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Publication Details

This paper was originally published as: Michael, K, The importance of conducting geodemographic market analysis on coastal areas: a pilot study using Kiama Council, in C. D. Woodroffe & R. A. Furness (eds.), Coastal GIS 2003: an integrated approach to Australian coastal issues, Centre for Maritime Policy, Wollongong, Australia, 2003, 481-496.

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Keywords

geodemographics, Kiama, geographic information systems, coastal GIS, council planning, preservation

Disciplines

Physical Sciences and Mathematics

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This conference paper is available at Research Online: http://ro.uow.edu.au/infopapers/373

The importance of conducting geodemographic market analysis on coastal areas: a pilot study using Kiama Council

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Abstract

In February of 2003 Kiama Council launched a preliminary survey to gather community attitudes on the future growth of Werri Beach and Gerringong, NSW (Nelson). The survey focused primarily on what actions Council should take to manage population growth within existing neighbourhoods. This paper aims to support the preliminary survey by proposing that a geodemographic market analysis be conducted to complement the findings of the study published in May 2003 (Wiggins). The use of a Geographic Information System (GIS) can add great value to the strategic decision-making process and it is the recommendation of this paper that GIS should become an integral component of Council's day-to-day planning function. This type of analysis does not negate the requirement for community participation in local issues rather it enhances the planner's ability to make more informed decisions using a holistic approach throughout the lifetime of a given project. The findings of this paper indicate that GIS is an important element of any coastal assessment. The process outlined here could be adopted by councils located all along the Australian coastline.

Introduction

Kiama Council covers a surface area of 256 square kilometres. Within its bounds is the rapidly expanding coastal town of Gerringong, located within the post code 2534. Gerringong is known for its picturesque rolling hills, lush evergreen dairy farms, and famous surf beach (Werri Beach), all of

which make it a popular holiday destination and ideal for residential settlement. However, so many attractions undoubtedly place pressure on the environment as increasing numbers of tourists visit, and demand for housing continues to rise. Council is left with the challenging task of catering for the diverse range of needs both of the permanent local and temporary populations. This paper will identify the need to conduct geodemographic market analysis using a variety of statistical and spatial sources from different data suppliers, including the Australian Bureau of Statistics (ABS). It will explore how GIS could be applied by Kiama Council to better plan for the future growth of Werri Beach/ Gerringong and Gerroa and finally offer some preliminary findings. Throughout the paper space will also be dedicated to some of the more practical issues that the GIS analyst could be faced with in conducting such a study.

Background

Kiama Council is typical of most local councils. It has a small planning team and a defined annual budget for information technology (IT) requirements. In 2002 the need for Council to invest in a state-of-the-art GIS was investigated and several platforms evaluated. As a result GIS software and support hardware was purchased in 2003 and a newly-established GIS team was formed. Council is actively trying to incorporate GIS into a range of functions because it foresees positive flow-through effects through this type of inter-departmental collaboration. However, in the short-term resource constraints mean that specific applications of GIS pertaining to the planning function may be delayed, in preference to other core council requirements. One of the problems identified by the planning team was actually defining those important applications that would help them do their work more efficiently and effectively. This is a common hurdle that non-GIS professionals face as they are trying to come to terms with the value the software can bring to their organisation and more specifically, to their job role. The very positive attitude the planners have toward one day integrating GIS into their existing processes and practices means that successful implementation is likely. The following pilot study is representative of what is possible in the future.

Methodology

A semi-structured interview was conducted with one of Kiama Council's strategic planners to ensure that a gap was being filled with the proposed pilot study. The interview was open-ended and probing questions were asked to determine the current state of GIS practice within the planning department in the Council. A subsequent literature review found the link between geodemographic market analysis and coastal issues to be severely lacking. Some of the more relevant publications included Maguire et al. (1991), Grimshaw (1994), Goss (1995) and Birkin et al. (1996). As an outcome of the interview and literature review it was decided to document the high level process required to build a GIS for geodemographic purposes and outline how spatial analysis could be used to aid Council's strategic planning function. The contribution of this paper is not in its statistical output but in demonstrating the value of GIS for strategic planning in coastal areas. Admittedly one of its limitations is that it does not take into consideration longitudinal trends and patterns, but it does illustrate the power of GIS to represent cross-sectional demographic data.

