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USING A GIS TO IDENTIFY ARCHAEOLOGICAL SITES ON DISCRETE LAND BLOCKS: A CASE STUDY FROM THE CHATHAM ISLANDS

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Introduction

Following a world trend, computer-based 'Geographic Information Systems' (GIS) are fast becoming the database tool used for land management in New Zealand. In the public sector many local and regional governments and government agencies have already established geographic information systems, for example Department of Conservation, Opotiki District Council, Western Bay Of Plenty District Council, Waitakere City and Auckland Regional Council. Forestry companies (such as Carter Holt Harvey) and other land managers, as well as vested interest groups, including iwi and hapu based organisations, are also turning to geographic information systems as ways of dealing with large amounts of data that can be spatially referenced. GIS are also being used in New Zealand to complement and illustrate historical research by Maori presenting claims to the Waitangi Tribunal, such as Te Uri o Hau o te Wahapu o Kaipara (Jackson, 1997) and others.

The use of GIS is not limited to storing and retrieving information; GIS can also be used for analyses, predictive modelling and 3-D modelling as well as producing hard copy maps. Types of data frequently incorporated into a GIS include physical and biological information relating to flora, fauna, geology, elevation, hydrology and social and cultural information such as health statistics, census data and cadastral information.

In New Zealand land managers are bound by legislation such as the Resource Management Act 1991 and the Historic Places Act 1993 that requires them to manage various biological and cultural resources including the archaeological resource. Archaeological site information is well-suited to GIS

use and some of the above mentioned organisations already have coverages of databases that include archaeological sites. Specific data relating to individual archaeological sites must be referenced through the use of a unique identifier - the full NZAA site number is ideal for this purpose. Archaeological data is easily incorporated into a GIS and some DoC conservancies are including archaeological information into their GIS computer systems.

For those groups using GIS as a land management tool, good management of the archaeological resource may include the creation of a GIS map of archaeological sites already recorded with the New Zealand Archaeological Site Recording Scheme. As a first step in archaeological site management such coverages can provide useful information but this is obviously limited given the inaccuracy of many archaeological site location coordinates.

The problem of accuracy is becoming a major issue at a time when much greater accuracy is required of and achieved by surveyors and others through the use of differential GPS (Global Positional System). Some archaeologists are using differential GPS (e.g. Fredericksen *et al.* 1997) with success and digital data obtained via a differential GPS is suitable for use with GIS. But it will be some time (if ever) before the skills, resources and commitment allow for the resurveying of every recorded archaeological site using a GPS, let alone the unsurveyed areas in New Zealand. Until such a time archaeologists have to work with the data as it currently exists. GIS have facilities such as 'buffering', making it possible to create 'red flag' areas where at least one archaeological site is likely to be found thus alerting land managers to the fact that archaeological expertise may be required.

'Red flag' models for archaeological site management are being developed and used in the U.S. and elsewhere and are often part of a predictive modelling process which alerts land managers to archaeological site locations in a region. (Altschul, 1990) In New Zealand Harmsworth (1997), in collaboration with some iwi, has created GIS maps of 'red flag' areas which contain wahi tapu without clearly pinpointing their location. The associated database for such an area may list a contact person or representative of a hapu or iwi group for consultation purposes. A 'red flag' approach was taken when identifying how many previously recorded archaeological sites were located in specific land blocks on the Chatham Islands.

