Metadata for South African Geographic Names Databases

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The relevance of adequate information on digital datasets of geographic names is being recognized world-wide. During the development of the geographic names databases of the Human Sciences Research Council (HSRC) it was found that descriptive background information or metadata on such databases is lacking in South Africa. The HSRC databases are discussed here in relation to the standards set to such databases, and to some of the problems of defining the information fields and technical issues of developing such large databases in digital format. Furthermore, the advantages of descriptive metadata relating to common data standards are explored in this context. Finally, reference is made to the formulation of a policy or framework for the South African context that would set the parameters to promote the optimal use of these datasets.

Decision makers and the general public need access to geo-referenced national databases for research purposes. This necessitates accurate information on the availability and quality of such datasets. The metadata on geographic names databases for instance, should direct users to access the data on features designated by geographic names. Where a database on geographic names is envisaged for national use, adherence to metadata standards becomes imperative. Metadata refers to background information, and the analysis of datasets according to predetermined criteria. According to Stadler (1998b, 30) metadata usually gives an analytical description of what the dataset contains. The information on criteria for metadata provided in this article relates to geographic names and is summarized *inter alia* from Marsden, *et al* (1998); the *Content Standard for Digital Geospatial Metadata* of the United States Federal Geographic Data Committee (1997), and other sources. Marsden, *et al.* (1998, 1-2, Annex C) summarize metadata as "additional information required by the user of a data set to interpret competently the data contained therein. This additional information is generally referred to as *metadata.*"

Another practical consideration is that the provision of metadata on geographic names datasets should be included in the initial data capturing phases. Through systematic recording and descriptions of all relevant content and quality aspects of the data sets, this information becomes an indispensable analytical component of the database. Once geographic names data is further enhanced through digital mapping in GIS, metadata acts as an

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essential tool to address the needs of information management and maintenance to a number of related fields such as land information, land tenure and land settlement issues. The compilation of explanatory information to support existing datasets minimizes the duplication of databases as well as the maze of divergent formats and standards being applied.

Local developers and managers of large datasets need to establish how this descriptive information, set within other geo-information strategies, can be proposed to promote a better understanding of the effects of information management and dissemination in general in South Africa (Stadler 1998a, 34).

Effective management strategies for data systems require new ways of determining state-of-the-art metadata for databases. Decision-makers need to know which datasets have been developed, for what purpose, what their specific focus is, and whether these datasets serve as by-products for other datasets, for instance those compiled from demographic, specifically census survey findings. Bassole (1998, 18) argues that if Africa is to survive the rise of globalization, governments and the private sector must urgently tackle issues of data standardization. The main problem is that too "little information is circulated formally about existing data;" that datasets are not maintained due to a number of reasons, e.g. "lack of funds and poor strategic planning" which culminates in the difficulties of re-using existing datasets. The main threat to positive changes in decision-making on these issues is, according to Bassole, "the lack of coherent policies for coordinating data management at national and regional levels. To overcome this, national experts need to be appointed to develop the strategic action plans for managing geographic and spatial information." In this respect the South African Metadata Clearinghouse efforts by Geographic Information Management Systems (GIMS) through means of gateway facilities are lauded, but as Van Helden (1997, 94) points out on the issue of networked directories: "For the future it is feasible that the concept of centralised and somewhat monolithic metadatabases will be superseded. The facility to access remote sites through a telecommunications network (e.g. Internet) has meant that it is now possible to consider dispersed metadatabases, within which users may be linked to local directories from distant nodes."

Rationale for the Provision of Metadata

The overall aim for providing metadata is to give some guideline or framework regarding the existence, maintenance and dissemination of information on databases. The accessibility and appropriateness of the data to specific end users should also be indicated, e.g. GIS data for the mapping of urban, formal settlement patterns. These users all need sound, comparable frameworks within which to operate, calling for compatible datasets on geographic references, as well as the assistance of clear policy for metadata.