Process

A work-in-progress custom GIS was created using the MapInfo Professional application with supporting data sets from a variety of suppliers and vintages. The following steps were taken to build the GIS:

(1) understand the various spatial units of analysis and determine which level(s) of detail are appropriate and useful for Council;
(2) identify and acquire the separate layers of spatial data required to conduct meaningful research and consider how these could be used in prospective applications (e.g. roads, parks, rivers and other features);
(3) gather demographic data for residential and business market segments (either internally or externally available to the Council, and of primary or secondary research sources);
(4) geo-reference demographic data to designated spatial units;
(5) determine how the custom GIS can be used to shed light on issues of human geography and the environment; and
(6) conduct geodemographic analysis using structured query language (SQL) and thematic mapping to uncover specific trends and patterns.

Spatial Units of Analysis

Prior to building a GIS for a specific area the planner must be able to identify all those important units of analysis that are relevant and meaningful to the study. Depending on the scope of the study, one may choose to start their analysis at a coarse level of detail, such as a local government area (LGA) unit and work their way down to a census collection district (CCD) level. The top-down approach is to be preferred in large-scale projects like the Comprehensive Coastal Assessment (CCA) initiative proposed by the Department of Infrastructure Planning and Natural Resources. Only in this manner can planners prioritise responses to pressing issues over a variety of locations. What is paramount, independent of the scope of the study is that recognized spatial units are used in the GIS, such as those defined in the Australian Standard Geographical Classification (ASGC) hierarchical list (Castles 1993). In the case of the Kiama Council pilot study, which focused on the post office area (POA) of Gerringong, planners specifically requested the need to use CCD level information, and if possible, to perform an even more granular investigation. This especially posed a challenge to the author, particularly because the public availability of demographic data at the street or dwelling unit (cadastral level) is very limited, save for internal Council intelligence information. Provided that strict controls were placed upon the access and use of the latter, Council would be adhering to Australia's Information Privacy Principles.

Spatial Layers of Information

The three categories of layers in the pilot study included: natural features, non-natural features and government-defined spatial boundaries. The vector layers are represented as region, line or point objects dependent on what they are depicting. Natural features included layers like rivers, lakes, the coastline, parks and reserves, while non-natural features included layers like roads, bridges, railways, residential and business dwellings, and public amenities. As a general rule, the more layers of spatial information one can acquire for a particular study, the richer the results. Important to note however, is the scale of the map layer in question, its currency (in terms of lifetime), its quality, and its purpose to a given GIS project.

MapInfo (among many other suppliers, like ESRI) develop and supply spatial layers that proved to be useful in this pilot study. The first are the ASGC administrative spatial boundaries as defined by the ABS in the

CDATA2001 product; everything from LGAs to CCDs, including POAs. The second is the detailed road network that is available in the StreetPro® Australia product that contains street addressing and an additional fourteen layers of data. The third is the MapInfo® CadastralPlus product that contains individual land parcels from which centroid longitude and latitude locations can be extracted. And finally the MapMarker® Australia product, which includes an intelligent address parser, and can be used to pinpoint dwelling locations using either internal Council address information or external sources like Brylar's Australia on Disc (AOD) database. MapMarker's capabilities differ significantly from the Cadastral spatial layer, in that the former allows for residential and business names to be geo-referenced to a street address (i.e. a longitude and latitude location). Apart from vector-based data, raster data like aerial photographs could also be used to enhance the planner's perspective of a given problem. Other spatial data, like hardcopy building approval plans could be scanned and geo-referenced, although such a process would be time-consuming and expensive, it would in the longer-term pay for itself.

