



Cape Peninsula
University of Technology

GIS TIME SERIES MAPPING OF A FORMER SOUTH AFRICAN HOMELAND

By

**SALIH MOHAMED SIDAHMED ALI
214319954**

Thesis submitted in fulfilment of the requirements for the degree

Master of Technology in Cartography

In the Faculty of Engineering

At the Cape Peninsula University of Technology

Supervisor: Mr. S. Motala

Co-supervisor: Prof. R. Fox

Bellville 2016

CPUT copyright information

The dissertation/thesis may not be published either in part (in scholarly, scientific or technical journals), or as a whole (as a monograph), unless permission has been obtained from the University

Declaration

I, Salih Mohamed Sidahmed Ali, declare that the contents of this dissertation/thesis represent my own unaided work, and that the dissertation/thesis has not previously been submitted for academic examination towards any qualification. Furthermore, it represents my own opinions and not necessarily those of the Cape Peninsula University of Technology.

Signed

Date

Abstract

This case study investigates the change in the geographical boundaries by creating a Spatio-temporal mapping of Ciskei (one of the so-called Bantustans or Homelands) during the period of Apartheid. It examines the reasons for its establishment, and what impact the apartheid land legislation had on the geographical boundaries of Ciskei. GIS technology was used in this study to create time series animation and Static map to display the spatial change of the Ciskei boundaries. This investigation was split into quantitative and qualitative assessments. The aim of the quantitative assessments was to determine the amount of the spatial change of the Ciskei geographic boundary. The qualitative methods was used to investigate the map viewer's understanding of the amount of the information in the static and animated maps. The results of qualitative assessments showed that static and animated maps have their respective advantages in the visualization of the map viewer. The importance of this research is to take advantage of time series mapping techniques to study the homeland areas in South Africa and see all the changes that have occurred as a result of a period of apartheid legislation. For this research, the following data were gathered: Attribute and metadata was the legislation and laws related to the land and the geographic data was the historical maps and coordinate data.

Acknowledgments

Foremost, I would like to express my sincere gratitude to my advisor Mr. S. Motala for the continuous support of my MTech research, for his patience, motivation, enthusiasm, and immense knowledge. His guidance helped me in all the time of research and writing of this thesis. I could not have imagined having a better advisor and mentor for my study.

I would like to acknowledge the Department of Rural Development and Land Reform, Chief Directorate: National Geospatial information specially Mr. Aslam Parker for providing the necessary access to their library and historical data.

Also I would like to thank the library staff in CPUT Bellville campus for their help and providing the references and journal articles from other institutions through Interlibrary Loan Request. Specially Engineering section and post graduate section.

The financial assistance of the University Research Foundation towards this research is acknowledged. Opinions expressed in this thesis and the conclusions arrived at, are those of the author, and are not necessarily to be attributed to the University Research Foundation.

Table of Contents

Declaration.....	i
Abstract.....	ii
Acknowledgments.....	iii
Table of Contents.....	iv
List of Figuers.....	viii
List of Tables.....	x
List of Acronyms.....	xi
Chapter 1: Introduction of the study.....	1
1.1 Introduction.....	1
1.2 Background and Motivation.....	2
1.3 Problem statement.....	2
1.4 Research Questions.....	3
1.5 Significance.....	3
1.6 Limitations.....	4
1.7 Methodology.....	4
1.7.1 Stage one (Data collection):.....	4
1.7.2 Stage two data (Geoprocessing):.....	5
1.7.3 Stage three (Quantitative Assessments):.....	6
1.7.4 Stage Four (Qualitative Assessments):.....	6
1.7.5 Stage Five (Results):.....	7
1.8 Objectives and Outcomes.....	8
Chapter 2: Literature review.....	9
2.1 Introduction.....	9
2.2 Time series animation.....	9
2.2.1 Types of animation.....	9

2.2.2	Time Series Animation Techniques	10
2.3	Time series mapping	10
2.3.1	Animated Maps.....	11
2.3.2	Static Maps.....	13
2.4	Spatio-temporal and time series mapping	14
2.4.1	The significance of spatio-temporal mapping	15
2.4.2	Types of spatio-temporal data	16
2.4.3	Time as a dimension.....	18
2.4.4	Spatio-temporal and animated mapping	19
2.4.5	Representation of spatio-temporal change in static maps.....	20
2.5	Mapping of historical data	20
2.5.1	Background and History of South Africa	22
2.5.2	The Native Land Act 27 of 1913	22
2.5.3	South African Homelands	23
2.5.4	Land Acts	25
2.5.5	Ciskei History.....	28
Chapter 3: Research design and methodology.....		31
3.1	Introduction	31
3.2	Research Resources.....	33
3.3	Data preparation	33
3.3.1	Data Sources.....	33
3.3.2	Data Cleaning Methods	37
3.3.3	Problems Encountered	43
3.4	Geo-processing.....	45
3.4.1	Georeferencing.....	46
3.4.2	Digitizing.....	49
3.4.3	Adding attribute data.....	54

3.4.4	Merge	55
3.5	Time Series animation and Static map	55
3.5.1	Static Map	56
3.5.2	Time slider and animated maps.....	56
3.6	Participants	59
3.6.1	Geospatial industry participants.....	60
3.6.2	Non-geospatial participants	60
3.7	Interviews.....	60
3.8	Questionnaire.....	62
Chapter 4:	Results and Analysis.....	65
4.1	Introduction	65
4.2	Spatial change of Ciskei.....	66
4.3	Animated and Static map results.....	70
4.3.1	“Where” Questions	70
4.3.2	“When” Questions.....	71
4.3.3	“What” Questions.....	72
4.3.4	“Spatial change” Questions.....	74
4.4	Participants: Geospatial and non-geospatial results.....	75
4.5	Individuals familiar with the change and history of Ciskei	78
4.6	Interview Results.....	79
4.6.1	Needs for Historical research of the Homelands	79
4.6.2	Land reform and infrastructural development.....	82
4.6.3	Land Restitution Support	84
4.6.4	The advantages of Static and animated maps	84
4.7	Conclusion	85
Chapter 5:	Conclusion and Recommendations.....	87
5.1	Introduction	87

5.2	Conclusion on the Study	87
5.3	Recommendations for future work.....	88
	References.....	89
	Appendices	98
	Appendix A: The Native Land Act No. 27 of 1913	99
	Appendix B: Questionnaire.....	117
	Appendix C: Key Map of the Union of SA to Accompany Report of Natives Land Commission 1916.	120
	Appendix D: The Development Atlas, printed by Government Printer 1966.....	122
	Appendix E: Static maps	124
	Appendix F: Ciskei time series animation (animated map). https://www.youtube.com/watch?v=OLX_XIZ1wKA	126

List of Figures

Figure 1. 1 Flowchart outline the methodology stages.....	7
Figure 2.1 The snapshot approach for representing spatio-temporal data (Peuquet and Duan 1995)	14
Figure 2.2 Facets within the space time cube and its relevant domains (Hogeweg, 2009)	15
Figure 2.3 Linked spatio-temporal representations and time series (University of Texas at Austin CRWR, 2006)	17
Figure 2.4 The question triad as reproduced from Peuquet (1994).....	18
Figure 2.5 The Homelands (scheduled areas) and the white South Africa as it was in 1916. (Digitized from the key map of the Union of South Africa to accompany of the report of the Native Land Commission 1913).....	25
Figure 2.6 Map showing the location of Ciskei and all other Homelands in 1994.....	30
Figure 3.1 Research design flowchart	32
Figure 3.2 Key Map of the Union of SA to Accompany Report of Natives Land Commission 1916	39
Figure 3.3 Ciskei territories 1936. Digitized from Bergh & Visagie, (1985, p. 24)	40
Figure 3.4 Ciskei boundaries in 1980: Digitized from Bergh & Visagie, (1985, p. 25)....	43
Figure 3.5 Consolidation Plans and Development Atlas Map 1975.....	44
Figure 3.6: the steps used to produce a shapefile from hardcopy maps	46
Figure 3. 7: Illustration of the Georeferencing process	47
Figure 3.8 Control points used for geometric transformations in 1913 Ciskei map.....	48
Figure 3. 9: The shapefiles creation process	50
Figure 3. 10: Inconsistencies between 1913 map and report.....	50
Figure 3.11: The 1936 polygon layer digitized from (Bergh and Visagie, 1985, p. 24) ...	52
Figure 3. 12 Attribute table of the 1936 shapefile layer in ArcGIS.....	55
Figure 3. 13: Time Slider tools ArcGIS 10 (Environmental Systems Research Institute, 2014).....	57
Figure 3. 14 The spatial change of Ciskei between 1966 -1975	58
Figure 4. 1 Time series map of Ciskei between 1913 and 1994	65
Figure 4. 2 Change of the Perimeter between 1913 and 1994.....	66
Figure 4. 3 Change of the Area between 1913 and 1994	66
Figure 4. 4 The consolidation plans 1973-1976.....	68

Figure 4. 5 The populated area in Eastern Cape (2011) with the Ciskei boundary in 1994.....	69
Figure 4. 6 Results of SM and AM Question 3.....	70
Figure 4. 7 Results of SM and AM Question 4.....	71
Figure 4. 8 Results of SM and AM Question 5.....	72
Figure 4. 9 Results of SM and AM Question 6.....	72
Figure 4. 10 Results of SM and AM Question 7.....	73
Figure 4. 11 Results of SM and AM Question 8.....	73
Figure 4. 12 Results of SM and AM Question 9.....	74
Figure 4. 13 Results of SM and AM Question 10.....	74
Figure 4. 14 Results the geospatial industry and the non-geospatial industry. Question 3	75
Figure 4. 15 Results of the geospatial industry and the non-geospatial industry. Question 4.....	76
Figure 4. 16 Results of the geospatial industry and the non-geospatial industry. Question 5.....	76
Figure 4. 17 Results of the geospatial industry and the non-geospatial industry. Question 6.....	77
Figure 4. 18 Results of the geospatial industry and the non-geospatial industry. Question 7.....	77
Figure 4. 19 Results of the geospatial industry and the non-geospatial industry. Question 8.....	77
Figure 4. 20 Results of the geospatial industry and the non-geospatial industry. Question 9.....	78
Figure 4. 21 Results of the geospatial industry and the non-geospatial industry. Question 10.....	78
Figure 4. 22 the 1913 map showing the areas between Ciskei and Kei River.....	81

List of Tables

Table 2.1 Descriptions of the facets in the space time cube and its relevance to spatio-temporal	16
Table 3.1 Attributes captured for the polygon shapefile representing the reason for each filed.	36
Table 3. 2 The differences in Y and X co-ordinates of town points.....	49
Table 3. 3 A breakdown of the number of participants.....	60
Table 4.1 The results of Question 1 and Question 2.....	79
Table 4.2 Distribution of total area of South Africa (Statistics South Africa, 2009)	80
Table 4. 3: Target areas identified by WOP (National Development Agency, 2008)	83
Table 4. 4 Overall correct results of animated and Static map in relation to the triad assembly of questions and spatial change	86

List of Acronyms

AM	Animated Map
ArcGIS	A geographic information system (GIS) for working with maps and geographic information
CD: Land Restitution	Chief Director: Land Restitution Support
CD: NGI	Chief Director: National Geospatial Information
CPUT	Cape Peninsula University of Technology
ESRI	Environmental Systems Research Institute
GCS	Geographic Coordinate System
GIS	Geographical Information System
GNU	A complete free operating software system
NGI	National Geo- Spatial Information
OCR	Optical Character Recognition
OS Geo	Open Source Geospatial Foundation
QGIS	Quantum Geographical Information System
RDBMS	Relational database management system
RSA	Republic of South Africa
SA	South Africa
SADT	South African Development Trust
SAHO	South African History Online
SGO	Surveyor-General Office
SM	Static map
WGS	World Geodetic System

Chapter 1: Introduction of the study

1.1 Introduction

The Ciskei Homeland was located in what is now the Eastern Cape Province. Ciskei was created as a reserve for the South African Xhosa-speaking people as part of apartheid racial segregation in 1913. Despite Government rhetoric that this would encourage cultural protection and separate development of its people, the Ciskei along with other Homelands served to provide white South Africans with cheap, controlled labour (South African History Online, 2011). Even though Ciskei does not exist today, its legacy can be seen in the pattern of the current populated areas. A calculation of the population density using the 2011 census data shows that the towns that were in Ciskei have higher population densities than the towns that were not part of the Homeland in the Eastern Cape Province (see Chapter 4).

The spatial change in geographic boundaries that occurred in Ciskei Homeland over the years from 1913 to 1994 has been significant. For this reason, it has been selected as a case study for time series mapping using Geographical Information Systems (GIS) technology. According to the Chief Director: National Geospatial Information [CD: NGI] (2015): The majority of South Africans understand the history of Ciskei but are not fully aware of the extent of boundary changes that have occurred over time. This is where the need for time series mapping may be applied in order to simplify the understanding of the spatial change of the Ciskei boundaries.

