The South African Index of Multiple Deprivation 2001 at Datazone Level

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Acknowledgements

Contents

1 Introduction

This report presents the South African Index of Multiple Deprivation 2001 (SAIMD 2001) at datazone level. The SAIMD is a composite index reflecting five dimensions of deprivation: income and material deprivation, employment deprivation, education deprivation, health deprivation and living environment deprivation. The SAIMD and the component domains of deprivation are presented at datazone level. As will be elaborated below, datazones are small areas containing approximately the same number of people (average 2 000).

The datazone level SAIMD therefore provides a fine-grained picture of deprivation in South Africa and enables pockets of deprivation to be identified.

1.1 Background

A key objective of the South African government since 1994 has been the improvement of the quality of life of all South Africans and the reduction of poverty and inequality. Furthermore, the South African constitution requires the Parliament to ensure that financial resources are distributed equitably among provincial and sub-provincial governments, based partly on levels of poverty and disadvantage (Alderman *et al.*, 2003). In recognition of this a team from the University of Oxford's Centre for the Analysis of South African Social Policy (CASASP), the Human Sciences Research Council and Statistics South Africa (StatsSA) developed a small area measure of multiple deprivation known as the Provincial Indices of Multiple Deprivation (PIMD) (Noble *et al.,* 2006a, 2006b, 2009 forthcoming). This project was funded by a 'pump priming' grant from the University of Oxford.

The PIMD has been used in various ways to target deprivation across the country (Noble *et al.*, 2009 forthcoming).

At that time the geographical unit employed to identify small area deprivation was the electoral ward. However due to the variation in the population size of wards across the country meant that this geography was less than ideal for comparative purposes. Indeed this was the reason why an index of multiple deprivation was separately created for each province rather than an overall index of multiple deprivation for the whole country. As was stated in Chapter 6 of the PIMD report:

> "The original intention was to produce ward level South African Index of Multiple Deprivation (i.e. a single index for the whole country). However, the country's wards vary considerably in population size, especially by province. Though the national mean ward level population size is around 11 500, mean ward size by province ranges from around 5 000 in the Northern Cape to 20 000 in Gauteng. This raises two important issues: first, provinces with large wards will tend to be under-represented in

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national indices of deprivation; and second, pockets of deprivation in larger wards may be 'diluted' or hidden by relative non-deprivation in the vicinity." (Noble *et al.*, 2006a, p 53)

The recommendation in the original PIMD report to deal with this problem was:

> "To address the issues raised above, it is recommended that a new small area unit be constructed that takes into account homogeneity and population size. The research team accordingly plans to develop Data Zones for South Africa which use Enumeration Areas as building blocks. This exercise will draw on work that has been carried out to create new small area geographies by the Office for National Statistics (England and Wales), the General Register Office for Scotland and the Northern Ireland Statistics and Research Agency. In these countries, similar problems with ward size and changing boundaries were encountered and it was therefore decided to develop a range of statistical areas that would be of consistent size and whose boundaries would not change. The key thing to note is that Data Zones would be analytical or statistical boundaries not political or administrative boundaries. They would be generated solely to ensure equity and consistency in the geographical measurement of deprivation." (Noble et al., 2006a, p 54)

The National Department of Social Development, recognizing the importance of creating a national index at the new geography, supported this project as part of its DfID funded SACED[1] programme and as a result a new statistical geography (datazones) was created (See Section 3). Datazones have been designed to nest within municipalities and have a mean population of around 2000 with most datazones having populations between 1000 and 3000.

Having created the datazones StatsSA then agreed to re-run the SAS code used to produce the PIMD at ward level on the 100% 2001 Census and supply the project team with datazone level data to construct the original PIMD domains and indicators at datazone level. This has enabled a national SAIMD at datazone level to be created.

It is important to stress that the rationale, model of deprivation, the domains and their component indicators and the techniques used are, by design, identical to the PIMD. As this is the case some sections of this report are drawn from the original PIMD report[2].

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[1] Strengthening Analytical Capacity for Evidence-based Decision-making.

[2] This allows this document to be read as a 'stand alone' report without constant reference back to the original PIMD report. Original copyright is duly acknowledged and material drawn from the original report is enclosed in double quotation marks but (usually) not page referenced.

1.2 Why measure deprivation at the small area level?

"Why is small area level deprivation important? First, geographical patterns of social disadvantage (or advantage) are not random: the spatial distribution reflects the results of dynamic social processes, economic change, migration, availability and costs of living space, community preferences, and policies that may distribute particular groups to certain areas or exclude them from others. Second, the spatial concentration of multi-dimensional deprivation means that – when correctly measured – the most deprived areas can effectively be targeted (Smith, 1999; Kleinman, 1999; Smith *et al.*, 2001). Third, the concentration of poor people in an area may mean that local services struggle to meet high demand, or that areas lack resources to support certain services. Fourth, when a range of deprivation measures is collected on an area basis, the exact mix of problems will vary from area to area."

1.3 Defining deprivation

"Townsend defined people as poor if 'they lack the resources to obtain the types of diet, participate in the activities and have the living conditions and amenities which are customary, or at least widely encouraged or approved in the societies to which they belong' (Townsend, 1979: 31). Conversely he defined people as deprived if 'they lack the types of diet, clothing, housing, household facilities and fuel and environmental, educational, working and social conditions, activities and facilities which are customary' (Townsend, 1987: 131 and 140). Deprivation therefore refers to peoples' unmet needs, whereas poverty refers to the lack of resources required to meet those needs. This underpins our model of multiple deprivation. Townsend also lays down the foundation for articulating multiple deprivation as an accumulation of single deprivations (Townsend, 1987) - a concept which also underpins this project."

1.4 Dimensions of deprivation

"This view of multiple deprivation allows the separate measurement of different dimensions of deprivation, such as education deprivation and health deprivation. In the case of low income, there is an argument that, following Townsend, within a multiple deprivation measure only the deprivations resulting from a low income would be included and low income itself would not be a component. However, the considerable problems of measurement of material deprivations such as lack of adequate diet, clothing etc., mean that a measure of low income or consumption could be regarded as a useful proxy for material deprivation." In practice, as will be seen, an Income and Material Deprivation Domain was produced.

"To summarise, the model which emerges from this theoretical framework is of a series of uni-dimensional domains of deprivation which may be combined, with appropriate weighting, into a single measure of multiple deprivation." The South African Index of Multiple Deprivation 2001 (SAIMD) has been developed using this model.

1.5 Structure of the report

Section 2 presents the domains and indicators for the SAIMD. **Section 3** describes the new datazone geography used in the SAIMD. **Section 4** explains the methodological approach used. **Section 5** presents an overview of the SAIMD at datazone level.

2 Domains and Indicators

The datazone level South African Index of Multiple Deprivation (SAIMD) was constructed using the model of multiple deprivation briefly described in Section 1.3 above. The SAIMD comprises indicators which were first combined to form domains of deprivation. The domains and constituent indicators were identical to those used for the PIMD (Noble *et al.,* 2006a). As with the PIMD a score for each of the domains was produced – referred to as a domain index - and these domain indices were ranked to give a relative picture of each dimension of deprivation across the whole of South Africa. The domain indices were then combined to form the overall SAIMD.

2.1 An introduction to the domains and indicators

2.1.1 The model of multiple deprivation

As indicated, the conceptual model which underpins the SAIMD "is based on the idea of distinct domains of deprivation which can be recognised and measured separately. These are experienced by individuals living in an area. People may be counted as deprived in one or more of the domains, depending on the number of types of deprivation that they experience. The overall [South African] index of multiple deprivation is conceptualised as a weighted area level aggregation of these specific domains of deprivation".

2.1.2 Domains

Five domains of deprivation were identified that could be constructed using the 2001 Census to form the SAIMD. These were: Income and Material Deprivation, Employment Deprivation, Health Deprivation, Education Deprivation, and Living Environment Deprivation.

"Each domain is presented as a separate domain index reflecting a particular aspect of deprivation. Thus the Employment Deprivation Domain captures exclusion from the world of work and conditions of work – not the low income that may flow from it. The Income Deprivation Domain can be used separately from [the SAIMD] to examine low income alone. The Education Deprivation Domain represents educational disadvantage and does not include non education indicators which may contribute to education deprivation such as the lack of electric lighting to undertake homework. Such an indicator would be captured in the Living Environment Deprivation Domain. This approach avoids the need to make any judgments about the complex links between different types of deprivation (for example the links between poor health and unemployment), and enables clear decisions to be made about the contribution that each domain should make to the overall [SAIMD]".

While the domains represent distinct dimensions of deprivation, it is perfectly possible, indeed likely, that the same person could be captured in more than one domain. So, for example, if someone was unemployed, had no qualifications and no or very little other income they would be captured in the Employment Deprivation, Education Deprivation and Income Deprivation Domains. This is entirely appropriate because one individual can experience more than one type of deprivation at any given time."

2.1.3 Indicators

"Each domain index contains a number of indicators, totalling thirteen overall (please see **Appendix 1** for full details). Given the exclusive use of StatsSA's 2001 Census data for the construction of the index, all the indicators relate to 10 October 2001 (Census night). The aim for each domain was to include a parsimonious (i.e. economical in number) collection of indicators that comprehensively captured the deprivation for each domain, but within the constraints of the data available from the Census. Three further criteria were kept in mind when selecting indicators:

- They should be 'domain specific' and appropriate for the purpose (as direct as possible measures of that form of deprivation);
- They should measure major features of that deprivation (not conditions just experienced by a very small number of people or areas);
- They should be statistically robust.

The model is designed to be updated in three ways: first, to allow for the re-evaluation of the number and nature of the dimensions of deprivation; second, to allow for new and more direct measures of those dimensions to be incorporated; and third, to measure changing deprivation 'on the ground' as required."

2.1.4 Population denominators

"To enable the calculation of *rate* statistics, counts of deprived characteristics were divided by an appropriate population denominator. Since 2001 Census data were used, the denominators were also drawn from the Census. **Appendix 1** lists the denominators that were used to create each of the indicators."