Both government and private sector database developers need to take cognizance of the issues regarding metadata on geographic names databases, the requirements for common data standards as relating to toponymic data, and especially of the cost effectiveness of utilizing existing datasets or creating new ones. Van Helden (in Stadler 1998b, 30) explains the value of metadata as a measure for evaluating datasets. Relevant issues in establishing an efficient set of metadata in general, would, according to Van Helden (1997, 12-13), include information on:

- "the type of the core data, that is the characteristics of the data;
- how the data can be accessed;
- whether the data is of a high quality with at least the minimum required or sufficient fields of information for the end users;
- whether the necessary data standards and classification principles have been followed in the design, creation and compilation of the dataset.

According to Marsden, *et al.* (1998, 2) metadata on geographic names databases "serves to answer four basic questions:

1. What sets of data exist for a geographic location?
2. Does a set of data meet a specific need?
3. How is a set of data acquired?
4. What information is required to process and use a set of data?"

Another valuable benefit is that metadata enables standardization procedures and deliberations. With reference to the standardization of data on geographic names, Payne (1995, 311, 314) concludes that by including the provision of metadata, the standardization of geographic names is promoted. This is seen as an "essential first step for the preparation necessary for names under consideration." It eventually promotes effective communication and information management on various levels of government.

Clear and unambiguous information on geographic names should be furnished as metadata to describe the existing datasets, the availability of these in various formats, the fields of information they contain, and how to functionally activate the datasets. The metadata therefore, provides the recipient or user of a dataset with information to determine the content and utility of a dataset on geographic names. This, according to Marsden, *et al.* (1998, 1-2), is usually provided in a text file (or as a readme.file to the dataset), it may be encoded or not, and is often provided as additional hard copy text to the database.

In South Africa divergent datasets on geographic names are being

accumulated, e.g. the Landsat of Environmentek at the Council for Scientific and Industrial Research (CSIR), Projects Elf, Miracle and Eagle of the Independent Electoral Commission (IEC) in conjunction with the Department of Land Information, the Directorate of Surveys and Mapping, and the gazetteer component of Statistics South Africa (Stats SA). The provision of metadata on these datasets is of crucial importance for verification and comparison purposes. In the cadastral information of Project Miracle "seven million surveyed or registered urban and 300,000 rural land parcels" were captured (Stadler 1998a, 34). From these maps of various scales (1:250,000 and 1:50,000), and from the census surveys thousands of geographic names were recorded, mainly referring to previously unrecorded settlements, administrative sub-divisions and enumerator areas.

Little has in effect been done to compile either the required metadata or a system of linkages for all these datasets on geographic names in Southern Africa. The issues that need to be looked into in this context, apart from and in addition to the above-mentioned general metadata requirements, are *inter alia*:

(a) Under whose auspices is the dataset managed and maintained, government or private sector? Editing and updating, for instance, comprise the most expensive exercise after the initial raw data capture, compilation and development phases.

(b) What is the specific focus and the intrinsic value of the dataset?

(c) In which format is the data available? What does the content look like and does it comply with the minimum required information fields as indicated by Smith (1992, 300-304) and Marsden, *et al.* (1998, 2)?

Relevant considerations for South African database developers include: Does the database serve South African as well as international user needs? Does it comply with the Federal Geographic Data Committee of the USA and International Standards Organisation (ISO)? Marsden, *et al.* (1998, 2) emphasize that "metadata characterizing geographic names datasets for instance typically comprise the following subsets:

1. "Identification information - basic information about the data including the developer and the publisher.
2. Text encoding standards - identification of the national, international or proprietary standard used to represent the text digitally in the data set.
3. Data quality information - a general assessment of the quality (accuracy, currency) of the dataset.
4. Spatial data organization (if applicable) - the mechanism (text,

point, vector, raster) used to represent spatial data in the dataset.

5. Spatial reference information (if applicable) - the description of the reference frame for coordinates in the dataset.
6. Entity and attribute information - the description of the content of a dataset including entity types, their attributes and domains, i.e., that which qualifies as entity and attribute metadata, e.g., the name fields as demonstrated in the database.
7. Software information - identification of the software configuration used to create the dataset, including identification of operating system and application.
8. Distribution information - information about the distribution of and options for obtaining the dataset."