Demographic Data

There is usually a plethora of demographic data available at high levels of granularity, such as at the statistical local area (SLA) and POA levels. While the data at this level is considered coarse, by most regional Councils, the overall key indicators are helpful in establishing a background setting for the study. There are also two broad categories of demographic data that can be acquired; these are either primary or secondary in nature. In general, secondary data is usually a lot more affordable than primary research data. Examples of secondary data used in this study include: ABS CensusData and the Australian Business Register (ABR). Additional data sources that would prove useful include: the ABS Integrated Regional Database (IRDB), the ABS Socio-Economic Indexes for Areas (SEIFA), Salmat's MarketFind database and Dun & Bradstreet's Marketing List. The specific fields of data included in the above-mentioned sources are too many and varied to list, even in a tabular format- the CensusData data source alone would fill several pages. However the demographics can be categorised as pertaining to either the residential or business market segment.

Residential data that can be obtained includes (aggregated down to the CCD level) attributes like: the number of people, the number of household

dwellings, resident age and background, the average individual/ household income, the number of employed/ unemployed persons, the qualification level reached by residents and their occupation, housing status and level of ownership. Other residential-specific databases aim at providing predefined target groups based on the level of income earned or other economic or education-based indicators. For example, Salmat's Marketfind tool distinguishes 24 demographic profile types, ranging from the 'Prestige' category to 'Suburban Welfare' and also brings together customer lifestyle and attitudes profiles. Specific AC Nielsen data can be added to this as well, if required. Business data that can be obtained (down to the POA level) includes the size of business, in terms of the number of employees or annual turnover amount in dollars. The type of business, based on the Australian and New Zealand Standard Industry Code classification (ANZSIC) can be obtained at either the industry division (17 categories) level or subdivision (53 categories) level. At the individual company level, the industry classification can be acquired (as specified in the Australian Yellow Pages), including full postal address and telephone/ fascimile details, as well as a web site and email address if provided. The Dun and Bradstreet Marketing List also includes a contact name for each company, the line of business, revenue, exact number of employees and more.

As for internal intelligence sources, these were not obtained for the pilot study but it is assumed, that if Council adopted the findings of this paper, that they would be able to use appropriate internal data to further enhance the GIS. The attributes that would be useful, among others, include ratepayer information per dwelling/ land parcel, land-use zoning information (such as residential, commercial, industrial categories), specific building regulation constraints and the number of temporary versus permanent residents (for instance during public and school holiday periods).

Geo-referencing Demographic Data to Spatial Units

One of the fundamental uses of GIS is to bring spatial data together with aspatial data. Potentially this also presents the GIS administrator with one of the greatest challenges- how to integrate two or more sets of aspatial data sources that are not 100 per cent compatible with the designated spatial layers. While the use of ASGC boundaries has been encouraged in this paper, planners should be aware that boundaries like SLAs and CCDs are variable in nature, depending on the growth or decline of a given area over

time. For instance, the 1996 and 2001 Australian SLA boundaries differed in number and in name. A SQL statement could easily identify the discrepancies in the spatial layers from year-to-year but this still does not resolve the problem of matching databases of various vintage successfully to base spatial layers. And this is not only a problem limited to ABS-defined boundaries; this same problem is recurrent in natural and non-natural spatial layers. Consider the case where new roads are added to a town as a result of a new housing estate being established, among many other examples. GIS users need to think about how their organisation will overcome ungeocoded records (i.e. those records that remain unlinked using a given primary key), without compromising the overall accuracy of the results. The ideal situation is to continue to upgrade data sources as they become available, although this becomes an expensive exercise and is not always feasible given that some databases do not follow a periodic release schedule. Whatever solution is sought, what is certain is that guidelines need to be drawn and implemented. These guidelines may also vary dependent on the type and size of database being geocoded. Sometimes manual manipulation is plausible, other times it is not. For example, hit rates for the geocoding of telemarketing information to street addresses commonly range between 60-70 per cent of total records dependent on the intelligent addressing product in question and how clean the database being geocoded is (Drummond 1995; Holloway 1998). Checking one hundred ungeocoded street address records manually (one-by-one) may be a manageable exercise, while one hundred thousand would be unacceptable.