2.2 Income and Material Deprivation Domain

2.2.1 Purpose of domain

"The purpose of this domain is to capture the proportion of the population experiencing income and/or material deprivation in an area.

2.2.2 Background

As indicated in the section outlining the conceptual framework for multiple deprivation, this domain sets out to capture material deprivation. However, there are few indicators of material deprivation contained within the Census or otherwise available at small area level. Income deprivation is a good proxy for general material deprivation and is included in this domain alongside two *direct* measures of material deprivation.

Despite advances in poverty measurement in South Africa over the past decade, and the emergence of a voluminous literature on the subject, the patterns and dynamics of poverty and inequality have become the subject of much debate. The key issue of contention relates to whether poverty has increased or decreased over the period. This situation has developed partly due to the wide range of definitions used. This is compounded by the absence of an official national poverty line, resulting in poverty estimates that fluctuate within quite a broad range, even when referring to a single dataset.

Notwithstanding these debates, income deprivation is now often measured at national level as the proportion of households below a particular low income threshold. International comparisons frequently use the proportion of households living below various fractions (usually ranging from 40 to 60 %) of median or mean income. The availability of data in the Census on income distribution yields valuable insights into low income at very small spatial units.

2.2.3 Indicators

- Number of people living in a household that has a household income (need-adjusted using the modified OECD equivalence scale) that is below 40% of the mean equivalent household income; or
- Number of people living in a household without a refrigerator; or
- Number of people living in a household with neither a television nor a radio.

The income deprivation aspect of this domain is represented by the number of people in a [datazone] living in households with an equivalent income of less than 40% of the national mean. Several household equivalent income thresholds and equivalence scales were investigated (see below) and the modified OECD

equivalence scale was selected. This commonly used scale, which was initially suggested by Hagenaars *et al.* (1994), allocates a value of 1 to the household head, of 0.5 to each additional adult member or child aged 14 or over and of 0.3 to each child under 14. Mean equivalent income was calculated using the 2000 Income and Expenditure Survey (IES) data and adjusted to 2001 levels using the Consumer Price Index. Having performed these calculations, a threshold of 40% of mean equivalised income in 2001 was adopted.

With regards to material deprivation, there are questions in the 2001 Census questionnaire about the possession of material goods (e.g. radio, television, computer, refrigerator, telephone, and cell-phone). These are widely used measures of variations in living standards. For the purpose of the provincial indices, three of the six household durables were included in the income deprivation domain - a refrigerator, radio and television. Ownership of a refrigerator represents a fundamental basic asset for safe storage of food, while ownership of a radio or television represents an important mode of communication with the outside world and a means of accessing information critical to one's life and livelihood. According to the 2001 Census, nearly three-quarters (73%) of households in the country had a radio, while slightly more than half had a television or refrigerator (54% and 51% respectively). For the other three excluded private goods, the levels of ownership were substantially lower. Cellular telephones were present in 32% of households, landline telephones in 24% of households and computers in a mere 9% of households. The current low levels of computer ownership in South Africa suggest that the lack of a computer is not a good indicator of deprivation at this stage of development. Telephone access has been included under the Living Environment Deprivation Domain and was thus not considered here.

2.2.4 Combining the indicators

A simple proportion of people living in households experiencing one or more of the deprivations was calculated (i.e. the number of people living in a household with low income and/or without a refrigerator and/or without a television and radio divided by the total population)."[3]

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[3] Please see Noble *et al*. (2006a) and Noble *et al*. (2006b) for a full account of other issues considered

2.3 Employment Deprivation Domain

2.3.1 Purpose of domain

"This domain measures employment deprivation conceptualised as involuntary exclusion of the working age population from the world of work

2.3.2 Background

In determining what constitutes employment deprivation in the South African context, the intention was to move beyond a mere count of those who would be classified as officially unemployed. It was felt that elements of the 'hidden unemployed' should also be included, such as those who are involuntarily out of the labour force due to sickness or some form of disability.

2.3.3 Indicators

- Number of people who are unemployed (using official definition); plus
- Number of people who are not working because of illness or disability.

Stats SA uses two definitions of unemployment. According to the (international) official or strict definition, the unemployed are those people within the economically active population who (a) did not work in the seven days prior to Census night, (b) wanted to work and were available to start work within a week of Census night, and (c) had taken active steps to look for work or start some form of self-employment in the four weeks prior to Census night. Active steps to seek work can be registration at an employment exchange, applications to employers, checking at work sites or farms, placing or answering newspaper advertisements, seeking assistance of friends, etc. A person who fulfils the first two criteria above but did not take active steps to seek work is considered unemployed according to the expanded definition. This broad definition captures discouraged work seekers, and those without the resources to take active steps to seek work." For the reasons discussed in the original PIMD report the 'official definition' is used (see Noble *et al.*, 2006a).

2.3.4 Combining the indicators

"The domain was calculated as a proportion of the economically active population (15 to 65 year olds inclusive) plus people not working due to illness or disability that were unemployed or not working due to illness or disability (i.e. the number of people who are unemployed + the number of people not working due to illness or disability divided by the number of people who are economically active + the number of people not working due to illness or disability)."

2.4 Health Deprivation Domain

2.4.1 Purpose of domain

"This domain identifies areas with relatively high rates of people who die prematurely.

2.4.2 Background

It is generally accepted that as a person ages they will have a greater risk of death in any given time period than those younger than them. This greater risk of death is not deemed by society to be unfair or unjust. Everyone will experience this deficit of health in his or her lifetime and it is therefore seen as an acceptable and unavoidable aspect of life. What is defined as unjust, and is therefore defined here as health deprivation, is unexpected deaths. The usual way of operationalising this principle in a measure is to age and gender standardise the data; that is to compare the number of deaths or level of morbidity in an area to what would be expected given the area's age and gender structure.

2.4.3 Indicator

- Years of Potential Life Lost

For the measure of premature deaths used in [the SAIMD], Years of Potential Life Lost (YPLL), the level of unexpected mortality is weighted by the age of the individual who has died (see Blane and Drever, 1998). An area with a relatively high death rate in a young age group (including areas with high levels of infant mortality) will therefore have a higher overall YPLL score than an area with a similarly relatively high death rate for an older age group, all else being equal.

The YPLL indicator is a directly age and gender standardised measure of premature death (i.e. death under the age of 75). Because the direct method of standardisation makes use of individual age/gender death rates it is particularly prone to problems associated with small numbers. An empirical Bayes or 'shrinkage' technique is therefore used to smooth the individual age/gender death rates in order to reduce the impact of small number problems on the YPLL (see **Section 4** below).

2.5 Education Deprivation Domain

2.5.1 Purpose of domain

"The purpose of this domain is to capture the extent of deprivation in education qualifications in a local area. The primary focus for this measure is adults aged 18 to 65 years.

2.5.2 Background

There is a close link between educational attainment, the type of work an individual is engaged in and the associated earnings potential. The level of education an individual has achieved determines both current income and savings potential and future opportunities for individuals and their dependents (Bhorat *et al.*, 2004).

Although the present South African government is intent on rectifying the disadvantages in education which stemmed from the apartheid system, there are still wide disparities, with the greatest challenges in the poorer, rural provinces (Chisholm, 2004; Reddy, 2005). This domain thus identifies areas where historical educational disadvantage is greatest by describing lack of educational qualification in the working age adult population.

2.5.3 Indicator

- Number of 18-65 year olds (inclusive) with no schooling at secondary level or above."

2.6 Living Environment Deprivation Domain

2.6.1 Purpose of domain

"The purpose of this domain is to identify deprivation relating to the poor quality of the living environment.

2.6.2 Background

This domain considers different aspects of the immediate environment in which people live that impact on the quality of their day-to-day life. There are indicators measuring the quality of housing, the amenities within the dwelling, and access to adequate living space. […]

2.6.3 Indicators[4]

- Number of people living in a household without piped water inside their dwelling or yard or within 200 metres; or
- Number of people living in a household without a pit latrine with ventilation or flush toilet; or
- Number of people living in a household without use of electricity for lighting; or
- Number of people living in a household without access to a telephone; or
- Number of people living in a household that is a shack; or
- Number of people living in a household with two or more people per room.

2.6.4 Combining the indicators

A simple proportion of people living in households experiencing one or more of the deprivations was calculated (i.e. the number of people living in a household without piped water and/or without adequate toilet and/or without electricity for lighting and/or without access to a telephone and/or that is a shack and/or that is overcrowded divided by the total population)."

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[4] Please see Noble *et al*. (2006a) and Noble *et al*. (2006b) for a full account of other issues considered

3 The datazones

As referred to above, the SAIMD 2001 was made possible by the creation of a new statistical geography – the datazones. This section briefly describes the process of creating these datazones.

Datazones use Census Enumeration Areas (EAs) as the building blocks to create a standard geography. In simple terms a datazone comprises one or more contiguous EAs which share common characteristics. The creation of datazones involved complex geographical programming. The process of creating datazones from EAs involved several steps which were specified in terms of a series of rules. The process ensures that the datazones created are as appropriate a statistical geography as possible, and the datazones created share key common characteristics:

Geographical nesting: Datazones are based on the existing EA geography and nest within 2001 municipality boundaries.

Population size: Datazones were designed to have a common resident population size (within a fixed range). This allows comparability across the whole country.

Population density: EAs must be sufficiently similar to one another in terms of population density to be allowed to merge and form part of the same datazone. This ensures that urban areas, particularly those at the edge of towns, do not 'blur' into adjacent areas which are more rural and which have much lower population densities. Doing so helps to maximise the internal consistency of the datazones in terms of the population density.

Internal homogeneity: Datazones must be internally homogenous in terms of area type. This ensures that datazones are a 'meaningful' geography in the sense of capturing areas which are relatively similar to each other and that the datazones, therefore, represent 'an area' in a socio-economic as well as a statistical sense. The process of guaranteeing internal homogeneity of area type was achieved through cluster analyses which assigned EAs to cluster types. In the process of creating datazones, province-tailored rules were established which specified the types of areas which are sufficiently similar to merge with each other.