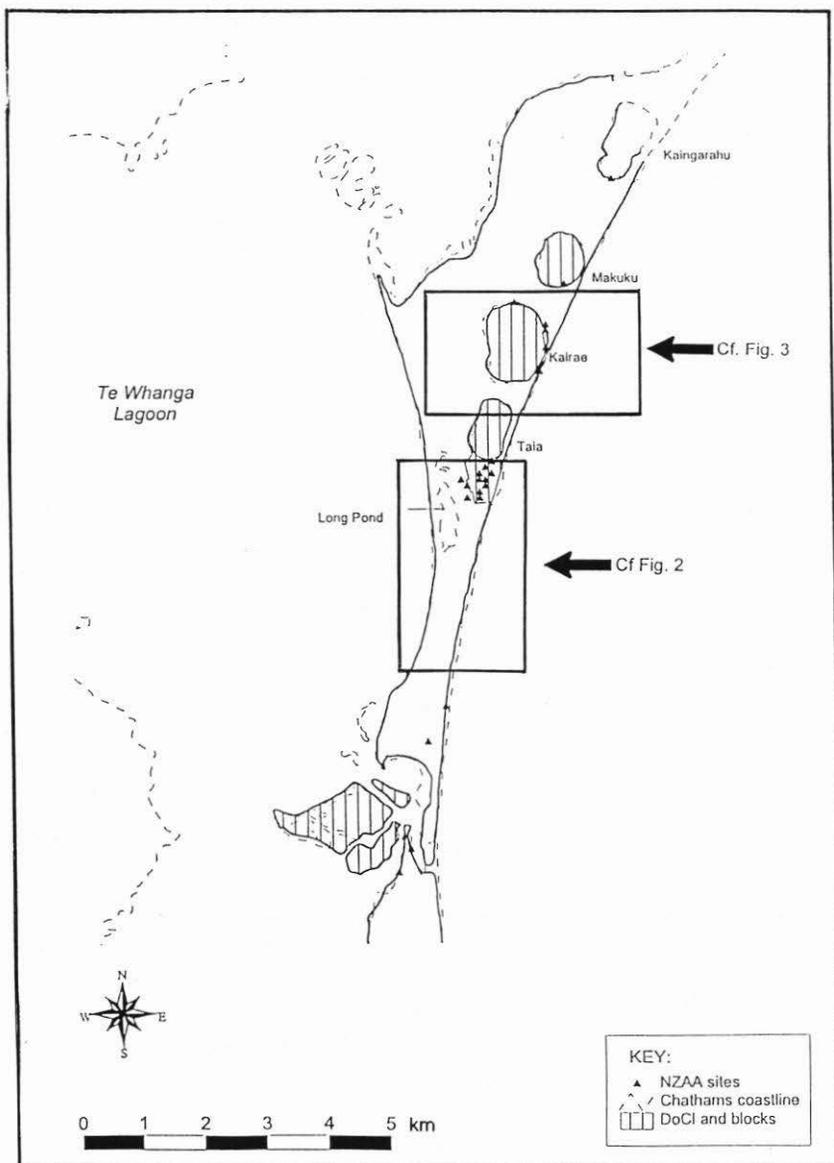


Figure 1. Chatham Island: section of the east coast.

Chatham Islands Archaeological Sites

In 1997 the Centre for Archaeological Research (CAR) was commissioned by Canterbury Conservancy, Department of Conservation (DoC), to create a digital map of particular types of archaeological sites on DoC managed land on the Chatham Islands.

There are 738 archaeological sites (excluding shipwrecks) on the Chatham Islands listed with the New Zealand Archaeological Association site recording scheme; most of these sites were recorded in the 1970s by a team of archaeologists from the University of Otago (pers. comm. Prof. Doug Sutton). Large areas on the islands have not been surveyed and therefore more archaeological sites exist than have yet to be identified and recorded.

Information supplied by DoC identified 88 archaeological sites on the DoC estate in the form of an inventory, *The Chatham Islands Archaeological Sites on DoC Land*. The sites were grouped by a land unit number and had metric coordinates location for each of the 88 sites [actually 87 sites as one site, CH 563, was listed twice]. A further document was supplied identifying 9 other archaeological sites giving a total of 96 archaeological sites identified as being on DoC managed land. A GIS coverage of these sites was created from the above data.

