National Report to the 12th General Assembly of ICA

Cartographic Activities in New Zealand 1999-2003

New Zealand Cartographic Society

Cartographic Activities in New Zealand 1999-2003
National Report to the 12th General Assembly of ICA
Durban, August 2003

Edited by
Igor Drecki
New Zealand Cartographic Society

Each national member of the International Cartographic Association (ICA) is obliged to submit a report on cartographic activities for the period between General Assemblies. This report has been prepared by the New Zealand Cartographic Society to meet the above requirement.

Introduction

Although an attempt has been made for this report to be wide-ranging and comprehensive, in some sectors of cartography it is far from adequate. A number of organisations and individuals have been invited to submit a suitable material to present a general perspective on the cartographic activities in New Zealand. However, due to the limited resources of time and money, not all parties have been contacted. Also, some of those contacted have not responded to the invitation.

The report provides a 'snapshot' of some of the activities being carried out within the cartographic establishments. It aims to bring together and highlight the endeavours of the professionals who advance cartography in the private and governmental sectors, and the support provided by educational and research organisations. The report is intended to act as a benchmark for future reporting on New Zealand cartographic activities.

The report is arranged thematically. The themes include:

1. Cartographic and Mapping Societies
2. Central Government Organisations
3. Local Government Organisations
4. Crown Research Institutes
5. Commercial Cartographic Firms
6. Cartographic Education
7. Resources for Research in Cartography

1. Cartographic and Mapping Societies

Currently, there are two active map-oriented societies in New Zealand; the New Zealand Cartographic Society and the New Zealand Map Society. These are non profit organisations that embrace a wide range of individuals - professionals, educators, curators and map enthusiasts. Despite their similar focus, unfortunately there has been little interaction between these societies over the years.

The New Zealand Cartographic Society

www.cartography.org.nz

The New Zealand Cartographic Society (SGES, The University of Auckland, Private Bag 92019, Auckland 1001, New Zealand) was founded on 23 February 1971 and its mission is to promote the development of cartography.

The main aims of the Society are:

- to bring together all persons interested in cartography
- to promote and encourage the science of cartography in all its aspects
- to create a forum for the expression of new ideas
- to inform the public of the role of cartography
- to conduct discussions, seminars and lectures
- to actively investigate advances in cartography
- to establish and maintain contacts with other similar bodies world-wide

The Society is an open association for those individuals and organisations with an interest, passion and excitement for the study, production and use of maps. Membership is open to all interested persons and organisations.

Volunteer members manage all Society activities. Services provided include a biennial National Cartographic Conference *GeoCart* (so far organised in 2001 (1st) and 2003 (2nd)), support for students to attend the Conference, biennial National Cartographic Exhibition, coordination of the National Children's Map Competition (part of the ICA Barbara Petchenik Children's Map Award), the maintenance of the Society website, and provision of

general cartographic information and advice. The Society publishes a newsletter *CartoGRAM* and *GeoCart* proceedings and materials.

The Society's executive committee includes Robin Phillips (President), Igor Drecki (Vice President), Peter Wood (Secretary), Gareth Evans (Treasurer) and six committee members: Pip Forer, Jan Kelly, Russell Kirkpatrick, Chris McDowall, Nick Nelson and Andrew Shelley. The Society is currently reviewing its constitution to better reflect conceptual and technological advances in cartography particularly over the last two decades.

The New Zealand Cartographic Society is the official New Zealand representative to the ICA (since the 5th General Assembly in Moscow in 1976). At the 1999 International Cartographic Exhibition in Ottawa, Canada, two entries from New Zealand won the Excellence in Cartography Awards *Historical Atlas of New Zealand* (Atlases) and *Ocean Circulation New Zealand* (Hydrography). The *Authentic Upside Down World Map* earned an Honourable Mention Award. In May 2001, the Society organised the first ever ICA event in New Zealand - the meeting of the ICA Commission on Visualisation and Virtual Environments. In August 2001, for the first time New Zealand children were represented at the Barbara Petchenik Children's Map Exhibition in Beijing, China during the 20th International Cartographic Conference. Igor Drecki is the New Zealand principal delegate to the ICA General Assembly and a corresponding member of the Commission on Visualisation and Virtual Environments

The New Zealand Map Society

Known originally as the New Zealand Map Keepers' Circle, the Society was established in February 1977, with its objectives being to further the development and promotion of high standards in map collections in New Zealand; to encourage communication between map users, map librarians and map producers; and to liaise with similar organisations overseas. The Society changed its name to New Zealand Map Society in 1987, as part of a move to broaden its membership to include not only those working with maps, but map collectors, map users, map makers and people with an interest in New Zealand geography and history.