The resultant datazones were then checked in three ways:

1. Overlaying the datazones onto Google Earth Professional and examining the fit on the ground.
2. Checking with people who had detailed knowledge of the areas.
3. Occasionally, through site inspections.

A number of issues and problems emerged from this checking process and additional rules were therefore introduced and the whole process repeated. Examples of rules introduced included the need to control the overall shape of the resultant datazone (to promote circularity) and to deal with a number of special problems posed particularly by the EA geography in former homeland areas.

In order to improve the datazones a final process of optimisation was undertaken. EAs were iteratively swapped in order to test whether doing so improved the composition of each datazone in terms of the population density of its component EAs.

Some problems remain insoluble because of the underlying 'building block' geography, (i.e. problems with the EA geography). This results in some datazones remaining as irregular shapes, as 'islands' in 'seas', or with populations that are either too small or too large.

Datazones with small populations (often remote rural areas such as mountain tops) or forming part of District Management Areas[5] were deleted. This left a base set of 22 251 datazones.

In addition, datazones where the non-institutional population is less than 300 were dropped leaving 22 164 datazones for which domain indices were created.

The provincial breakdown is as follows:

Table 1 Number of datazones in each Province for the SAIMD 2001

Province	Number of datazones
Western Cape	2 184
Eastern Cape	3 181
Northern Cape	417
Free State	1 373
KwaZulu-Natal	4 663
North West Province	1 827
Gauteng	4 280
Mpumalanga	1 527
Limpopo	2 712
TOTAL	22 164

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[5] District Management Areas are areas such as National Parks.

4 Methodology

4.1 Use of the 2001 Census

The SAIMD (like the PIMD) is based on the 2001 Census. Using the 10% sample of the 2001 Census made available by StatsSA, the team developed code in the statistical analysis package SAS to provide to StatsSA so that they could run the code on the 100% Census and aggregate the results to datazone level to create the SAIMD. An EA to datazone look-up table (LUT) was also produced. The SAS code and LUT enabled a datazone level set of indicators to be produced at StatsSA which CASASP was then able to process into the domain scores and overall SAIMD.

4.2 Creating domain indices

4.2.1 Dealing with small numbers

"To improve the reliability of a score which is based on small numbers, the shrinkage estimation technique can be applied. The effect of shrinkage is to move the score for a small area towards the average score of a larger area for a particular indicator. For example, where [datazones] are the small area geography, the [datazone] level scores would be moved towards the average score for the municipality in which the [datazone] is located. The extent of movement depends on both the reliability of the indicator and the heterogeneity of the larger area. If scores are robust, the movement is negligible as the amount of shrinkage is related to the standard error. The shrinkage technique does not mean that the score necessarily becomes smaller (i.e. less deprived). Where [datazones] do move this may be in the direction of more deprivation if the 'unreliable' score shows less deprivation than the municipality mean"[6]. Shrinkage was applied to all domains.

4.2.2 Combining indicators into domain indices

For each domain of deprivation (Income, Employment, etc) the aim is to obtain a single summary measure whose interpretation is straightforward in that it is, if possible, expressed in meaningful units (e.g. proportions of people or of households experiencing that form of deprivation). Apart from the Health Deprivation Domain, all of the other domains were created as simple rates. This avoided the key issue of weighting indicators which is necessary when combining indicators into a single measure. Because the domain scores are rates they are easy to interpret (i.e. X% of people in the [datazone] of the relevant age are

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[6] For further information see Noble *et al.* (2006b) pp 17-21.

experiencing this type of deprivation). As discussed in **Section 2.4**, the Health Deprivation Domain is more complex as it had to be age standardised.

There is no double counting of individuals within a domain. An individual may be captured in more than one domain but this is not double counting: it is simply identifying that they are deprived in more than one way."

Five domain indices were created which were then combined into an overall SAIMD.

4.3 Combining domain indices into an index of multiple deprivation

4.3.1 Standardisation and transformation

"Domains are conceived as independent domains of deprivation, each with their own contribution to multiple deprivation. The strength of this contribution should vary between domains depending on their relative importance. Once the domains had been constructed, it was necessary to combine them into an overall [SAIMD]. In order to do this the domain indices were standardised by ranking. They were then transformed to an exponential distribution.

The exponential distribution was selected for the following reasons. First, it transforms each domain so that they each have a common distribution, the same range and identical maximum/minimum value, so that when the domains are combined into a single index of multiple deprivation the (equal) weighting is explicit; that is there is no implicit weighting as a result of the underlying distributions of the data. Second, it is not affected by the size of the [datazone's] population. Third, it effectively spreads out the part of the distribution in which there is most interest; that is the most deprived [datazones] in each domain.

Each transformed domain has a range of 0 to 100, with a score of 100 for the most deprived [datazone]. The exponential transformation that was selected for standardising the domains in the [datazone] level [SAIMD] stretches out the most deprived 25% of [datazones] in [the country]. The chosen exponential distribution is one of an infinite number of possible distributions."[7]

4.3.2 Weighting

"An important issue in constructing an overall index of multiple deprivation is the question of what 'explicit weight' should be attached to the various components. The weight is the measure of importance that is attached to each component in

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[7] See Noble *et al*. (2006b) for further information

the overall composite measure. How can one attach weights to the various aspects of deprivation? That is, how can one determine which aspects are more important than others?

There are at least five possible approaches to weighting:

1. driven by theoretical considerations;
2. empirically driven;
3. determined by policy relevance;
4. determined by consensus; and
5. entirely arbitrary.

In the theoretical approach, account is taken of the available research evidence which informs the theoretical model of multiple deprivation and weights are selected which reflect this theory.

There are two sorts of empirical approaches that might be applicable. First a commissioned survey or re-analysis of an existing survey might generate weights. Second one might apply a technique such as factor analysis to extract some latent 'factor' called 'multiple deprivation', assuming that is, that the analysis permitted a single factor solution (see Senior, 2002).

Alternatively, the individual domain scores could be released and weighted for combination in accordance with and proportional to the focus of particular policy initiatives or weighted in accordance with public expenditure on particular areas of policy.

Another approach would be for policy makers and other 'customers' or experts to simply be consulted for their views and the results examined for consensus.

Finally, simply choosing weights without reference to the above or even selecting equal weights in the absence of empirical evidence would come into the category of 'entirely arbitrary'. Weighting always takes place when elements are combined together. Thus if the domains are summed together to create an index of multiple deprivation this means they are given equal weight. It would be incorrect to assume that items can be combined without weighting.

For the [SAIMD], equal weights were assigned to the exponentially transformed domains in the absence of evidence suggesting differential weights should be used."

5 The geography of deprivation

5.1 How to interpret the datazone level results

There are six datazone level measures: five domain measures (which were combined to make the overall SAIMD) and one overall SAIMD. These six measures are each assigned a rank. The most deprived datazone for each measure is given a rank of 1. The ranks show how a datazone compares to all the other datazones in South Africa.

5.2 The five domain measures and ranks

Each domain measure consists of a score which is then ranked. These domain measures (sometimes referred to as *indices*) can be used to describe each type of deprivation in an area. This is important as it allows users to focus on particular types of deprivation and to compare this across the country.

"The scores for all domains except the Health Deprivation Domain are straightforward rates[8]. So, for example, if a [datazone] scores 38.6 in the Income and Material Deprivation Domain, this means that 38.6% of the [datazone's] population are income deprived. The score for the Health Deprivation Domain is an age adjusted rate of years of potential life lost per 1000 population, so, for example, a score of 200 means that there are 200 years of potential life lost per 1000 of the population of the [datazone] in question. Within a domain, the higher the score, the more deprived a [datazone] is. However, the scores should not be compared between domains as they have different minimum and maximum values and ranges (before exponential transformation has been applied and the domains combined). To compare between domains, the ranks should be used. A rank of 1 is assigned to the most deprived [datazone]."

5.2.1 The South African Index of Multiple Deprivation 2001

Each overall SAIMD describes a datazone by combining information from all five domains: Income and Material Deprivation, Employment Deprivation, Health Deprivation, Education Deprivation and Living Environment Deprivation. These were combined in three stages; first each domain was standardised by ranking; the ranks were then transformed to a standard distribution – the exponential distribution described above. Finally the domains were combined using equal weights. The final datazone level SAIMD was then ranked in the same way as the domain measures.

"[The SAIMD] score is the combined sum of the weighted, exponentially transformed domain rank of the domain scores. Again, the bigger the [SAIMD]

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[8] Although, as has been indicated the scores have been made more robust by employing 'shrinkage estimation' the resultant scores are still rates and can be interpreted as such.

score, the more deprived the [datazone]. However, because of the exponential distribution, it is not possible to say, for example, that a [datazone] with a score of 40 is twice as deprived as a [datazone] with a score of 20. In order to make comparisons between [datazones], it is recommended that ranks should be used. The [SAIMD is] ranked in the same way as the domain measures, that is, a rank of 1 is assigned to the most deprived [datazone] within the [country].

