The world’s population balance has shifted. In 2008 for the first time in history, more people live in cities than in rural areas [1]. Urbanisation has accelerated from only 2% living in urban areas in 1800, to half the world’s population of 3-billion people, with two thirds of the world expected to live in cities by 2050 [2]. This equates to 180 000 people moving into cities daily, with many cities in Africa and Asia expected to double in size in the next 15 to 20 years [2]. As people flood into urban areas, cities around the world are battling to cope with the demand for additional infrastructure and services, lack of housing, worsening environmental problems and increasing traffic congestion. These are familiar problems for South African governmental authorities and its citizens. As a city grows to absorb immigration and natural growth, the city expands beyond its defined boundaries into the sphere of influence of neighbouring cities, urban and peri-urban areas [3]. Given not only the intense flow of people, but information, trade, finances and resources between cities, a traditional approach to planning and governance is increasingly untenable. A new approach to planning and managing these burgeoning urban areas is required.

City-regions

A city-region is defined as a group of cities within a wider territory that have an interdependent relationship forming an economic footprint that comprises the city-region [4]. Cities have distinct but complementary functions. They interact across local and administrative boundaries through people, resources, information, finances and services. A city-region is more than just a city and some nearby towns – it stretches from beyond the core city or cities to urban, semi-urban and rural areas surrounding and within commuting distance of the city [5]. This functional geography can be described as the functional economy of the city-region.

Turok [4] states: “It is widely argued that if policies towards spatial planning, infrastructure, and service delivery are devolved to the city-region level and coordinated across relevant local authority jurisdictions, they may improve the efficiency of labour and housing markets, streamline transport systems, and generate economic spin-offs through increased productivity, knowledge spillovers, and innovation”. Adopting a successful city-region approach therefore, will advance the interests of all citizens in the city-region [3].

A few examples of global city-regions in the world include Greater London, Isle de France (Paris), the Randstad in Holland (consisting of the four cities of Amsterdam, Rotterdam, Utrecht and The Hague), Sao Paulo and Mumbai. In South Africa, Gauteng and the greater Cape Town area are considered to be primary city-regions, with eThekwini/Msunduzi (Durban/Pietermaritzburg) as a possible third city-region.

The Gauteng City-Region

The Gauteng City-Region (GCR) is an integrated cluster of cities, towns and urban nodes that together make up the economic heartland of South Africa (see Fig. 1). It contributes some 50% of South Africa’s economic output, with different areas focused variously on mining, manufacturing, financial and business services, innovation or trade; ideally working together to constitute a
functionally integrated urban economy and single labour market. This region is the country’s centre of trade with Southern Africa and beyond. As such, it is a growing pole of attraction for migrants from South Africa’s rural areas and other urban centres, as well as immigrants from the continent, giving it an increasingly cosmopolitan character and vibrant social and economic life.

The region that gets its name from South Africa’s smallest but most densely populated province of Gauteng includes the cities of Johannesburg, South Africa’s financial and provincial capital, and Pretoria/Tshwane, the country’s administrative capital. It also includes a number of smaller urban centres including Germiston, Alberton, Boksburg, Benoni, Springs, Nigel, Heidelberg, Vereeniging, Vanderbijlpark, Krugersdorp, Randfontein and Westonaria that spread out across the province to create an almost continuous urban agglomeration.

The GCR has features of a poly-centric city-region (one that has multiple centres) that is anchored by the three large metros of Johannesburg, Tshwane and Ekurhuleni. These metros together had a population of 8,9-million people in 2007, according to Statistics South Africa’s (StatsSA) national Community Survey [6]. StatsSA’s 2009 mid-year population estimates indicate that Gauteng currently houses 10 531 300 people [7]. However, these figures exclude the municipal area of Merafong, which is in the process of being re-demarcated into Gauteng. On the basis of estimates from the Community Survey 2007, this adds a further 215 860 people to the population tally, giving the province a total population of 10 667 562.