Background to the Development of the HSRC Placenames Databases

The development of the HSRC Placenames Database may serve as an example of how complex, yet essential, adherence to basic standards and provision of metadata is in the establishment of a national database. This database on geographic names was established in accordance with the requirements of United Nations resolutions adopted at the United Nations Conferences on the Standardization of Geographical Names (Orth 1986a & b). It had already been initiated in 1972 by Peter E. Raper, Head of the Onomastic Research Centre of the HSRC, after extensive research on similar automated databases in other countries. From this international comparative research it was ascertained how database systems and directories relating to them could best be developed, and what the required criteria should be for inclusion of minimum fields of information for such databases on geographic names. The metadata or information on the database, i.e., how it was to be captured and managed, was already formulated at that early stage in the development of the database in digital format.

The database consists of some 98,854 records on geographic names in several digital files and is known collectively, as the HSRC Placenames Database. It is available in the Windows driven FolioView 4.1 text based format as well as in Atlas GIS, a dBase format with mapping facilities. It can also be provided in other formats.

The database may seem small in comparison to other major datasets as mentioned above, but what the HSRC Placenames Database may seem to lack in numbers, it provides in the variety of formats, and in content and extra fields of information, e.g. status, language of origin and etymology of the names, i.e. the historic background information. These information fields are especially useful to government departments and the national names authority for consideration of new names to be ratified, and for purposes of redress of past imbalances as relating to inaccurate renderings of geographic names. Added to this, the digital set of the *Gazetteer of South Africa* from the United States Board on Geographic Names has been obtained for purposes of verification and cross-referencing.

The work by the Onomastic Research Centre was undertaken in several phases, following negotiations in 1978 with the Director-General of Surveys and Mapping (DGSM) on the acquisition of their fieldwork questionnaires. As part of their methodological approach the DGSM field workers gathered additional background information on the geographic names. This information provided essential content to the data records.

In the first phase of developing the database nearly 90,000 names were gleaned from the DGSM questionnaires, from standard literature relating to South African geographic names, in particular references to the standardization of geographic names (Raper 1989, 1997), as well as cartographic sources, e.g., maps of different scale. This was the first major digital data capturing phase of geographic names in Southern Africa. In this format the geographic names formed the descriptive layer to which geo-coded attributes in GIS were linked in the second phase of development (1996 to 1998), in order to capture the toponymic landscape of South Africa in a digital and spatial context.

The initial questionnaires of the DGSM to a large extent already contained the essential fields of information on the data records as specified by Smith (1992, 300-301) for the production of gazetteers and names lists, also for digitally developed lists as recommended by Resolution 4(E) of the First United Nations Conference on the Standardization of Geographical Names (Resolutions 1991/2, 30-31).

These information fields include the names of the features, the feature types referred to, the administrative divisions or districts and provinces, the coordinates of latitude and longitude, or map sheet references, language of origin and etymology where known, and the source. Additional findings of research undertaken into e.g., Khoikhoi, Zulu and other geographic names were also included in the first phase.

The database can supply information on the geographic names as well as on additional fields of information, especially from geo-linked databases such as selected demographic information, e.g., population statistics relating to places in certain districts or regions, linked via the names and feature types and their distribution. The database in Atlas GIS provides access to the geographical, socio-political and cultural information available at present on the features referred to in the dataset both in tabular and map format.

While compiling the HSRC Placenames Database the concomitant products emanating from it, i.e., the digital maps, datasets in tabular and text format, name lists (with all fields of information accessible through search facilities of the relevant software packages), were maintained in both text and dBase files. The main objective of the conversion into GIS was to add spatial mapping facilities to the database and provide for a variety of outputs. In this context the databases can in the future, also provide information for the purposes of verification, standardization and officialization, for example, to the national naming authority.

From the evaluation of the database it became obvious that further

research would need to be done into, for example, the inclusion of indigenous geographic names appearing as alternative forms or variants of names in the eleven official languages, as well as name changes that have occurred since the establishment of the database, and whether these have been officially approved or not. To maintain the database as current and comprehensive with these additional levels of information, the records need to be continually updated and edited. The provision of metadata as set out in the above *Report* by Marsden, *et al.* (1998) should guide this process.