The Society publishes an annual *Journal*, which is wide ranging in the material it includes for publication. Material of interest to both map curators and cartographers is included, along with papers of interest to those who simply have a love of maps. An annual seminar is held, and the papers given at each seminar are usually published in the *Journal*. The annual seminar brings together quite widely converging cartographic interests, and provides also a forum for map librarians to meet and discuss mutual issues and problems. A joint meeting with the Australian Map Circle was held some years ago, and a further such meeting is planned for 2004.

Datum, a newsletter which appears twice a year, has been published since 1995. It keeps members up to date with current developments in map publishing in New Zealand, map curatorship, and provides a forum for contacting the dispersed membership of the Society.

The Society has on a number of occasions made representations to Government when it has been unhappy with proposed changes to map publishing policies.

Now 26 years old, the Society continues to maintain steady membership and an active programme of seminars and publications.

2. Central Government Organisations

In New Zealand, there are several government departments that engage in cartographic activities, mainly in map publishing (rather than production), assembly and maintenance of various spatial databases and dissemination of maps on the Internet. These include Land Information New Zealand (LINZ), Department of Conservation, Statistics New Zealand, the New Zealand Electoral Commission, Ministry of Health and the New Zealand Defence Force. LINZ is the national mapping organisation that publishes all topographical and nautical maps in New Zealand. Department of Conservation publishes park maps and recreation maps. Statistics New Zealand provides a wide range of statistical and administrative mapping products. The New Zealand Electoral Commission publishes maps showing electoral boundaries. The Ministry of Health, through its Public Health Intelligence Unit, supports the provision of health-related mapping and mappable data sets throughout the health sector. Most significantly, the New Zealand Defence Force has recently established the Joint Geospatial Support Facility that services New Zealand Army, Air Force and Navy operational needs, but is also active as a map publisher with an emphasis on maraitime-related map products.

Land Information New Zealand

www.linz.govt.nz

Land Information New Zealand (LINZ) is the government department responsible for the provision of national topographic mapping. The New Zealand topographic database is maintained by the Government for defence, emergency services and constitutional purposes. This digital database *NZTopo* provides vector coverage at a nominal scale of 1:50,000 and is the source data for the national 1:50,000 scale map series.

NZTopo was fully populated in 1999 and realised a single authoritative record of the land, in the form of a fully structured, seamless database of mainland New Zealand. As early as 2000, favourable results were achieved in generating maps to the national specification, directly from the GIS in effect, maps-on-demand.

Over the past four years, LINZ has taken full advantage of modern technology in the delivery of on-line products and services, and a web based version of the national digital topographic database is now available at *www.nztopoonline.linz.govt.nz*. Known as 'NZTopo*Online*', this is the culmination of 3 years development.

'NZTopo*Online*' fully represents the paradigm shift from a product base (the paper map) to an information base, whereby maps and other forms of information are simply a by-product or derivative of an up-to-date database. This in turn has generated efficiencies and improvements for LINZ in terms of data collection and the need for conventional map production. A brand new map series which will take advantage of a recent datum change and replace the current map series, will be delivered in sheet form via the internet without any manual cartographic intervention. This means that with on-demand user defined custom maps and web map service (WMS) capability, a great many more users worldwide, will be able to take advantage of this mapping for their own purposes.

3. Local Government Organisations

Majority of local government organisations in New Zealand are similar in their approach to cartographic activities. Cartography is carried out by either GIS, or Planning or Draughting departments. They produce and publish maps of their areas of responsibility on a variety of themes. District and City councils are primarily concerned with the production of zoning, planning and infrastructure maps, while Regional councils' focus is on environmental control and resource mapping.

Recently, some local government organisations adopted a novel approach to meet mapping requirements, where dedicated cartographic sections (or suitable individuals) are undertaking cartographic production.

Environment Bay of Plenty

www.envbop.govt.nz

Since the mid 1990s, the majority of Local Government organisations in New Zealand have had well-established GIS sections that are required to undertake all GIS related tasks including the production of map products. In the late 1990s, staff at Environment Bay of Plenty recognised that the skills required to undertake GIS work were different from those required for map production and that these two areas were unique disciplines.