The historical research of early maps has been an advantaged domain of research for historians, but not so much for cartography specialists. Consequently, the historical map has been considered for a long time as a library document of territories and cities in different historical periods. As a result of the development of mapping and graphic design technologies, historical maps are no longer considered as static graphic documents offering the grounds for historic, sociological or literary studies. The historical maps become an important source of spatial information, containing important geographic information related to geometry generally, and to geometry-related objects in particular. Modern technologies offer new thinking for the study of early cartography and maps. This opens new possibilities in cartographic heritage. (Balletti, 2006)

1.2 Background and Motivation

The Department of Rural Development and Land Reform (DRDLR) has identified the need for research on the effects of apartheid legislation that directly affected the creation of boundaries that separated the different racial groups during apartheid rule. The DRDLR prioritizes its district municipalities, so a good understanding of the Ciskei boundary will be important to understand which district municipality or part there needs to be focused on for service prioritization (CD:NGI, 2015).

In particular, the spatial origination and effects of the Native Lands Act¹ of 1913 (subsequently renamed Bantu Land Act, 1913 and Black Land Act of 1913, Act No. 27 of 1913) needed to be carried out. The need to conduct the historical research for land restitution purposes is very important. According to the Chief Director of Land Restitution (CD: LR) Support (2015), most of the land claim requests occurred after 1913. Secondly, many of the claims are related to where the people came from, and did not indicate the places that they had moved to (Homelands). Historical research needs to be done on the displaced areas as well as the Homelands.

This project was ideally suited for Geographic Information Systems (GIS) because of the large spatial component inherent in the data. It also provided a good opportunity to investigate whether animated or static maps are better at displaying change over time.

1.3 Problem statement

The effect of the Native Land Act No. 27 of 1913 on the change of the Ciskei boundary needed to be investigated. This act had a deep effect on the black population across the country. Moreover it laid the foundation for other legislation, which further rooted dispossession of black peoples. These acts and legislations shaped the land policies in South Africa (Christopher, 1994). For town planning purposes, the Surveyor-General in the Eastern Cape expressed the need to determine which areas of the Eastern Cape formerly had been part of the Homelands (Williams- Wynn, 2015). The spatial change of the boundary of Ciskei needed to be investigated.

¹ The Act is sometimes referred to as 'Native Land Act', or 'Natives Land Act' or 'Native Lands Act' in different documents. This thesis will use the term 'Native Lands Act' for consistency. However, if an alternative name is used in specific legislation that is being discussed, that name will be used as it appears in the legislation.

A time series mapping of Ciskei was produced in the form of a static map and an animated map. It is unclear which of the maps – animated or static – are better at displaying change over time.

1.4 Research Questions

1. What was the Ciskei, and how were the geographical boundaries of Ciskei influenced by the apartheid land legislation?
2. How can GIS techniques and time series mapping be used to create an animation of the development of the South African Homelands?
3. How can an animation be produced that shows the changing boundaries of the Homelands (especially Ciskei) together with the legislation that created them?
4. What conclusions and connections can be made about the current South African society as a result of the spatio-temporal mapping of the Homelands?
5. Are animated maps better than Static map in terms of detecting changes and displaying the time series maps?
6. What are the potential uses and benefits of a spatio-temporal mapping of the Ciskei?

1.5 Significance

Currently, an adequate spatial documentation and understanding of the implementation of the Native Lands Act does not exist. Much evidence exists across many different sources, and a coherent mapping of the implementation of the act, together with its effects, needs to be done. The Department of Rural Development and Land Reform has requested higher education institutions offering GIS to carry out this analysis. The importance of this work is that it is the first study to illustrate the change of the geographical boundaries of Ciskei, by using a time series animation within a GIS. Coupled with this, there has been much progress in the field of spatio-temporal mapping, which is at the forefront of GIS research. This project represented a good opportunity to link these two areas.

1.6 Limitations

The time-frame of the area being investigated was limited to the period between 1913 and 1994. The geographic boundaries under investigation were limited to those of the Ciskei.

1.7 Methodology

As a test case, the development of all the former SA Homelands was mapped by QGIS time manager, and imported into professional movie-making software. This was to establish the methodology of the Ciskei mapping.

This project was conducted in numerous stages in order to answer the research questions. For the analysis, quantitative as well as qualitative data analysis techniques were used. The time series mapping of Ciskei was presented in the form of a static map, as well as an animated map. Various participants took part in the study and were given an opportunity to view the mapping, before completing the questionnaire. Some the participant were interviewed. The reason for the questionnaire was to investigate and compare map-readers' cognition at detecting change between static map and animated maps.

1.7.1 Stage one (Data collection):

In this very important stage, a large amount of data had to be collected for the study. South African base data was collected from the appropriate government departments, such as National Geo-Spatial Information (NGI), the offices of various provincial Surveyors-General, and Stats. The author travelled to the Office of the Surveyor-General in the Eastern Cape to obtain maps of the so-called "Native Reserves" from the time of their proclamation, and collected information from various respondents who viewed the final mapping. To import the spatial data into GIS format, the methodology of Thorne, et al. (2008) was used. This included image registration, polygon creation and attribute creation. The base maps that were used came from a variety of sources, e.g. Christopher (1994) has maps of the Homelands for the following years: 1955, 1960, 1973, 1975, 1978, 1985, 1990 and 1994. Maps from other years were obtained from NGI, together with other historical documents. Interviews were conducted at the Surveyor-General in East London to obtain a more detailed understanding of the historical mapping of the Ciskei.

The relevant legislation that played a role in the formation of the Homelands was obtained mainly from the Government Gazettes that were published at the time. The Gazettes contained the proclamations that affected the boundaries of the Homelands. To obtain the benefits of the time series mapping of Ciskei, interviews and questionnaire data were collected from government agencies who would benefit from this research, such as the Chief Directorate: National Geospatial Information (NGI), the Surveyor-General's Office (East London) and the Chief Directorate: Land Restitution Support. The process of the interview and how the participants were chosen was described in the Research Design and Methodology chapter (see sections 3.6, 3.7 and 3.8).

1.7.2 Stage two data (Geoprocessing):

The Time Manager Plugin is a QGIS tool that allows the researcher to create and visualise a time series mapping. Using the plugin, vector features were imported and an animation was created based on a created time attribute. Time Manager allows the researcher to create animations directly in a map window and export an image series (QGIS, 2014).

All the data were converted into GIS format, in order to be manipulated using GIS software (ArcGIS and QGIS). There were two types of data that needed to be converted:

1. Geographic data (the historical maps) to be converted to shapefiles.
2. Attribute data (land legislation) to be converted to metadata or attribute tables.

This stage was accomplished in three steps, based on an adaptation of the methodology of Thorne, et al. (2008).

1. Geo-referencing: To remove the locational and scale errors by aligning the raster using control points. The georeferencing process includes identifying a set of ground control points with known X, Y coordinates that connect locations on the raster dataset (source data) with locations in the georeferenced dataset (target data).
2. Digitizing: this process defined as a process of converting the scanned historical maps from raster format to vector format (shapefiles).
3. Creating tables (attribute data): The process of adding information to the attribute data of the vector maps, such as the names of the Homelands, date, legislations and other attribute data.

1.7.3 Stage three (Quantitative Assessments):

A time series mapping of the Ciskei was produced, showing the formation of the Homeland over time. The time series mapping was related to the underlying legislation, by adding the relevant legislation name in the attribute table on the map view. The changing area of Ciskei was calculated and presented as graphs and maps. The towns, cities and other human settlements that fall within the boundary of Ciskei were shown.

An animated time series mapping was produced by importing the animation into Camtasia Studio to produce a video file. The animation showed the appropriate legislation that affected the changing boundaries. Other important apartheid legislation and events were also shown to contextualise the animation within the history of South Africa. The process of creating the Static map and animated maps was described in the methodology chapter.

1.7.4 Stage Four (Qualitative Assessments):

Interviews² were conducted with employees of the government departments that would stand to benefit from this research. The first interview was conducted with a staff member of the Chief Directorate: National Geospatial Information (CD: NGI) at their office in Mowbray, Cape Town. NGI is the national mapping agency of South Africa, and is part of the Department of Rural Development and Land Reform. The staff member who was interviewed was a director in the CD: NGI office.

The second interview was made with the Surveyor-General, Eastern Cape, located in East London. The seven regional Surveyor-General offices report directly to the Chief Surveyor-General, whose mission is “to provide a national cadastral survey management system in support of an equitable and sustainable land dispensation that promotes social-economic development” (Chief Surveyor General, 2015)

During the same meeting, a questionnaire was given to some members of the Surveyor General’s Office (SGO) staff after they were given an opportunity to view the Static and animated mapping.

The third interview was recommended by staff from CD: NGI and SGO in East London. They recommended an interview with the Chief Director: Land Restitution Support in the Western Cape. It is a government agency responsible for the settlement of land restitution claims under the Restitution of Land Rights Act No 22 of 1994, as amended,

² Informed consent to use the interview transcriptions were obtained from all interviewees

and to provide settlement support to restitution beneficiaries (Surveyor General's Office- East London, 2015). The interview was conducted with the Chief Director: Land Restitution Support. The interview process and the questionnaire were described in section 3.7.

1.7.5 Stage Five (Results):

The last stage in this research was to deduce conclusions and to provide recommendations that were made, based on the research analysis.

An animation showing the yearly change in the boundaries of Ciskei was created in ArcGIS.

Static and animated time series mapping were produced by importing the GIS Time Series animation into Camtasia Studio to produce a movie file. The animation shows the appropriate legislation as the boundaries changed. A comparison of results of the animated and static map participant answers, was presented. These results were analysed to deduce which map display is better in its respective facets.

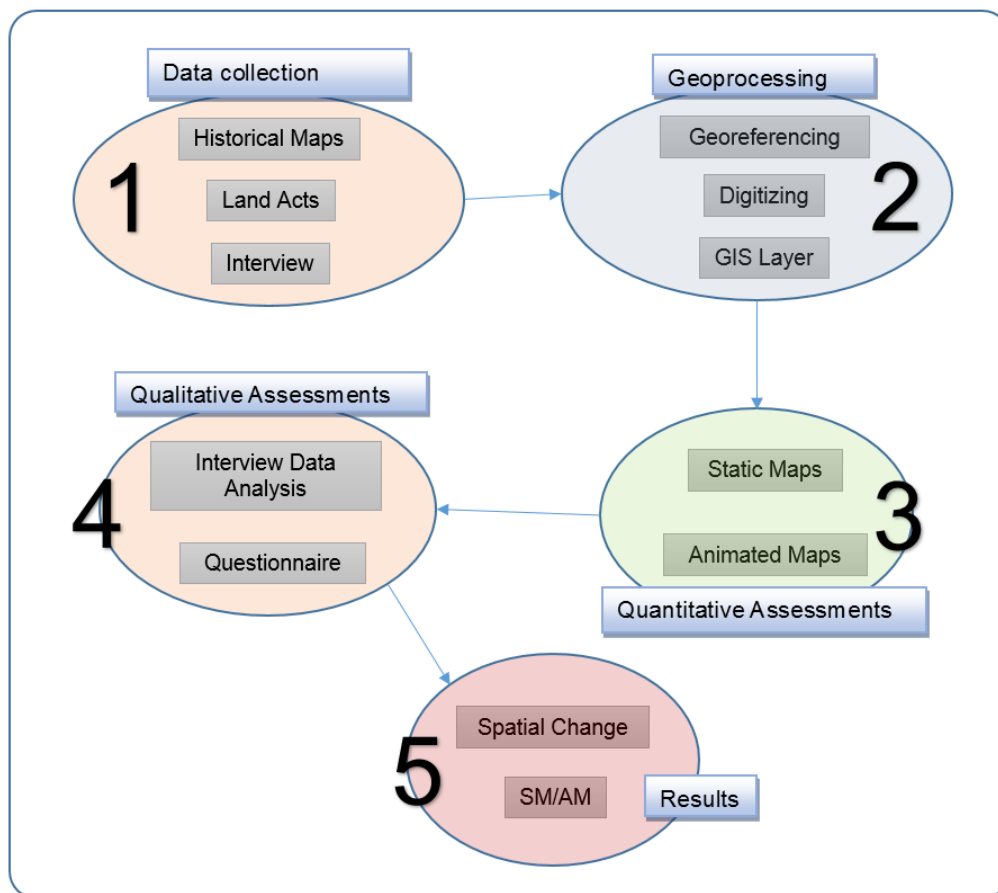


Figure 1. 1 Flowchart outline the methodology stages

1.8 Objectives

Research was conducted on the effects of the Natives Land Act of 1913 and subsequent legislation on the Ciskei boundaries. This research had specifically been requested by the Department of Rural Development and Land Reform, which expressed the need for a better understanding of the development of the Ciskei over time. The Department's assistance and guidance was sought throughout the course of the project. This research collaboration between Cape Peninsula University of Technology CPUT and national government will benefit society in general, but South African society in particular, as it will shed new light on the effects of apartheid planning and policies.