Aspects of Compatibility and Accuracy

Integration and consolidation of existing databases pose very specific challenges. The problems of accuracy encountered in the HSRC Placenames Database development related mainly to the method of data capturing, conversion processes and merging of database information, the inherently multilingual status of the data, and the technical ramifications of the conversion procedures. The multilingual data capturing processes used in the past influenced the integration and consolidation of the databases in several instances.

With a multilingual situation in South Africa and eleven languages having official status, researchers faced the challenge of incorporating information on placenames originating from various languages. Where these names were found in divergently captured databases, that is, where different choices had been made for alphabetical ordering for the lemmatization, for instance, (as in the case of using prefixing or not to indicate locatives), the merging process was quite a daunting task. This contributed to the names existing as duplicates, variant forms and alternatives.

Since the collective databases were compiled at different stages by different bodies, and the questionnaires were completed in either English or Afrikaans, various feature type designations were used and generic descriptions were allocated, some even added as tautological translations. This also resulted in variant spellings of names that were then captured as either separate records or as variations in the same record. It was necessary to include in the database, where possible, apart from language of origin, deeper levels of information such as etymology and spelling forms recorded from other source documents. The ideal would be to cross-reference also to dialectical forms and phonological variants, as well as indicate for each name record the status. At present a list of official geographic names exists only as a limited dataset called the Committee of Placenames (COMP) database.

Because the database had been captured from fieldwork questionnaires and, in some cases from non-standardized automated formats as unedited, raw material, over a period of more than twenty-five years, the inclusion of corrupted name forms was inevitable. These names were recorded in the past by field workers unaccustomed to the pronunciation or the writing system of these indigenous languages. Although the field workers had heard the names being pronounced by the local speakers, the names were often

reproduced in the phonetic form of the mother tongue of the field worker. The office staff capturing these names digitally also lacked a standardized diacritic system in the automated conversion tables, and ISO standard formats at that time were not yet fully compatible with all software and processing systems, as for instance in the indication of click sounds from Khoi and San languages. Neither did the field or office workers have access to fixed orthographies for many of the languages spoken in South Africa. It is therefore not unusual to find many names incorrectly recorded and the mistakes perpetuated in official documents and other sources, such as gazetteers, maps and official name lists.

Where such information was put into one national database on geographical names, the language aspect regarding accurate translation of feature designations and correct diacritical signs (especially as mentioned earlier for the click sounds in placenames emanating from such languages as Nguni, San and Khoikhoin), was not fully realized. Only in separate studies such as those of Nienaber and Raper (1977, 1981) were these toponymic ramifications indicated. The language aspect will therefore remain a crucial element of the updating and editing of the databases on placenames in Southern Africa. This may serve as an example where problems in data capturing procedure affected the compilation of toponymic data files. These problems mainly relate to transfer formats and standards as reported on by the UNGEGN Working Group on Toponymic Data Exchange Formats and Standards to the United Nations Conferences on the Standardization of Geographical Names (Resolution 7/6, 1998).

The information layers on language of origin and etymology may prove essential for comparative references and queries from decision makers such as the national and provincial naming authorities. To fully address the corruption of geographic names within an automated database will, however, require more intensive research and comparison of various name datasets and orthographic forms, for example, on maps of different dates, types and scales, and other official documents or from unofficial sources. Orthographic variants can therefore be compared in future making use of the HSRC database.

Features and Format of the HSRC Placenames Databases

The required data elements to be included in a dataset, according to Smith (1992, 300-304) and Marsden, *et al.* (1998), comprise the minimum set of critical geographic names information for digital data exchange as recommended in Resolution 4 of the First United Nations Conference on the Standardization of Geographical Names. This relates to the content of a dataset, often called the name fields, that which qualifies as entity and attribute metadata of the database.