5.3 Datazone level results

Table 2: The fifty most deprived datazones in South Africa

Rank	Datazone code	Municipality name	Province	Rank	Datazone code	Municipality name	Province
1	531_239	Ulundi	KwaZulu-Natal	26	546_51	Maphumulo	KwaZulu-Natal
2	520_6	Nqutu	KwaZulu-Natal	27	520_9	Nqutu	KwaZulu-Natal
3	517_23	Okhahlamba	KwaZulu-Natal	28	546_61	Maphumulo	KwaZulu-Natal
4	515_77	Indaka	KwaZulu-Natal	29	232_416	Qaukeni	Eastern Cape
5	233_362	Port St Johns	Eastern Cape	30	535_95	Hlabisa	KwaZulu-Natal
6	515_107	Indaka	KwaZulu-Natal	31	211_437	Mnquma	Eastern Cape
7	231_436	Ntabankulu	Eastern Cape	32	522_59	Msinga	KwaZulu-Natal
8	233_273	Port St Johns	Eastern Cape	33	232_171	Qaukeni	Eastern Cape
9	230_397	Mbizana	Eastern Cape	34	529_74	Abaqulusi	KwaZulu-Natal
10	515_90	Indaka	KwaZulu-Natal	35	522_137	Msinga	KwaZulu-Natal
11	515_111	Indaka	KwaZulu-Natal	36	547_4	Ingwe	KwaZulu-Natal
12	233_301	Port St Johns	Eastern Cape	37	531_241	Ulundi	KwaZulu-Natal
13	238_919	Umzimvubu	Eastern Cape	38	522_178	Msinga	KwaZulu-Natal
14	238_1330	Umzimvubu	Eastern Cape	39	235_859	Mhlontlo	Eastern Cape
15	522_8	Msinga	KwaZulu-Natal	40	222_532	Intsika Yethu	Eastern Cape
16	547_10	Ingwe	KwaZulu-Natal	41	540_29	uMlalazi	KwaZulu-Natal
17	231_219	Ntabankulu	Eastern Cape	42	540_78	uMlalazi	KwaZulu-Natal
18	515_34	Indaka	KwaZulu-Natal	43	232_125	Qaukeni	Eastern Cape
19	231_292	Ntabankulu	Eastern Cape	44	236_2	King Sabata Dalindyebo	Eastern Cape
20	238_1383	Umzimvubu	Eastern Cape	45	236_1061	King Sabata Dalindyebo	Eastern Cape
21	530_198	Nongoma	KwaZulu-Natal	46	232_136	Qaukeni	Eastern Cape
22	230_7	Mbizana	Eastern Cape	47	529_171	Abaqulusi	KwaZulu-Natal
23	233_356	Port St Johns	Eastern Cape	48	522_134	Msinga	KwaZulu-Natal
24	528_3	uPhongolo	KwaZulu-Natal	49	230_46	Mbizana	Eastern Cape
25	233_347	Port St Johns	Eastern Cape	50	542_179	Nkandla	KwaZulu-Natal

The table above lists the 50 most deprived datazones in South Africa. Of these 27 are in KwaZulu-Natal while the remaining 23 are in the Eastern Cape. They are all located in former homeland areas.

If we take the 10% most deprived datazones in South Africa we find that they are shared between the nine provinces as follows:

Table 3: Provincial share of the most deprived national decile of datazones of SAIMD

Province	Share of most deprived 10% of datazones
Western Cape	0.0
Eastern Cape	46.8
Northern Cape	0.0
Free State	1.2
KwaZulu-Natal	44.7
North West	3.6
Gauteng	0.1
Mpumalanga	1.4
Limpopo	2.3
N of datazones	2216

Most are located in either the Eastern Cape (46.8%) or KwaZulu-Natal (44.7%).

Another way of looking at the picture is seeing what proportion of a province's datazones are in the most deprived 10% or 20% of datazones nationally. Table 4 shows the numbers of datazones per province, the number of these in the most deprived 10% nationally and the number in the most deprived 20% nationally. The final two columns show the percentage of the province's datazones which are in the most deprived 10% and the most deprived 20% nationally.

Table 4: The percentage of each province's datazones in the most deprived decile and the most deprived quintile of the SAIMD

	N datazones	N in 10% most deprived	N in 20% most deprived	% in 10% most deprived	% in 20% most deprived
Western Cape	2184	0	5	0.0	0.2
Eastern Cape	3181	1036	1583	32.6	49.8
Northern Cape	417	0	18	0.0	4.3
Free State	1373	27	143	2.0	10.4
KwaZulu-Natal	4663	991	1729	21.3	37.1
North West Province	1827	79	275	4.3	15.1
Gauteng	4280	2	40	0.0	0.9
Mpumalanga	1527	31	187	2.0	12.2
Limpopo	2712	50	452	1.8	16.7

Nearly a third of the datazones in the Eastern Cape are in the most deprived 10% (decile) of deprivation nationally whist just over a fifth (21.3%) of KwaZulu-Natal's datazones are similarly deprived. There are no datazones in the Western Cape or Northern Cape in the most deprived decile and only two datazones in Gauteng in this decile.

If we focus on the most deprived 20% we see that nearly half (49.8%) of the Eastern Cape's datazones are in the most deprived quintile whilst for KwaZulu-Natal the figure is 37%. These are followed by Limpopo (16.7%), North West (15.1%) and Mpumalnga (12.2%).

The geography of deprivation across South Africa is now presented for the SAIMD 2001. Because of the relatively small size of datazones, the results are presented in nine maps, one for each province. These maps (**Maps 1, 2, 3, 4, 5, 6, 7, 8** and **9),** are located at the end of this section. The datazones have been divided into *national* (i.e. South Africa wide) deciles of deprivation - ten equal groups. On the map, the thin dark grey lines depict the datazone boundaries, the thicker black lines are the municipality boundaries, and the thickest black lines are the province boundaries. The most deprived 10% of datazones *nationally* are shaded in dark blue and the least deprived 10% of datazones are shaded in bright yellow (areas left white are datazones that were excluded for the reasons outlined in Section 3).

If we consider the most deprived datazones (the blue areas) – these overwhelmingly map onto the former homeland areas. In the Eastern Cape (**Map 2**) both the former Transkei and Ciskei are prominent. In KwaZulu-Natal (**Map 5**)

deprivation is predominant in the areas comprising the former KwaZulu homeland. In North West province (**Map 6**) deprivation is most prominent in the former Boputhatswana homeland. This concentration of poverty in the former homelands is also evident in Limpopo (**Map 9**), Mpumalanga (**Map 8**) and the Free State (**Map 4**). On the other hand relatively little of the most severe deprivation is present in Gauteng (**Map 7**) or the Western Cape (**Map 1**).

However, the strength of the datazone geography is that pockets of deprivation can be picked up in otherwise affluent areas. So for example, taking Gauteng **(Map 7)**, and considering the City of Johannesburg pockets of deprivation are apparent in parts of Soweto, Lenasia, and Orange Farm. Similarly within the City of Cape Town (**Map 1**), pockets of deprivation are apparent in Langa, Nyanga Crossroads, Imizamo Yethu, Masiphumelele and Khayelitsha.

South African Index of Multiple Deprivation 2001 at Datazone Level
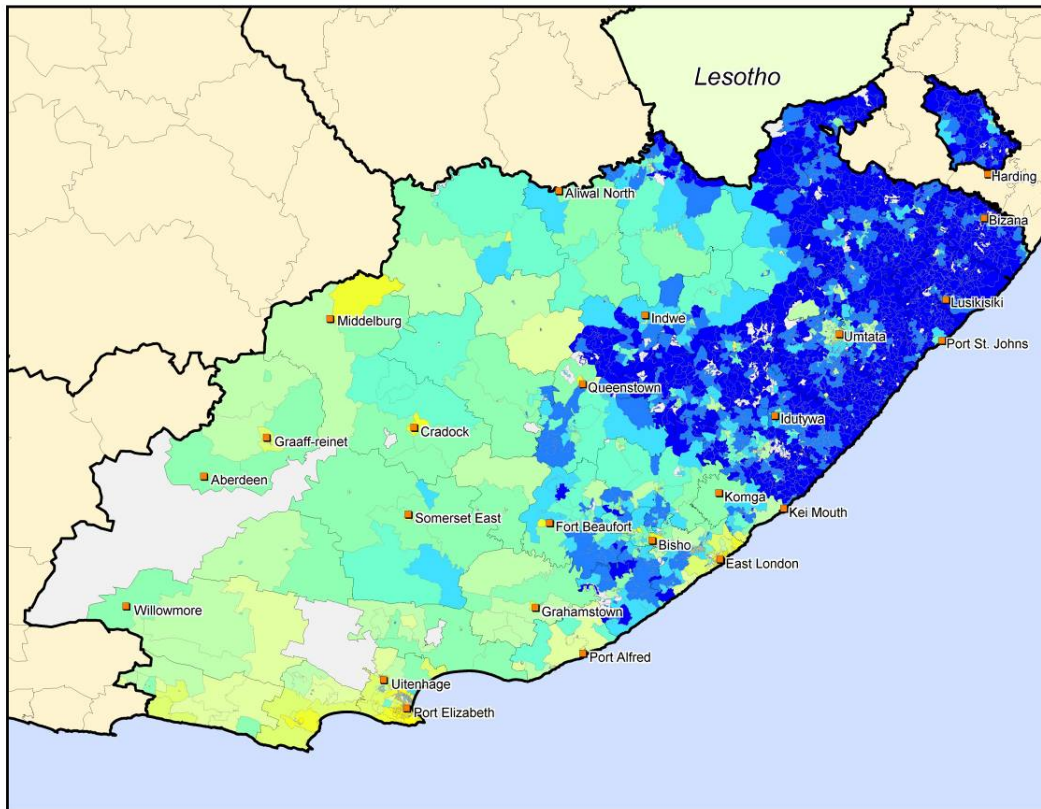Map 1 - Western Cape
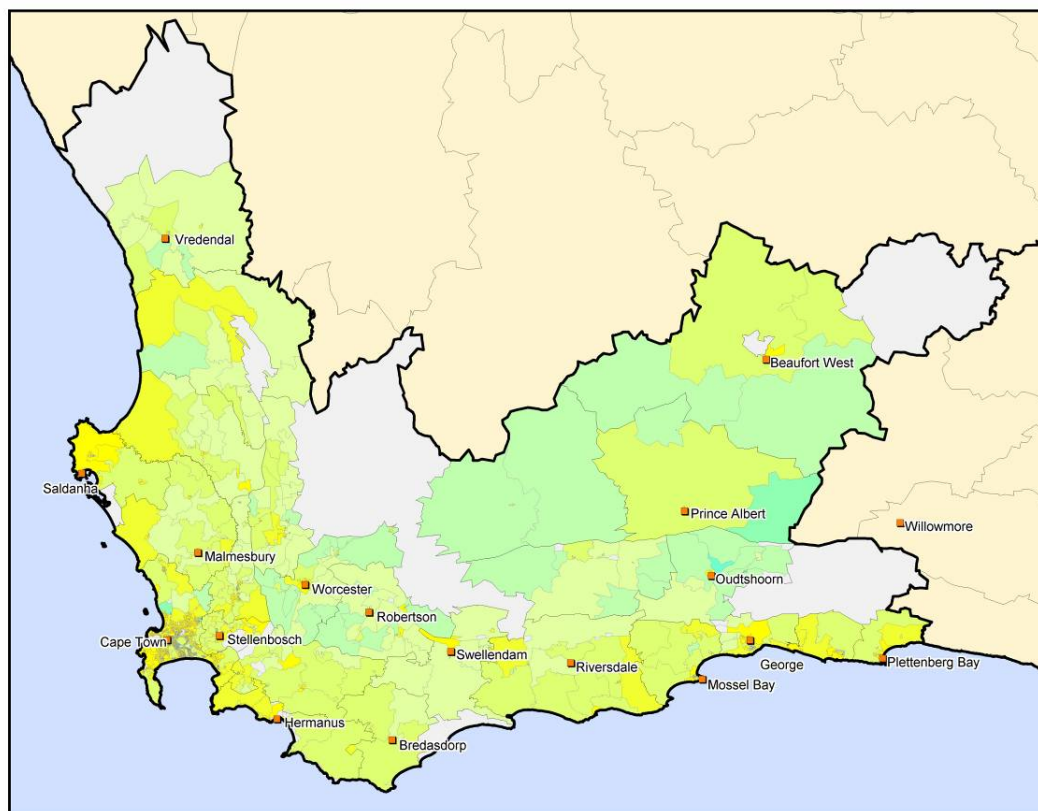
SAIMD 2001 Datazones
National deciles