In addition to creating time series maps of the Ciskei, the second aim of this work was to investigate the difference in change detection of participants who viewed the animated and static map. In order to achieve this, the following objectives were met:

- 1) Determine the amount of change and information that is perceived by map users in static and animated maps.
- 2) Examine to what extent map readers have difficulty in detecting change in animated and static map.
- 3) Ascertain the usefulness of such an exercise in spatio-temporal mapping. In this regard, interview data was gathered from various stakeholders to find out the value of the animated and static mapping of the Ciskei, and how it could be put to use going forward. It can be seen that in order to meet the objectives, a combination of qualitative and quantitative enquiry was necessary.

Chapter 2: Literature review

2.1 Introduction

This chapter provides a summary of previous research that was relevant to this particular study. It gives an understanding of mapping of historical data and the various aspects of the time series animation.

Section 2.5 provides a background and history of South Africa, the Native Land Act No 27 of 1913, the South African Homeland history and the history of Ciskei. This was to address research question (1) in Section 1.4.

2.2 Time series animation

According to Hansen & Henning (2001) time series animation is a visually natural way to display change over time and urban growth. They generated an animation of land use change for the Baltimore Washington region by showing a series of images one after the other in sequential order. Different issues which will affect the quality of animation should be considered before creating the animation. These issues include: the number of original data frames to use, the optimal animation display speed and the number of intermediate frames. "Animation is the process of stringing together a series of static images in a timed order to present sensible uninterrupted movement" (Turdukulov & Kraak, 2007)

2.2.1 Types of animation

Dorling (1992) mentioned three types of animations (1) animating space or panning and zooming around two-dimensional static images; (2) animating time or time series animation of two-dimensional images; and (3) three-dimensional animation or using animation to investigate three-dimensional structures. In time series animations, each image represents one moment in time. In Dorling's other animation categories, each image represents a different viewpoint.

2.2.2 Time Series Animation Techniques

Peterson (1995) produced frame-based animations by showing a series of images and frames one after the other in temporal order. To create a frame-based animation, firstly create a set of images or frames, and then display the frames sequentially on a computer screen or by means of a video recorder. The effort involved in producing an animation will differ, depending on the method used to create the frames for the animation sequence. The easiest animation to generate is one that simply displays the original cartographic data sequentially. In the Ciskei animation case, the spacing of real time was irregular because the time interval differs between the mapped data layers. To produce a better animation the original input data and a number of frames were duplicated to ensure that real time is mapped constantly to display time.

2.3 Time series mapping

Animations and videos are normally designed to present information that includes change over time, in such a way as to aid understanding and facilitate learning. However, in many studies static map displays have been found to be equally beneficial and sometimes better (Arguel & Jamet, 2009).

There are many reasons for assuming that visual representation formats, animations as well as static map or pictures, can be useful for learning. As for animations, one might argue that they help in mentally visualizing a procedure, resulting in a reduction of cognitive load compared to a situation in which the process or the procedure has to be reconstructed from a series of static pictures Höffler and Leutner (2007).

The difference in learning from dynamic and non-dynamic pictures with retention or problem-solving tasks has been researched. In particular, deeper understanding and thus the ability to solve advanced problems should result from learning with animations (Mayer & Moreno 2002). However, previous studies provide a very varied picture.

In the last two decades, the use of computer animation has progressed significantly, and it has been recognised in different industries such as film, architecture and the sciences. This development confirms that the use of animation in cartography allows the spatial information and geographic features to be displayed dynamically within map sequences.

In animated maps, the time (date) is considered as a cartographic variable. A question arises in the mapping discipline, whether is it necessary to display this type of information. Can animation present new forms of perspective, other than those which we already have? Already spatial disciplines have changed from the study of static representations to the study of processes and animation (Karl, 1992).

In GIS technology various extensions and tools have been added to GIS packages to run processes depicting change over time such as the experimental Time Manager plugin associated with QGIS and the Time Slider tool in ArcGIS.

According to Bertin (1983), the data that is to be graphically displayed can be transcribed in three ways:

1. One single static map: temporal data is displayed graphically depicting variables.
2. Many maps, in series: segments of time are displayed by individual continuous maps. One might state that the temporal progression is characterized by the spatial progression, which is viewed by the map reader to perceive the change over time. The number of entries is limited, as the map reader will find difficulty in following a long series of maps.
3. Animated map: the temporal data is represented on one display, however no graphical entities are used for the temporal aspect as such.

A combination of all Bertin's (1983) data types were used to display the Ciskei Time Series maps in section 3.5.

2.3.1 Animated Maps

There are two types of animations: temporal which shows change through time, and non-temporal which is not time related (Tyner, 2010). The effectiveness of an animation depends on different factors related to characteristics of the data represented (e.g. complexity, spatial and temporal resolution), and to the design of the animation (e.g. use of the representation variables, controls provided, multiple views on the data). It also depends on the purpose and general goal of use, characteristics of the user, and of the user environment. The interactions of these factors prevent straightforward conclusions, but one reason for the varied results is that the full potential of animations has often not yet been utilized. For example, interactive control of the animation by the user has to be considered (Koussoulakou & Kraak, 1992, Blok, 2005).

Harrower (2003) stated that the use of animated maps presents a greater cartographic challenge. Creating such a map is time consuming and expensive, therefore the designer would want his efforts to be worthwhile in the end. Ideally, the map should be informative and striking. A cartography researcher who intends making use of animated maps should understand the limitations of this medium as a tool.

Listed below are some very important factors and solutions that were considered in the Ciskei animated maps. Stated by Harrower (2003):

1. Disappearance: Animation by design involves change. This would therefore potentially cause the observer to miss important information.
Possible solution: (a) allow the map-reader to watch the animation a number of times (on the loop); (b) play the animation frame by frame, continuing after stops; (c) regulate speed and alter the frame rate of the animation.
2. Attention: the map-reader is unsure where to look or focus attention whilst the animation plays.
Possible solutions: (a) by placing the information in a logical and systematic manner, the map-reader will be more likely to notice significant features or events in the animation; (b) by using sound prompts and/or narration in directing attention; (c) by using dynamic symbols at key points in the animation such as arrows or flashing symbols.
3. Complexity: one of the many faults of a Static map is that it tries to do too much and in turn fails to allow the map-reader to gain from it. "Burdening the user with more information than they can process in real-time, undermines the map's design and may confuse or mislead the reader." (Harrower, 2003, p. 64).
Possible solutions: (a) Allow users to turn data on and off, thereby reducing overload of information. (b) Regulate animation speed at key points. (c) Allow users to have control over the speed of the animation.
4. Confidence: People in general have more experience in interpreting static graphs than animated graphics. This is understandable if they do not possess the required training in this regard. Possible solutions: (a) a brief introduction can be employed to increase user confidence which can be less than 30 seconds in providing an understanding before the data is viewed. Most of the viewers would not be experienced in GIS viewing or would not have been exposed to it on a regular basis. They would therefore be more confident in viewing simpler interfaces. If the interface was more complex, they might abandon the map

because the possibility exists that they might feel intimidated, and not because they do not have the ability to understand the map.

These factors and solutions were considered in the process of creating the Ciskei animation, as described in the Methodology chapter, section 3.5.2.

Koussoullakou and Kraak (1992) have conducted studies by comparing animated and Static map of spatio-temporal data. They have noticed that observers' ability to recover accurate information and distinguish between temporal trends have shown no major difference in this regard.

Blok (2005) has shown that as many as 80% of expert users who participated in evaluating animation of satellite imagery were in agreement that less information should be provided, or the animation should be played continually as they were inclined to be diverted from the overall display.

Dawood and Motala (2015) conducted a study in which they evaluated an animated and static time series map of District Six. They concluded that there are advantages and disadvantages associated with animated and Static map display. This research is an extension of Dawood & Motala's (2015) research, with more rigorous qualitative analysis conducted in this study. This research confirmed that there is advantages of the static and animated maps over each other, and are described in the results and analysis chapter.

2.3.2 Static Maps

To represent any event or features at any moment in time, a conventional map may be employed. An efficient method to depict spatial change between two time intervals on a Static map would be to draw a comparison between these time intervals. Note that in the instance where there are too few time slices, the representation of evident and structured feature character traits is restricted on a static map, such as urban expansion or decrease in vegetative areas. An exercise in comparison can also be carried out with a series of Static map, referred to as small multiples (Tufte & Graves-Morris, 1983).

Even though they possess functional and practical uses, maps have restrictions (Tyner, 2010). A map viewer may not be fully aware of these limitations. These limitations are sometimes evident in the design of a number of published maps. A part of the problem stems from the perception of the map viewer who may think that a map

shows everything in much the same way as a photograph. “Maps are graphic representations, which by their very nature are selective and symbolic, that is, generalized.” (Tyner, 2010 p. 9).

Tyner (2010) explains that it is important for this distinction to be made, as photographs are not selective, except through the selection of resolution in relation to the scale of the visible objects. The decision about what kind and amount of information to include on a map depends on certain factors. This is totally up to the cartographer, client or interested parties, as the decision is made on which features are highlighted or which areas are emphasised over others. Therefore, all maps are considered to be biased to some degree, because cartographic selection is employed. Maps fundamentally are spatial representations of locations, space and features on the earth. They can be used as exploratory tools due to their ability to show spatial relationships of many features to each other. Above all maps are used to deliver information to a specific viewer or viewers.

2.4 Spatio-temporal and time series mapping

Even though GIS and geographical databases have existed for the last few decades, it has only been in the last few years that attention has been given to temporal dimension. The reason for this focus in GIS science has been driven by the need to analyse spatial patterns and their change, over time. The data models available within existing GIS can be used to generate snapshots of time to create a temporal series, as illustrated in figure 2.1. These would then be used as a spatio-temporal elements in a subsequent representation (Peuquet & Duan, 1995).

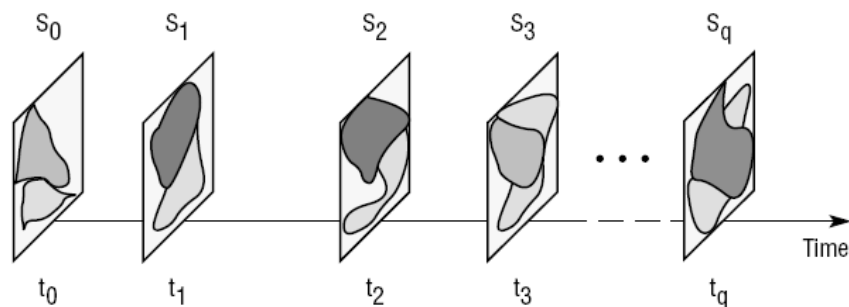


Figure 2.1 The snapshot approach for representing spatio-temporal data (Peuquet and Duan 1995)

2.4.1 The significance of spatio-temporal mapping

Hogeweg (2009) explains that there are constant changes in the real world and both components, namely spatial and non-spatial, develop over time. The nature of spatio-temporal data is that can be visualised, analysed and queried to have influence on decisions taken on future initiatives by its specific users. Three domains exist to portray this information:

- 1 Spatial domain: present within the real world
- 2 Temporal domain: present or occurs within a specific time
- 3 Thematic domain: has property traits

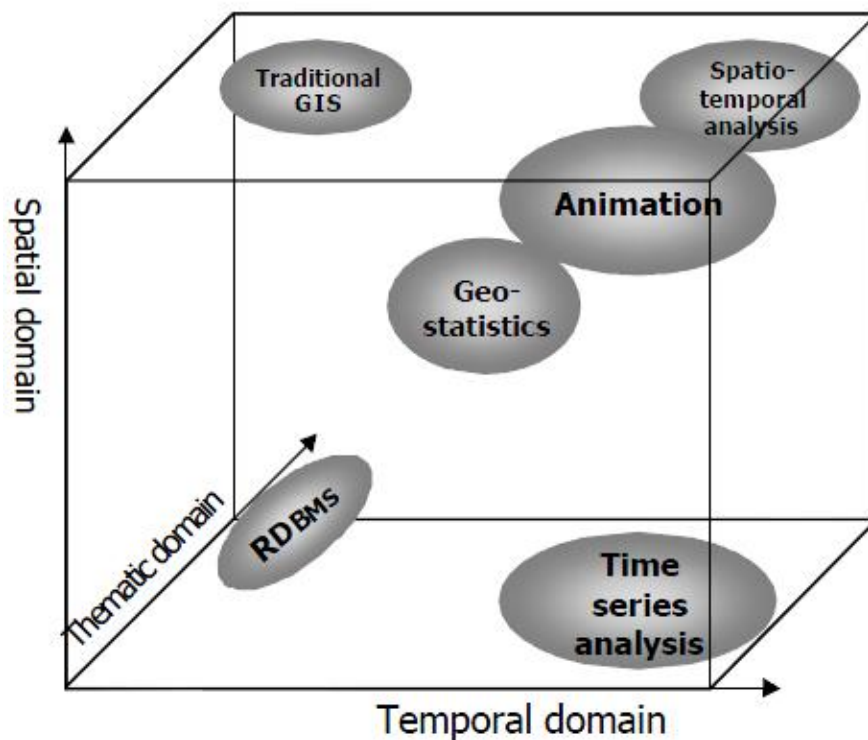


Figure 2.2 Facets within the space time cube and its relevant domains (Hogeweg, 2009)

In figure 2.2 the three domains are represented on the axes of the cube. Some of the facets that exist within the cube are functional techniques used to visualise, analyse and query information at the chosen point of interest. As indicated by the arrows along the axes, an increased amalgamation of particular domains can best be exploited by the appropriate techniques shown. A description of the other facets in the cube is briefly given in Table 2.1.

