PUBLIC SPACE AND THE DIGITAL AGE

HOW DIGITAL TECHNOLOGIES ASSIST IN CAPTURING PUBLIC LIFE IN JOHANNESBURG BOTANICAL GARDENS

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Introduction

The current conventional mapping methods fall short in capturing the dynamic nature of urban environments and fail to provide real-time insights into how these spaces evolve over time. There is a need to find reliable methods of recording qualitative data through field observations over a large area in urban design research, where an opportunity lies in leveraging digital mapping technologies to record qualitative data in urban green spaces, such as user density, furniture quality, and proximity to amenities. This research investigates the utilisation of digital mapping tools to archive and analyse activities, social interactions, and spatial transformations within urban green spaces, and offers a transformative path toward more informed and data-driven urban planning and design, ensuring that our cities evolve in ways that meet the diverse and evolving needs of their inhabitants.

Opportunity Statement

- Demand for **innovative solutions** in navigating complex urban landscapes
- Adaptation of tools and methodologies for **sustainable** and **inclusive urban environments**
- **Potential of digital technology** to transform urban planning, design, and management
- Inadequacy of conventional mapping methods **hindering data capture and accessibility**
- Limitations of **static data collection methods** for public green spaces
- **Lack of real-time insights** hindering informed decision-making
- Restrictions on proactively addressing emerging challenges in urban spaces
- Need for **reliable methods** like digital mapping technologies for **real-time data assessment**
- **Leveraging GIS, remote sensing, and mobile applications** for comprehensive and updated views of urban spaces

Threats

- *static data collection methods*
- *database is not easily updatable resulting in hindered real-time insights of space*
- *limited informed decision-making or effective public engagement*

Opportunities

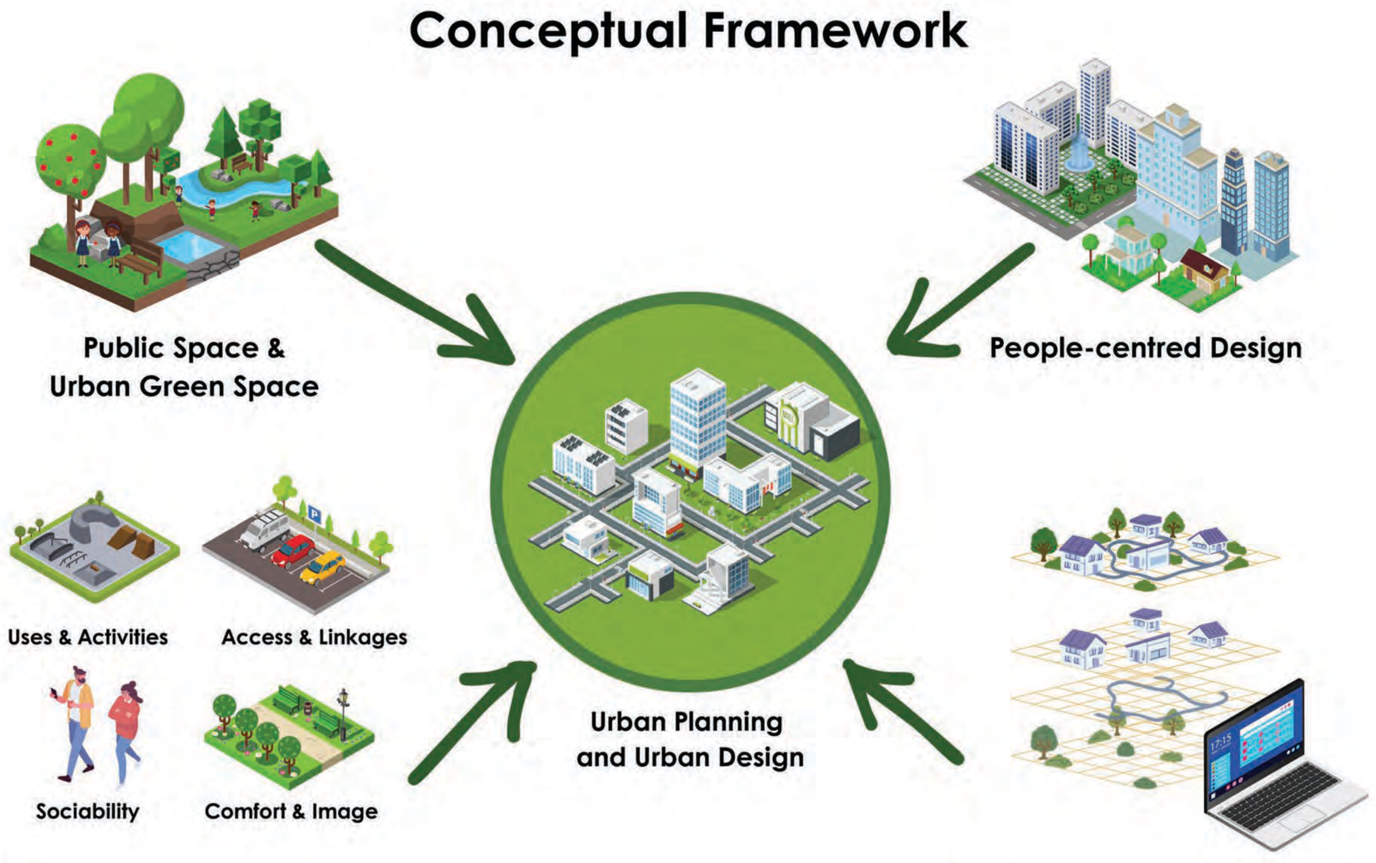
- *archivable and upgradable database*
- *improved visualization of data*
- *efficient data collection methods and data accuracy*

Research Questions: Unraveling the Impact of Digital Mapping

How does the use of digital mapping tools facilitate the archiving and analysis of activities and spatial changes in public green spaces?

1. *What are the digital mapping tools currently available to urban planning and urban design practitioners?*
2. *What kind of information can be captured, mapped and archived on digital mapping technologies?*
3. *Which patterns of activities and social interactions within Johannesburg Botanical Gardens are revealed by digital mapping?*
4. *How can digital mapping tools aid in the identification and assessment of potential design improvements or interventions for public green spaces?*

Conceptual Framework



Objectives

- Test how **efficiently** digital technologies can **capture data** and what **kind of information** it can capture
- Create a **digital narrative experience** demonstrating and summarizing the **user experience** in the Johannesburg Botanical Gardens

Testing the Digital Technology

ArcGIS Survey123

Software produced by Esri, Survey123 is an intuitive **form-centric data gathering** solution for **creating and analysing surveys.**

ArcGIS QuickCapture

Software produced by Esri, QuickCapture is **field data capture app** that allows you to capture data quickly, allowing you to capture both the **location and attributes of assets** or incidents as you travel.

ArcGIS Map Viewer

Software produced by Esri, Map Viewer is a **browser-based mapping tool** that can **view, create, and save web maps.** It can be used to perform common GIS tasks, such as change the basemap, add data layers and styles, and execute different types of analyses.

ArcGIS StoryMaps

Software produced by Esri, StoryMaps is a **story authoring web-based application** that allows you to share your maps in the context of **narrative text** and other **multimedia content.**

Conclusion

Park Management

- *community engagement*
- *spatial analysis capabilities*
- *archivable and upgradable database*
- *real time insights*

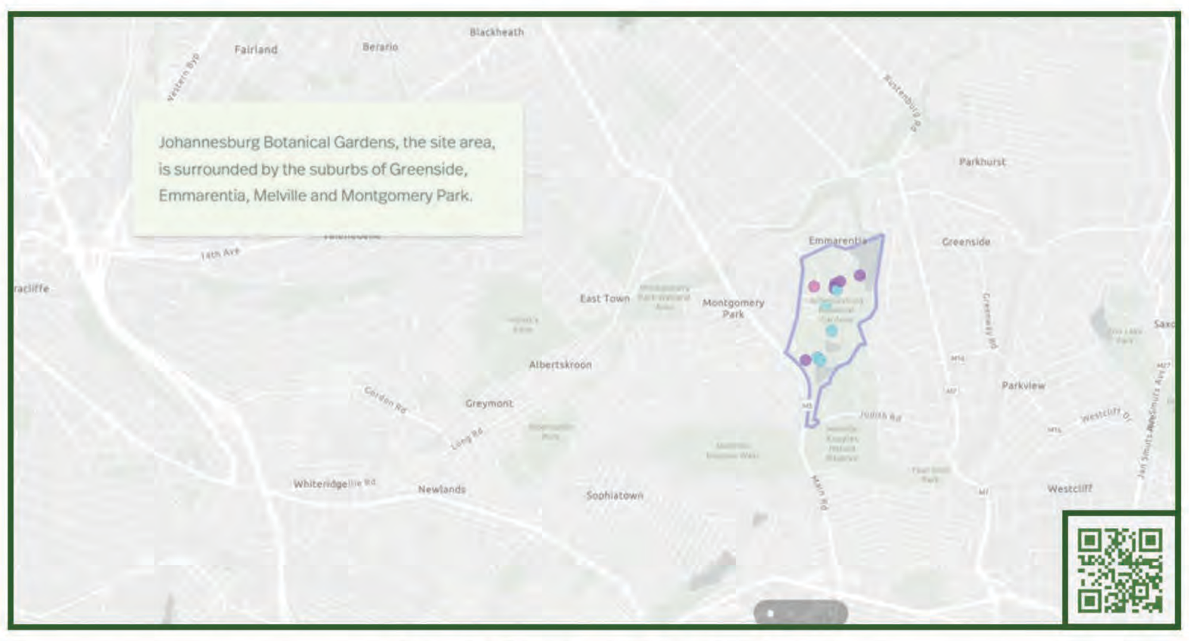
Community Stakeholders

- *community engagement*
- *enhanced visualization*

Urban Practitioners

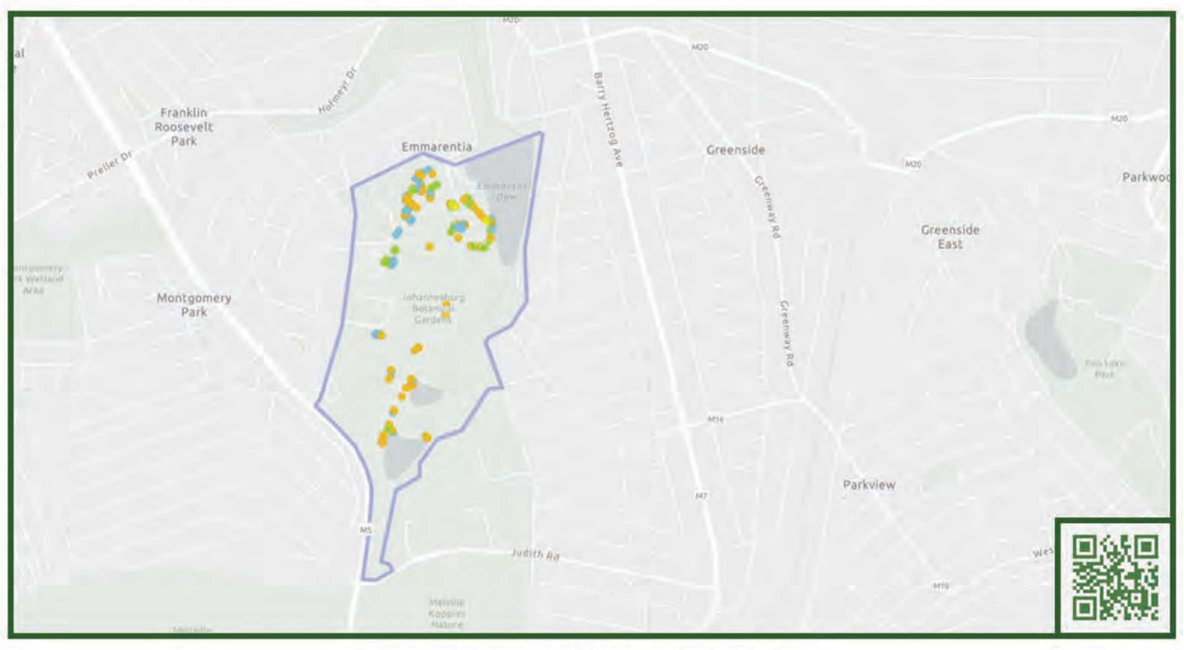
- *efficient data capture process*
- *improved data accuracy*
- *archivable and upgradable database*
- *real time insights*
- *integration of multiple data sources*
- *spatial analysis capabilities*