At the outset of this project it had been assumed that the information supplied by DoC was accurate in terms of the number of archaeological sites on DoC managed land. However, when the site coordinates of these sites was 'overlaid' with the coastline and land blocks it became apparent that some of these sites fell well outside these boundaries and the degree of inaccuracy was considerably more than the 100m accuracy stated for NZAA site locations. On the basis of this finding, a decision was made to check the accuracy of the site information. A sample area, a section on the east coast of Chatham Island which included part of the DoC estate, was selected. The GIS map of the archaeological sites created from the aforementioned data was compared to a series of archaeological maps of this area found in *Survey of Archaeological Sites: Te Awapatiki to Hapupu, Hanson Bay Chatham Island* (Smith and Wernham, 1976).

The most obvious difference between the data supplied by DoC from NZAA records (Fig. 1 Chatham Island: section of eastern coast. Note the thick black line is part of DoC esplanade reserve, the legend shading is not clear at this

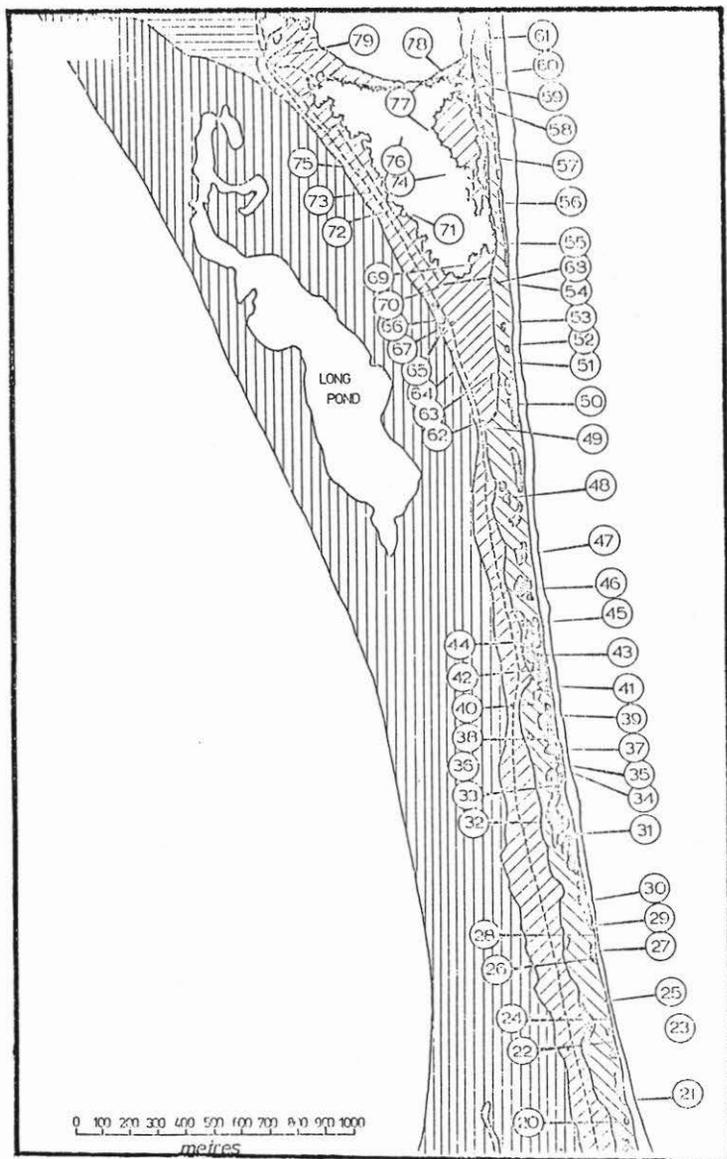


Figure 2. Archaeological sites identified in 1976 survey, east of Long Pond, Te Whanga Lagoon (after Smith and Wernham, 1976).