Council Applications of GIS

Once a GIS inventory has been created and appropriate data sources geocoded to spatial locations, an organisation can begin to program automated applications, in order of priority. The planning function at Kiama Council has been identified as being made up of mainly routine tasks. GIS applications lend themselves well to such tasks, allowing for automated reports to be generated periodically that show results not only in tabular and graphical views but also in spatial ways as well. The spatial element, in a digital form, can add a lot of value to decision-making processes as it grants the planner an additional perspective to the problem(s) at hand. GIS can also be used for non-routine tasks that require specific inquiries to take place as requested by council members. The applications that may be considered for implementation by Kiama Council are described below.

- Basic geodemographic profile: defining discrete places within Gerringong which are meaningful to Council planners and extracting demographic data based on these areas, such as "Gerringong Central Business District" (CBD) and "Werri Beach". The statistics should incorporate both residential and business information over time. Forecasts of these figures should be calculated as well using appropriate types of trend analysis.
- Re-evaluating land-use zoning development controls: the ability to consider whether a given area should be classified as a particular type of zone (e.g. residential or light industrial).
- Considering building proposals: Council has the ability to either accept or reject a building proposal based on evidence provided in the GIS (using both raster and vector spatial layers of information). Geographic data such as the area of the dwelling in proportion to the rest of the block, the gradient of the driveway, the aspect the dwelling faces (i.e. energy-saving measures), even the distance between one dwelling and the next, can all be factored in to preserve the local character of the location in question.
- Calculating the dwelling height: the ability to calculate the heights of existing dwellings within a given area and to determine whether proposed structures meet height restrictions (e.g. careful design of buildings that does not lead to overly dominant structures).
- Considering residential redevelopment proposals: Council can consider residential subdivision, dual occupancy development, integrated housing and villa homes, based on perspectives offered by the GIS. Additional layers acquired from utilities would also be helpful, including water, sewerage and electricity pipeline locations.
- Choosing areas suitable for housing development: Council can determine the most suitable location for a new housing estate and comply with current standards without compromising, despite the pressure for more land parcels to be made available to prospective residents on permanent housing waiting lists. The size of the block for instance, should remain as close as possible to the existing average land parcel. Roads and pathways as well as reserves should be intelligently scoped into new housing estate areas. For example, the new Elambra Estate (see figure 1).
- Approving local business opportunities: considering the needs of local residents and acting according to these needs. For instance, the approval of the Independent Grocer's Association (IGA) supermarket.

- Ensuring adequate commercial and industrial floor space: calculating the availability of business floor space for particular types of companies, as increasing numbers of people reside in Gerringong.
- Protecting the coastal strip: Council can ensure that development within the coastal strip meets all rules and regulations. The distance from the coastline can be measured precisely and appropriate action taken in a given scenario. For example, preserving the character of Werri Beach, despite the obvious opportunities to invest in high-rise apartments, such as on the southern headland.
- Services to the community: identifying areas where particular services to the community are required and targeting those clients, dependent on the service. For example "meals on wheels", or the possibility of a local high school or police station. The relocation of Gerringong Primary School to Greta Street is another example.
- Demand for public amenities: understanding the need for amenities such as public pools, barbecues, toilets and bins in key locations or pathways leading to the beach to ensure that sand loss does not occur. For instance, the decision to rebuild the local surf club and associated bowling club on Pacific Avenue.
- Catering to increasing traffic pressures: the consideration of adequate parking facilities that meld into the surrounding streetscape.
- Sewerage and drainage schemes: identifying those residents that are yet to connect to the new Gerringong-Gerroa sewerage scheme and those areas that are prone to flooding after heavy rainfall.
- Sustaining the needs of increasing numbers of visitors and temporary residents: determining whether there is enough temporary housing such as caravan parks and hotels as well as parks and reserves.
- Affordable housing: determining the mix of housing available and planning for a range of options in terms of affordability.