Digitally Capturing User Traffic
QuickCapture to ArcGIS StoryMaps



Scan QR code to play video

Digitally Capturing Urban Elements
QuickCapture to Map Viewer



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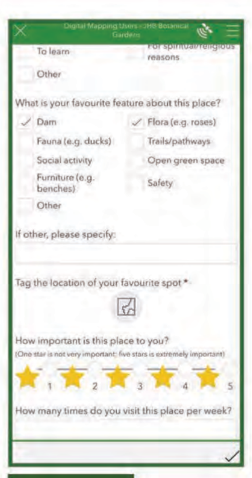
User Feedback
Survey123



50% of interviewees said that the dam and/or the **open green space** was their favourite feature

75% of interviewees visited the park to spend time with **friends, exercise** and/or for **calmness**

45% of interviewees were concerned about **safety** in the park. 60% of them were **women.**

Scan QR code to play video

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EVALUATING ANIMATED 3D GEOVISUALISATIONS OF THE EL NINO PHENOMENON FOR TEACHING AT THE UNIVERSITY OF PRETORIA

UNIVERSITEIT VAN PRETORIA
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Introduction

It is usually assumed that animation and 3D visualisation improves the understanding of a subject, object or phenomenon however, this has not been explored in the visualisation of El Nino at the University of Pretoria.

The poster shows results of the created 3D geovisualisations which are used to evaluate the effectiveness of the visualisations by way of carefully structured interviews of meteorology students and a lecturer that were conducted.

Research Questions

Do the geovisualisations improve the students' understanding of El Nino?

Can these animated geovisualisations be used in the teaching of El Nino at the University of Pretoria?

Method

- Creation of the visualisations, animation and interviews
- 4 participants; 3 meteorology students and 1 expert (professor)
- Independent variable: Time
- Dependent variable: Effectiveness of the geovisualisations

Geovisualisations

The data used for this project was sourced from the NOAA library. The spatio-temporal data comprised of temperature and zonal winds as the variables. Temperature is used as a variable because El Nino is based on the sea-surface temperature in the easterly tropical pacific region thus it is the main variable. Zonal winds data was included as an additional variable to identify possible trends and correlation with temperature. There is an understanding of this relationship within the meteorology field.

The 3D geovisualisations were created using ArcMap 10.4.1 and ArcGIS Pro 1.4. Processing involved creating a fishnet to represent the points as square plates, z-enabling the data and assigning the variable value as the z value. Because the values were so close, exaggeration had to be done by way of a mathematical expression. This allowed for the differences in values to be visible.

Figure 1 and 2 are the result of the created 3D geovisualisation.

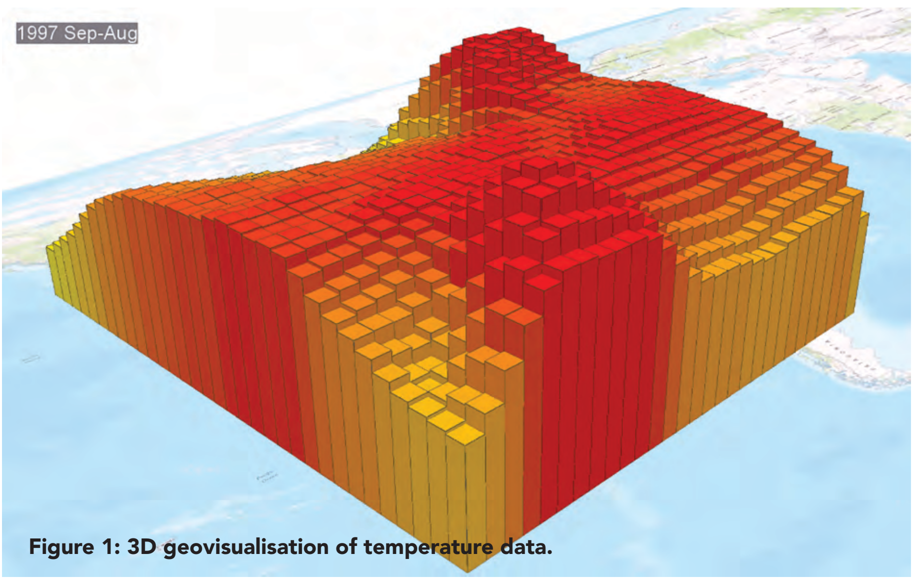


Figure 1: 3D geovisualisation of temperature data.

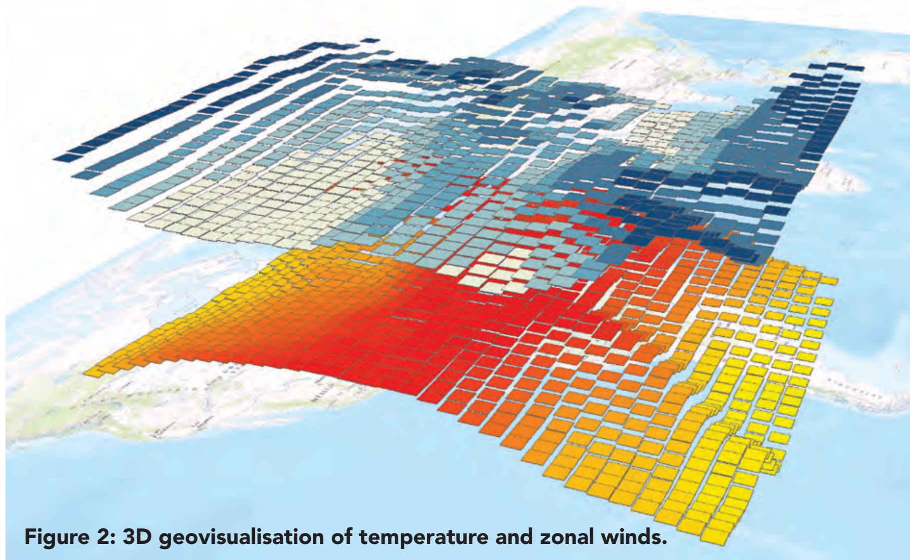


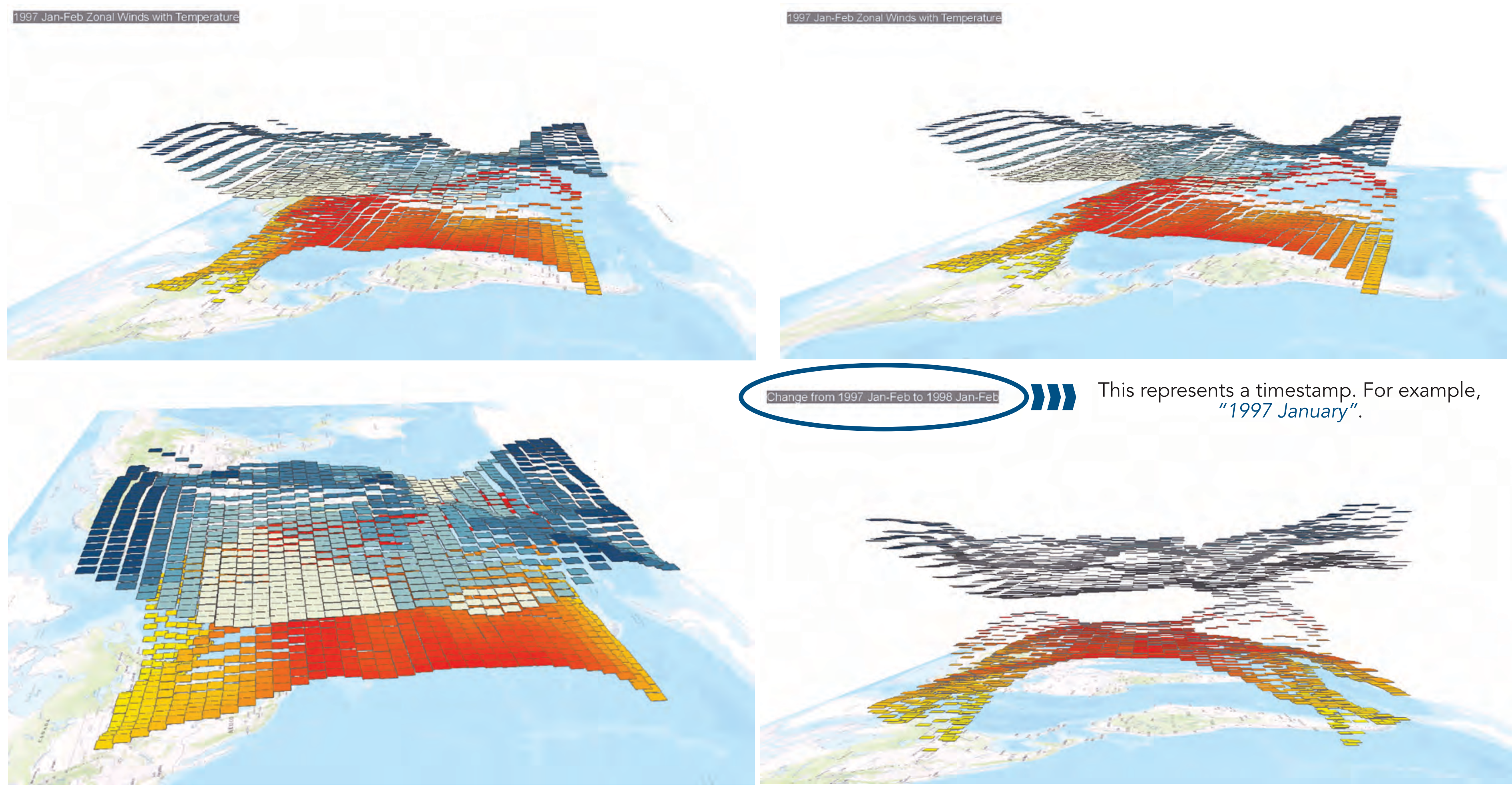
Figure 2: 3D geovisualisation of temperature and zonal winds.

Animations

The below collage shows the same animation video. With the animation tool, one can show the same visual from different angle. This was done by defining the start position of the image and the final position. The motion itself is done automatically. Although the below collage does not show all the frames, the last frame depicts a change hence there are two zonal wind sets of data and two temperature sets of data. These were moving from January 1997 to January 1998. The aim of this visualisation was to identify a trend in these variables.

Animation of the 3D geovisualisations was introduced to show the change in temperature over time. This is done by placing subsets of time of the visualisation to display the overall time frame. The data was separated by two month intervals from January of 1997 to December of 1998. Thus 12 sets of data had to be downloaded and processed for the animation to represent what is explained.

3D Animation Illustrations



The animations can be seen on the following links:

youtu.be/Oef2ceQ0cPA youtu.be/taEjmdieZy8 youtu.be/rYCu9gmeUQc

Interviews

Key questions that were asked and the summarized responses from the interviewees

How do you see a 3D visualisation of El Nino improving the students' understanding of the effect?

How do you see a 3D visualisation of El Nino improving the students' understanding of the effe"From experience, when one sees something in real life such as people, they are 3 dimensional thus this experience is applicable to the El Nino effect. I think it will help them relate to it more in terms of it being visualised in 3 dimensions therefore improving their understanding."ct?