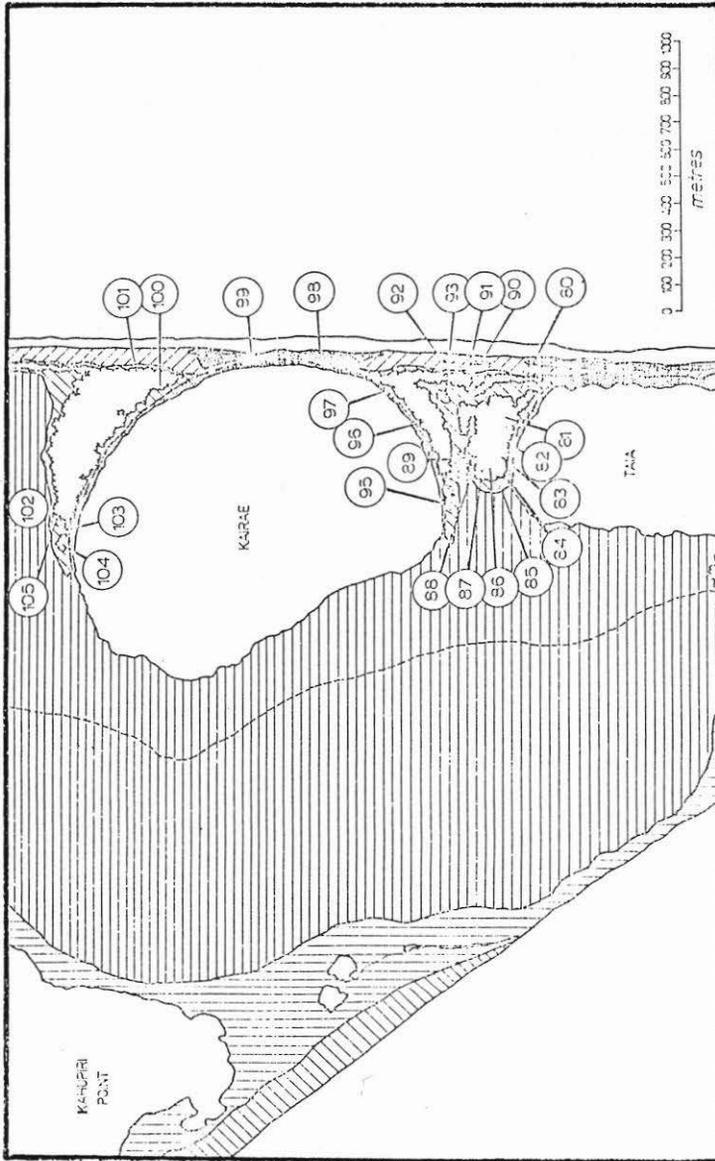


Figure 3. Archaeological sites identified in 1976 survey, Lake Kairae area, Te Whanga Lagoon (from Smith and Wernham, 1976).

scale) and that illustrated in the archaeological maps (Fig. 2 and Fig 3 - photocopies of two of the latter maps) is the number of archaeological sites in this area. There are considerably more archaeological sites noted on the Smith and Wernham maps than those on the GIS coverage of DoC archaeological sites.

One explanation for this difference could have been that most of the Smith and Wernham (1976) sites fall outside the DoC land blocks and thus would not appear on the DoC sites coverage. On closer examination, many of the former sites were located between a track and the coastline close to where an esplanade reserve strip was marked on the land blocks map. Further, descriptions in the text note that many of the sites (especially the southern sites in the sample area) were located on the dunes, often behind the foredune crests; this information indicated that these archaeological sites were on or very close to the DoC esplanade reserve in this area.

Results

A solution to this problem was to create a digital coverage of all 738 Chatham Islands' archaeological sites using the map grid references supplied from the NZAA site recording forms and, by utilising a GIS 'cookie-cutting' technique, identify all sites within the DoC land blocks using the digital coverage of the DoC estate land blocks which included the esplanade reserve.

A digital map of the DoC estate land blocks was provided by Canterbury Conservancy. The land blocks were buffered to 100m and 200m, creating a zone around the perimeters of each individual land block. An alternative procedure would have been to buffer the individual sites and then overlay with the land blocks to get a similar result, though that method would have been a little more complex.