With this philosophy in place, Environment Bay of Plenty established a cartography section in 1998. They were possibly the first council in the country to do this (a clear distinction is made here between cartography and the work undertaken by a Draughting Section, which in some organisations is also tasked with map production). Since this time, a number of other local authorities have recognised the success of this move, and have implemented their own cartography sections in various ways.

With the close integration of digital cartography with GIS, the role of the cartography staff have been intermixed with the GIS staff, with some minor GIS functions being part of the cartographers job. There has been, and continues to be, a well-defined boundary between the tasks undertaken by GIS and Cartography staff, even when the tool sets are the same.

Since its conception, the Cartography Section has continued to improve on the quality and volume of material being produced each year. The graphics packages (CorelDraw, Illustrator, Freehand) were (and still are) the quality cartographic toolset, but CAD, GIS and remote sensing tools supplement these to a large extent.

Traditionally, the primary means of dissemination of maps has been via hard copy output, however the Internet now allows updates to be viewed as they are made. The Internet is changing the way people view and access spatial data. Being able to access the

attributes linked to a map object has become a necessity for many customers using Internet maps. It is anticipated that there will be a continued growth in Internet based map products, but for the foreseeable future hard copy map production still has a well established place that requires highly skilled and dedicated staff.

4. Crown Research Institutes

Crown Research Institutes (CRI) are government-owned businesses with a scientific purpose. Each institute is based around a productive sector of the economy or a grouping of natural resources. Three CRIs in particular are actively engaged in cartographic activities. These are: Institute of Geological and Nuclear Sciences (GNS), National Institute of Water and Atmospheric Research (NIWA) and Landcare Research New Zealand.

GNS publishes a range of New Zealand geological and magnetic maps (predominantly at the scales of 1:250 000 and 1:50 000), as well as other related scientific maps. More recently, GNS developed a series of modeling tools for natural hazard predictions and monitoring. NIWA publishes a variety of oceanic and bathymetric charts. Their posters and maps are characterized by innovation and cartographic fidelity, and frequently extend into the Pacific, well beyond the traditional scope of New Zealand mapping. In the last few years NIWA won several awards, including ICA Excellence in Cartography Award in 1999. The Landcare Research profile is given below.

Landcare Research New Zealand Ltd

www.landcareresearch.co.nz

Landcare Research is a predominantly government funded research agency of the terrestrial environment, and cartography in Landcare Research is synonymous with production of map-based outputs from analyses using GIS and satellite image processing (IP). So any examination of cartographic activity has to be seen in the context of Landcare Research's use of GIS and IP as research tools. During the period 1999-2003 Landcare Research has derived a number of significant new spatial datasets: including LENZ, ECOSAT, CMS, and Pohnpei (FSM) Vegetation 2002 that illustrate Landcare's use of GIS, IP and cartography.

LENZ (Land Environments of New Zealand) is an innovative quantitatively-based classification of New Zealand's terrestrial environments that will help assist biodiversity conservation and natural resources management throughout New Zealand. LENZ capitalises on the relationship different species have with their environment by identifying landform and long-term climatic factors likely to influence species distribution. LENZ uses these factors to define a landscape classification that groups together sites with similar environmental conditions. Although LENZ was originally envisioned as a tool for biodiversity management, it has a much wider application. This is because the environmental factors that control the distributions of many land based plants and animals (temperature, water supply, availability of nutrients, etc.) are also factors that provide major constraints on human land uses such as agriculture, horticulture, and forestry. The LENZ poster won the top award at ESRI's 2002 International User Conference.

In contrast to LENZ which is a classification of long-term environmental potential, ECOSAT provides a detailed snapshot of current vegetation derived from a rule-based landscape classification of recent high resolution (15m) satellite imagery. ECOSAT has wide application and is proving extremely cost-effective for design of possum monitoring regimes, and wetland management. In New Zealand, wild possum populations are controlled because they carry Tb and are a major threat to our native forests. ECOSAT's success is built on new algorithms developed by Landcare staff for elimination of the topographic effect in satellite imagery, refinements in correcting for atmospheric absorption and

The Carbon Monitoring System (CMS) is a core part of New Zealand's response to the Kyoto Protocol for Climate Change. At its core is a map of New Zealand's carbon inventory in forests, scrublands and soil for the Kyoto Protocol baseline date of 1990. This inventory is a synthesis of our knowledge of the C cycle through tree growth and decay, soil processes and atmospheric CO_2, combined with mapping of our land resources.