Will the 3D animation assist students in understanding the El Nino effect? Why or why not?

"Yes it will. What I found interesting is how strong the winds are in the mid-latitudes are compared to the tropics. We usually look at the anomalies. I find that the analysis done is consistent with some predictions and modelling work I have done and I am glad your analysis shows this."

Conclusion

- Positive feedback from a meteorology expert.
- Animated 3D geo-visualisation of El Nino was useful in increasing students' understanding of the phenomenon.
- Overall feedback from the students is positive.
- Expert and students in meteorology would recommend the use of animated 3D-geovisualisation.
- Animated 3D-geovisualisation can be added to the resources used in teaching but cannot replace what is already there.

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A GIS-BASED MULTI-CRITERIA DECISION ANALYSIS APPROACH TO LOCATING POTENTIAL SITES FOR WIND TURBINES IN THE GAUTENG PROVINCE OF SOUTH AFRICA

UNIVERSITEIT VAN PRETORIA
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Scan QR Code for Story map

Introduction

South Africa, like many developing nations, has set goals towards decreasing its dependence on fossil fuels and integrating more renewable energy into electricity generation. Multi-Criteria Decision Analysis (MCDA) is a common method applied in the selection of suitable sites for wind farms. Wind energy is a low impact renewable energy that is economically viable and has little effect on the environment as opposed to the heavy coal used currently.

This study investigates the potential of wind farm development in the Gauteng province of South Africa using a GIS based Multi-Criteria Decision Analysis hybrid model. The MCDA approach takes multiple and conflicting factors, criteria or objectives and consolidates them into a decision-making model while GIS allows to solve the problem spatially. Gauteng is an industrialised province and highly populated. Therefore, the demand of energy in Gauteng is directly related to the economic hub status of the province. Exploring whether wind power is possible could be a great investor attraction and contribute to coal emission reduction.

Aim and Objectives

Aim: to locate potential sites for wind farms in Gauteng where the suitability of the site is defined by multiple criteria pertaining to environmental, economic, technical, and social factors while integrating these criteria into a decision-making model that describes the suitability.

The following three key objectives will help achieve the stated aim:

1. To identify a set of socio-economic, environmental, ecological, and technical criteria that will serve as determining factors in the suitability analysis of wind turbine sites in Gauteng.
2. To model a hierarchy structure for the multi-criteria (literature based) in the decision-making model by assigning weights to the criteria.
3. To identify suitable areas for wind farms in Gauteng and determine a degree of suitability.

Methodology

MCDA and Analytical Hierarchy Process (AHP)

1. Identify the goal i.e. to identify potential sites for wind turbines in the Gauteng province.
2. Establish a decision-making structure by defining the objectives, alternatives and criteria.
3. Score the alternatives against the criterion using the Saaty Scale (1-9) (*Table 1*).

Table 1: Saaty Scale of Importance

Intensity of Importance	Definition
1	Equal importance
3	Moderate importance of one over another
5	Strong importance
7	Very strong importance
9	Extreme importance
2,4,6,8	Intermediate values
Reciprocals	If criterion A has one of the above numbers assigned to it when compared with criterion B, then criterion B has the reciprocal value when compared to criterion A.

4. Apply AHP and calculate the relative weights of each criterion selected using a normalized pairwise matrix of all the scores.
5. Evaluate consistencies in the scoring using the consistency Ratio

Geographical Information Systems (GIS)

- Collecting data (vector and raster) based on the criteria from various sources like NGI, Global Wind Atlas, EGIS, OpenStreetMap, etc.
- Criteria is categorised into constraints and factors.
- Prepare the data by projecting all layers into a WGS 84 UTM Zone 35S, cropping to the study area and resampling the wind raster and DEM raster layer.
- Extract the slope from DEM.
- The Euclidean Distance tool measures the distance from one cell to the nearest source cell. The tool is used to calculate the maximum distance of the criteria/layer to the full extent of the study area (Gauteng province). The criteria are then reclassified according to different threshold that define suitability.
- For the, constraints criteria(Land cover, Birds Areas (IBA), Geology, Airfields, Protected Areas, Hydrology), Boolean logic is applied to determine suitable and unsuitable areas for wind turbines. 1 is regarded as suitable and 0 as unsuitable using the reclassification tool in ArcGIS Pro.
- A mask layer is created by combining all the constraints using the raster calculator tool and this layer masks out all the unsuitable areas and will be further be used to mask out the factor map.
- The factor raster are multiplied by their respective weight from the AHP pairwise matrix calculation and then added together using the weighted sum tool.
- Factor maps define some degree of suitability and the classification describe a degree of suitability.
- The scale for classification ranged from (0-1). Unsuitable areas are classified as 0 and regarded a constraint i.e., these areas are excluded from the final factor maps. Therefore, suitability ranges from 1 to 3.
- Finally, the extract by mask tool extracts suitable areas from the weighted factor maps and get a final suitability map.

Results and discussion

Table 2: Normalised Pairwise Matrix with weights

Criteria	Wind speed	Slope	Proximity to electric gridlines	Proximity to transportation	Proximity to urban areas	Criterion Weight (GW)
Wind speed	0.5263	0.6916	0.4138	0.4000	0.3125	**0.46885**
Slope	0.1316	0.1729	0.4138	0.2400	0.3125	**0.25416**
Proximity to electric gridlines	0.1316	0.0432	0.1034	0.2400	0.1875	**0.14115**
Proximity to transportation	0.1053	0,0576	0,0345	0,0800	0,1250	**0.08048**
Proximity to urban areas	0,1053	0.0346	0.0345	0,0400	0,0625	**0.05537**
Sum	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**

- ➢ Factor criteria with their weights.
- ➢ To ensure consistency and accuracy, the outlier scores were detected using box plots in Microsoft Excel and removed before the average score for each criterion pair.