area excluded	(60)
Most Deprived	(0)
	(5)
	(30)
	(54)
	(63)
	(145)
	(310)
	(447)
	(444)
Least Deprived	(686)

N

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South African Index of Multiple Deprivation 2001 at Datazone Level
Map 2 - Eastern Cape

SAIMD 2001 Datazones
National deciles

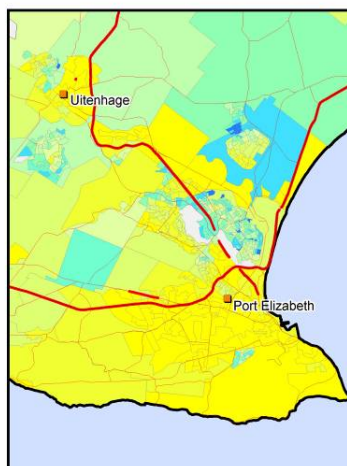|	
area excluded	(286)
Most Deprived	(1036)
	(547)
	(320)
	(222)
	(222)
	(210)
	(192)
	(154)
	(129)
Least Deprived	(149)

N

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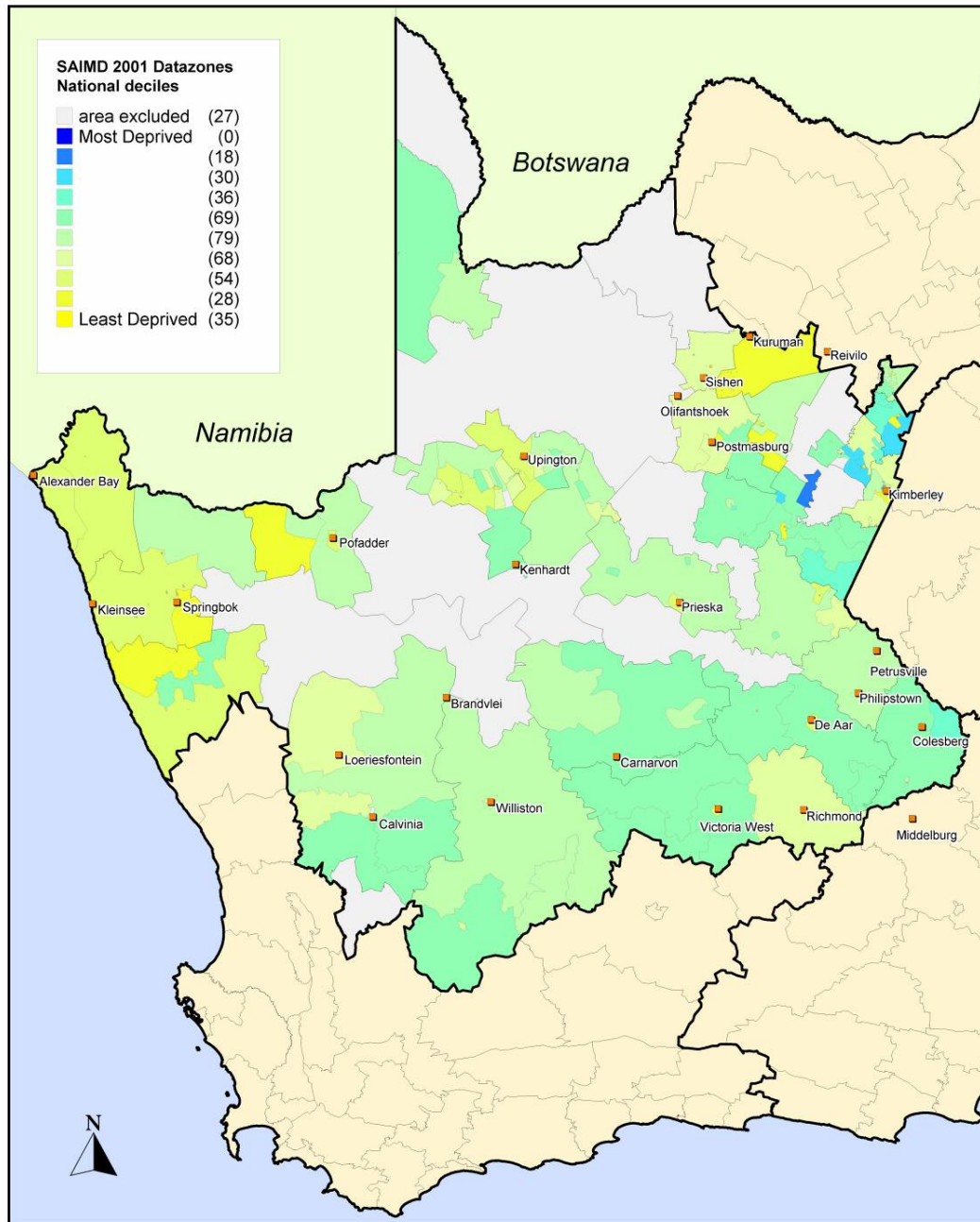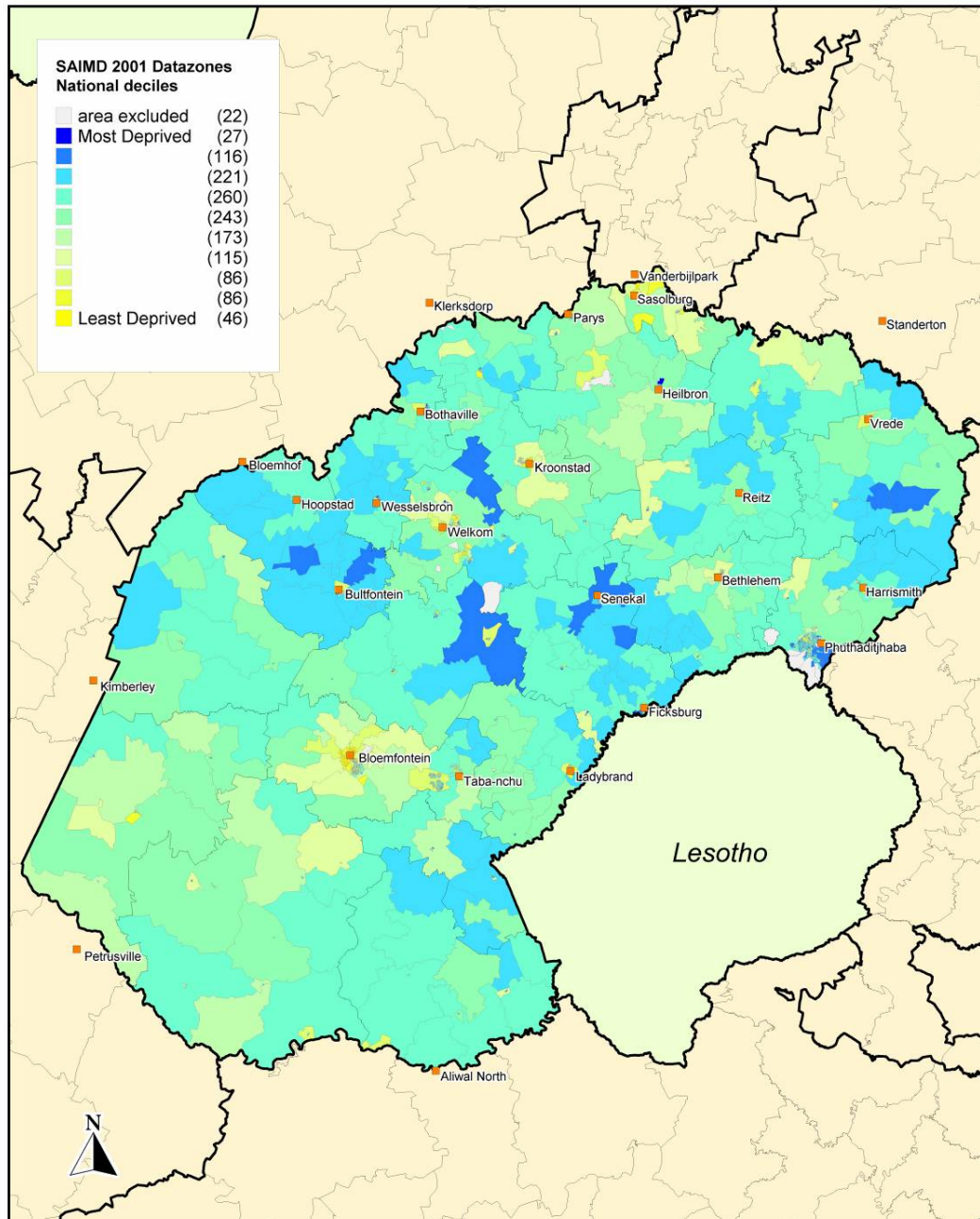## South African Index of Multiple Deprivation 2001 at Datazone Level
Map 3 - Northern Cape