Finally the map of Pohnpei's vegetation in 2002 was the result of traditional aerial photograph interpretation and ground work to produce the latest in a series of three vegetation maps (1975, 1995, 2002) that are used to trace vegetation change due to cultural pressures and to inform environmental protection and urban policy development in Pohnpei.

A wide variety of cartographic products have been created form each of these datasets depending on the needs of the particular users.

5. Commercial Cartographic Firms

The commercial sector in New Zealand derives its current form from government two reforms. One devolved map production into a State Owned Enterprise, and thence to the private sector. The prime outcome of this was the creation of Terralink International, by far the largest player in the commercial cartography market (see below). The second reform began in the late 1990s with the adoption of policies that freed up access to public spatial data bases. This move dramatically reduced cost of access to most national data sets, most notably the 1:50,000 topographic data base. Prior to this policy numerous potential map products were complicated in development and marketing by high data licence costs. Traditional map makers, such as Minimap and Wises who specialise in small format street maps or the Automobile Association, maintained production. However, innovative products and new entrants to the market were discouraged. The main area of development rode on the back of newly-created data sets, often brought into being to fill inadequacies of some of the main data themes (house location and as-built road position, for instance). Critchlows, a GIS company, is a good example of a firm that has levered such enhanced data bases into cartographic outputs.

The dramatic change in data availability has encouraged established players to be more innovative in products, has enabled many organisations to provide maps as extensions of their traditional activities and has brought a new raft of small companies into existence. Many of these have focused on CD-based map products for the likes of hikers and trampers. Others have provided new forms of printed maps targeted to special purposes. Some external firms such as Hema Maps, have moved in to New Zealand to develop new products, such as four wheel drive atlases. Some firms have simply concentrated on providing new material for cartographic production, such as the DTM and mapping textures marketed by GeographX. A small but lively industry has emerged.

The paragraph above identifies the main players in the cartographic market. A note should also be made of image-based innovations such as *e-map*, and a strong publishers' involvement in atlas production. There are now several competing products from publishers such as Reeds, Bateman, Penguin and Hodder Moa Beckett which look at the broad geography of New Zealand within a substantive atlas framework, whether from the perspective of the driver, the wine drinker, the tourist, the student or the general reader. These are likely to be further augmented and updated in the near future.

In short, the commercial cartographic industry in NZ is expanding overall, with more small firms taking advantage of computerised technology and access to a variety of spatial databases to produce a widening variety of map products. The background to the largest actor in the mapping arena follows.

Terralink International Ltd

www.terralink.co.nz

Terralink International (Terralink) is a progressive, commercially focused company supplying a wide range of services and products to its customers in both digital and printed formats, covering all aspects of cartography from design concept through to final production and printing. First level cartographic production platforms are MicroStation and ArcInfo with second level design, manipulation and supply packages of CorelDraw, PhotoShop, PageMaker, Illustrator and Freehand. Terralink has production expertise in each of these software packages.

Terralink delivers a wide range of solutions to meet specific client needs, including large-scale street maps, topographic maps, park and tourist maps, scientific maps, 3D visualisations from satellite imagery and terrain models, atlases, web maps and electoral and census maps. Only a few are described below in more detail.

Comprehensive indexed street maps provide national coverage of New Zealand cities, towns and other populated places, where mapping data is maintained and constantly updated in Terralink's integrated mapping system.

Terralink produces topographic maps in scales between 1:50,000 and 1:2 Million for a variety of New Zealand and international customers. It is contracted by the New Zealand Government to produce and print the country's official 1:50,000 and 1:250,000 scale topographic maps, and since 1996 has produced more than 220 maps in the series. These maps provide the baseline information for New Zealand in printed form. They act as the inventory of the New Zealand landscape for public good, military, search and rescue, and planning purposes. There are approximately three hundred maps in the 1:50,000 scale series and eighteen in the 1:250,000 scale series. Terralink was involved for many years with the New Zealand Department of Conservation in providing digital map production and update of the Parkmap and Trackmap map series. Recently, Terralink has published a suite of five recreational maps. The production and design of the

maps series has been totally market driven with each map custom designed to cover a popular recreational area.