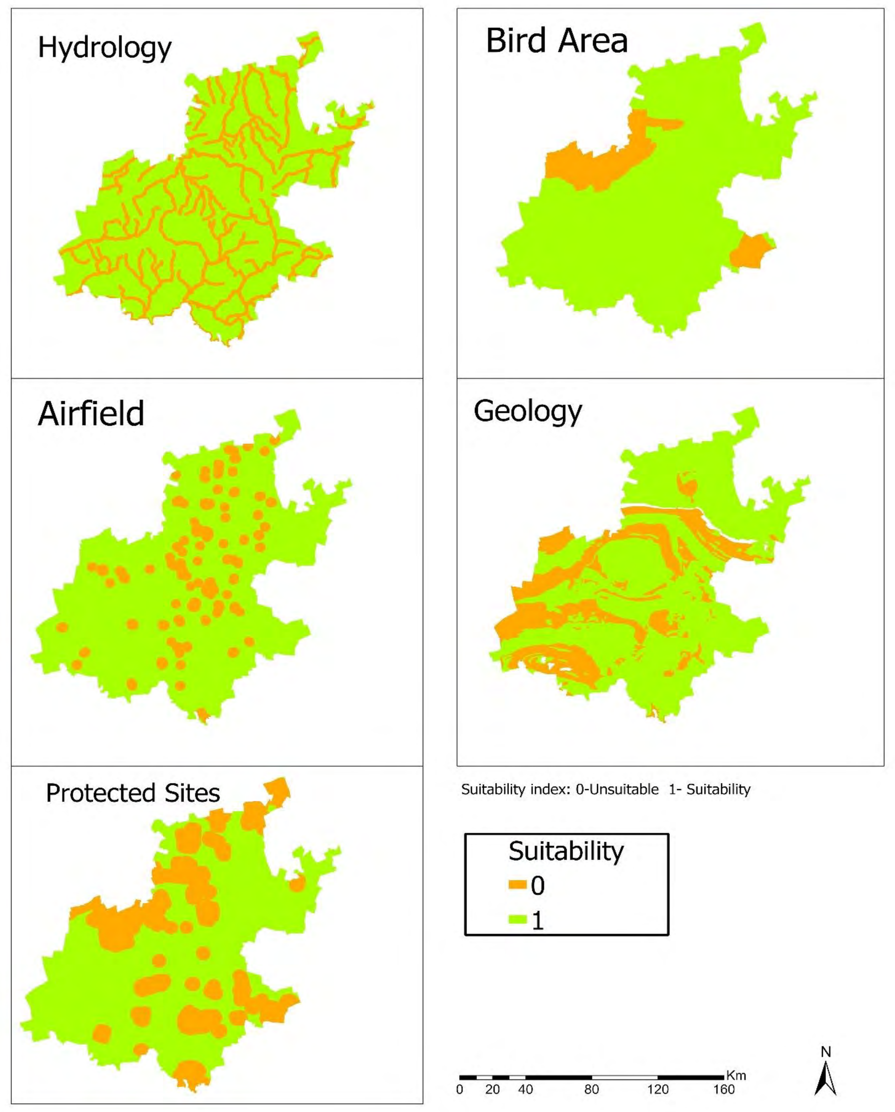

Fig. 1: Constraint maps

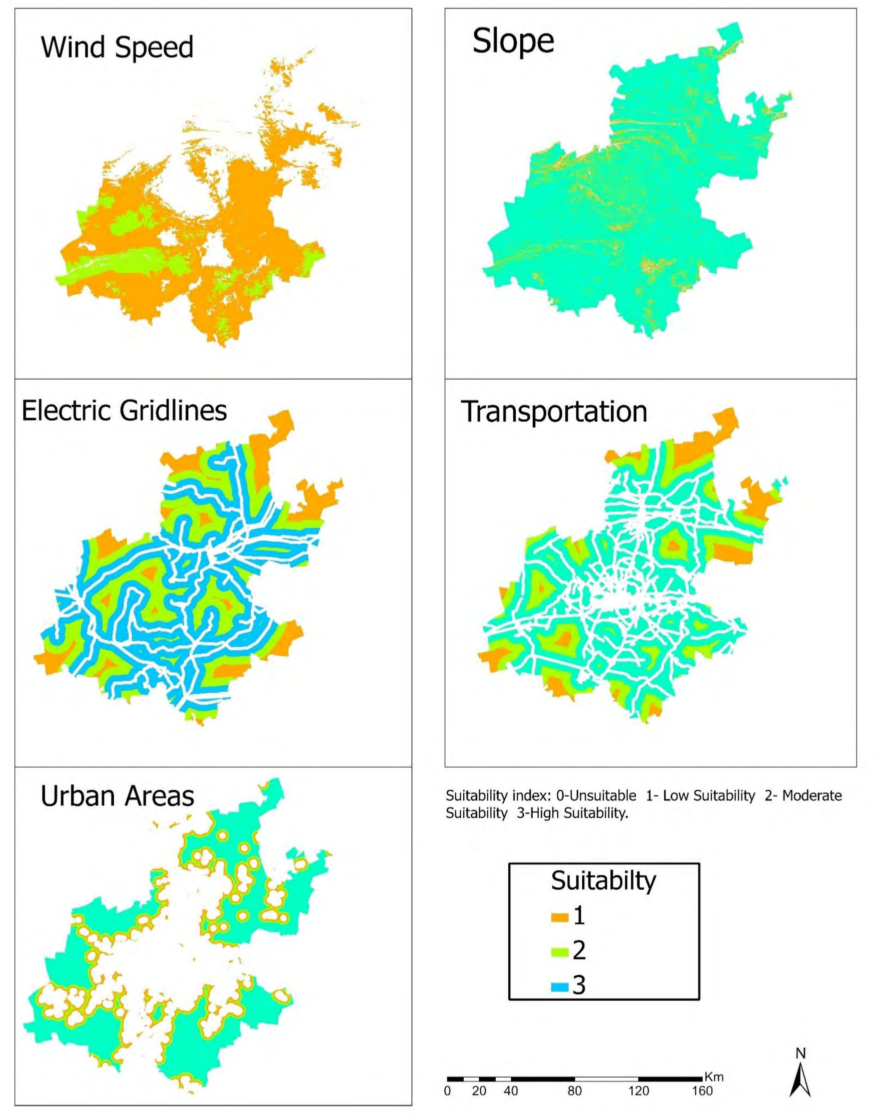

Fig. 3: Factor maps

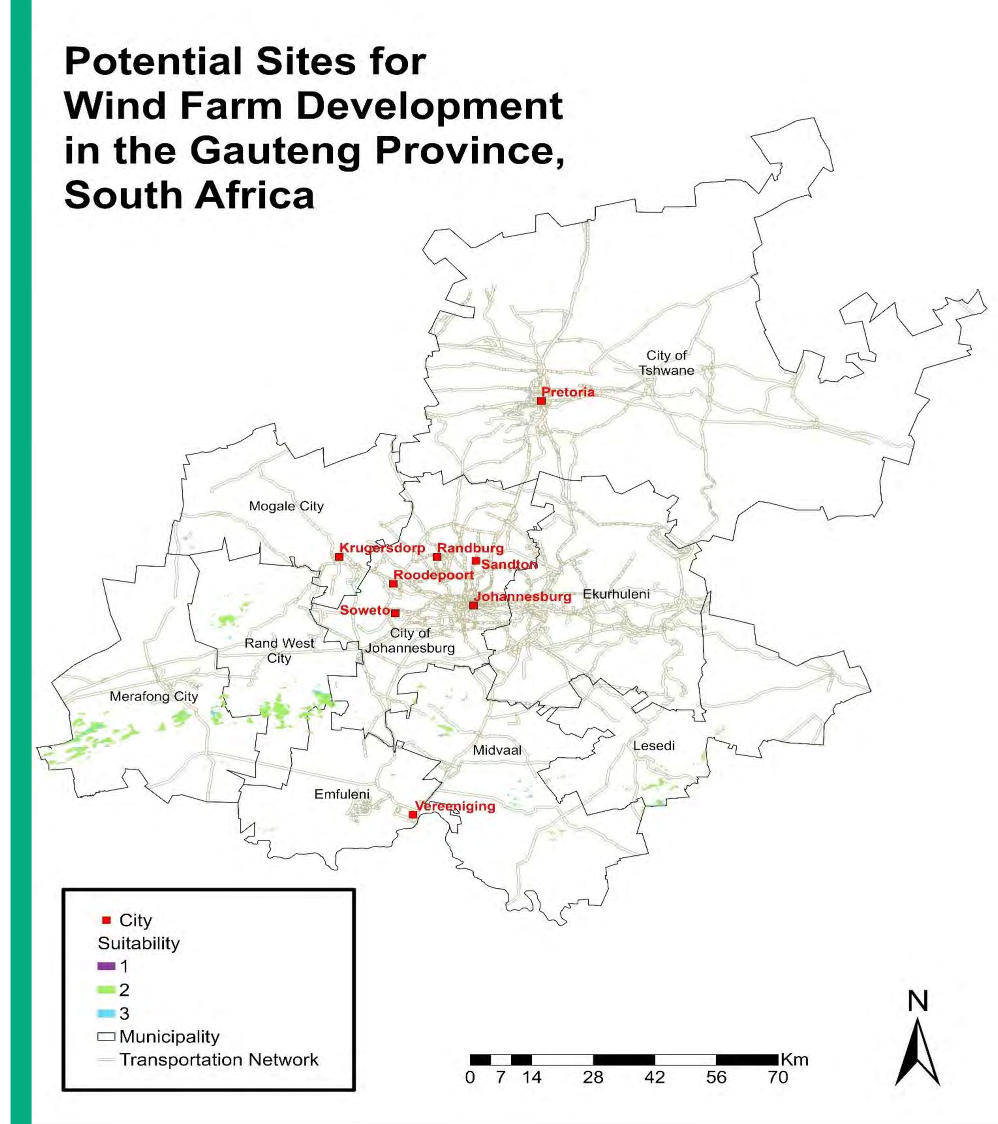

Fig.4: Final suitability factor map

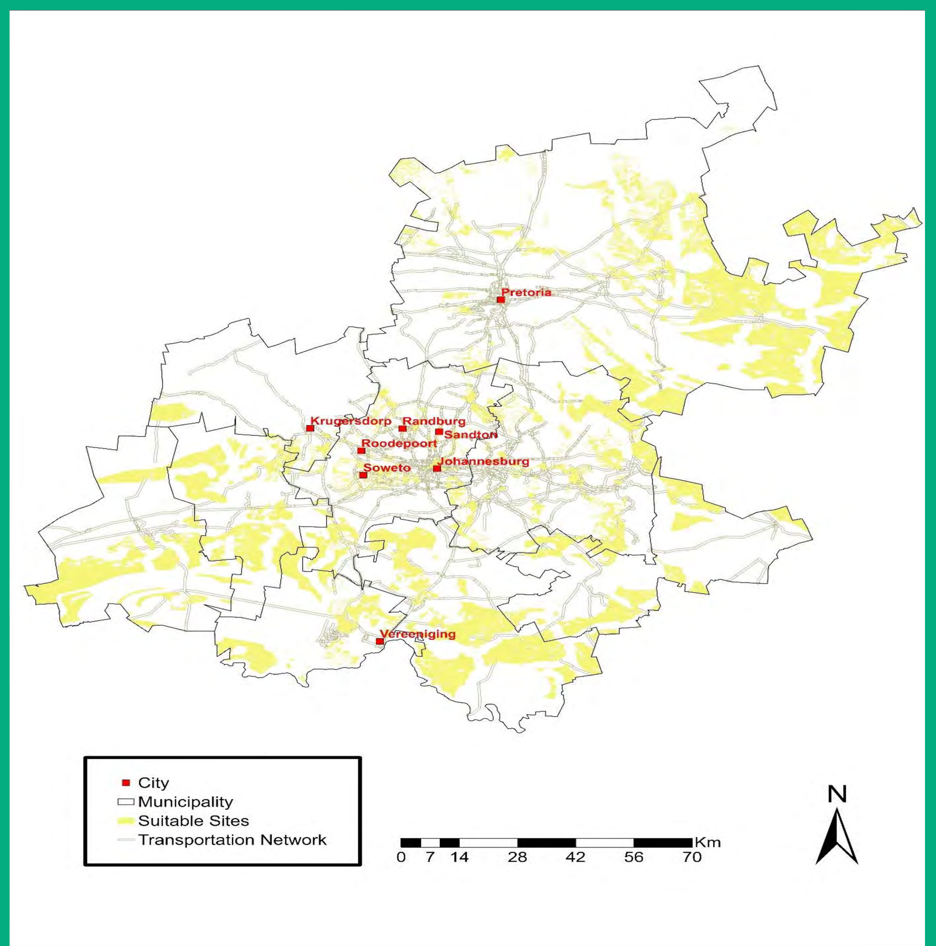

Fig. 2: Suitable sites before factor criteria

- The results of the GIS model reveal the performance of the reclassified individual constraints maps (fig. 1). 0 represents unsuitable while 1 is suitable areas for wind turbines.
- Fig. 2 is the combined constraints map that depicts the areas suitable according to aggregated constraints. This map is used to extract suitable sites from the weighted factor map, which results in the final suitability map (fig.4)
- Fig.3 depicts the performance of the individual factor criteria. The factor maps show a degree of suitability ranging from 1 to 3, with 1 representing low suitability, 2-moderate suitability and 3 being high suitability. This indicated that wind farm suitability analysis is not only wind dependent as suitability is defined differently by different factors.
- In fig 4. the factor maps are combined with weighted sum tool and the final weighted criterion map is shown. This is regarded as the final suitability map where potential of wind farms in Gauteng can be assessed.
- Suitable areas are mainly concentrated in the Southern –West region of the province. The total land surface area of the Gauteng province is equal to 18 170.20 km^2 and only 131 km^2 were found to be suitable for wind turbines.
- Of the 131 km^2 , low suitability areas occupied 0.340 km^2 , moderately suitable equalled 121.3 km^2 ,while highly suitable areas occupied 9.36 km^2 .
- Highly suitable areas are 7.15% of the total suitable areas and only 0.052% of the total land surface area of the Gauteng province.
- Suitable areas occupy only **0.72%** of the total area of the Gauteng province.

Conclusion

- With the application of GIS-MCDA, very small wind farm potential exists.
- Small scale wind turbines may be beneficial for local use in municipalities that do have some potential. For example, moderate to high suitability exits in vegetated and cultivated land in the Midvaal Local municipality.
- Intricate and conflicting muti-criteria were implemented successfully into a decision-making model using GIS.
- A different approach to AHP was applied instead of the typical gathering of experts in the industry to deliberate the criterion scores and weights of the criterion. A literature based AHP worked in this regard as a Consistency Ratio(CR) of <0.01 was achieved for the pairwise matrix.
- GIS-MCDA was successfully applied in locating potential sites for wind farms in the Gauteng province.
- This research is essential for future research into the application of GIS-based Multi-Criteria Decision Analysis in locating suitable sites for Renewable Energy plants across South Africa.

Abbreviations

MCDA- Multi-Criteria Decision Analysis
GIS-MCDA: Geographical Information Systems-Multi-Criteria Decision Analysis
AHP- Analytical Hierarchy Process
DEM- Digital Elevation Model
NGI- National Geo-Spatial Information (portal)
EGIS-Environmental GIS (portal)

Acknowledgements

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DEVELOPMENT OF A GEO-LOCATION SYSTEM TO VISUALISE AND PROFILE LOCATION-SPECIFIC RISK FACTORS (2018)

Luke Boswell

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NWU NORTH-WEST UNIVERSITY NOORDWES-UNIVERSITEIT YUNIBESITI YA BOKONE-BOPHIRIMA

Centre for BMI Senteramo ya DII Sentrum vir BWI

Introduction:

In countries such as South Africa where a large portion of the population is unable to access formal credit, many potential credit worthy customers are lost or turned away simply as a result of lack of sufficient credit history. The phrase "you need a credit history to get access to credit" is one of which many South African's fall victim to and as such, new methods of evaluating credit worthiness are being investigated.

This project demonstrates the cross-pollination of data science, quantitative risk analysis and location analytics to uncover spatial relationships of both average monthly spend and consumer credit risk across South Africa. Three leading platforms for statistical analysis, business intelligence and geographical analysis (SAS, Power BI and Esri's ArcGIS Online and ArcGIS Pro) were jointly used throughout this project. The final system demonstrates the vast potential for insight-driven decision-making through a combination of the capabilities within each of these three leading platforms. This project then demonstrates location-based credit profiling that could potentially assist those, who currently have no access to formal credit, to obtain credit. The project was undertaken and completed during the period July 2018 – December 2018.

Aims and Objectives:

- Identify a suitable software platform to showcase the results.
- Perform data extraction, manipulation and feature engineering and ensure the final dataset as well as subsequent results match expectations.
- Demonstrate creative problem solving techniques in-line with the proof-of-concept nature of the project.
- Determine if there is sufficient evidence to suggest that there are spatial relationships regarding credit risk across South Africa, specifically within the telecommunications industry.