SAIMD 2001 Datazones
National deciles

area excluded	(27)
Most Deprived	(0)
	(18)
	(30)
	(36)
	(69)
	(79)
	(68)
	(54)
	(28)
Least Deprived	(35)

Botswana

Namibia

Kuruman
Reivilo
Sishen
Olifantshoek
Postmasburg
Upington
Kimberley
Alexander Bay
Pofadder
Kenhardt
Prieska
Kleinsee
Springbok
Petrusville
Philipstown
Brandvlei
De Aar
Colesberg
Loeriesfontein
Carnarvon
Calvinia
Williston
Victoria West
Richmond
Middelburg

N

South African Index of Multiple Deprivation 2001 at Datazone Level
Map 4 - Free State

SAIMD 2001 Datazones
National deciles

	area excluded	(22)
	Most Deprived	(27)
		(116)
		(221)
		(260)
		(243)
		(173)
		(115)
		(86)
		(86)
	Least Deprived	(46)

Vanderbijlpark

Klerksdorp

Sasolburg

Standerton

Parys

Heilbron

Vrede

Bothaville

Kroonstad

Bloemhof

Reitz

Hoopstad

Wesselsbron

Welkom

Bethlehem

Harrismith

Bultfontein

Senekal

Phuthaditjhaba

Kimberley

Ficksburg

Bloemfontein

Taba-nchu

Ladybrand

Lesotho

Petrusville

N

Aliwal North

South African Index of Multiple Deprivation 2001 at Datazone Level
Map 5 - KwaZulu-Natal
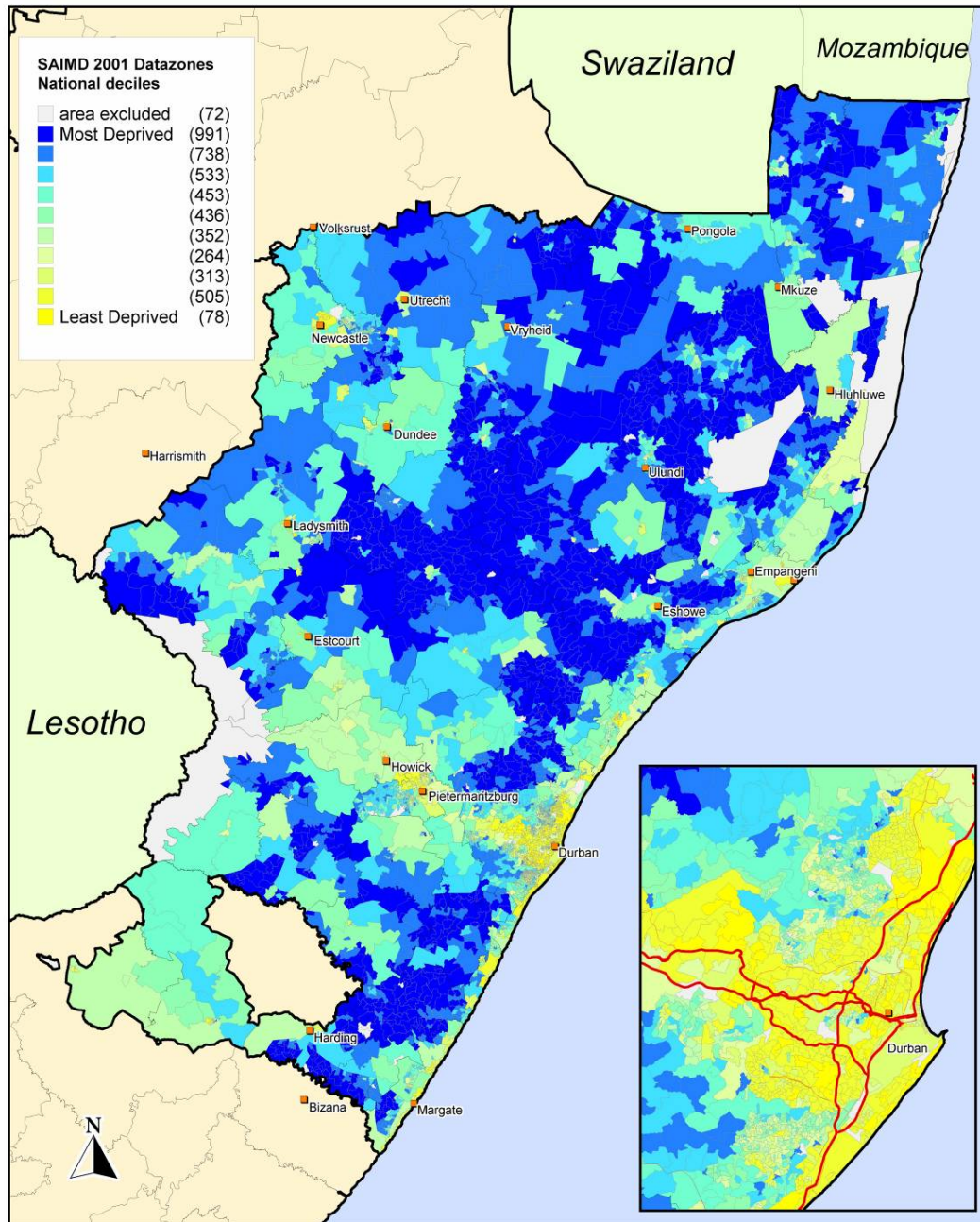
SAIMD 2001 Datazones
National deciles

	area excluded	(72)
	Most Deprived	(991)
		(738)
		(533)
		(453)
		(436)
		(352)
		(264)
		(313)
		(505)
	Least Deprived	(78)

Swaziland

Mozambique

Lesotho

Volksrust

Pongola

Mkuze

Utrecht

Vryheid

Newcastle

Hluhluwe

Dundee

Harrismith

Ulundi

Ladysmith

Empangeni

Eshowe

Estcourt

Howick

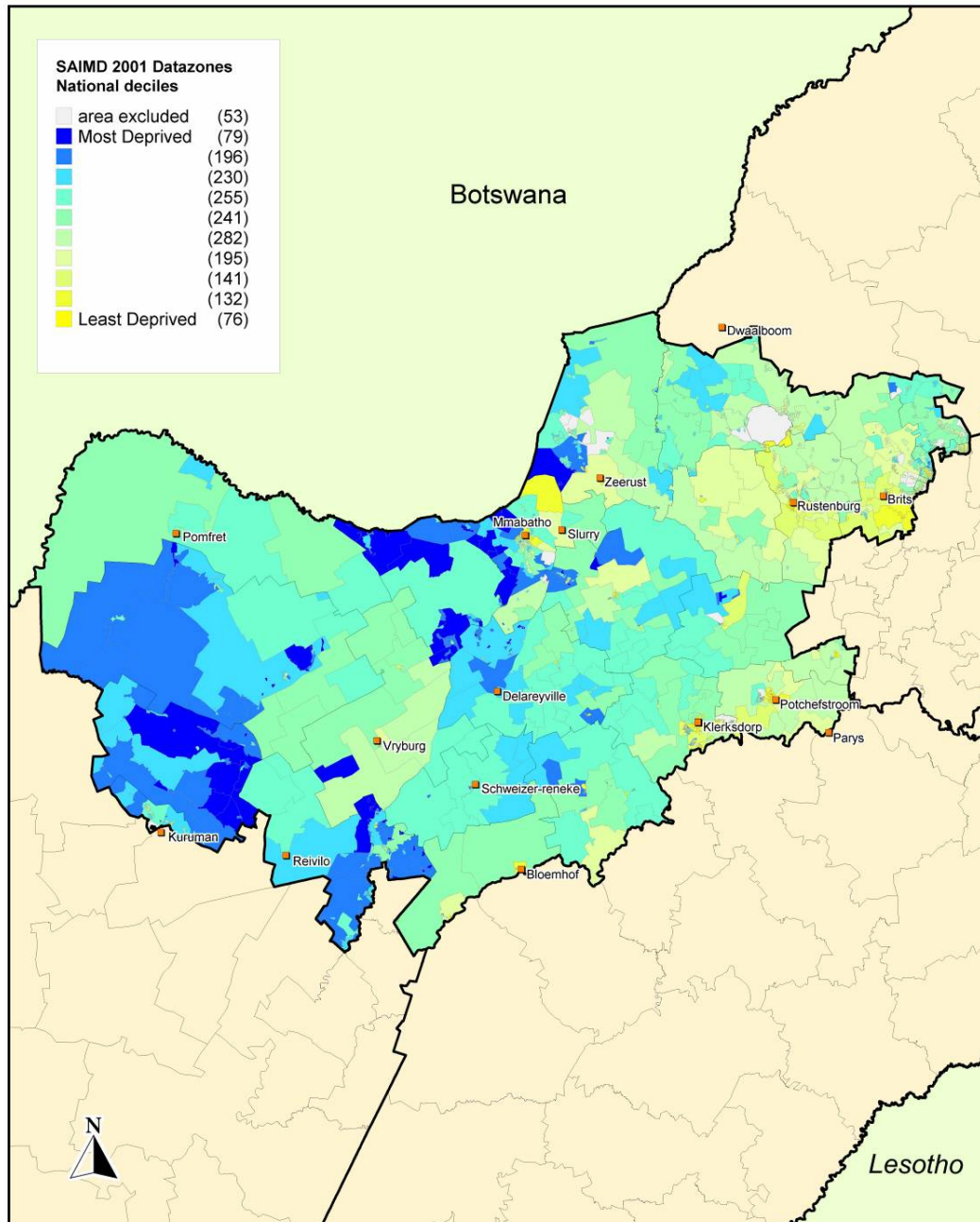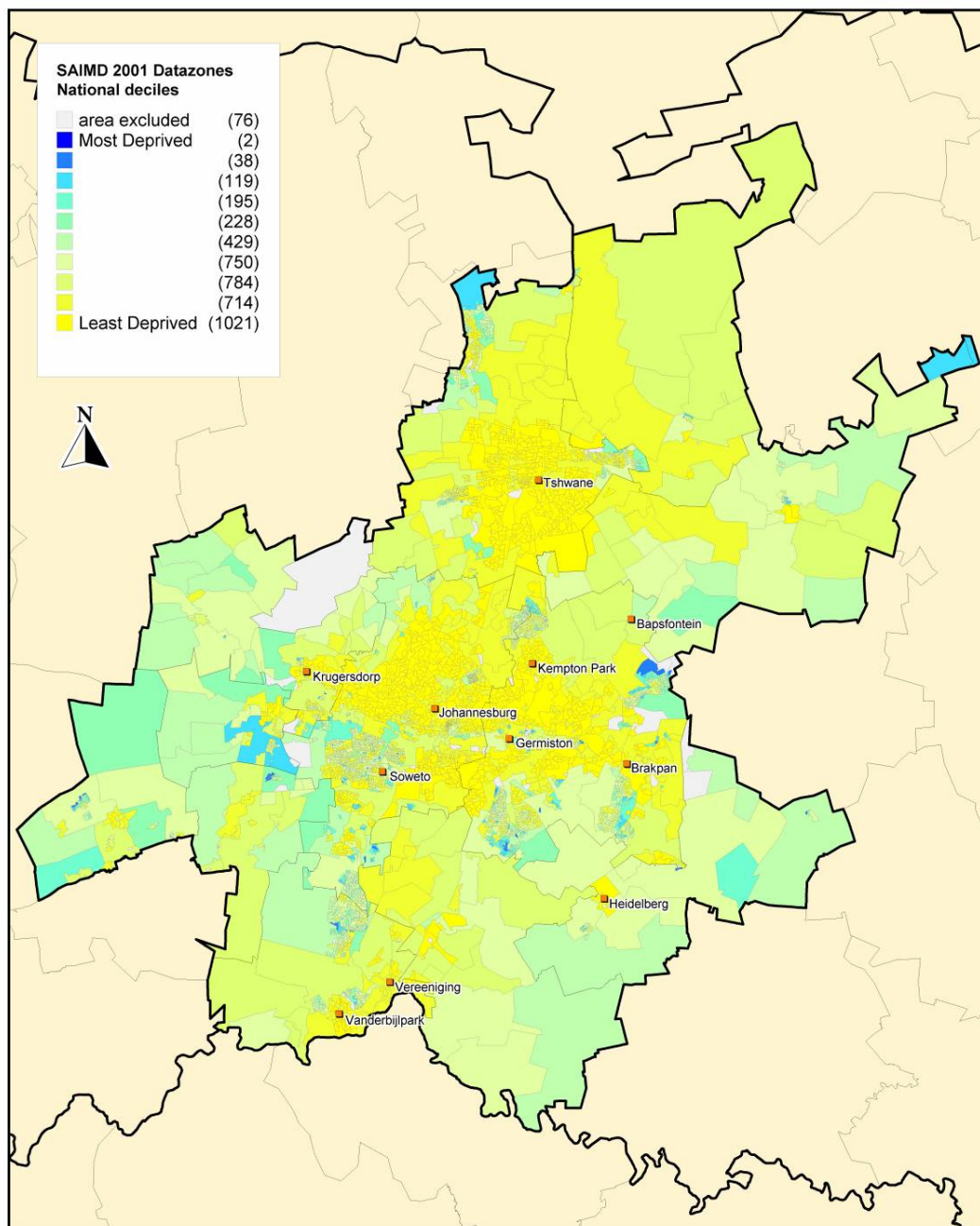Pietermaritzburg