Terralink maintains an aeronautical database from which it produces aeronautical charts for New Zealand's aviation authorities, the New Zealand Air Force and other clients in the aviation industry. Documents and charts meet strict international publication dates and requirements set by the International Civil Aviation Organisation.

Terralink has developed digital CD-Rom maps for Auckland, Christchurch, Wellington and Dunedin/Queenstown, The map-viewer software has been specially built by Terralink GIS software developers. This CD map product is unique in the New Zealand market in that it allows users to interact with the maps. Users can add their own information to the maps and create personalised records, insert images and photos and create their own route plans.

Terralink also produces mapping for Geoscience Australia - the Australian Federal Government's national mapping agency. The project requires supply of topographic data and maps (more than 60 a year) produced using data sourced from several State and Territory mapping agencies, and the formation of a seamless map database spanning eight UTM zones.

AgriQuality New Zealand

www.agriquality.co.nz

AgriQuality New Zealand Ltd is a relatively new company on the agribusiness scene, emerging in November 1998 as a result of the restructuring of MAF Quality Management , a unit within government. AgriQuality's main business focuses are food quality and biosecurity services, in which spatial systems and mapping play important roles.

Individual Farm/Property Maps

AgriQuality is involved in many national projects for external clients. The majority of these projects require customised maps to be sent to a large number of properties throughout New Zealand. These maps generally include an individual property map, based on the farm business unit and land use information stored in AgriBase.

Biosecurity

AgriQuality currently provides surveillance and emergency response services for a range of situations, including exotic pest and disease outbreaks and climatic and environmental responses. Over the past 5 years, GIS has become widely recognised as a vital part of AgriQuality's Biosecurity Services. Nearly all teams involved in Biosecurity responses rely on maps and GIS analysis to complete their jobs more quickly and accurately. A recent Painted Apple Moth eradication campaign that has run in Auckland for the past few years has been completely dependant on the AgriQuality GIS team to establish spray regimes as well as to check accuracy of spraying. Maps were used to keep the public informed of spray zone extent prior to each spray round, and were used by the project call centre to track in real-time which areas were being sprayed in order to handle customer queries.

Farm Plans

AgriQuality has developed a process for utilising highly technical mapping software, scanning equipment, and a degree of manual input to produce accurate farm plans from aerial photographs. The plans are used for a variety of on-farm purposes, including fertiliser application and planning contract work.

6. Cartographic Education

This section focuses on cartographic education in secondary schools and universities. Amongst eight universities in New Zealand, none of them offers a dedicated paper in cartography. However, Auckland, Waikato and Otago Universities offer several courses with a strong cartographic content (details below). Since 1994 cartography has no longer been taught at New Zealand polytechnics.

Due to the absence of academic cartographers, cartographic research in New Zealand is limited. The *GeoCart* Conference is the only national cartographic forum specifically dedicated to share research ideas and facilitate networking amongst cartographic community. Contributions from New Zealand authors have rarely appeared in the international cartographic literature.

Cartographic Education in Secondary Schools

Although there are many teachers who use a variety of map-drawing and map-use exercises in primary and intermediate classrooms, there is no formal requirement to engage with map making and map use until students enter secondary school. Cartography enters the school room in the compulsory secondary sector through Social Studies, generally in the Social Studies strand at years 9 and 10 (age about 13-14). In years 11-13 map design and map use are part of the required skills in the Geography Syllabus with the

detailed description of these terms in a very much out of date volume republished from the 1970s. The use of prepared maps and map construction are two important parts of the geography syllabus, but they are not widely supported by (i) strong teacher preparation environments, (ii) effective classroom resources or (iii) institutional interest. This commentary describes the cartography syllabus within secondary Geography before looking at the three impediments identified.

A focus on assessment has distracted geographers from curriculum review and the professional development needed in cartography. This issue are exacerbated when it is reported that some geography teachers have little formal geography training in their degrees. Teachers faced with familiar assessment targets teach the constructions or précis maps without offering much insight into contemporary cartography, data visualisation and spatial visualisation.