Table 2.1 Descriptions of the facets in the space time cube and its relevance to spatio-temporal

Facet	Strengths
Traditional GIS	Many forms of data from many sources can be combined to form new data and present information. Analysis of data (Hogeweg, 2009).
Animation	Provides a useful means of communication in the sense that it can reveal changes of data in terms of movement, location and shape (Hogeweg, 2009).
Geo-statistics	Referred to as the statistical method of providing reliable and accurate estimations at unmeasured locations within spatial modelling (Geovariances, 2014) Methods include: Variography – modelling spatial patterns Kriging – predicting values at unmeasured locations and assessing uncertainty within this phenomena (Environmental Systems Research Institute, 2014)
Relational database management system (RDBMS)	As stated by Veldwijk (cited in Hogeweg 2009), spatial and temporal domains are supported where the attribute table possesses dates and coordinates.
Time Series Analysis	Provides measures in analysing a single entity of time series or sets of time (Hogeweg, 2009).

2.4.2 Types of spatio-temporal data

The commercial Geographical Information Systems have traditionally focused on geospatial and not temporal referencing of data, limiting the use of GIS for visualizing on dynamic geographic events (University of Texas at Austin Centre for Research in Water Resources (CRWR), 2006). Recent research at the (CRWR) has focused on designing a set of spatio-temporal data types, proficient at providing the foundation for a temporal

GIS. The result is three spatio-temporal data types called "Attribute Series", "Feature Series", and "Raster Series" presented in Figure 2.3 with a generic non-spatial data type called "Time Series".

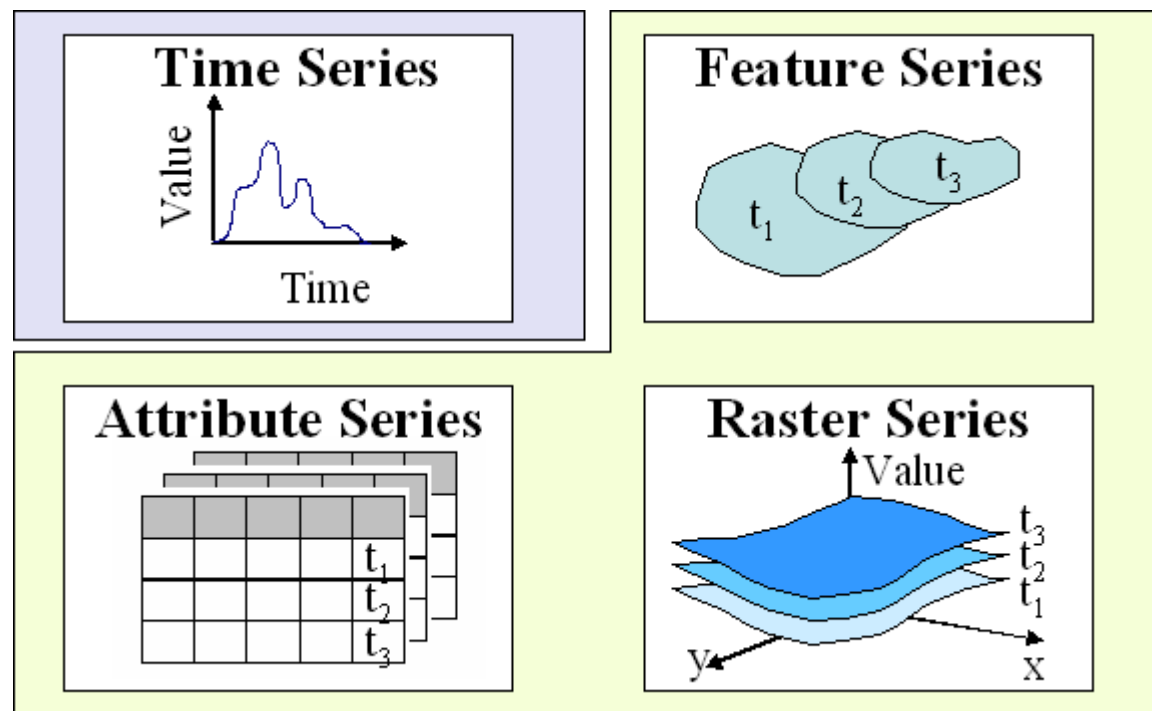


Figure 2.3 Linked spatio-temporal representations and time series (University of Texas at Austin CRWR, 2006)

Time Series: Snapshots of time series can be linked to a number of spatial features at the same time and are not necessarily directly geo-referenced. As shown in Figure 2.3, the time series section is displayed separately from the rest of the elements. This indicates that it is not a spatio-temporal data structure, but rather a connection to the facets that exist in the real world for the purposes of analysis and modelling.

Feature series: The feature series can be defined as a collection of features; each feature happens for a different time-slot. This provides a structure for representing a series of data relevant to its time.

Attribute series: This is a collection of time-value pairs which are directly connected to a specific spatial feature. Each attribute describes and gives the properties related to each specific spatial attribute in respect to its time.

Raster series: By linking a series of raster's together, it can describe the change that occurs over time of the same area where it is indexed by time. Hence giving meaning to the term "a snapshot of time".

In the Ciskei time series mapping, a combination of feature series and attribute series were used. The change of the Ciskei boundaries was presented as a change in polygon features. The change of the time was added to the attribute of each layer and presented respectively with the feature.

2.4.3 Time as a dimension

A conceptual framework developed by Peuquet (1994) involved the development of a geographical information system incorporating spatial temporal dynamics. , These dynamics must be considered an integral part of representing time in geo-visualisation. As shown in figure 2.4, central to this framework is the where/when/what triad of questions.

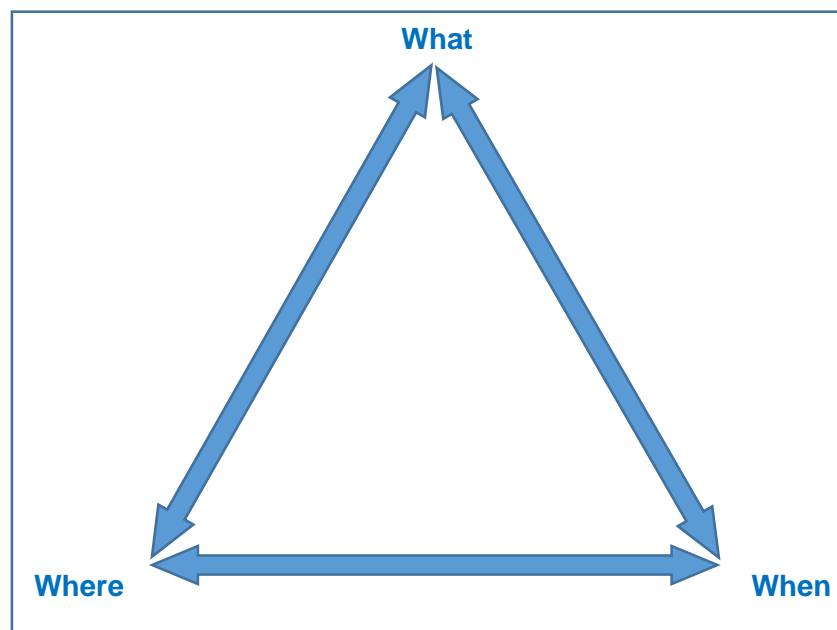


Figure 2.4 The question triad as reproduced from Peuquet (1994)

Peuquet (1994) concluded that the geographic experience can be accessed from three various angles, facilitating three simple questions:

1. "When + where → what: Describe the features or set of features that are present at a specified position or set of positions (where) at a specified time or set of times (when).

2. When + what → where: Describe the features or set of features (where) involved by a specified position or set of positions (what) at a specified time or set of times (when).
3. Where + what → when: Describe the times or set of times (when) that a specified feature or set of features occur(s) (what) involving a specified position or set of positions (where)” (Peuquet, 1994).

Mennis et al. (2000) proves that there is evidence which advocates that people store ‘what’, ‘where’ and ‘when’ knowledge in a particular knowledge hierarchy, associating it with relevant characteristics and purposes. The triad questions were considered when designing the questionnaire shown in Appendix B. Six questions were made from the trial test, two sets of questions for each type (what, where and when) were designed to test the change detection ability of the map viewer. The design of the questionnaire is described in section 3.8. The design of the questionnaire of this study is an adaptation of the study by Dawood and Motala (2015) as it is an extension of their study.

2.4.4 Spatio-temporal and animated mapping

Spatio-temporal data was defined by Andrienko & Andrienko (2006) as data having spatial and temporal components. “A set of Static maps showing sequential selected representations of the process can be very useful to help the viewer build a mental model of the dynamics he is observing”. Such a set of maps is called small multiples. The animation of maps and small multiples are but two of the techniques used to present data of a spatio-temporal nature. One of the advantages of the small multiples is comparing the status of spatial features at different moments in time (Becker, 2009). Animated maps provide a relatively easy understanding for displaying real world phenomena (Blok, 2005).

An overview of multidimensional data presented by animated mapping is considered by Andrienko and Andrienko (2006), and methods available to depict spatio-temporal data with extensive values in the temporal dimension are discussed. The most likely advantage of this display is to note indirect changes in spatio-temporal patterns (Harrower, 2008). Becker (2009) further explains that in GIS, vector data holds attributes which are within a database. The same would apply to data that is present in an animated sequence that contains a temporal attribute and would in turn be

advantageous in conducting queries within a database to evaluate, for example, data integrity and consistency. Animated mapping may derive benefit from certain perspectives on user needs as highlighted by Becker (2009):

- 1 To visualise different types of data (point, line, and polygon) and real world phenomena;
- 2 Data exploration and presentation to the general public.

The above perspectives have been taken into consideration for the implementation of the data presented for the case study. As mentioned in the methodology chapter, the geographic boundary of the Ciskei was represented as polygon data types, and presented to the map viewer in the form of Static map and animated Map.

2.4.5 Representation of spatio-temporal change in static maps

Cartographers have an array of methods in representing spatio-temporal change in Static maps. Cartographers may depict change with a single map or a series of maps, known as small multiples (Campbell and Egbert, 1990, Tufte & Graves-Morris, 1983). Temporal changes can be represented with a single map in attributes using a “change map” (Monmonier, 1990) or with visual variables that depict change in a map (Bertin, 1983). An illustration of this change can be shared by the use of thematic maps where various polygons are shaded by different colour hues by representing, for example, the geographic change of the Ciskei that was represented in three polygon with different colours (see figure 3.14). Cartographers can also depict change over time as static graphics within a series called small multiples. Small multiples present the same geographical area in a chronological order of sequence at different periods in time (Fish, 2010). These types of graphics allow map users to distinguish the change over time. The Static maps of Ciskei were designed based on this idea. See section 3.5.1 and Appendix E.

2.5 Mapping of historical data

Harrower (2007) discusses the important cognitive differences between static and animated maps, and the designing of animated maps. The challenges faced are numerous, and are related not only to the software, but also to the hardware and the data. Other challenges are the limited visual and cognitive processing capabilities of the map-reader. Over the last 20 years, researchers have looked into cognitive approaches in psychology and education and have developed a set of theories that explain how people view dynamic images (Harrower, 2007).

According to Höffler and Leutner, (2007), visual representations, animations and static pictures are favourable for learning, and there are several reasons for expecting this outcome. A point could be made that animations are understood to be better for visualising a process or procedure compared to a series of static pictures.

Questions about whether animated graphics are better than static graphics have been asked by media researchers. Echoing similar concerns within cartography, this overly simplistic question is unproductive (Mayer and Moreno, 2002) and has been largely uncontrolled (Clark, 1994). The answer to such a question will always be 'it depends on the purpose of use'. Animated maps and graphics are neither better nor worse than Static map – they are simply different. Fuhrmann et al. (2005) indicate that the challenge is to understand how animation and Static map are different. It can be effective based on the purpose of it and the users or map readers. The fact that the animated maps and Static map are different was confirmed by Dawood & Motala, (2015) in their study evaluating an animated and static time series map of District Six. They followed Moreno's nine principles to create the animation, and this approach was also followed in the present research which can be seen as an extension of their study.