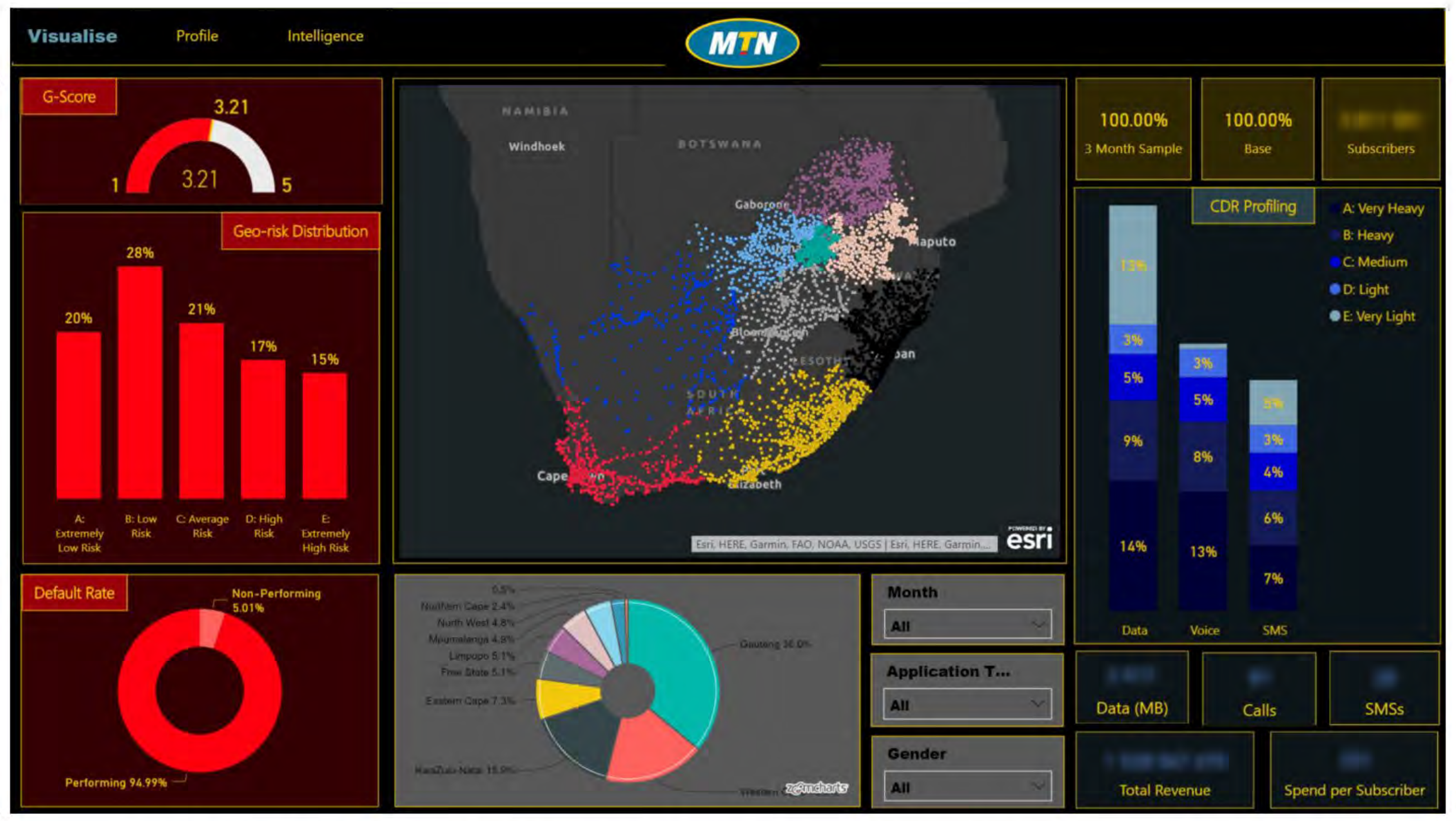
Method:

1. Research and identify suitable software platforms for handling and visualising location data.
2. Perform data extraction from multiple sources of risk, network and location data stored within the data mart of one of South Africa's largest mobile telecommunications networks – MTN SA.
3. Engineer the raw data into new, meaningful and insightful features (variables) that allow for appropriate visualisation.
4. Perform spatial analysis on a chosen feature to identify possible spatial relationships (Getis-Ord Gi* Statistic – Hot-spot Analysis using Esri's ArcGIS Pro)
5. Report on the results of the Hot-spot Analysis in comparison to the other visualisations.

Quantitative Risk Features:

- Feature Engineered G-Score that quantitatively aggregates a categorical variable representing risk segmentation. The higher the value, the lower the risk. The population average is 3.21 (slightly above medium risk).
- Risk distribution based on feature-engineered binning.
- Default rate with hover-over drill down for additional segmentation such as age, application type and a few others.

The grey panel provides drill-down functionality for the spatial hierarchy: Country → Province → District → City/Town



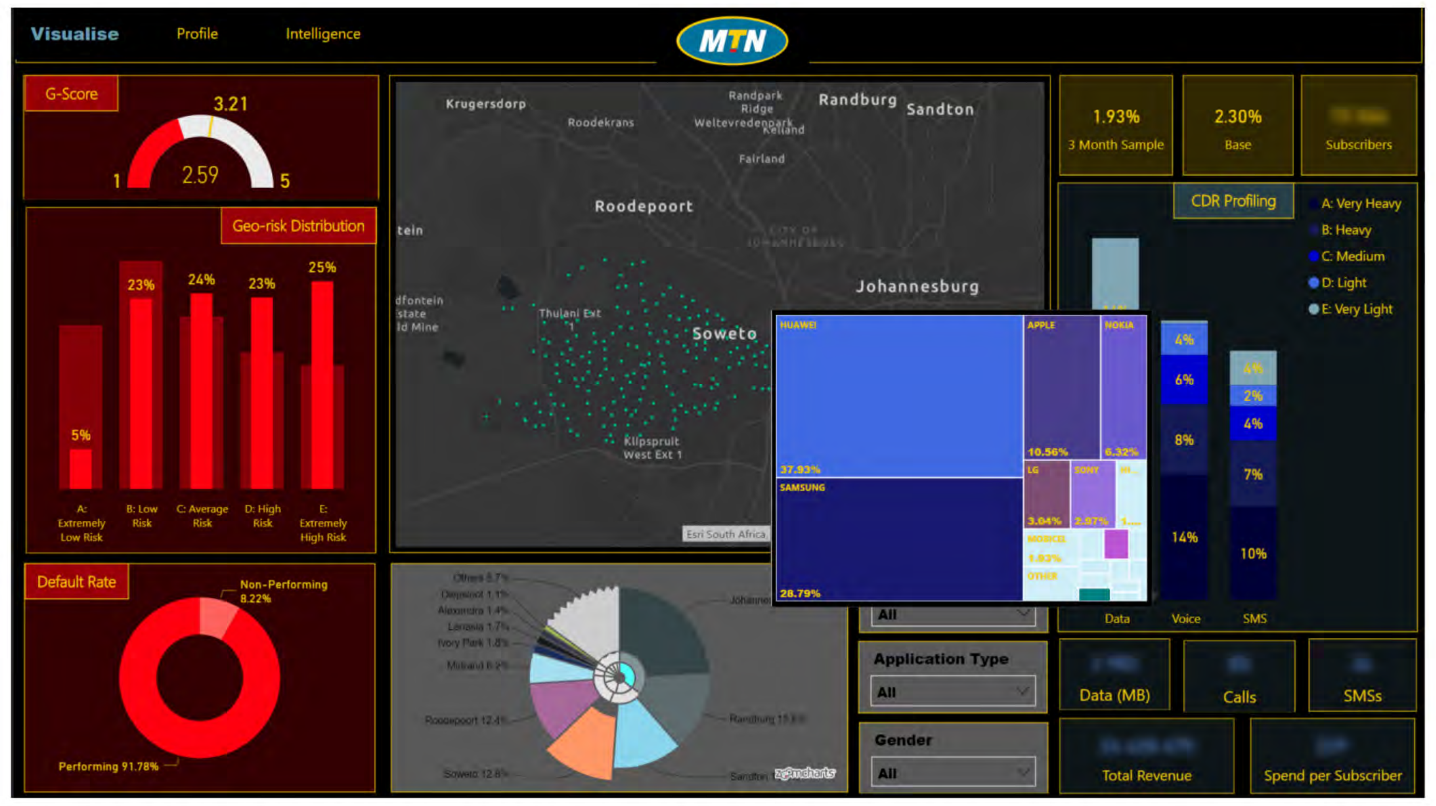
NOTE: Specific values have been purposely blurred out to preserve the confidentiality of the data

Conclusion:

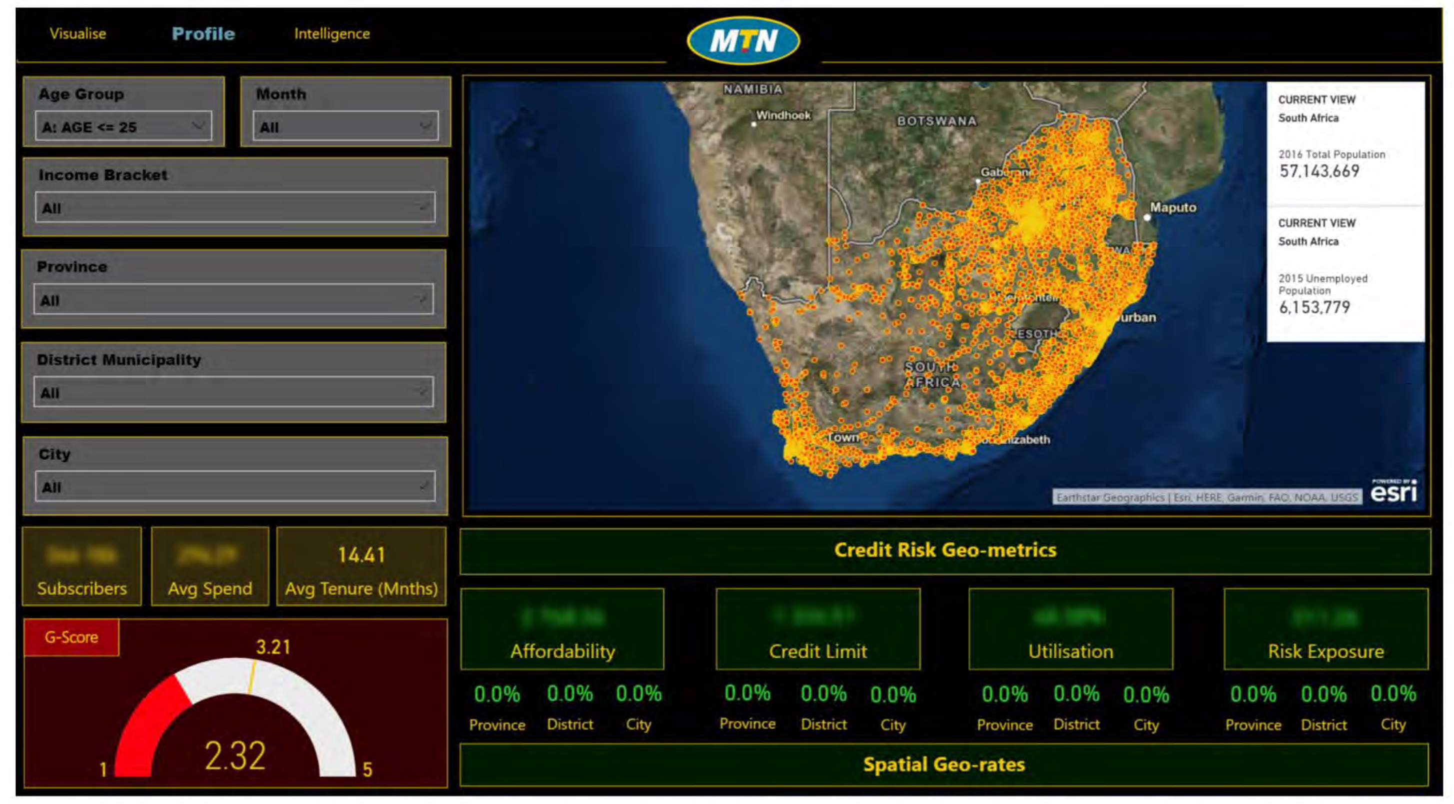
South Africa is relatively unique in its distressing geographic and demographic layout. A common topic of discussion amongst urban geographers is the concept of an 'Apartheid Planned City'. This concept briefly implies that each major town or city has distinct buffer zones whereby vast differences in demographics are observed. Areas known as 'Townships' distinctly identify a lower-income and less-developed residential settlement. This geographic phenomenon already provides a motivation as to why these areas typically exhibit lower average monthly spend and subsequently higher credit risk. The final system produced in this project confirms the geographic and spatial segregation through the use of location intelligence. The most important conclusion to be made is that, in South Africa, the urban geography guides and supports the results of the project, however, this project demonstrates that location intelligence has the potential to reveal hidden spatial correlations when the geography may not provide any indication of spatial correlation.