The composition of the existing data files in the HSRC Placenames Database was based on these international standards and formats. The database originally consisted of three main files:

1. The Placenames (PLAC) database of topographical and topocadastral features.

This database contains some 88,699 records of placenames, referring to topographical and topocadastral features in Southern Africa, originally captured from the questionnaires of the Chief Directorate of Surveys and Land Information. Each record contains ten fields of information or data elements.

(a) Fields of information

In each data record of the database the following fields of information were indicated. Codes for these fields were originally captured in Afrikaans abbreviations and are explained below:

DO: Document or record number;

NA: Name of the entity;

NS: Feature designation, type of feature, e.g., mountain, town, etc.;

LD: Location as per district, that is according to administrative division, e.g., magisterial district and province;

LI: Location indicated according to either coordinate system of latitude and longitude in degrees and minutes; by alpha-numeric map sheet reference, with sheet name of map, e.g., 2530 Barberton of the 1:250,000 map series. Some records are indicated with distance from magisterial seat, some with indication of direction from the magisterial seat, e.g., N.W. or S.E.;

OS: Origin and meaning of the name where known;

TA: Language of origin;

BR: Source of record used, e.g. DGOS/DGSM= Director-General: Surveys & Mapping, or NPNC= National Placenames Committee, or map series used and date of approval where known.

Each data record of a placename and its layout in the original database was designed according to these fields of information. The descriptions of entity designations and attributes were gleaned from the original field questionnaires as well as from bibliographic and cartographic sources, documents and other research findings.

2. Committee of Placenames (COMP) database

The COMP database consists of records compiled from questionnaires of officially approved placenames from the archives of the NPNC. This database is not complete and approved geographic names need to be added as they become available. The fields of information are the same as for the PLAC database, although some fields, e.g. latitude and longitude were not always indicated on the office schedules of the NPNC, and hence neither in previous data capturing phases. In the questionnaires acquired at a later stage the coordinates were indicated or could be ascertained from maps, and

were subsequently added to the relevant columns to provide for more comprehensive and correct data elements.

3. Foreign Placenames Database: BUIT (*Buitelandse Plekname*)

This database contains some of the major feature types in the world, and comprises the names of countries, major cities, lakes, bays, islands, mountains, and so forth, in English and Afrikaans. It consists of a total of 4,484 foreign placenames, that is, names of places outside South Africa, together with their exonyms in English and Afrikaans. It also gives, where possible, the endonym of the place, i.e., the name in the language of origin, or the name in the official languages of that country. Its records were compiled from UNGEGN documents and publications (especially those of the UNGEGN Working Group on Country Names), ordinary language and geographic names dictionaries and other lists.

Data Files in Atlas GIS

Through the conversion of the text information fields of the PLAC database into the dBase files in Atlas GIS it is possible to create spatial maps of the distribution of feature types. Not all the data fields mentioned in the PLAC database were included in the conversion for Atlas GIS. From this dBase file some new fields for the conversion to the Atlas GIS format were needed, for example for geo-referencing purposes which included the 1:50,000 grid reference. To indicate which geocoding process was used, a GEOCODE column was created and the following text was entered in that column: Grid_50 (1:50,000 grid) or LAT/LON (Latitude/Longitude). Data fields on attributes of the features can either be expressed or suppressed according to specific needs, and be accessed in the tabular contents of the database in Atlas GIS. The magisterial and provincial boundaries can be super-imposed onto the dBase files containing the 88,699 records of the PLAC database. This allows users to select and map the location of specific features in Southern Africa according to distribution and occurrence. Examples of the selected categories of features linked and mapped onto other attribute information fields are illustrated in Map 1 where the feature types of towns and settlements in relation to population density are shown, and Map 2 where dams, koppies (hillocks) and forests of the Eastern Cape region are highlighted. Other features such as main roads, streams, waterfalls, fishing spots, coastal resorts, shipwrecks, monuments or tourist attractions, are collated from the different databases and presented in GIS format as Map 3.

The selection of categories gives an indication of the variety of categories included in the database. The finer categorizations of generic descriptions and terms in both English and Afrikaans in the database actually complicated the selection of categories for map production. In the initial data capturing procedure generic descriptions recorded were not standardized. In the future an attempt should be made to standardize these generic descriptions according to the cartographic standards of the International Cartographic Association and other geo-spatial metadata specifications.