Based on previous research, Mayer and Moreno (2003) have drawn nine principles for designing effective animated graphics. These principles summarize much of the discussion in this research and provide a starting point for thinking about creating a parallel set of principles for Static map design:

1. When possible, offload work from the eyes to the ears.
2. Segment content and provide pauses within the animation.
3. Include pre-training (e.g. a narrated introduction) to familiarize viewers with important terms and ideas.
4. Weed out extraneous material that detracts from the animation (e.g. needlessly complex transitions).
5. Signal to viewers what content is most important (e.g. by placing it highest in the visual hierarchy).
6. Put related content spatially as close together as possible.
7. Put related content temporally as close together as possible.
8. Eliminate redundancy (e.g. use text or narration, not both).
9. Individualize content for learners of differing abilities.

These very important design principles were closely followed in the design of the Ciskei animation, discussed in section 3.5.

2.5.1 Background and History of South Africa

The history of South Africa has been characterised by the conflict of several racial groups. Originally the Khoikhoi people lived in the region for millennia. The majority of South Africans attribute their history to migration. Black populations in South Africa are immigrants from different places in Africa, who first entered what are now the borders of South Africa, approximately one thousand seven hundred years ago (South African History Online, 2011). White populations in South Africa are progenies of later European immigrants, mainly from the Netherlands and Britain. The Coloureds are descended at least in part from all of these groups, as well as from slaves from Madagascar, East Africa and what was then known as the East Indies. Many South Africans are of Indian and Chinese origin, descendants of labourers who arrived in the nineteenth and early twentieth centuries (Lahiff & Scoones, 2001)

This study focused mainly on the history of the black populations, the Homelands and the role that the apartheid land legislation played in shaping the South African land policies, specifically the Ciskei Homeland. The main goal of this study was to investigate the development of the Ciskei Homeland boundary from the time of the promulgation of the 1913 Native Land Act No 27, until the first democratic elections on 27 April 1994, when the ruling African National Congress came to power as the dominant political party of South Africa.

2.5.2 The Native Land Act 27 of 1913

In 1913 the white minority government in South Africa passed a major law that would affect the entire black population. This was the Native Land Act on 19 June 1913. This act had a profound effect on the demographic distribution of the African population across the country. The act was followed by other legislations which further entrenched removal of African people and segregation later of Coloured and Indian people (South African History Online, 2011). A copy of the original act is attached in Appendix A.

The term “Native” was defined in the act as “any person, male or female, who is a member of an aboriginal race or tribe of Africa” (The Union of South Africa, 1913, p. 446). The most unjust effect of the Native Land Act for African populations was the prohibition from buying or hiring land in 93% of South Africa (Parker, 2015). The black Africans, despite being more in number, were only allowed to live and own 7% of South Africa’s land. In 1936 this area was increased with the enactment of the Development Trust and Land Act (The Union of South Africa, 1936).

By these acts black people were prohibited from entering into any agreement or transaction involving land outside the reserves. As stated in the Native Land Act section 1(a) “A Native shall not enter into any agreement or transaction for the purchase, hire, or other acquisition from a person other than a Native, of any such land or of any right thereto, interest therein, or servitude there over.” (The Union of South Africa, 1913, p.438). Africans were only allowed to buy and sell land in reserves or scheduled areas, and whites were not allowed to own land in these areas. The act defined the boundaries of the reserves, which were referred to as ‘scheduled areas’ in the 1913 Act and as ‘released areas’ in the 1936 Development Trust and Land Act. These boundaries were used in this research to create the shapefiles of 1913 and 1936 of the Ciskei Homeland.

Feinberg and Horn (1993) state that scheduled areas included land which Africans had acquired by grant from the Orange Free State government. These areas were previously created as locations or reserves – land owned under the informal and formal trusteeship system which emerged in the nineteenth century in the Transvaal, and land purchased in the Cape and Natal (Feinberg and Horn, 1993).

White areas were effectively created by labelling resident blacks as ‘squatters’:

Loosely defined, a squatter was a “Native” tenant who paid for his tenancy using money or sharing part of his produce with the farmer. Consequently, the effect of the Land Act was to eliminate black tenants and to replace them in white areas by black servants or labourers who would no longer be allowed to lease land in white areas (Flemmer, 1976 p.10)

The Native Land Act was followed by numerous land acts that created and affected the Homelands boundaries over the years.

2.5.3 South African Homelands

The apartheid government established the “Bantustans” or Homelands, areas to which the majority of the black population were removed see figure 2.5, and it became illegal for a black person to live in the urban areas of South Africa (Christopher, 1994). The Homelands were created in 1913 as the result of Native Land Act No 27 of 1913, and ceased to exist in 1994 after the first democratic election in South Africa.

The term “white South Africa” was used for the land in South Africa other than Homelands. The Government aimed to move every black person to his or her individual

ethnic Homeland in order to have South Africa completely in the hands of the white population. Blacks were given Homelands, and that meant that whatever their culture was, they were forcefully removed to the designed homelands (UK Essays, 2015).

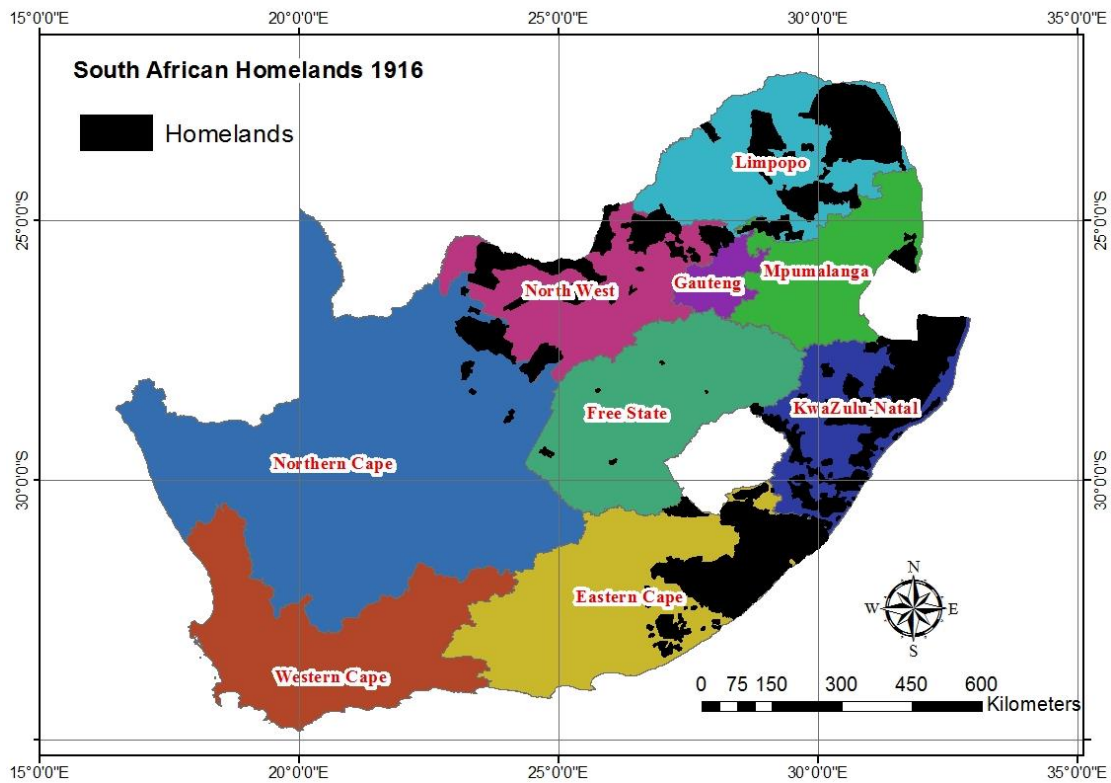


Figure 2.5 The Homelands (scheduled areas) and the white South Africa as it was in 1916. (Digitized from the key map of the Union of South Africa to accompany of the report of the Native Land Commission 1913)

In total, ten Homelands were created in South Africa. These were the Transkei, Bophuthatswana, Ciskei, Venda, Gazankulu, KaNgwane, KwaNdebele, KwaZulu, Lebowa, and QwaQwa (see figure 2.6). The Homelands were designed to separate the black ethnic groups. For instance, the Xhosa speakers were moved to Ciskei and Transkei, while the Tswana people were moved to Bophuthatswana, KwaZulu was only for Zulu people, Lebowa for the Pedi and Northern Ndebele, Venda only for Vendas, Gazankulu for Shangaan and Tsonga people and QwaQwa were for Basothos (South African History Online, 2011).

The Bantu Homelands Citizenship Act of 1970 was passed to allow black individuals to become citizens of their independent Homelands. This allowed blacks living throughout South Africa to be regarded as legal citizens in the Homeland designated for their particular ethnic group. The act deprived black people South African citizenship, as well as civil and political rights. Blacks had rights only in their

“Homelands” but they were not completely independent. Other laws included the Bantu Authority Act 68 of 1951, which provided for the establishment of black Homelands and regional authorities. The aim of this act was to create greater black self-government. The Promotion of Bantu Self-Government Act 46 of 1959 separated black people into different ethnic groups. Each Homeland had a Commissioner General who was tasked to develop a Homeland which would be allowed to govern itself independently without white involvement (Christopher, 1994). This was not actually the case, as ultimate power lay in the hands of the apartheid government.

In the 1970’s four Homelands were declared as independent Homelands by the South African government. These were the Transkei in 1976, Bophuthatswana in 1977, Venda in 1979, and Ciskei in 1981. The remaining Homelands continued to be self-governing, but did not have independent rights. This was a government strategy to push all blacks out and have them isolated from South Africa. It meant that blacks would have to support themselves in these areas (Ross et al., 2011)

The economy of the Homelands was under-developed. Homelands depended almost entirely on white South Africa’s economy. Farming was not very supportive of the Homelands’ economies because of the poor agricultural land. In addition, blacks owned only 13% of South Africa’s land. These farmlands were in poor condition because of soil erosion and overgrazing. As a result, millions of blacks had to leave the Homelands daily and find employment in the mines, in other industries in the cities or they had to work for white farmers. The Homelands served as labour reservoirs, housing the unemployed and releasing them when their labour was needed in white South Africa (Christopher, 1994).

The South African Homelands or Bantustans ceased to exist on 27 April 1994. They were reincorporated into the new nine provinces of the democratic South Africa (South African History Online, 2011).

2.5.4 Land Acts

The 1913 Land Act was followed by numerous of legislations and acts that had a direct or indirect effect on the Ciskei boundary. The apartheid land legislations that indicate the change to the Ciskei Homeland, are listed below: These acts were linked to the maps of Ciskei, and presented in the time series maps as described in the methodology chapter.

1 The Native Land Act 27 of 1913

This act prohibited blacks from owning or renting land outside designated reserves as mentioned previously. These reserves represented approximately 7% of land in the country (The Union of South Africa, 1913). This act created the Scheduled Areas that would become the Homelands. See Appendix A for an extract of the 1913 Native Land Act showing a list of the districts, locations and farms that fell into the Native areas in the Cape Province, excluding Transkei territories.

2 Native (Urban Areas) Act No. 21 of 1923

This act made each local authority responsible for the blacks in its area. The country was divided into prescribed (urban) and non-prescribed areas, and movement between the two was strictly controlled (The Union of South Africa, 1923).

3 Native Administration Act No. 38 of 1927

The act stated that all moveable property belonging to a black and allotted by him or accruing under black law or custom, to any woman with whom he lived in a customary union, or any house, shall upon his death devolve and be administered under black law and custom. Section 25(1) states: "From and after the commencement of this act, any law then in force or subsequently coming into force within the areas included in the Schedule to the Native Land Act, 1913 (Act No. 27 of 1913), or any amendment thereof, or such areas as may by resolution of both Houses of Parliament be designated as Native areas for the purposes of this section, may be repealed or amended, and new laws applicable to the said areas may be made, amended and repealed by the Governor General by proclamation in the Gazette." (The Union of South Africa, 1927 p. xliii)

4 Development Trust And Land Act 18 of 1936

This act, also known as the Bantu Trust and Land Act, 1936 or the Native Trust and Land Act, 1936 authorized the Department of Bantu Administration and Development to eliminate 'black spots' (black-owned land surrounded by white-owned land). The act added released areas to the Homeland, and increased the percentage of the black people's lands to 13% of the South African land. These 'black spots' would later (after 1975) decrease in number as the Ciskei tended towards one consolidated geographical region.

It commenced on 31 August 1936 (The Union of South Africa, 1936).

5 Bantu Black Authorities Act 68 of 1951

In 1951, the South African government promulgated the Bantu Black Authorities Act to remove black people permanently from the urban areas. The Bantu Black Authorities Act was one of the acts that attempted to keep South African citizens apart on a racial and ethnic basis. The government introduced this act by setting up Black ethnic governments known as "Homelands".