Stella Bond's (1997) text is the most current classroom resource (devoting more than 35 pages to mapping and cartography skills) but the basic cartographic skills described are one of the four types of skills developed in the classroom. The use of contemporary atlases has generated some interest in cartography. The *New Zealand Historical Atlas*, the *Contemporary Atlas New Zealand*, and *Degrees of Deprivation in New Zealand* atlas all contain 'maps' on new thematic topics using a variety of interesting mapping techniques with the potential to stimulate discussion in almost any classroom context.

The universities, national mapping agencies and GIS companies offer token support for cartographic education. Skills-based courses like Cartography 101 have diminished roles in the undergraduate degree, and cartographic leadership from the (disestablished) Department of Lands and Survey is just a distant memory.

We could conclude that cartographic education in the secondary sector was beyond recovery, but that would be a hasty judgment. There are teachers in classrooms who passionate about maps, their design and their use. There is willingness in the New Zealand Board of Geography Teachers to engage in syllabus review and the restructuring of skills taught in geography. There are professional development options, and there is an organisation with a mandate to contribute to the definition of cartographic design skills and expertise in map use. There has never been a more appropriate time for the New Zealand Cartographic Society to engage with geographers in secondary education.

Cartographic Education and Research at Universities

University of Auckland
School of Geography and Environmental Science
www.auckland.ac.nz

Cartography at the University of Auckland has been a strong feature of the School of Geography and Environmental Science, but aspects of teaching and research related to cartography and visualisation can also be found in other areas, specifically the Faculty of Planning, Architecture and Fine Arts. However, in no case has there been a strong presence in courses devoted solely to cartography. Within Geography two distinct phases can be recognised, which reflect in both the provision of cartographic services and cartographic publication, as well as teaching and research in the areas.

The first of these phases ended in most ways in 1999, and was characterised by a more traditional approach to map making from cartographic data. This was represented in dedicated lectures and laboratories and within key Geography courses at all undergraduate levels, but in relatively small quanta. Simultaneously, research developed in which map making and cartographic representation was a substantial component, for instance early work on sustainable resource management in Tai Tokerau/Northlands. Within the research support area, two cartographers of national repute also contributed to cartographic output, developing an early cartogram of New Zealand and two editions of a widely-cited Atlas of New Zealand Boundaries.

The second phase overlapped from 1995 and has seen an accelerating move towards cartographic representation and wider geo-visualisation. Cartographic teaching has been represented in a similar way at most levels, and with similar quota, but now allied with (and often labelled as) teaching in GIS. Research has levered on this significantly, with a particular focus on issues of representing human movement, and the use of interactive visualisations for decision support. A graduate course aimed at using geo-visualisation of all kinds within decision support systems has been instrumental within this.

In the last three years some twenty conference papers have been presented in which visualisation of flow and movement data has been a focal topic and a widely circulated mapping of tourist flows in New Zealand has been published in book and poster form. In addition five theses and several dissertations have focused on the development of new applications of

interactive cartography, flow mapping and the enhanced use of cartograms. To support such work and other wider research the School's Spatial Analysis Facility has developed a data portal jointly with the University Library, including a standard backdrop raster derived from the NZ 1:50,000 topographic data series. This contributed as a significant cartographic element in the recent Wine Atlas of New Zealand, the winner of the 2003 Montana Book Award in New Zealand. Cartography was by Jan Kelly, a former staff member. The creation of the larger School in 2002 has allowed new synergies, and it is hoped to develop a clear teaching direction with a cartographic focus as well as build further on the deployment of interactive visualisation for research. At present work is under way on a national atlas of mortality and contributions to an upcoming commercial national atlas.

University of Waikato
Department of Geography
www.waikato.ac.nz

The University of Waikato maintains an interest in a cartographic curriculum and this interest is expressed through courses and research primarily in the Geography Department. The Earth Sciences department also have an interest in cartography. First year Geography courses contain elements of practical cartography, GIS applications with a cartographic component and (most positively) a critique of map making and map use. At second year students have access to an *Information Technology and Cartography* course, and cartographic output is a component of third and fourth year GIS courses taught by Lars Brabyn. The undergraduate stream produces more than 50 students with cartography as a named component of their undergraduate degree. At graduate level there is no formal cartography course, but there are well established interests extending from the two elements of cartography identified in the undergraduate curriculum. Technical aspects of cartographic experience are explored within the GIS stream, and the social critique of cartography is found in research and method courses.