Visualisations and Results:

Many factors came into consideration when choosing the final platform to showcase the results and although Power BI was a more suitable choice from a business intelligence perspective, the relationship between Power BI and ArcGIS Online truly put the cherry on-top for this project. This relationship provided a mechanism to combine the business intelligence capabilities of Power BI, with the spatial analytics capabilities of ArcGIS Pro as well as the hosted feature-layer functionality of ArcGIS Online. The result, an intelligence solution that tells a balanced and well substantiated story from a risk perspective, a location perspective and a business perspective, all driven by a carefully engineered sample of data.



Spatial filtering and hover-over tool tips with additional information representing handset-make by popularity.

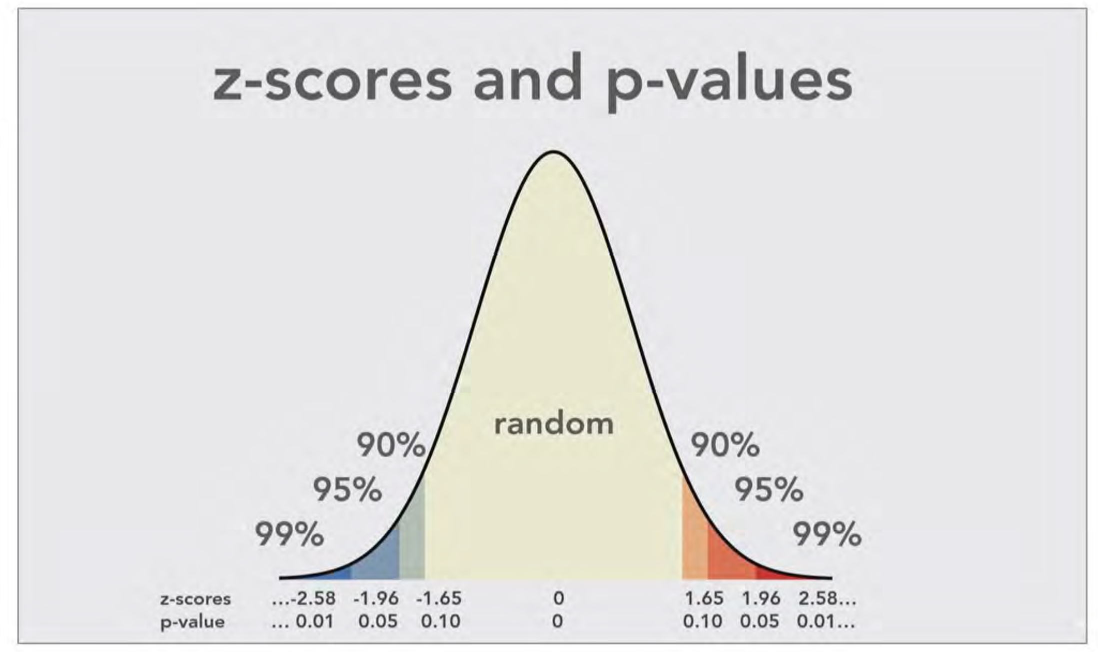


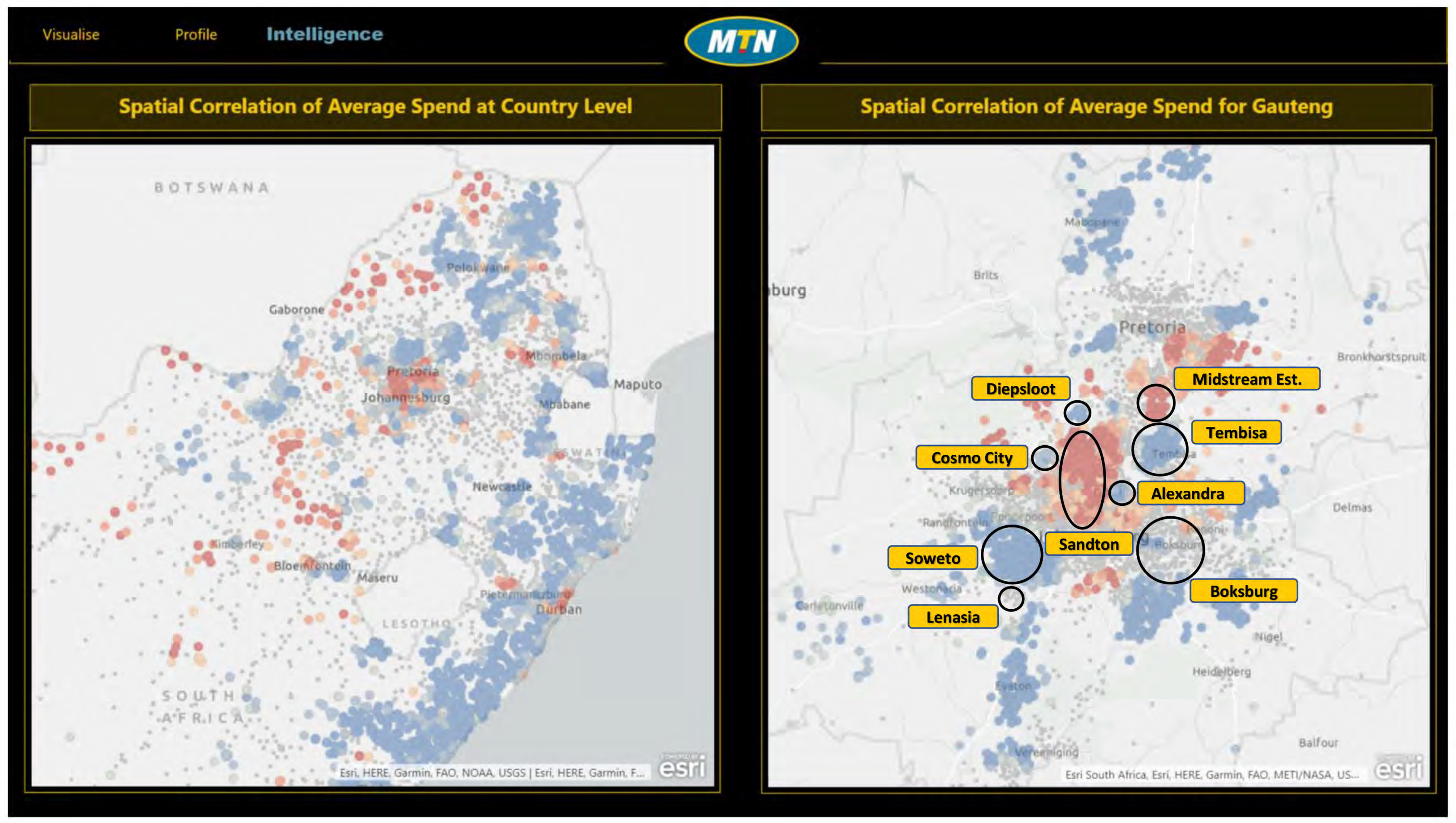
Demonstration of credit risk profiling, filtered by Age <= 25. As expected, low G-Score implies high risk.

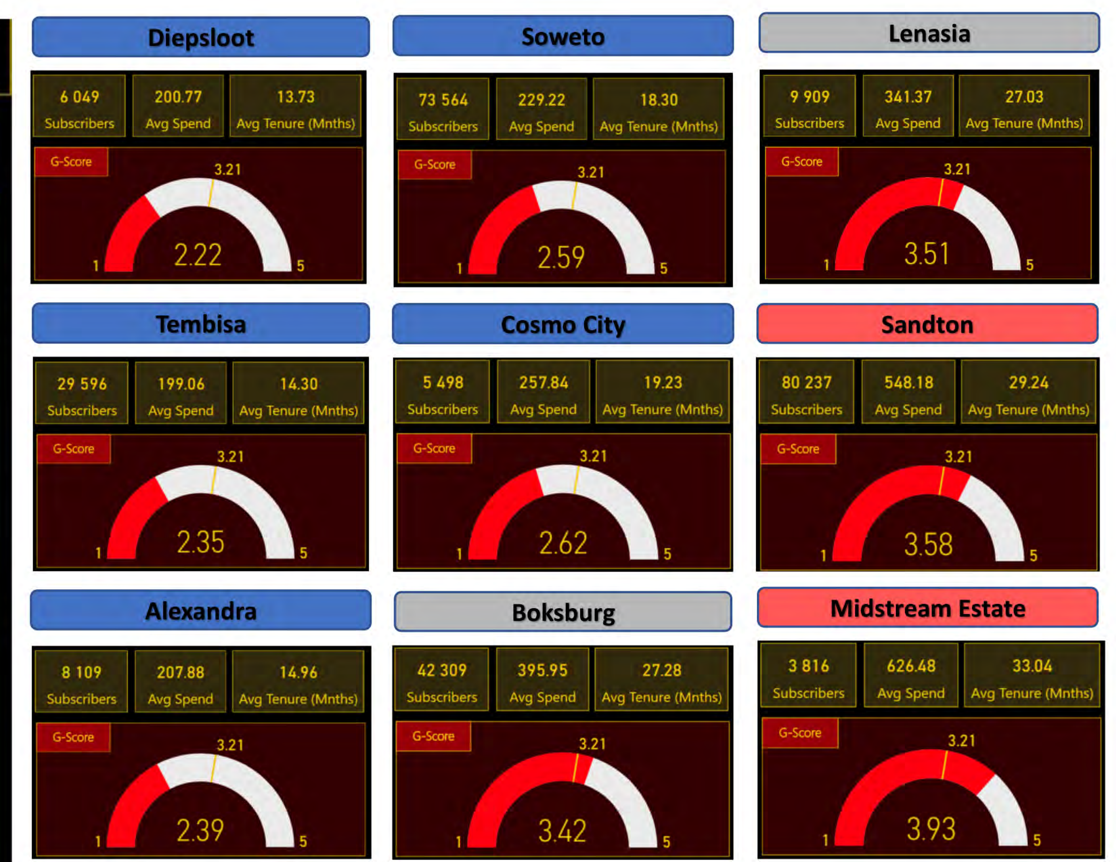
ArcGIS Pro Hot-spot Analysis hosted as a feature-layer through Power BI via ArcGIS Online

Location Intelligence:

As part of the literature study component of this project, an investigation into various methods of spatial correlation and autocorrelation was conducted. The Getis-Ord Gi* statistic and corresponding Hot-spot Analysis was identified as a suitable candidate to test for location intelligence within the data. The Hot-spot analysis was carried out on the features of latitude and longitude co-ordinates for the ± 12000 telecommunications network towers, scattered across South Africa that are owned by MTN SA. The variable of interest, average monthly spend aggregated by network tower, was chosen based on an assumed and visually identified correlation to quantitative credit risk (See risk gauges below). Therefore the assumption was made that if spatial correlation of average monthly spend exists as a result of the Hot-spot Analysis, then subsequently there exists a spatial correlation of quantitative credit risk. The distance band used in the analysis was based on a K-Nearest Neighbours approach since the position of the towers was not considered to be random and the density of towers related to the population density per region.