The government used this act to remove black people out of urban areas to these Homelands. Some of these Homelands were then granted independent status by the central government. Homelands were under chiefs who were subordinate to their masters in Pretoria. This act had a major effect on all black South Africans. The Homeland population would lose South African citizenship and all political rights including the right to vote. They even had to have passports to enter South Africa (The Union of South Africa, 1951).

6 Representation Between RSA and Self-Governing Territories Act 46 of 1959

This act declared the existence of eight African ethnic groups based on their morphological and cultural diversity. A Commissioner-General was appointed for each group as an official representative of the South African government. The Commissioner-General was appointed to set up and plan Homelands for each group. Each ethnic group was meant to govern itself, and provision was made for powers of self-government to be transferred, so that there would not be any white involvement in the governing of these groups. Transkei was formed first when the Transkei Self-Government Act and the Transkei Constitution Act were passed in 1963 (The Union of South Africa, 1959).

7 Self-Governing Territories Constitution Act 21 of 1971

The power of the Homeland government was increased by this act, thus facilitating their eventual 'independence' (The Union of South Africa, 1971).

8 The Ciskei Constitution Proclamation 187 of 1972

This act declared Ciskei as a self-governing territory. As stated in section 2. (1): "The area defined in subsection (2) shall under the name of the Ciskei be a self-governing territory within the Republic in accordance with the provisions of the act with effect from 1 August 1972." Furthermore: "The areas referred to in section 25 (1) of the Bantu Administration Act 1927 (Act 38 of 1927), read with section 21 (1) of the Bantu Trust and Land Act, 1936 (Act 18 of 1936), and situated within the following districts:

Mdantsane, Zwelitsha, Hewu, Victoria East, Herschel, Keiskarnmahoeek, Peddie, Middeldrift, Glen Grey and the area of the Zibula Tribal Authority. District of Sutterheim, established by Government Notice 1642. Dated 25 October 1963." (Republic of South Africa, 1972)."

The description of the areas under the Ciskei territory mentioned in section 2 (a) was compared with the consolidation plans to generate a 1975 Ciskei shapefile.

9 Status of the Transkei Act No. 100 of 1976.

This Act created a Transkei Constitution. The Transkei Constitution Act 100 of 1976 mentioned that the districts of Herschel and Glen Grey were excised from Ciskei and Ceded to Transkei.

"Districts created in terms of the Magistrates' Courts Act, 1944 (Act No. 32 of 1944), and comprising the Transkei:

Bizana Mount Frere, Butterworth, Mqanduli, Elliotdale, Ngqeleni, Engcobo, Nqamakwe, Flagstaff Port St. Johns, Glen Grey, Qumbu, Herschel, St. Mark's, Idutywa, Ntabankulu, Xalanga, Kentani Tsolo, Libode, Tsomo, Lusikisiki, Umtata, Matatiele, Umzimkulu, Mount, Ayliff, Willowvale and Mount Fletcher." (The Union of South Africa, 1976, p. 5).

10 The Status of Ciskei Act No. 110 of 1981

This act resulted in Ciskei gaining its independence (Republic of South Africa, 1981).

2.5.5 Ciskei History

Ciskei was situated on the southern seaboard of Africa. Figure 2.5 show the location of Ciskei and all other Homelands. It was bordered by the Kei River in the East, the Fish River in the West, the Stormberg Mountains in the North, and the Indian Ocean to the South. The Ciskei was one of two traditional homes of the Xhosa people, the other being the Transkei. The two territories were separated by the Kei River, hence their respective names: 'this side' and 'across' the Kei (Steward, 2008).

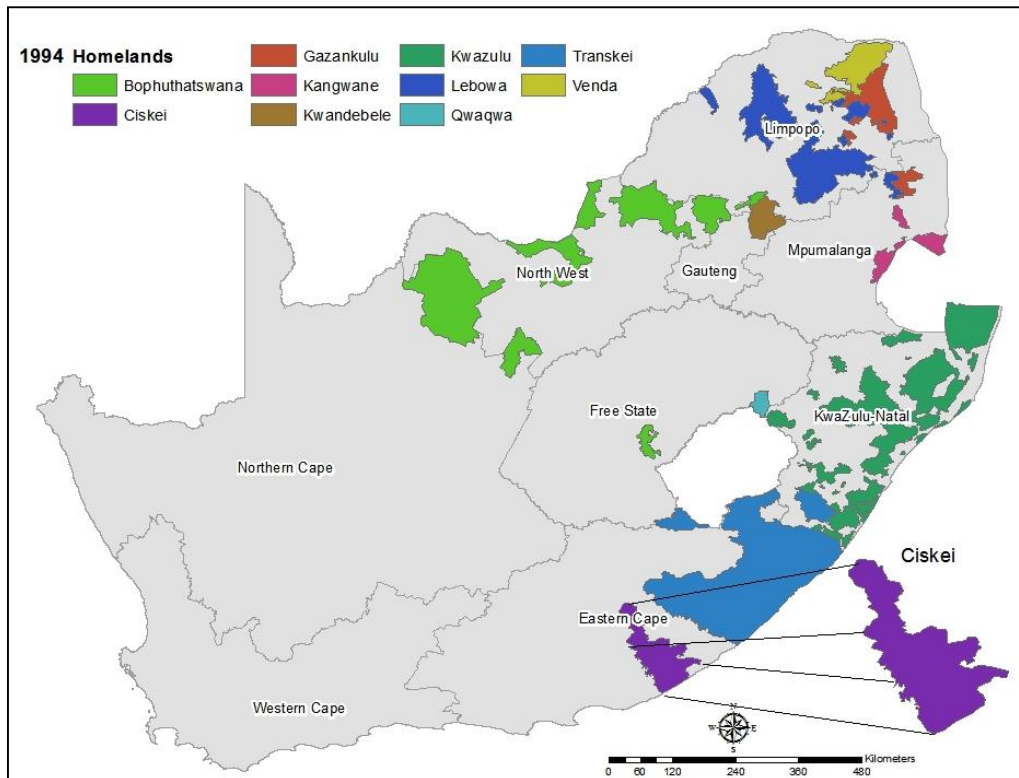


Figure 2.6 Map showing the location of Ciskei and all other Homelands in 1994

The history of Ciskei Homeland started in 1913, after the government introduced the Bunga system that was applied to administer areas under British colonial rule. The Bunga, which was an optional council comprising traditional authorities and the educated selected, held little power. The Bunga local unit consisted of a headman or the traditional 'inkundla' (local assemblies) system. Before colonial rule, these were self-ruling entities and their decisions were collective. Within the Bunga system, local assembly authority was subject to the Magistrate's Court. The Bantu Authorities Act of 1951 took away their remaining power and they came under direct control of the government. Chiefs and headmen were no longer responsible to their people, but to the government. The purpose of Bantu authorities was to pave the way for the creation of Homelands and racial segregation (South African History Online, 2011).

The Ciskei Homeland was created as a territory for South Africa's Xhosa-speaking people as part of apartheid racial segregation. The government declared Ciskei as an independent state in 1981. Government rhetoric stated that this 'independent state' would encourage cultural protection and separate development of the people within it. (Stewart, 2008).

Zwelitsha was initially declared as the capital of Ciskei by the working population of Zwelitsha. These people were mostly employed in white towns such as Graham's

town. In 1980 Bisho was declared the capital of Ciskei. The South African government declared Ciskei as a separate administrative territory in 1961, after which the government of Ciskei was formed. In 1972 self-government was granted to Ciskei. This overlapped with stronger efforts to forcibly remove Xhosa-speaking blacks to Ciskei. On 4 December 1982, Ciskei was declared an independent republic, recognised only by the South African government and other independent Homeland states in South Africa.

The majority of black populations were against the idea of Ciskei independence because Ciskeians would consequently lose their South African citizenship. The Ciskei and the Transkei were among the most undeveloped areas of South Africa. Jobs in the Ciskei, as in other Homelands, were limited to government or government-sponsored projects and South African-sponsored factories. Most of these factories were neither economically viable nor legal entities in terms of labour practice. They were mostly Taiwanese-owned enterprises that had emerged out of efforts to attract foreign investors with promises of cheap labour and repression of unions. These factories became the target of popular anger in the final days of the apartheid regime (Christopher, 1994). After the 1994 democratic elections in South Africa, all the Homelands were dissolved and the area known as Ciskei became part of the Eastern Cape Province.

Chapter 3: Research design and methodology

3.1 Introduction

A combination of qualitative and quantitative research techniques were used. Collected data was presented in the form of maps and animation to various participants who took part in the study.

This chapter describes the methods used to create the time series maps and animated maps, the data types and the different types of analysis used. One of the objectives of this research was to evaluate animated and static time series maps with regard to spatial and informational change. Methods and the design used for this study were based on the literature from the previous chapters. This chapter outlines the procedure that was followed as presented in figure 3.1. The research equipment and the software used in this research were described in section 3.2. Section 3.3 and 3.4 describes pre-processing and different software used to create the shapefiles. It includes the methods used to specify the coordinate system and the map accuracy adjustment of geographic data. This step is called geo-referencing. Section 3.4 describes the digitization (converting the data from raster to vector format) and adding of attribute data. This includes a description of filtering and preparing data for use in GIS format. Section 3.5 describes how the time series maps and animation were created. The last sections, 3.6 to 3.8, cover the questionnaire and interview process.

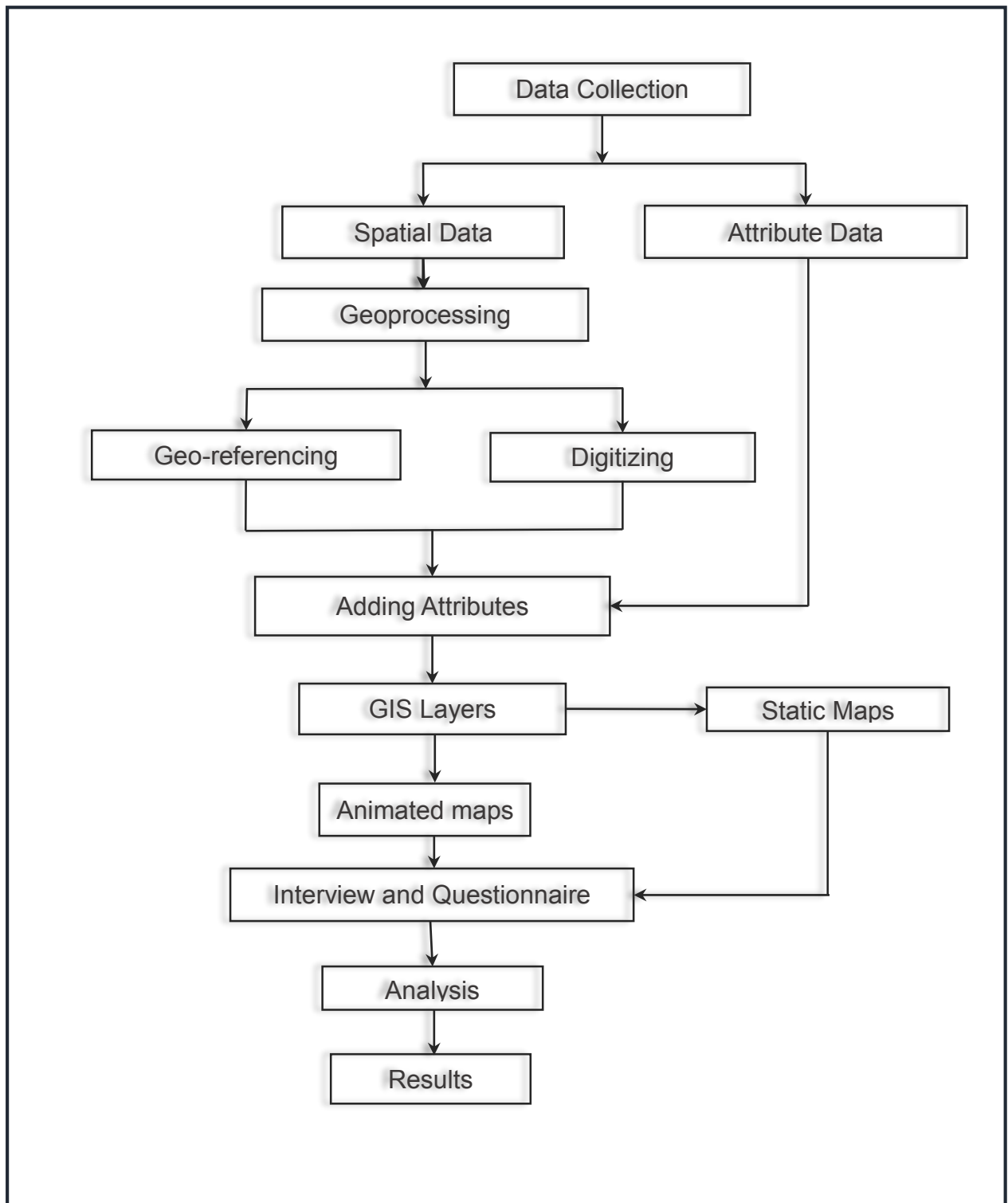


Figure 3.1 Research design flowchart

3.2 Research Resources

ArcGIS software was the tool used to create and represent the Ciskei in vector format. ArcGIS layout view was used to create the Static map as well. The Time Slider tool was the tool used to generate the animation from the vector data. The animation was also created by another method. Each “snapshot” of time was exported as an image. These images were then inserted into proprietary video editing software, Camtasia 8, developed by Techsmith. This allows to place the correct transitions between each “snapshot” and scene of time to create an animation. Relevant information was displayed in its respective time.

