginal communities can be realised, by ensuring their full control of this information and enabling them to use it to help obtain the outcomes they desire. For instance, the planning domain become maps of site potential and condition, without the need to reveal sensitive information such as the location of recorded sites. In doing so, it potentially offers to foster a much more productive engagement between Aboriginal communities and land-use planners. Additionally, it also goes someway to reversing the trend of viewing the indigenous landscape as a relic landscape instead of a living cultural landscape.

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Malcolm Ridges's primary research interest is in the application of systematic conservation planning to the conservation of Aboriginal cultural landscapes. My work in this field has involved archaeological predictive modelling of Australian Aboriginal features and using such information as the basis of mapping conservation priorities. My related interests lie in spatial data analysis, regional archaeological studies, GIS and site recording. After studying for a PhD in archaeology, I have worked for the past five years in the field of ecological conservation planning, but have recently moved back into a cultural heritage focus.