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ASSESSMENT OF THE GEOMORPHOLOGICAL DIVERSITY OF KOMATI GORGE, MPUMALANGA PROVINCE, SOUTH AFRICA

University of Venda
Creating Future Leaders

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INTRODUCTION

The emerging broad science of geodiversity defined in terms of geomorphological diversity (geomorphodiversity) assesses geomorphological features of a territory by comparing them in an extrinsic and intrinsic way. It is important to know where a landform is, why it is there, what it is made of and how it has changed.

Geomorphological studies are therefore designed to study landscapes and compare their present state to the past. This will determine and predict the future changes allowing geomorphologists a chance to come up with measures to protect, manage and restore the state of the environment. These studies investigate how and why landforms have changed and assess the geomorphological process rates and the role of human interventions in the changes. Geomorphological assessment studies further provide baseline data for soil scientists, landscape ecologists, river engineers, environmental analysts, land planners and land conservationists.

This poster shows the results of the geomordiversity assessment of Komati Gorge which led to the geomorphological landform inventory of the area by way of using Esri technology to analyse, assess and map geomorphological features of Komati Gorge.

METHOD

- Extract morphometric, morphographic, structural and morphogenetic characteristics data from the geological, hydrological and soil shapefiles from the CGS, DWAFF and IIAS online database respectively.
- Analyse geologic, hydrologic and soil data using SAGA GIS and Esri ArcGIS 10.2
- Download 30 m raster size SRTM DEM obtained from the NGI.
- Derive geomorphometric parameters (slope position, ruggedness, relative height, stream order, stream length ratio, bifurcation ratio, relief ratio, drainage density, stream frequency, form factor, circulatory ratio, elongation ratio and slope data) from the 30 m raster size SRTM DEM
- Computation of geomorphometric parameters from DEM using the spatial analyst extension deploying the TPI tool in ArcGIS 10.2.
- Georeference data to convert a description of the study area to a position on the earth's surface using GPS coordinates
- Point the study area on the topographical map using GPS tools in ArcMap and identify geomorphological features.
- Create a geomorphological landform inventory and profile them to create a geodatabase.
- Map the data on the seven factors (relative height, insolation, hydrography, geology, soils, ruggedness and slope position) from the G_mIS
- Normalise the seven factors to five classes by applying natural breaks classification method in spatial analyst tools (reclass) in ArcGIS 10.2 and later weight them before overlaying to create the final geomorphological map.

STUDY AREA

Komati Gorge is a river valley situated in the North Eastern part of South Africa. It is situated near the communities of Carolina and Machadodorp in the Mpumalanga Province.

The gorge is situated in the upper reaches of the 480 km long Komati River. It is situated at an altitude of 1,090 metres, at the line of latitude 25^0 S and line of longitude 30^0 E.

Komati Gorge is dominated by a wide sandstone krantzes, with exposures of the Kromberg formation and upper Hooggenoeg Formation of the onverwacht series. It also consists of a riparian zone, bluff habitat, thorn bushveld and highveld grassland.

Komati Gorge is under a sub-tropical and semi-arid climate with seasonal rainfall which occurs mainly in summer between October and March. The area has a cool dry winter period ranging from May to August. The mean annual rainfall is about 767 mm with large inter-seasonal variations of about 300 mm to 1200 mm.

The mean annual temperature is about 17 °C and maximum temperatures are experienced in January with an average of 21 °C.

RESEARCH QUESTIONS

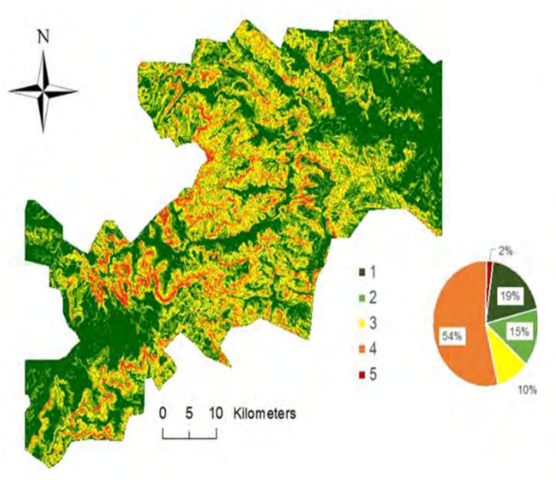
- What geomorphological features are found in Komati Gorge?
- What are the major morpho-characteristics of the geomorphological features?
- How are the geomorphological features of Komati Gorge distributed?

AIM AND OBJECTIVES

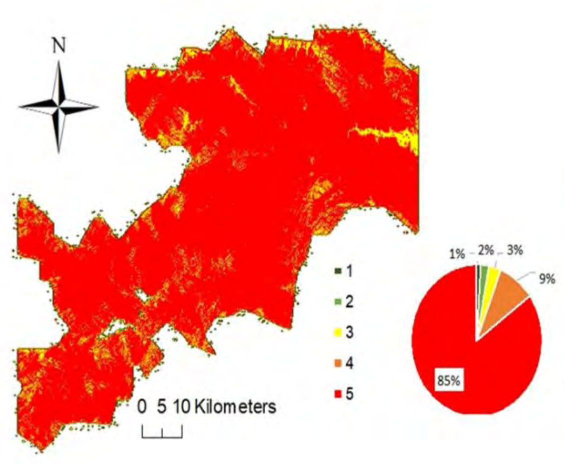
Aim: Assess the geomorphological diversity of the Komati Gorge located in Mpumalanga Province of South Africa.

- Identify and profile geomorphic features found in Komati Gorge
- Create a geo-database of geomorphic features of Komati Gorge
- Map the geomorphological features of Komati Gorge