Summary Facts and Figures

Reports that have been commissioned by Council, such as those compiled by Wiggins (2003) and ESD (2002) would be aided by the use of a GIS. Not only could qualitative outcomes from the reports be captured spatially for future re-use by Council planners but quantitative data could also be extracted to enhance report outcomes with accurate facts and figures (both current and forecasted). The following is a summary of some of the fundamental cross-sectional data that was captured by the work-in-progress

GIS for the post code of Gerringong (2534). The extracted data is shown by unit of analysis and should be considered in light of the GIS applications proposed above. While these figures do not depict clusters of typologies, nor consumer behaviour or attitudinal patterns, they do indicate the vital demographics any planner should be aware of before drilling down further. Only when a planner is comfortable with the high-level numbers, after laying the foundations of a basic GIS, can they fully appreciate the implications of particular geodemographic trends (Schensul 1999).

Post Code Analysis

The post code 2534 covers a surface area of about 86 square kilometers. There are 9 suburbs in the post code including: Gerringong, Gerroa, Werri Beach, Foxground, Toolijooa, Broughton, Omega, Rose Valley and Broughton Village. In 1996, the ABS census recorded 1458 residences and a total population of 4047. According to the ABS ABR, in 1998 there were 145 businesses operating in the post code and in 2001 there were 433 Australian Business Numbers (ABN) registered in the post code.

Collection District Analysis

There are 10 collection districts in post code 2534 which cover a surface area of about 82 square kilometers. The residential and business dwelling count per CCD can be found in a graduated thematic map in figure 2. In 1996, the median age was 40 years old and the median household income was between $500 and $699. Save for the United Kingdom and New Zealand, a very small proportion of persons residing in Gerringong were born outside Australia.

Roads Analysis

There are 129 roads in post code 2534 stretching a total of 80 kilometres in length. Seventy-five percent of residential dwellings are located in 30 roads and streets. Four streets have over 100 residential dwellings each, including Belinda Street, Renfrew Road, Fern Street, and Stafford Street. Forty percent of businesses are located on three roads, including Fern Street, Belinda Street and Rowlins Road. The respective graphs representing these statistics can be found in figure 3.

Dwelling Analysis
As of 2002 there were approximately 2000 residential dwellings in post code 2534, which equates to approximately 5200 permanent residents. Over 225 businesses are located in the area. Eight-four percent of businesses employ less than 5 employees. Over 50 per cent of business can be categorized as ANZSIC type Construction, Manufacturing or Retail.

Conclusion

Local councils are beginning to understand the power of geographical information systems (GIS). While GIS is not a new concept, many councils are only now adopting the technology. Spatial analysis provides a whole new dimension to the strategic planning process that can aid in producing a holistic perspective rather than a piecemeal approach to solving real and anticipated problems. A top-down analysis of a given scenario is always to be preferred to gain a macro to micro perspective, without accidentally omitting pieces of information, important to making a particular decision. Councils located in coastal areas in particular can benefit from using GIS for both human geography and environmental geography issues. Considering both of these aspects together is paramount for the preservation and conservation of a given area. GIS can incorporate both qualitative and quantitative data and capture patterns and trends more readily than any other information system. While this pilot study was cross-sectional in nature (i.e. a snapshot), an ideal study would incorporate a longitudinal view and forecast population growth rates that were sustainable for the area based on Council parameters. The most important outcome of the study was demonstrating the need for Council to quickly adopt GIS into its planning practices. While the cost of acquiring the data sources and spatial boundaries identified throughout this paper would total in excess of one hundred thousand dollars (i.e., for a single user license for the area covered by Kiama Council alone), the investment would have positive long-term implications.

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Suggested Resources for Spatial and Aspatial Data

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Acknowledgements

I would like to thank sales representative Brinda Rabi of MapInfo Australia who supplied free GIS software and associated spatial databases to the Faculty of Informatics at the University of Wollongong for research purposes in 2002. I would also like to thank the University of Wollongong who funded a New Researcher, and Start-up Researcher grant for the Spatial Database National Australia (S-DNA) project to the total value of $7,500 of which this study is a part of. Strategic planner, Peter Nelson, of Kiama Council was also helpful in establishing the scope for this GIS pilot study.