Metadata Management and Maintenance

Once the collective databases of the HSRC can be linked or accessed via remote nodes, e.g. the Internet, this would address the problem of inaccessible databases, as Van Brakel and Pienaar (1997, 109-116) argue that in South Africa: "Currently no standard method of accessing widely scattered geographic data exists." Although the Geographic Information Management Systems (GIMS) have endeavored to compile a common accessing metadata website that provides a gateway to other sources (Svensson 1997), it still lacks the real content to function as a substantial metadata clearinghouse for Southern Africa.

Through interactive access, and with due consideration of developers' reservations on "access to information and accessibility," as well as legal and other restrictions (Britz 1997, 18, 20), licensed end-users could add, correct and evaluate the database - if not directly, at least by suggestions on a web site page to reach the developers. This method of sharing metadata is envisaged by Svensson (1997) of GIMS in the policy and brief on the Southern African Metadata Clearinghouse. This would augment the informational content and increase the value of the databases. In South Africa particularly, the endorsement of compatible data transfer formats and standards, as well as using the same standard designation for feature types and information fields, would need to be sorted out with end users.

Conclusion

It is important to take cognizance of the key issues surrounding the successful implementation of existing databases into future metadata provision, not just with reference to the questions regarding accessibility and usefulness (Britz 1998, 20, 21), but also the question of addressing national information sharing and linkages.

Legislation necessarily affects all information workers including those working with digital databases as it could have far-reaching implications for aspects of "freedom of government information" versus private enterprise in South Africa (De Vries 1998, 16-18). These legal aspects have not been clearly defined in South Africa. The expectation is that copyright and developers' intellectual property rights will be respected as these need to be considered within an ethical perspective as pertaining to "democratization of knowledge" versus "intellectual property rights" (Britz 1998, 15-22).

Quite diverse viewpoints on this issue are noted worldwide (Barr 1998, 14-15) depending on the type of information, distribution restrictions and who the developers are. In Southern Africa specific historical and development problems, e.g., lack of a clear policy on digitally captured databases and metadata on geographic names databases, may contribute to general problems of costing, access and availability.

These views on regulation and deregulation of information; on access and availability may impact on government data policy formulations (Britz 1998,

20-21). Such policy and its implementation should not only promote the use, management and maintenance of geographic names datasets, but also make known to the public the rationale behind decisions and recommendations relating to producing and disseminating geographic names information.

These aspects have to be taken into consideration once metadata for databases are being developed and utilized. With reference to distribution of digital geographic names information on the Internet for instance, copyright and licensing arrangements for use of data need to be ensured. The Canadian statement (*UNCSGN, 1998, Working Paper No.E/Conf.91/L.33*, 6) regarding Internet accessible databases gives a clear option: "The challenge is to make as much data available as possible, but still to create a reference, rather than a data transfer, site."

Similar statements should be compared with local efforts on database accessing and linking via the Internet. The development of a national metadata and the criteria for access and linking of information sets within databases is still in its infancy. Defining the playing rules of access to such databases according to international standards is therefore crucial to all database developers and users.