The GCR economic footprint however extends beyond the borders of Gauteng into three other provinces; within a radius of some 150 km of the Johannesburg city centre are a number of other towns and population concentrations that form a more or less organic whole. To the north-west is the town of Rustenburg, a global centre of platinum mining. As the demand for platinum has increased over the last decade, mining activities have expanded and the area’s growth has accelerated. In 2007 the population of Rustenburg was estimated at 449 771. To the south-west is a patchwork of towns historically anchored respectively on coal mining, iron and steel production and energy generation, most of which output is exported to and used by Gauteng. All of these centres are functionally integrated with the cities and towns of Gauteng and constitute an extended GCR with a total population of 13-million that spills over into the three neighbouring provinces of North West, Free State and Mpumulanga. Fig. 2 gives an indication of the spatial distribution of the population by race across the broader city-region.

Fig. 2: Population by race (Census 2001) where 1 dot = 100 people.
There is an ongoing debate whether Thembisile and JR Moroka local municipalities, situated in the north east, should form part of the GCR. It is a swath of semi-urban settlements – a zone of displaced urbanisation – housing people once barred by apartheid from setting up home in South Africa’s whites only urban centres. This area of 525 495 people (on 2007 estimates) has little economy of its own but is functionally connected to the Gauteng economy by subsidised bus transport routes which have historically ferried thousands of workers into central Pretoria on a long-distance daily commute. An inter-linked set of variables needs to be analysed – transport (goods and people), economic activity, work-seeking, leisure and so on – to develop a robust basis for understanding the footprint of the GCR.

**The Gauteng City-Region Observatory**

The idea for a Gauteng City-Region was first formally expressed by the Premier in his opening address to the Legislature in February 2005: “... only through co-operating internally would we be able to compete more effectively externally. ... Success in effectively tackling the twin challenges of unemployment and poverty increasingly depends on our ability to position and grow ourselves as a successful global city region within the global economy” [8]. The Gauteng Provincial Government (GPG) recognised the need to build Gauteng as a globally competitive city-region and established the Gauteng City-Region Observatory (GCRO) in September 2008 as partnership between GPG, the University of Johannesburg, and University of the Witwatersrand [9]. Local government is also represented on the GCRO board. While it is located at the two universities, it is also charged with extending links to all the higher education institutions, as well as knowledge councils, private sector think-tanks, research NGOs and information-exchange and learning-networks operating in the city-region.

Behind the motivation for setting up the GCRO is a vision for a fast growing and dynamic urban region that through better planning and management, and in particular improved co-operative government relations between all spheres of government, will become more functionally integrated, spatially coherent, globally competitive, economically productive, environmentally sustainable and socially inclusive.

Better planning, management and co-operative government relies on improved data, information, analysis and reflective evaluation. The GCRO is responsible for building this strategic intelligence. Its mandate is to:

- Develop the datasets to enable the region of cities making up the GCR to better understand, and compare itself to equivalent city-regions in other parts of the world.
- Analyse the data to identify the key opportunities and challenges highlighted by these comparisons.
- Assist government and its partners to interpret the trends and forces shaping the city-region, both externally and from within.
- Through solid analysis and evaluation help decision-makers discern and weigh up the key future policy choices raised by prevailing, or possible future, opportunities and challenges.

This mandate requires the GCRO to provide direct policy support to government in leading the development of the city region, but also to be able to step back and critically reflect, through rigorous academic scholarship, on global city-region developments.

**The role of GIS**

GIS is integral to the work of the GCRO and its vision for a successful Gauteng City Region in five key ways:

**GIS – supportive of the analytical work of the GCRO**

The GCRO’s first year has mainly focused on gathering baseline data. Various layers such as administrative boundaries from the Municipal Demarcation Board, demographic layers (Census 2001 and Community Survey 2007) from StatsSA, and imagery from the CSIR Satellite Applications Centre, have been sourced to provide base mapping of the GCR (see Figs. 1 and 2). The GIS maps provide context within reports and support the GCRO researchers by visually representing data. This has been the traditional use of GIS in most projects, where GIS plays a mapping and supportive role.