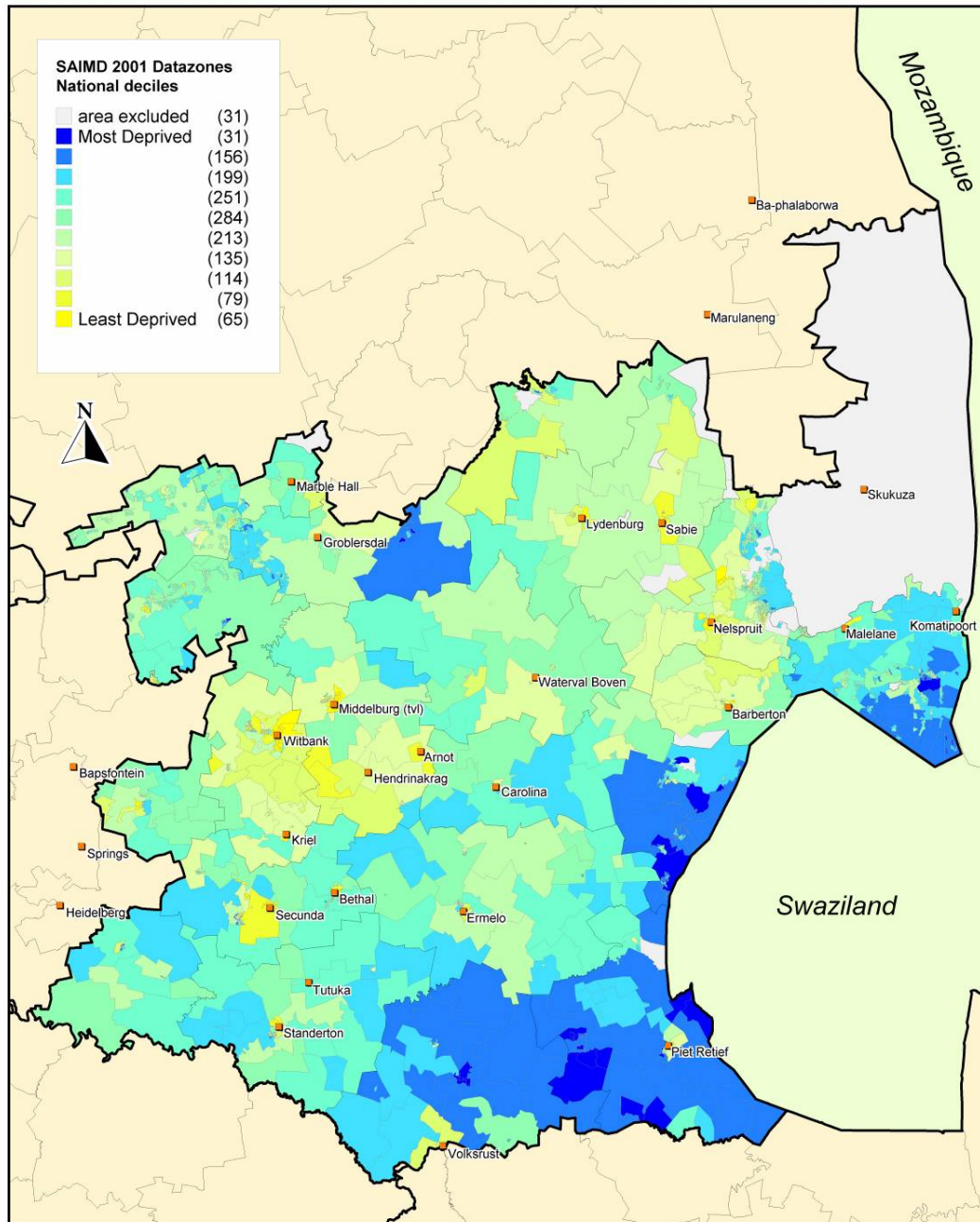Durban

Harding

Bizana

Margate

Durban

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South African Index of Multiple Deprivation 2001 at Datazone Level
Map 6 - North West Province

SAIMD 2001 Datazones
National deciles

	area excluded	(53)
	Most Deprived	(79)
		(196)
		(230)
		(255)
		(241)
		(282)
		(195)
		(141)
		(132)
	Least Deprived	(76)

Botswana

Dwaalboom

Zeerust

Pomfret

Mmabatho

Slurry

Rustenburg

Brits

Delareyville

Potchefstroom

Klerksdorp

Vryburg

Parys

Schweizer-reneke

Kuruman

Reivilo

Bloemhof

N

Lesotho

South African Index of Multiple Deprivation 2001 at Datazone Level
Map 7 - Gauteng

SAIMD 2001 Datazones
National deciles

area excluded	(76)
Most Deprived	(2)
	(38)
	(119)
	(195)
	(228)
	(429)
	(750)
	(784)
	(714)
Least Deprived	(1021)

N

Tshwane

Bapsfontein

Krugersdorp

Kempton Park

Johannesburg

Germiston

Soweto

Brakpan

Heidelberg

Vereeniging

Vanderbijlpark

South African Index of Multiple Deprivation 2001 at Datazone Level
Map 8 - Mpumalanga

SAIMD 2001 Datazones
National deciles

area excluded	(31)
Most Deprived	(31)
	(156)
	(199)
	(251)
	(284)
	(213)
	(135)
	(114)
	(79)
Least Deprived	(65)