3.3 Data preparation

3.3.1 Data Sources

Some of the (vector and raster) geographic data was gathered from CD: NGI. The vector data was in shapefile format. The raster data was the result of scanning of the historical maps of the Ciskei Homeland and the magisterial district map. These data were collected mainly from NGI. These scanned maps were converted to vector format so they could be used in a GIS. The conversion process is described in section 3.4.

The third source was “The Atlas of Apartheid” by Christopher (1994). This book contains a great deal of historical information and maps about the Homelands and how they were influenced by the apartheid land legislation.

The attribute data used in this research was the apartheid land legislation that had a significant impact on the Homeland boundaries, as described in section 3.2.2.1. The main source of this data was the published government Gazettes from Lexis Nexis South Africa (2012). A list of the attributes that was captured is shown in section 3.3.1.4.

3.3.1.1 The vector layers that were acquired:

1. South African Homelands map, as at 1994. This polygon layer had previously been digitized by staff at CD: NGI. The attributes of this layer were: Names of the ten Homelands. The coordinate system of this layer was GCS Hartebeesthoek 1994. This map is shown in Appendix C.
2. Current South African provinces and magisterial district boundaries as polygon layers. The coordinate system of these layers was GCS WGS 1984.

3. All South African towns as a point layer were acquired from CD: NGI. The attributes of this layer were: Object ID, Code, Province Name, and Name. The coordinate system of this layer was GCS WGS 1984.
4. Polyline shapefile of the rivers in and around Ciskei Homeland. The reason for including the river shapefile was that some sections of the Kei River and Fish River are referred to as the boundary of the Ciskei in some legislation and reports. River centrelines and riverbanks are sometimes used to define all or part of a boundary in South Africa. Provision is made for this in section 15 of the Land Survey Act 9 of 1927. The more recent Land Survey Act 8 of 1997 uses the same definition, which is described in section 33. Rivers were of importance to this study because they were used as known features in the georeferencing process of some of the scanned maps.

3.3.1.2 Hardcopy maps that needed to be digitized:

All the available historical maps of the Ciskei between 1913 and 1994 – i.e. all the maps listed below – needed to be converted to shapefiles to be able to be used in a GIS environment. The conversion procedure is described in section 3.4. In the NGI library, maps were found of the South African Homelands for the following years:

1913: key map of the Union of SA to accompany report of Natives Land Commission. In scale 1:3,000,000 printed at Government. Printing works, Pretoria. Compiled and lithographed at the Surveyor-General Office, Pretoria (Surveyor-General, 1916).

1966: Development Atlas Map in scale 1:3,500,000 printed by Government Printer 1966. Compiled and drawn by the Natural Resources Development Council, Department of Planning (Department of Planning, 1966).

1976: Development Atlas Map in scale 1:3,500,000 printed by Government Printer 1976. Compiled and drawn by the Department of Planning and Environment (Department of Planning and Environment, 1976).

Christopher (1994) listed the impact of apartheid land legislation of South African Homelands. A Ciskei map was found in different time periods in the following books:

1955: Tomlinson Commission Consolidation Plans. South Africa 1955 summary of the report of the commission for the socio-economic development of the Bantu areas within Union of South Africa, Pretoria: Government Printer (Tomlinson, 1955 p.34).

1960: Decentralization Policies 1960-73. Source: Statistics in Malan and Hattingh (1973, p. 90)

1973: Homelands Consolidation Plans, Lemon (1978, p. 75)

1978: Homelands Consolidation Plans, Source: Lemon (1978, p. 76)

1985: Deconcentration points 1985. Based on a map published by the Development Bank of Southern Africa (Christopher, 1994, p.93).

1990: Independent Homelands (Christopher, 1994, p. 97).

3.3.1.3 The magisterial district boundaries:

The maps of the magisterial district boundaries between 1913 and 1994 these maps were collected from CD: NGI.

1935: Magisterial Districts map scale 1:2,500,000. Issued by Department of Lands, central mapping office.

1938: Magisterial Districts map scale 1:3,000,000. Printed in the Union of South Africa by the Government Printer, Pretoria.

1952: Magisterial Districts map scale 1:3,000,000. Drawn by the Trigonometrical Survey office, 1951. Printed in the union of South Africa by the Government Printer, Pretoria, 1952.

1953: Magisterial Districts map scale 1:3,000,000. Drawn by the Trigonometrical Survey office, 1951 revised 1953. Printed in the union of South Africa by the Government Printer, Pretoria, 1953.

1954: Magisterial Districts map scale 1:3,000,000. Drawn by the Trigonometrical Survey office, 1951 revised 1954. Printed in the union of South Africa by the Government Printer, Pretoria, 1954.

1959: Magisterial Districts map scale 1:3,000,000. Drawn by the Trigonometrical Survey office, 1959. Printed by the Government Printer, Pretoria, 1959.

1960: Magisterial Districts map scale 1:3,000,000. Drawn by the Trigonometrical Survey office, 1960. Printed by the Government Printer, Pretoria, 1960.

1961: Magisterial Districts map scale 1:3,000,000. Drawn by the Trigonometrical Survey office, 1961. Printed by the Government Printer, Pretoria, 1961.

1962: Magisterial Districts map scale 1:3,000,000. Drawn by the Trigonometrical Survey office, 1962. Printed by the Government Printer, Pretoria, 1962.

1963: Magisterial Districts map scale 1:3,000,000. Drawn by the Trigonometrical Survey office, 1963. Printed by the Government Printer, Pretoria, 1963.

1966: Magisterial Districts map scale 1:3,000,000. Drawn by the Trigonometrical Survey office, 1966. Printed by the Government Printer, Pretoria, 1966.

1967: Magisterial Districts map scale 1:3000, 000. Drawn by the Trigonometrical Survey office, 1967. Printed by the Government Printer, Pretoria, 1967.

1969: Magisterial Districts map scale 1:3000, 000. Drawn by the Trigonometrical Survey office, 1969. Printed by the Government Printer, Pretoria, 1969.

1970: Magisterial Districts map scale 1:3,000,000. Drawn by the Trigonometrical Survey office, 1951 revised 1970. Printed by the Government Printer, Pretoria, 1970.

1980: Magisterial Districts map scale 1:3,000,000. Drawn by the Trigonometrical Survey office, 1951 revised 1980. Printed by the Government Printer, Pretoria, 1980.

1989: Republic of South Africa Magisterial Districts map scale 1:2,500,000. This map included the Homeland boundaries as well.

1994: Republic of South Africa Magisterial Districts and Provinces as at April 1994, scale 1:2,500,000, compiled by the Chief Directorate of Surveys and Land information, Department of Land Affairs. Printed by the Government Printer, Pretoria, 1994.

3.3.1.4 Attribute data capture

To create time series maps, time is a very important element that needs to be recorded as attribute data (Acevedo & Masuoka, 1997). In this case the time of the proclamations which affected the Ciskei boundary was captured as well as the time of the historical maps showing the change. Equally importantly, the name and the shape of districts needed to be captured. According to Aigner et al., (2007) the analysis of time-oriented data is an important task in many application scenarios. In recent years, a variety of techniques for visualizing such data have been published. This variety makes it difficult for prospective users to select methods or tools that are useful for the particular task at hand. The town and township names in the Ciskei were captured, together with some important the topographic features. A very important research aim in this study was to find out what exact proclamations affected the Ciskei boundary, and when these occurred. This was represented cartographically to produce an effective time series animation showing the legislation that affected the boundary definitions, the following attributes were captured:

Table 3.1 Attributes captured for the polygon shapefile representing the reason for each filed.

Attribute Name	Data Type	Reason
Name	Text	The name of the Homeland or the districts under the Homeland.
Date	Date	To describe the date of the map and the date of the land act that affects the

		Homeland boundary. This is the field used to create a time series map.
Formation	Date	To show the formation date of the particular Homeland.
Self-Governing	Date	To show when the particular Homeland became a self-governing territory.
Independence	Date	To show when the particular Homeland was granted independence.
Area	Number	The area of the Homeland or the districts under the Homeland.
Proclamation	Text	To describe the land act or the proclamation name and date that affects the Homeland boundaries.

Data were provided on the geographical coordinate system, WGS84 reference ellipsoid. All the raster data projected to this coordinate system and georeferenced, because this coordinate system was used in all the data gathered from CD: NGI.

3.3.2 Data Cleaning Methods

It was difficult to determine the exact proclamations that affected the Ciskei Homeland boundaries and the years in which they were published. It was difficult because there were proclamations that had an indirect impact on the Ciskei boundaries. These proclamations read with other proclamations and land acts in order to see the change. Also, in some land acts (e.g. 1913 Native Land Act), the boundary of Ciskei was described by the name of the areas that fell under the Ciskei. This description needed to be compared with the key map of the union of South Africa 1916 in order to get the exact boundary of the Ciskei.

The hardcopy maps of Ciskei were topographic maps containing information such as roads, railway lines, mountains, rivers, and magisterial district boundaries. For this study, the magisterial district boundaries was extracted and digitized, because the magisterial districts defined the boundaries of the Ciskei. Since the magisterial districts changed over time, the dates were also captured. These were the most important elements needed to produce a time series animation.

The land acts and proclamations described the Locations (e.g. the locations mentioned in the schedule of Native Areas in the 1913 Native Land Act) and districts under the Homelands. According to these descriptions, a map of the Ciskei was created for each proclamation that changed its boundary.

3.3.2.1 The legislations that affected changes to the Ciskei boundary:

There were many land acts and proclamations between the periods from 1913 to 1994. The only ones used in this research were the acts that had a significant impact on the Ciskei Homeland boundaries.

As mentioned in the literature review chapter section 2.5.4 all the legislation that effected a change of the Ciskei boundary was captured to create a shapefile of each change over time. These land legislations were compared with the historical maps that were found for the same dates. The reason for the comparison was to digitise the actual boundary of the Ciskei. Figure 3.4 is an example of digitising the boundary of Ciskei from the 1980 map, and this was checked against the legislation plans between 1973 and 1976. The checking was done by comparing the description of the districts contained in the legislation plans with the districts shown on the map. Listed below are the legislations that affected a change of the Ciskei boundary. Each of these acts resulted in a change in the boundary of the Ciskei, and this change can be seen in the Static maps, shown in Appendix E.

1 Native Land Act no. 27 of 1913

This act prohibited blacks from owning or renting land outside designated reserves as mentioned in the history of Homeland and Land Acts (in Chapter 2). The act contained a list of the districts, locations and farms that fell into the Native areas in the Cape Province, excluding Transkei territories. Figure 3.2 below shows the key map produced in 1916 as the report of 1913 Land Act. The oldest map of Ciskei after the Native Land Act 27 of 1913 was the key map of the Union of SA to Accompany Report of Natives Land Commission 1916” from CD: NGI library. See Appendix C for a larger version of the map.

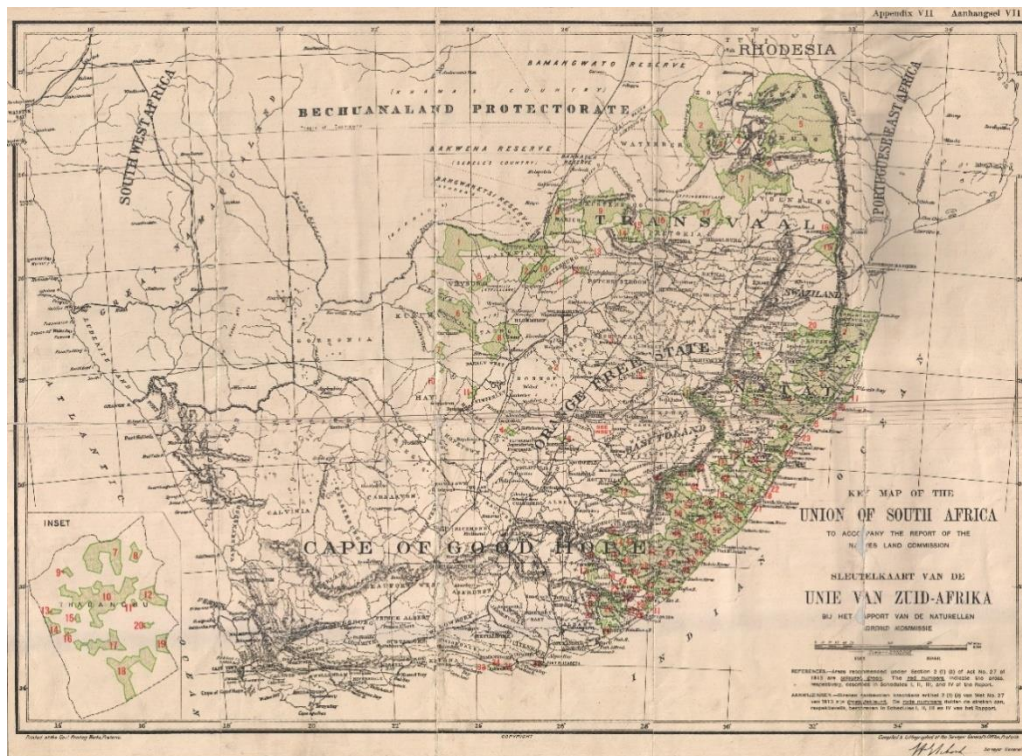


Figure 3.2 Key Map of the Union of SA to Accompany Report of Natives Land Commission 1916

Areas recommended under Section 2 (1) (b) of Act No 27 of 1913 are coloured green in Figure 3.2. Section 2 (1) (b) describes “what areas should be set apart as areas within which persons other than Natives shall not be permitted to acquire or hire land or interests in land.” (South Africa 1913). The red number indicates the areas respectively described in Schedules I, II, III, and IV of the Report. The schedules in this act described the Native areas. See appendix A for the scheduled areas.