**GIS – leading edge of the analytical work**

Taking GIS beyond mapping is to fully utilise the functionality and power of GIS. The role of GIS is reversed – instead of supporting the researcher, GIS leads and defines the research. The base data is not merely mapped, but analysed and modelled. However, given that 80 to 90% of all public sector data is spatially related, how much spatial analysis is performed on government data? In most government GIS departments, detailed GIS analysis and modelling is rare. This may be as a result of GIS departments traditionally focusing on data capture and maintenance, or the current skills shortage. Recent reports reveal massive levels of vacancies in state government with 36 588 vacant posts in 29 departments and an average period of 20 months to fill posts in the civil service [10].

To assist with GIS analysis and modelling of government data, the GCRO as part of its mandate aims to fulfil a government-academia portal role: to connect government to academic expertise, or to help academic students and specialists reach decision makers if their work has “policy implications”. The GCRO will be developing a list of GCR relevant GIS projects for honours, masters and doctoral students which will be circulated to universities throughout the GCR. These projects will assist students in furthering their studies in relevant government research, and in turn provide cutting edge, relevant analysis for government policy makers on how best to develop the city-region.

An example of a GCRO project that GIS will be playing a leading role is the Organisation for Economic Co-operation and Development (OECD) Territorial Review of the GCR, to be conducted by the OECD in partnership with GCRO, on behalf of the GPG. The OECD is an international organisation of 30 countries [11] that applies its wealth of information to help governments foster prosperity and fight poverty through economic growth and financial stability, while ensuring the environmental implications of economic and social development are also taken into account. The Territorial Review will identify GCR’s competitive advantages and weaknesses; what solutions have been attempted elsewhere, with what success; and how do we improve performance so as to lessen poverty and inequality and improve the lives of all citizens? GIS will be playing a leading role in analysing the
currently available data to identify key opportunities and challenges. The project has commenced with the first OECD mission visit scheduled for February 2010, and final OECD report to be published in 2011.

**GIS – Building new datasets**

Analysing existing data definitely has a role but in order to fully understand the dynamics of the GCR, new datasets focused on the specific areas of GCR research are required. The GCRO has initiated a number of projects in this regard.

The 2009 GCR Quality of Life/Customer satisfaction survey measures a wide range of issues such as levels of satisfaction with government services, poverty, socio-economic status, movement within the GCR and quality of life. This survey will allow comparisons across the entire GCR, including the economic footprints outside of Gauteng described above, with a sample large enough to allow analysis both within and across municipalities, not generally possible in previous province-wide surveys. The Quality of Life survey will provide a bottom up perspective to enable values and attitudes to be mapped and analysed on top of socio-economic variables. The fieldwork was completed in August and September of 2009, with 6636 respondents interviewed across 569 wards. The data will be made freely available to anyone interested in analysing it and will directly inform GCRO’s first “State of the Gauteng City-Region” report to be produced in the first half of 2010.

GCRO has linked up with a project to map urban growth within the GCR from 1960 to 2008. The project forms part of a doctoral study entitled: “Impact of transport corridors on urban development in the Gauteng Global City-Region” [12]. Part of the analysis will use aerial photography from the 1960s and 1970s together with satellite imagery from 1989, 2000 and 2008, to assess changes in land use over the past 50 years. This research will present a fascinating picture over time, of the urban evolution and birth of the GCR.

Further GIS data generation projects are in the pipeline, which will tap into GCRO government-academia portal.