South African Index of Multiple Deprivation 2001 at Datazone Level
Map 9 - Limpopo
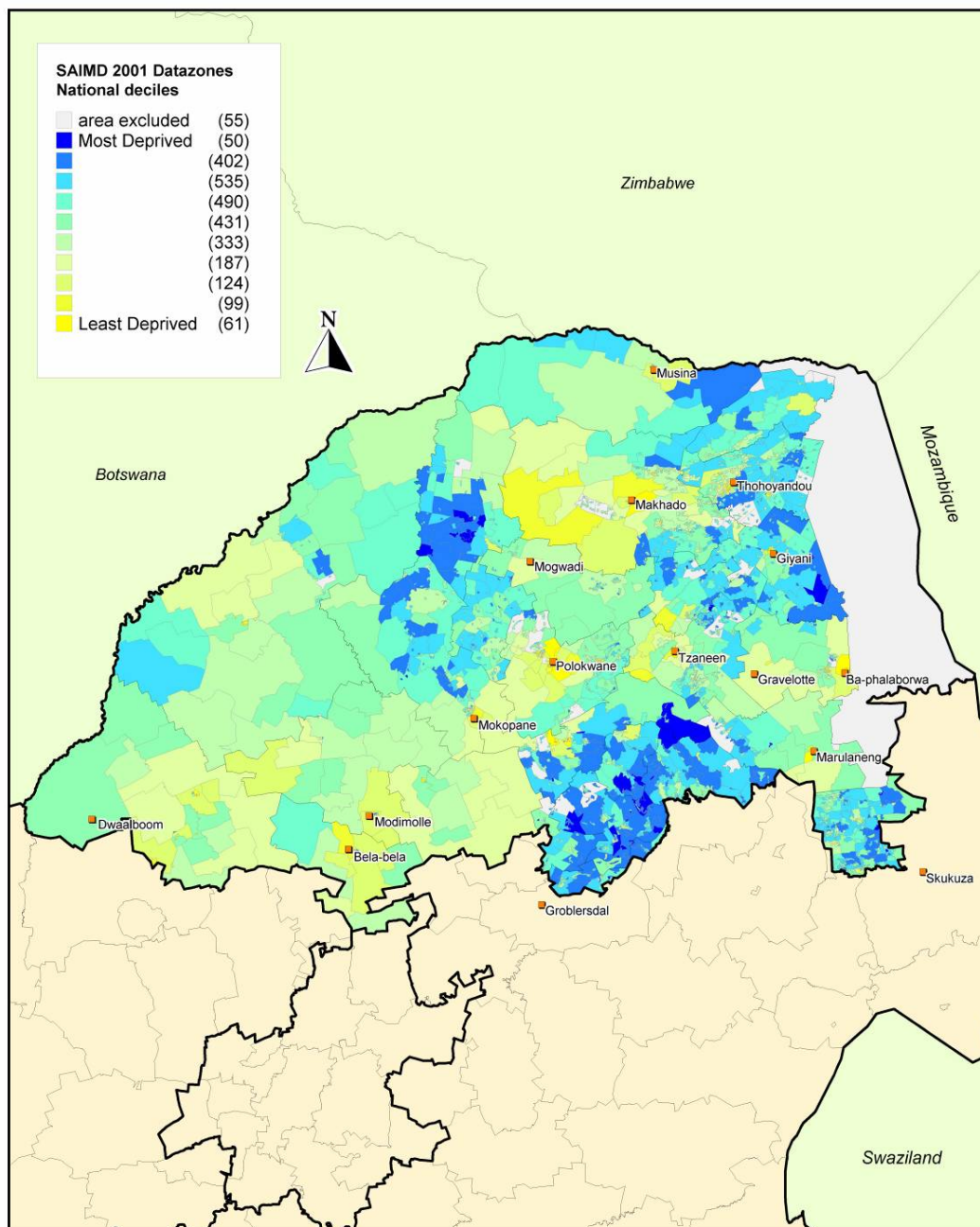
SAIMD 2001 Datazones
National deciles

area excluded	(55)
Most Deprived	(50)
	(402)
	(535)
	(490)
	(431)
	(333)
	(187)
	(124)
	(99)
Least Deprived	(61)

N

Zimbabwe

Botswana

Mozambique

Musina

Thohoyandou

Makhado

Giyani

Mogwadi

Polokwane

Tzaneen

Gravelotte

Ba-phalaborwa

Mokopane

Marulaneng

Dwaalboom

Modimolle

Skukuza

Bela-bela

Groblersdal

Swaziland

Appendix 1: Indicators used in the SAIMD 2001

"This Appendix gives further details of the indicators that were used in the SAIMD 2001. All indicators were derived from the 2001 Census. Information on the Census question used and the responses (codes) selected to define a person as deprived is provided below. All numerators and denominators exclude people living in institutions. For all domains apart from the Health Deprivation Domain, the score was calculated as a simple rate[9]: i.e. the percentage of people experiencing deprivation on one or more of the indicators in that domain.

Income and Material Deprivation Domain

Numerator

- Number of people living in a household that has a household income (need-adjusted using the modified OECD equivalence scale) that is below 40% of the mean equivalent household income

The Census question P-22 ("What is the income category that best describes the gross income of (this person) before tax?") was used to calculate a household income. A household equivalent income was calculated using this household income, a modified OECD equivalence scale, and Census question P-02 ("What is (the person's) date of birth and age in completed years?"). The cut-off used was 'below 40% mean household equivalent income derived from the IES 2000 and adjusted using the CPI. Further details of the equivalence scale used (and sensitivity testing of other equivalence scales) are given in the Technical Report.

- Number of people living in a household without a refrigerator

This indicator used Census question H-29 ("Does the household have any of the following (in working condition): radio, television, computer, refrigerator, telephone in the dwelling, cell-phone?"). People were selected who lived in a household without a refrigerator (code 2).

- Number of people living in a household with neither a television nor a radio

This indicator used Census question H-29 ("Does the household have any of the following (in working condition): radio, television, computer, refrigerator, telephone in the dwelling, cell-phone?"). People were selected who lived in a household with neither a radio nor a television (code 2 for both radio and television).

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[9] Adjusted using 'shrinkage estimation' see Methodology section

Denominator

This domain used the total population as a denominator.

Employment Deprivation Domain

Numerator

- Number of people who are unemployed

Unemployed people aged 15-65 inclusive were identified using the derived variable on employment status which has the following categories: not applicable, employed, unemployed, and not economically active. This derived variable is based on responses to five Census questions:

P-02 ("What is (the person's) date of birth and age in completed years?") – the unemployed derived variable uses 15-65 inclusive;
P-18 ("In the seven days before 10 October did (the person) do any work for pay (in cash or in kind) profit or family gain, for one hour or more?") – the unemployed derived variable selects people who said 'no'(code 5);
P-18a ("What is the main reason why (the person) did not have work in the seven days before 10 October?") – the unemployed derived variable selects people who said 'could not find work' (code 7);
P-18b ("In the past four weeks before 10 October has (the person) taken active steps to find employment") – the unemployed derived variable selects people who answer 'yes' (code 1);
P-18c ("If offered work, how soon could (the person) start?") – the unemployed derived variable selects people who said 'within one week' (code 1).

- Number of people who are not working due to illness and disability

This variable was created from Census question P-18a ("What is the main reason why (the person) did not have work in the seven days before 10 October?"), by selecting people aged 15-65 inclusive who said 'Unable to work due to illness and disability' (code 4).

Denominator

The denominator for this domain was constructed by adding the total economically active population to people not working because of illness or disability (15 to 65 year olds inclusive). The totally economically active population was taken from the Census derived variable on employment status (official/strict definition), codes 1 (employed) and 2 (unemployed). The number of people not working because of illness or disability was taken from Census question P-18a ("What is the main reason why (the person) did not have work in the seven days

before 10 October?"), selecting people who said 'Unable to work due to illness and disability' (code 4).

Health Deprivation Domain

- Years of Potential Life Lost

This directly age and sex standardised measure of premature deaths was calculated using Census questions:

P-02 ("What is (the person's) date of birth and age in completed years?")
P-03 ("Is (the person) male or female?")
H-31a ("What was the age in years at death?")
H-31a ("What is the sex of the deceased?")

Method: Blane and Drever (1998). In addition shrinkage was applied to age-sex rates and an upper age was set at 75.

Education Deprivation Domain

Numerator

- Number of 18 to 65 year olds (inclusive) who have no schooling at secondary level or above

This indicator used Census question P-17 ("What is the highest level of education that (the person) has completed?"). People were selected who had no schooling (code 99) or answered Grade 6/Standard 4 or less (codes 1 to 6).

Denominator

This domain used 18-65 year olds (inclusive) for the denominator, taken from Census question P-02 ("What is (the person's) date of birth and age in completed years?").

Living Environment Deprivation Domain

Numerator

- Number of people living in a household that has no access to a telephone

This indicator used Census question H-29a "Where do members of this household mainly use a telephone?", which was asked only to people in households that answered 'no' to having a telephone in the dwelling or a cell-phone (question H-29). People in households that responded 'at another location not nearby' (code 4), or 'no access to a telephone' (code 5) were selected.

- Number of people living in a household that has no piped water inside the dwelling or yard or nearby

This indicator used Census question H-26 ("In which way does this household obtain piped water for domestic use?") and selected people in households that responded 'no access to piped (tap) water' (code 1), or 'piped (tap) water on community stand: distance greater than 200m from dwelling' (code 2).

- Number of people living in a household that has no use of electricity for lighting

This indicator used Census question H-28 ("What type of energy/fuel does this household mainly use for cooking, for heating and for lighting?") and selected people in households that responded 'gas' (code 2), 'paraffin' (code 3), 'candles' (code 6), 'solar' (code 8), and 'other' (code 9).

- Number of people living in a household that is a shack

This indicator used Census question H-23a ("Which type of dwelling or housing unit does this household occupy?") and selected people in households that responded 'informal dwelling/shack in back yard' (code 6), 'informal dwelling/shack not in back yard e.g. in an informal/squatter settlement' (code 7).

- Number of people living in a household that has neither a pit latrine with ventilation nor a flush toilet

This indicator used Census question H-27 "What is the main type of toilet facility that is available for use by this household?" and selected people in households that responded 'chemical toilet' (code 3), 'pit latrine without ventilation' (code 5), 'bucket latrine' (code 6), and 'none' (code 7).

- Number of people living in a household that has two or more people per room

The Census question H-24 ("How many rooms, including kitchens, are there for this household?") was used in conjunction with a count of number of people per household to calculate the number of households where there were two or more people per room.

Denominator

Total population was used as the denominator for this domain.

Acronyms

The following abbreviations have been used in this report:

CASASP   Centre for the Analysis of South African Social Policy
EA   Enumeration Area
IMD   Index of Multiple Deprivation
LUT   Look-up Table
OECD   Organisation for Economic Co-operation and Development
PIMD   Provincial Index of Multiple Deprivation
SAIMD   South African Index of Multiple Deprivation
SDRC   Social Disadvantage Research Centre
SOA   Super Output Area
Stats SA   Statistics South Africa
YPLL   Years of Potential Life Lost

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