The 100m and 200m buffers were necessary to allow for the clearly apparent inaccuracies in the NZAA site location data e.g. several sites were in the sea and more than 200m from the nearest coastline. The 200m was selected as being more accurate over the 100m commonly cited as the level of accuracy for archaeological sites for the above reason and other discussions found elsewhere (e.g. Sheppard, 1991; Jackson, 1997). It needs to be noted that the DoC estate on the Chathams consists of many parcels of land that vary greatly in both size and shape; the identification of archaeological sites on or near these blocks using GIS simplified what previously would have been a difficult and time-consuming task.

The new buffered coverages were used to 'capture' all of the archaeological sites that fell inside the now buffered DoC land blocks. Of the 738 recorded archaeological sites on the Chatham Islands, 239 sites were identified as being on or within 100m of DoC land and a total of 332 sites were on or within 200m of the Chatham Islands DoC estate. A GIS coverage of the 332 sites was created and supplied to Canterbury Conservancy. The use of a 200m buffer zone is a somewhat inclusive approach and it may well be that some of these sites are not on DoC land at all, but it does compensate for well-recognised locational inaccuracies that currently exist in the Site Recording Scheme, particularly the case in sites that were first recorded using the imperial NZMS 1 map series and were later recalculated to fit the metric NZMS 260 map series.

Conclusion

This GIS approach allows land administrators to more accurately estimate (and budget for) the archaeological resource that they manage, using already existing data. This can be a first step until more accurate archaeological surveying in the field (perhaps using differential GPS) can be carried out.

A 200m buffer zone around each archaeological site would create a 'red flag' area that can be used to alert land managers to the fact that archaeologists need to be consulted to provide more up-to-date information. While one could argue that the maps found in the various Historic Places Inventory already serve this purpose (to a degree), they are hard copy maps and require translation of coordinates onto management maps.

GIS digital maps are superior to these not only because they have a relational database attached to the maps, but also because the mapped archaeological data can be compared with various types of physical and cultural maps within a GIS and various topographical relationships can be identified across a landscape. HPT maps found in the inventories are limited to basic cadastral information and site identifying symbols.

The GIS approach enables point data (such as archaeological sites) to be quickly combined with line data (for example rivers or roads) and/or area data (such as vegetation, soil types, and land boundaries) and thus provides an essential management tool (cf. Allen, 1988). Information about a site, including its NZAA number, site type and any other information such as that found on a site record form, can be quickly accessed from an on-screen GIS map with a click of a mouse button.

A GIS is a powerful tool with many uses for archaeologists both for archaeological site management and for research purposes. While it is relatively new to New Zealand archaeologists it has been used successfully by archaeologists working in the United States, Australia and elsewhere for several years.

Further Discussion

As a by-product of the project there now exists a GIS coverage of all NZAA archaeological sites on the Chatham Islands. The database contains basic information found on site record forms (e.g. site type) and does not identify special sites such as wahi tapu.

Negotiations between myself and DoC have resulted in approval being given to supply a copy of this coverage to NZAA for their use and this copy is currently held by CAR. Approval for giving this data was based on two concepts:

1. At some time in the future the DoC estate on the Chathams may be different from its existing form (larger/smaller etc). If there is an existing GIS coverage in an NZAA archive of all archaeological sites then it would be relatively easy and cost effective to adjust and update existing information.
2. The GIS coverage of the NZAA sites on the Chathams does not compromise any confidentiality issues and the only information on the coverage is that supplied by NZAA; northing, easting, NZAA site no., NZAA site type being the database fields used.

The NZAA makes archaeological site information available to various groups and individuals at little or no cost and some of the end users of such information are creating GIS databases from that information. In such cases NZAA should negotiate to be given a copy of the GIS coverage of archaeological sites created by such groups or individuals providing that coverage does NOT compromise confidentiality, commercial or other issues.

On discussing this with colleagues in the Anthropology Department, I was alerted to the fact that such information sharing can be fraught with potential difficulties in today's commercial environment and that clear protocols need to be established regarding the use of such information. Further discussion regarding archaeological information on GIS and the establishment of such protocols is obviously necessary - should anyone wish to contact me about

this or any other issues arising from this paper please do so: my e-mail address is MAJ@antnov1.auckland.ac.nz

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