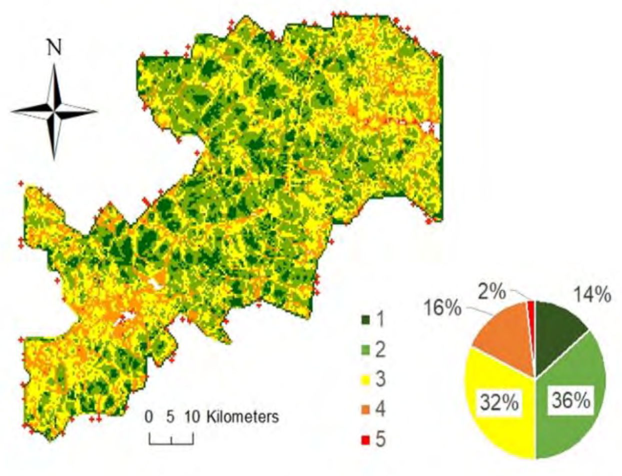
RESULTS AND DISCUSSION



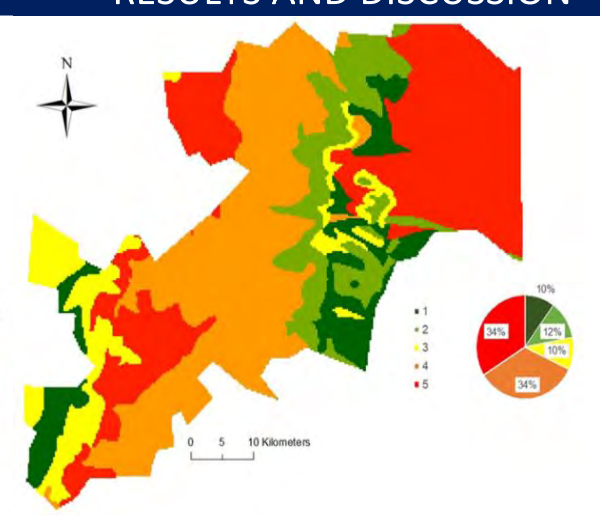
Relative height factor map



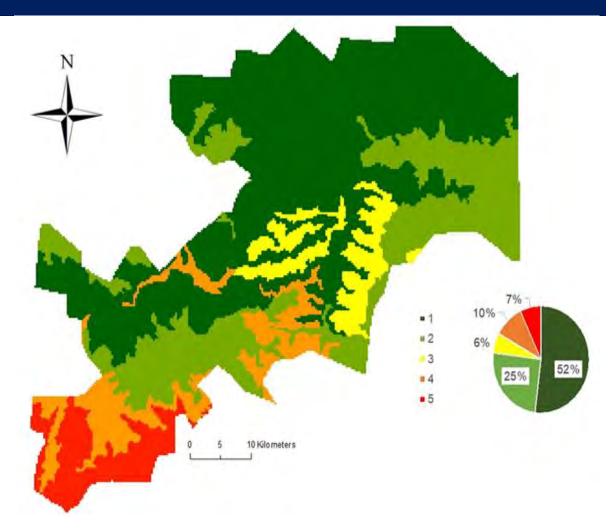
Insolation factor map



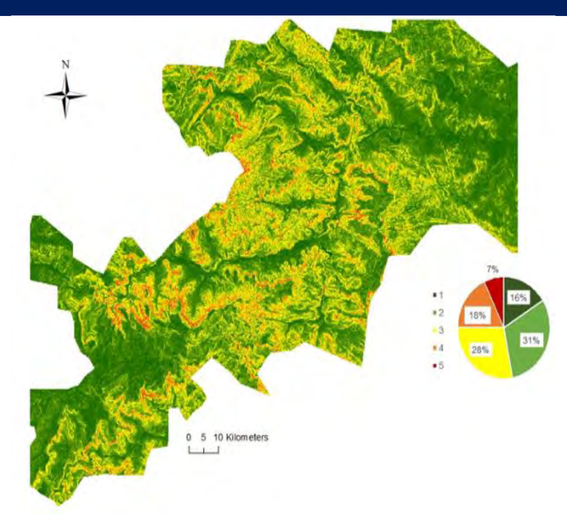
Hydrography factor map



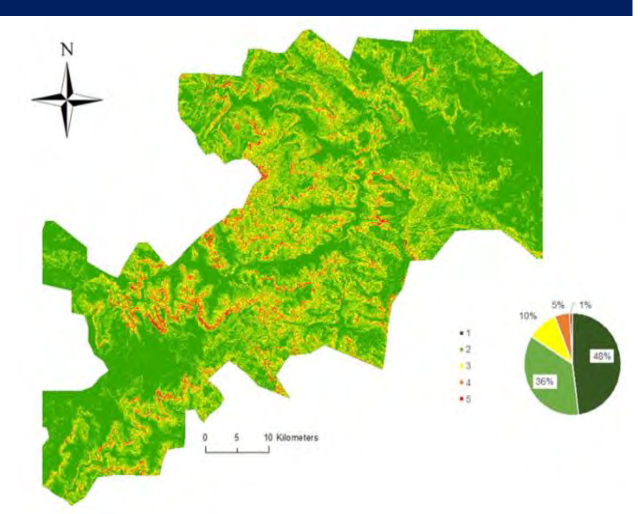
Geology factor map



Soil factor map

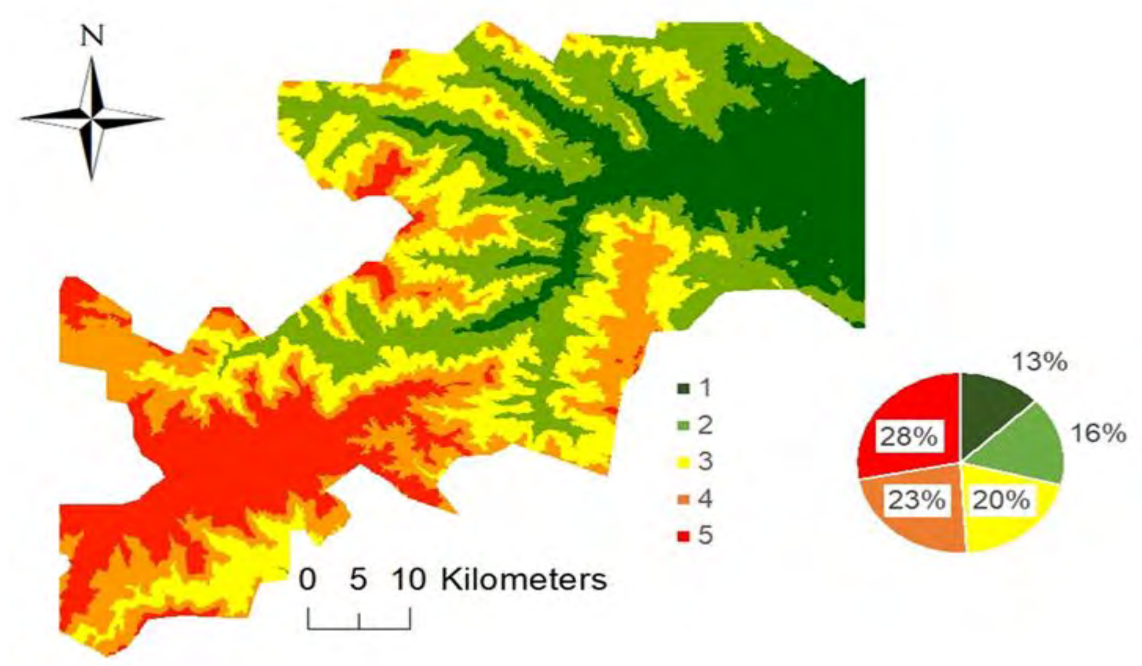


Ruggedness factor map



Slope position factor map

- The reclassified classes are presented in different colours, green represents very low geomorphodiversity, light green represents low geomorphodiversity, yellow represent medium geomorphodiversity, orange represent high geomorphodiversity and red represent very high geomorphodiversity.
- The maps reveal that the southwest parts of Komati Gorge have medium to very high geomorphological diversity.
- The northeast parts of Komati Gorge have low to medium geomorphological diversity. The suitable factors which led to this conclusion include relative heights, insolation, hydrography, geology, soil erodibility, ruggedness and slope position.
- The final geomorphological map shows that slope positions and relative height carry more weight. These have the most noticeable influence on the geomorphological diversity of Komati Gorge.
- Insolation, ruggedness, soil and geology carry the least weight and are observed as minor influencers of the geomorphological diversity of Komati Gorge.
- Slope is dominant across the entire area.
- Soils influence the edges of the south section. It was then concluded that Komati Gorge has significant geomorphological diversity. Very high and high geomorphological diversity occupy 51 % of Komati Gorge. Very low and low geomorphological diversity occupy less than 30 % of Komati Gorge.
- The final geomorphodiversity map showed that the edges of the area had very high geomorphodiversity, which was made up of 56 % of areas of high relative heights and 94 % of areas that receive abundant insolation. The inner parts however, showed very low geomorphodiversity.



Final geomorphological map

CONCLUSION

- Analysed factors used to assess the diversity of geomorphology of Komati Gorge led to a creation of the geodatabase of the area. The geodatabase revealed the prominent geomorphological features of the area.
- The landform inventory of the area was created and this revealed that Komati Gorge has high geomorphological diversity which makes it a significant landmark in South Africa.
- The variable with the strong influence on the geomorphology of the area was determined by mapping the data on the seven factors. This was proven to be the slope positions and the relative height.
- The overall detailed study of the geomorphological diversity of Komati Gorge has led to a much clearer understanding of the gorge.
- Expert and students in geography would recommend the use of Esri technology to assess the geomorphological diversity of an area in order to promote geoheritage and geo-education to local communities.

ABBREVIATIONS

Esri	Environmental System Research Institute
CGS	Council for Geoscience
DWAFF	Department of water Affairs, Forestry and Fisheries
IIAS	International Institute for Applied Systems Analysis online database
SAGA	System for Automated Geoscientific Analyses
ArcGIS	Aeronautical Reconnaissance Coverage Geographic Information System
SRTM	Shuttle Radar Topography Mission
DEM	Digital Elevation Model
NGI	National Geo-spatial Information
TPI	Topographic Position Index
GPS	Global Positioning System
G_mIS	Geomorphological Information System

LIFE IN AN INFORMAL SETTLEMENT OF SOUTH AFRICA: USING PARTICIPATORY GIS TO DEPICT DAILY STRUGGLES ON MAPS

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Introduction

- Informal Settlements are ever changing. They have a lack of infrastructure which results in those that live in these settlements to have compromised lives.
- Elements of daily struggles were identified and templates of the questions for the interview were derived using existing datasets such as Statistics South Africa Census and Gauteng City-Region Observatory Quality of Life.
- The elements of daily struggle focused on limited access to public transport, public services, health care and internet connectivity which all affect the livelihoods of the community members.
- Participatory GIS (PGIS) is a method that was used to collected information on these daily struggles.
- PGIS aims to use local knowledge to map an area and it places an emphasis on community involvement and empowerment.
- The use of PGIS allows for an open line of communication with the community in order to better understand their needs.

Aims and Objectives

AIM: Investigating how PGIS can be used to document, visualise and communicate daily struggles for in-situ upgrading in the informal settlement of Alaska.

- Design and conduct interviews about daily struggles and their spatial aspects in the informal settlement of Alaska.
- Perform analysis on the information collected and present interview responses in a way that is easy to map.
- Design data visualisations, namely a web map and a story map, that can be used in order to communicate with the community and other.
- Draw conclusions based on information collected. stakeholders

Study Area

- The informal settlement of Alaska is situated in Mamelodi, Pretoria East, South Africa which is approximate 30km from Pretoria CBD.
- Alaska is characterised by small make-shift dwellings as well as dirt roads and it separated from the rest of Mamelodi by a tarred main road.
- According to the Gauteng City-Region Observatory Quality of Life 2015 survey, ward 10 (Alaska is located in) only has 54-59% of the community members that are satisfied with the quality of their lives.
- The 2011 Statistics South Africa Census provides insight on access to resources such as 30% of community members using a communal tap within 200m of their dwelling as well as the 20% who use taps and other piped water in their yards.

Method

1. Design questionnaire centred around daily struggles in informal settlements deriving important elements from both the Gauteng City-Region Observatory Quality of Life 2015 survey and the 2011 Statistics South Africa Census.
2. Conduct fifteen-minute interviews with 12 participants from Alaska informal settlement about their daily struggles. Each question is to prompt a spatial answer then the response is indicated on an A3 aerial image.
3. Analyse information that has been collected and digitise it.
4. Create a storyline which will be used as an outline for the story map.
5. Create web map (Using ArcGIS Online Web Appbuilder), which is focused at the community itself and a story map (Using ArcGIS StoryMap), geared to stakeholders, who could potentially invest in the settlement.

Figure 1: Dwellings in the informal settlement of Alaska

Figure 2: Main road linking Alaska to Mamelodi

Results and Discussion

- Main elements of daily struggles have been identified and analysed so that visualisations can be created
- Two visualisations were created, a web map created in ArcGIS Online using Web Appbuilder and a story map in ArcGIS StoryMaps.
- The web map is a visualisation of the information that was collected from the individual interviews. This was created for community leaders when they need to communicate with local government and other stakeholders such as non-government organisations (NGOs).
- The story map provided a more emotional narrative of the daily struggles in order to communicate with NGOs, local government and other stakeholders.
- Story maps would be useful in getting the attention of non-experts in hope to motivate why the informal settlement needs upgrading

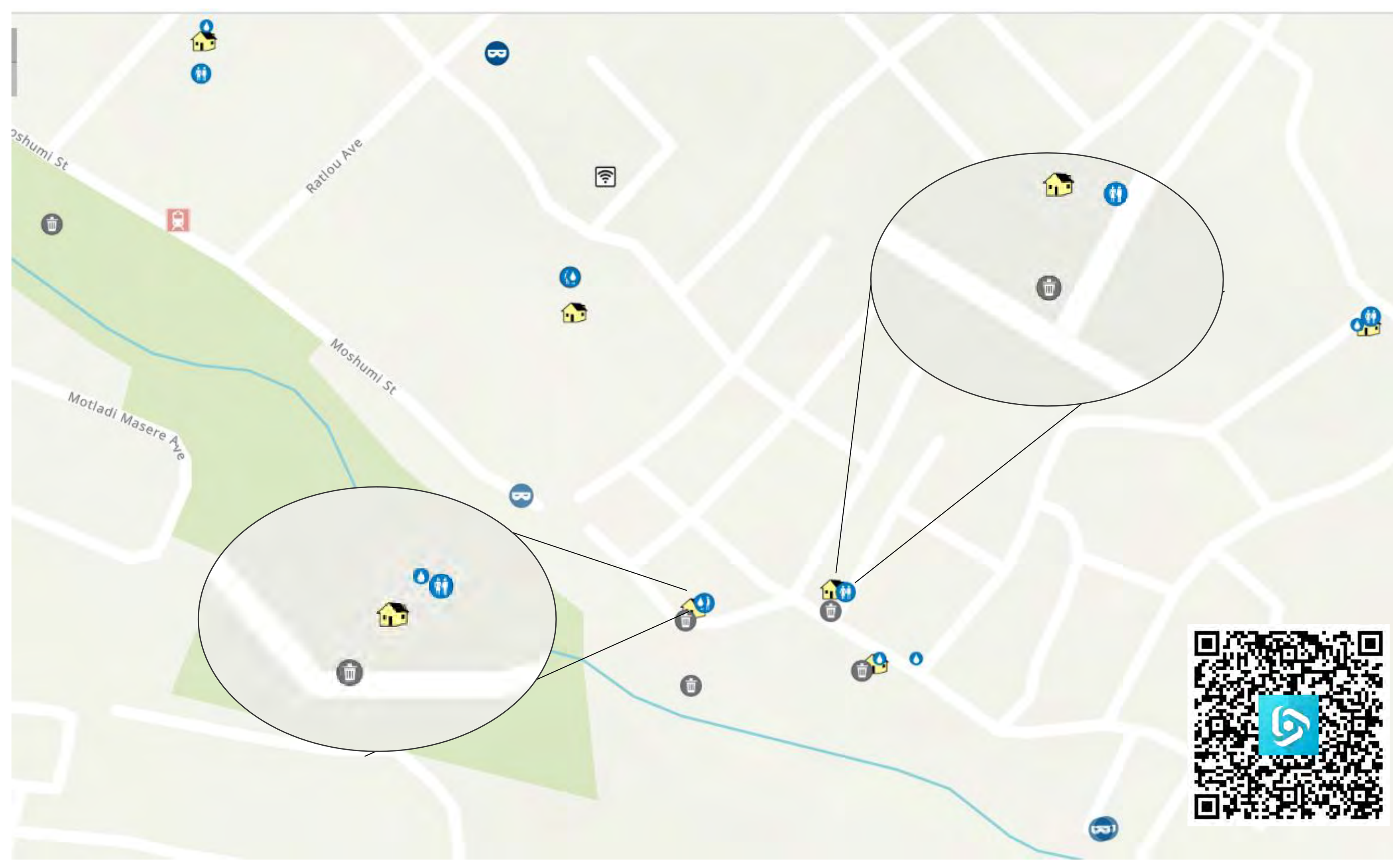

Figure 3: Web map of the information collected showing the elements of daily struggle

Figure 4: Snippet from Story Map of a community collecting water from a communal tap

Conclusion

- Results from the investigation into daily activities and struggles in informal settlements reveal information which is previously unknown to local governments, NGOs and other stakeholders.
- This is particularly important in South Africa's context as qualitative information such as the one produced is not included in national and local socio-demographic datasets such as Statistics South Africa Census.

esri South Africa