**GIS – Breaking down government data barriers**

Although government public sector information is slowly becoming available, access to spatial information within government is still limited. In a recent HSRC seminar entitled, “Maximising the value of Public Sector Information”, Sharif [13] stated that despite all the policies in place, there are still problems accessing government information in South Africa, such as: the open availability of information, institutional and socio-cultural barriers and timeliness of the information. Sharif suggested that the main problems are with the implementation of public sector information policy and that a high level of coordination and collaboration is urgently required to: increase the awareness of policy makers and public servants about the importance of public sector information, and institutionalise new follow-up, monitoring and evaluation methods and activities to ensure effective utilisation of public sector information. The lack of public open access to some municipal GIS data was recently debated in the November/December 2009 issue of PositionIT [14, 15], with Shuttleworth Foundation Intellectual Property Fellow Andrew Rens describing it as “a missed opportunity for innovation”. Public sector spatial data can and should be used and shared by all spheres of government. The GCRO is committed to breaking down data barriers across all levels of government, with spatial data leading the way to enable easier access to all information for both local and provincial government, and universities and students. A first step towards achieving this goal is to establish a Memorandum of Understanding (MOU) between the GCRO and GPG. The MOU aims to avoid duplication of GIS datasets and projects and promote sharing of GIS data and knowledge. The Cape Urban Observatory is also working on a similar MOU between the Western Cape Provincial Government and City of Cape Town: “These negotiations aim to facilitate formal relations between the two organisations, reducing the reliance on personal relationships and providing a clear data sharing framework” [16]. Until government data becomes freely available, formal data relationships will need to be established.

**GIS – the power of easily accessible online data: web mapping services**

As described earlier, the GCR covers a vast area covering 21 municipalities and four provinces. To obtain datasets and maintain data from all these different sources would require a dedicated effort. Data availability, accuracy and currency would also vary across the different authorities.
Frustratingly, freely available websites such as Google Maps often serve more up-to-date imagery and base layers (such as streets) than the data available within many government departments. GIS data has moved online and there are numerous free sources of online data that can be loaded into desktop GIS applications and mapping websites as Web Map Services (WMS). ESRI software can access various base layers from the ArcGIS online resources website and Microsoft Bing maps [17], and open data initiatives such as Open Street Map offer free (licensed under the terms of the Creative Commons Attribution Share-Alike 2.0 license) downloadable street datasets for the world [18]. Web 2.0 tools such as data mashups (a web page or website that combines data, information and services from multiple sources on the web [19]) and application programming interfaces (API) provide the tools to access online data.

A successful model for sharing and accessing data on web is the OneGeology site which aims “to create dynamic geological map data of the world available via the web” [20]. Through the OneGeology portal (see Fig. 3), participating organisations and government departments can upload their published geological layers’ WMS links, and users can view, access and overlay these WMS datasets on their own data within their own GIS software or GIS websites. Wouldn’t it be great if every South African government department would publish and make available their data on a South African data portal for anyone to access?

The GCRO recognises the power of online data and in 2010 will be developing a Web 2.0 website that will incorporate freely available online base layers, together with an analysis of the Quality of Life layers, in a dynamic GIS website to assist the GCR policy-makers. The website will also be publically accessible, breaking down further barriers and opening access for all citizens to public sector information on the GCR.

Conclusion

“The days of governments at all levels – national, state/provincial or local – operating primarily as singular entities are over. Tomorrow’s governments cannot deliver the policy outcomes that society expects if they continue to hold onto yesterday’s monolithic-leadership model” [21].

City-regions offer a new model for planning and managing rapidly expanding urban areas. If well managed and governed, they will play a vital role in sustaining and developing both national, and the global economy. The GCRO is committed to developing a globally competitive, integrated, environmentally sustainable and socially inclusive GCR. GIS is a key component for evaluating, analysing and managing the GCR. In order to assist the Gauteng policy-makers relevant data will be visualised using the latest web technology and online data. Hopefully this will lead to improved cooperation between the sections of government, and greater collaboration between government, business and civil society, so that the cities and towns stretching across and beyond the boundaries of the Gauteng province can be made to work better as a more integrated, productive and sustainable whole.

GIS is at the heart of the vision of a successful Gauteng City-Region.

References

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