Support for cartography in the universities is well served through the teaching research interface. GIS applications contain conventional and innovative cartographic products, but the professional interest of staff has led to several projects with interesting cartographic dimensions. Max Oulton has significant experience in the documentation and representation of Maori land as a result for his cartographic input to the Waitangi Tribunal, Russell Kirkpatrick continues his production and critique of contemporary cartography and Lex Chalmers has a research project on the use of cartography and professional development of teachers in the secondary education system.

Massey University
School of People, Environment and Planning
www.massey.ac.nz

Massey University has not offered specific courses in cartography, nor does it intend to do so. An introduction to cartographic design is included in the *Introduction to GIS* paper, but it can best be described as elementary. The paper includes some other cartographic content as well, e.g. an introduction to map projections.

Victoria University of Wellington
School of Earth Sciences
www.vuw.ac.nz

As a result of various management decisions, the School of Earth Sciences specifically, and VUW more generally, now offer no courses or training in cartography. All effort and resources have now been directed into GIS applications - effective presentations etc. being no longer a taught consideration.

University of Otago
School of Surveying
www.otago.ac.nz

In June of 2003 the University of Otago's School of Surveying was officially certified by the International Hydrographic Organization (IHO) as a Category A hydrographic education provider. The IHO/Cat A syllabus prescribes many elements of cartography as part of its requirements. This includes map projections; nautical chart compilation; automated contouring and plotting; 3D modelling and visualization; raster and vector digitizing and plotting systems, and Electronic Chart Display and Information Systems (ECDIS). In addition to the hydrographic cartography, the School of Surveying teaches an undergraduate paper called *Spatial Data Visualization* in which vector and raster data is studied in the context of Geographic Information Systems. The paper is also concerned with data sources and capture; base maps and geocoding; and the basics of cartography such as generalization, symbolization, colour theory, and map composition. Approximately 50 students a year enter surveying and they are all required to take *Spatial Data Visualization*. Approximately 20 students a year take two hydrographic papers which have a significant cartographic component. Much of the teaching in the School of Surveying would support or underlie

cartography. The subject of remote sensing is a good example of this. The end products of remote sensing are maps, just as the end product of much surveying are maps of various forms.

Peter Knight (lecturer in hydrographic surveying) is constantly involved with cartography in both teaching and research. He is presently trying to initiate a project which will involve mapping of oyster beds in Foveaux Strait. His hope is to map the beds in 4-dimensional GIS.

7. Resources for Research in Cartography

There are a number of map collections in New Zealand which have sufficient depth in their collections to be able to provide materials for serious research.

Auckland City Libraries

www.aucklandcitylibraries.com

The Auckland City Libraries map collection consists of around 7,000 maps, mainly of New Zealand and the Pacific with special emphasis on the Auckland provincial area, from the early nineteenth century to the present. The collection contains both manuscript and printed maps. A major part of the collection is early land sale maps of Auckland City and suburbs. The library also holds maps from Governor Grey's collection, valuable to any student of 19th century New Zealand history. The library has almost completed a project to digitize around 600 maps from the collection which will be available through the libraries web page.

University of Auckland Library

www.auckland.ac.nz/lbr/

The University of Auckland's map collection consists of approximately 51,000 sheets, with particular strengths in New Zealand and Pacific material. Most of the maps in the collection have been published since the Second World War. The map collection is housed in the new Map Room of the General Library of the University, and consists of the former Geography Library and Geology/Science Library map collections, which came together when the Geography and Science Libraries were incorporated into the General University Library early in 2002. Associated with the Map Room are collections of air photographs and atlases.

The University Library is currently investigating ways of cataloguing the collection, and has purchased MapSearch, a digital and online solution for interactive spatial querying and management of map and spatial data collections. MapSearch is being developed by the Australian firm of Mapping and Beyond, based in Adelaide. In collaboration with the School of Geography and Environmental Science it is also developing a web-bases portal for map access.

University of Waikato Library

www.waikato.ac.nz/library/resources/maplib.shtml

The University of Waikato's map collection is based in the University Library. Like the University, the collection dates from the early to mid 1960s. The Library was fortunate to acquire the collection of the New Zealand Geographical Society, which formed the backbone of the subsequent collection. It is housed in a separate room in the Library and is looked after by a Map Librarian in the mornings only. The collection is available from 8.30 until 5.00 Monday to Friday but in the afternoons no staff is present.