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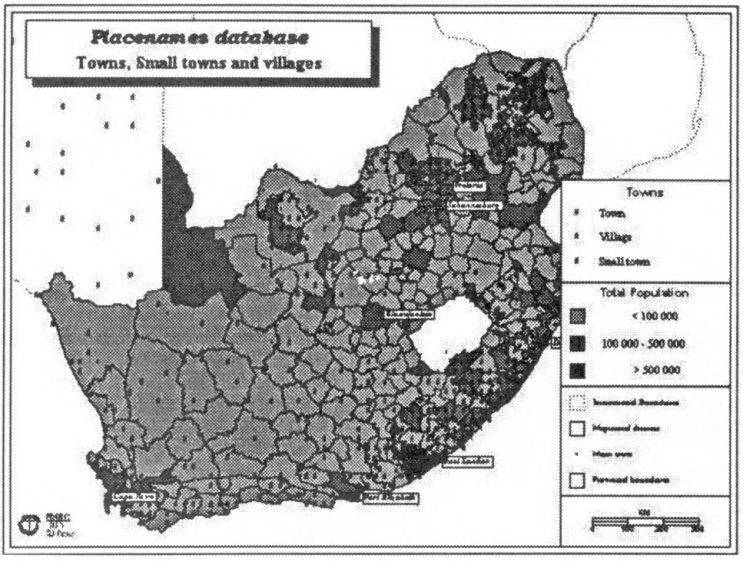
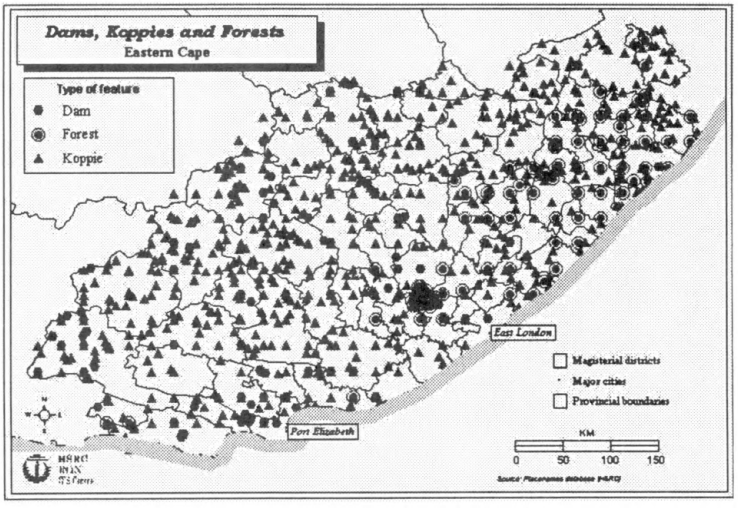
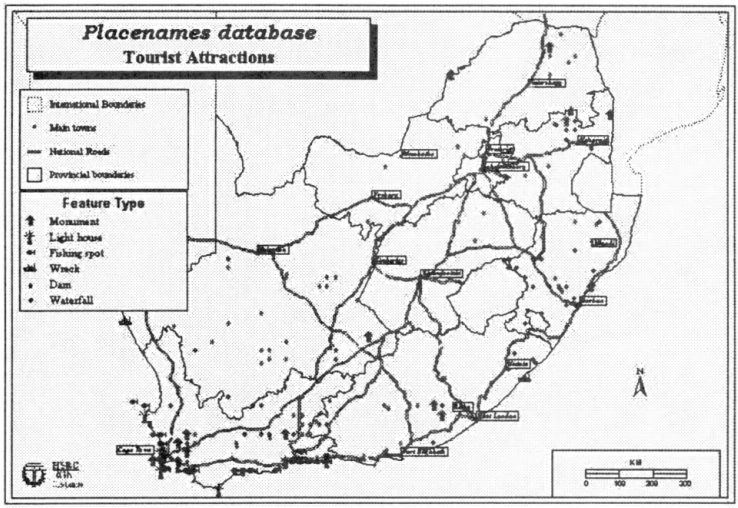

Placenames database
Towns, Small towns and villages
Towns
Town
Village
Small town
Total Population
< 100 000
100 000 - 500 000
> 500 000
KM

Map 1


Dams, Koppies and Forests
Eastern Cape
Type of feature
Dam
Forest
Koppie
East London
Port Elizabeth
Magisterial dirtricts
Major cities
Provincial boundaries
KM
0
50
100
150

Map 2



Map 3

An important project of which readers of Names should be aware is Wilfried Seibicke's Historisches Deutsches Vornamenbuch [Historical Dictionary of German First Names], which is in process of publication. Volume I (A-E) was published in 1996 and Volume II (F-K) in 1998. The remaining two volumes will follow in due course. On completion, this substantial compendium by the foremost German scholar in the field will undoubtedly be the definitive work on German first names and no library should be without it. A full review of the entire series will follow upon publication of the fourth volume.

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