The collection comprises about 50,000 items, mostly in hard copy. In recent times some material has been obtained as CD-Roms and access is now provided online to other cartographic information. Books about maps, cartography, GIS, gazetteers and a wide range of atlases are also held. The emphasis is on New Zealand and the collection includes topographic, geology, soil, forestry, hydrographic, and oceanographic maps. The collection aims to be current and comprehensive in these areas. A small historical collection, concentrating on the Waikato, has been built up.

Alexander Turnbull Library Cartographic Collection

The Alexander Turnbull Library Cartographic Collection contains about 60 000 manuscript and printed maps from the 16th century to present times. Atlases and digital maps are also included. The collection concentrates on New Zealand, Pacific and Antarctic material and compliments the map collections of Archives New Zealand and Land Information New Zealand. Although the collection contains many thousands of maps of other parts of the world, that coverage is not intended to be comprehensive. About 10 000 maps are available on microfilm.

The material is supplemented by a wide range of cartographic reference tools periodicals, cartobibliographies, gazetteers, indexes, catalogues and works on the history of cartography. The National Library Catalogue *http://nlnzcat.natlib.govt.nz* are the starting points for researchers' access. Since

1972 the Collection has benefited from receiving maps from publishers under legal deposit.

Archives New Zealand

The map collection contains about 500,000 manuscript and 200,000 printed maps from the 1840s to the present day. It concentrates on New Zealand, the Pacific and areas where New Zealanders served in World War I and II. Most of the maps, plans and architectural drawings have been produced by various New Zealand government departments with some of the more important being the Marine, Public Works and Railway departments. The collection holds only some of the original maps produced by Land Information New Zealand and its predecessors: most of these are retained by LINZ at their various branches.

University of Canterbury
Department of Geography

The Map Library in the Department of Geography, University of Canterbury holds a collection of approximately 150,000 maps. The collection covers all parts of the world. Its coverage is particularly strong in maps of New Zealand (especially of the Canterbury region), of Canada and the United States (until recently it was a depository for government topographic maps from both countries), and of the Antarctic (it has recently received the map collection of Antarctica New Zealand).

The library also has collections of atlases, New Zealand aerial photography, theses, video recordings, journal-article reprints, and monographs from government and other agencies. The library premises were expanded in 1995 and refurbished in 2001. It has a staff of 1.4.

University of Otago
Hocken Library

The map collection has approximately 10,000 items built up from Dr Hockens' original collection of less than 80 items. The collection consists of maps, charts, aerial photos and atlases, and relevant periodicals. The collection focus is particularly on New Zealand, with selective coverage of Australia the Pacific and southern Polar regions. Holdings are particularly strong for Dunedin sales plans and material relating to Southern New Zealand. There is a small but good collection of early world and Pacific maps and charts (1650 - 1850). The focus is historical but the library does collect current material and holds the major series maps of New Zealand.

The Map Curator works mornings. The library, which is part of the University Library but also open to the public, is housed in a recently refurbished building in Anzac Avenue, Dunedin.

Other collections

Other significant map collections include those held by the Auckland Institute and Museum Library, the Auckland Maritime Museum Library, the Hydrographic Office of the Royal New Zealand Navy (Takapuna), the Wellington Maritime Museum, and the Canterbury Museum Library. A number of local territorial councils, public libraries, and other local museums, also hold material of a local nature that is unique to that region. Significant archival air photograph collections are held by New Zealand Aerial Mapping Limited at Hastings and by Land Information New Zealand at their Air Photo Library in Wellington.

Acknowledgements

This report has been produced with the assistance of many authors. Without their contributions production of this report would not have been possible.

The contributing authors are: Janet Bray (University of Canterbury), Marni Cavis (AgriQuality New Zealand), Lex Chalmers (University of Waikato), Karen Craw (University of Otago), Gareth Evans (Environment Bay of Plenty), Pip Forer (University of Auckland), Robert Gibb (Landcare Research), Stuart Halliday (Environment Bay of Plenty), Peter Knight (University of Otago), Brian Marshall (University of Auckland), Jack McConchie (Victoria University of Wellington), Dave Mole (Land Information New Zealand), Alistair Pearce (Terralink International), John Robson (University of Waikato), Dave Small (Alexander Turnbull Library), Ian Snowdon (Auckland City Libraries) and Derek Williams (Massey University).

References

Bond S (1997) *Social Sciences Skills*. New House Publishers, Auckland.