According to this information, the areas with green colour were digitised as the Native Homelands. This map was the base map of this research.

2 Development Trust And Land Act 18 of 1936

This act authorized the Department of Bantu Administration and Development to eliminate ‘black spots’ (black-owned land surrounded by white-owned land). The act added released areas to the Homeland, and increased the percentage of the black people’s lands to 13% of the South African land. These ‘black spots’ would later (after 1975) decrease in number as the Ciskei tended towards one consolidated geographical region. It commenced on 31 August 1936 (The Union of South Africa, 1936).

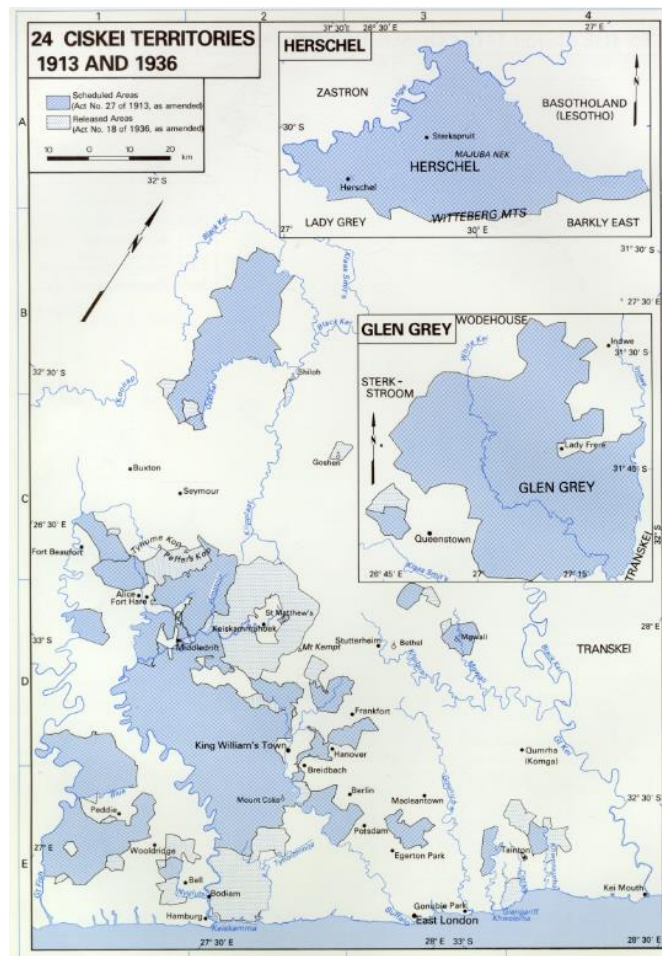


Figure 3.3 Ciskei territories 1936. Digitized from Bergh & Visagie, (1985, p. 24)

The Development Trust and Land Act 18 of 1936, enlarged the area of Ciskei. The map in figure 3.3 was digitised and compared to the description of the Ciskei boundary mentioned in the 1936 Development Trust and Land Act.

3 Bantu Black Authorities Act 68 of 1951

As it was mentioned in previous chapter, the South African government released the Bantu Black Authorities Act in 1951 to remove black people permanently from the urban areas. The Bantu Authorities Act³ was one of the acts that attempted to keep South African citizens apart on a racial and ethnic basis. The government introduced this act by setting up Black ethnic governments known as “Homelands”, one of which was the Ciskei Homeland. The description of the Ciskei in this act was compared with the map found in the Tomlinson Commission report (Tomlinson, 1955 p.34). This became the 1955 Ciskei shapefile.

4 Representation Between RSA and Self Governing Territories 46 of 1959

³ The Act in some source documents is referred to as “The Bantu Authorities Act”

This act declared the existence of eight African ethnic groups based on their morphological and cultural diversity. A Commissioner-General was appointed for each group as an official representative of the South African government. The Commissioner-General was assigned to develop a Homeland for each group. Provision was made for the transfer of powers of self-government whereby each ethnic group would govern itself independent of white involvement. Transkei was the first territory to benefit from the provision of this act when the Transkei Self-Government Act and the Transkei Constitution Act were passed in 1963 (The Union of South Africa, 1951).

5 The Ciskei Declaration as self-governing territory and constitution of Legislative Assembly 187, 1972.

This act declared Ciskei as a self-governing territory. As stated in section 2. (1) of the act : “The area defined in subsection (2) shall under the name of the Ciskei be a self-governing territory within the Republic in accordance with the provisions of the act with effect from 1 August 1972” (Republic of South Africa, 1972). The following districts were listed to form the Ciskei:

Mdantsane, Zwelitsha, Hewu, Victoria East, Herschel, Keiskarnmahoe, Peddie, Middeldrift, Glen Grey and the area of the Zibula Tribal Authority (District of Sutterheim).

The acts between 1973 and 1976 were called consolidation plans. Together with Homelands Consolidation Plans, Lemon (1978, p. 75) and the Development Atlas Map1976 were used to create the consolidation plans shapefile of Ciskei.

6 Status of the Transkei Act No. 100 of 1976.

This act created a Transkei Constitution. The list of districts in this act (mentioned in section 2.5.4), were compared with the consolidation plans to create a 1976 Ciskei polygon shapefile.

7 The Status of Ciskei Act No 110 of 1981

When Ciskei was granted its independence (Republic of South Africa, 1981) on 27 November 1981, the Ciskei consisted of the following areas: Hewu (Whittlesea), Keiskammahoek, Mdantsane, Middeldrift, Peddie, Victoria East (Alice) and Zwelitsha. This then became the extent of the territory of Ciskei at Independence in 1981.

Stewart (2008) discusses Volume 2 of the report by the Surplus Peoples Project, which covers the forced removals in the Eastern Cape from 1970 to 1983. The report lists the following places in Ciskei where settlements occurred during that period:

Mdantsane district – Mdantsane and Potsdam;

Zwelitsha district – Dimbaza, Mnxesha, Zwelitsha, Ilitha Ndevana, elcomewood, Tswele Tswele, Kalken, Athile, Gobityolo, Madakeni, Braunschweig and Frankfort;

Hewu district – Sada, Emadakeni, Whittlesea North, Oxton, Oxton Manor, Embekweni, Yonda, Bushy Park, Zweledinga, Spring Grove, Tentergate, Rocklands, Mitford, Thornhill, Ntabethemba and Phelandaba;

Victoria East district – Glenmore;

Keiskammahoek district – Elukhanyweni;

Peddie district - Kammaskraal, Zweledinga and Bingqala.

The above districts were compared to the map by Bergh & Visagie (1985, p.25) to create a 1980 Ciskei shapefile.

The Transkei Constitution Act 100 of 1976 mentioned that the districts of Herschel and Glen Grey were excised from Ciskei and Ceded to Transkei (South Africa 1976). Figure 3.4 shows the extent of the Ciskei by the year 1980.

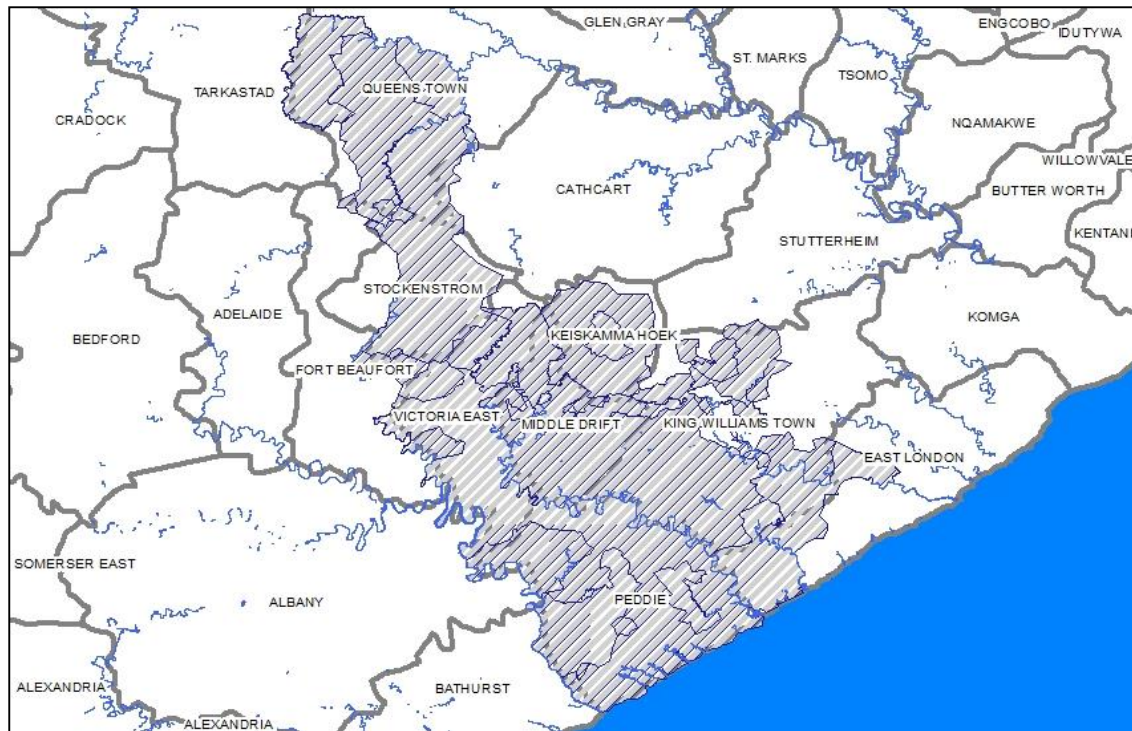


Figure 3.4 Ciskei boundaries in 1980: Digitized from Bergh & Visagie, (1985, p. 25)

Ciskei and all of the other Homelands were reincorporated into South Africa on 27 April 1994, after the first post-apartheid elections. Along with Transkei, Ciskei became part of the new Eastern Cape Province. Its capital, Bisho, became the capital of the Eastern Cape Province.

3.3.3 Problems Encountered

Many problems were encountered in the data collection process, especially in acquiring maps, land legislation and proclamation. Days spent at the NGI library Cape Town in order to obtain the old maps were inadequate because it is only the SG that was able to provide a map depicting Homeland boundaries and magisterial boundaries from the early 1900s.

Some maps that were sourced from two different organizations had contradictory information, e.g. the NGI library contained the Development Atlas Map in scale 1:3,500,000 printed by Government Printer 1975, compiled and drawn by the Department of Planning and Environment. This was compared to the Ciskei 1975 Consolidation Plans digitized from “the Eastern Cape frontier zone 1660-1980” (Bergh & Visagie, 1985, p. 25)

The two maps contained the description of Ciskei boundary in 1975, but the shape and the area were different. It was difficult to know which map contained the correct information. To solve this problem a comparison between these two maps was made with the descriptions in the consolidation plans from 1973 to 1975.

From 1973 to 1975, the South African Parliament approved plans for the partial consolidation of black national states. Final details were contained in the first report of the Select Committee on Bantu Affairs for 1975. In terms of these consolidations plans, the Transkei was to be consolidated in three areas, viz. the main area, Mzimkhulu, and Herschel. Both Herschel and the Glen Grey districts, which had formerly formed part of the Ciskei, were incorporated into the Transkei at the end of 1975 (South Africa, 1975). Under these new plans, Ciskei was to become a single consolidated area, the various large Ciskeian areas to be joined through the addition of intervening white owned land. Areas to the west and east of the Ciskei and along the coast were also included (Malan & P.S. Hatingh, 1973).

As a result of this comparison, the Ciskei 1975 Consolidation Plans map was chosen to be the Ciskei 1975 polygon layer, due to the match between these two consolidation plans, and the report. Figure 3.5 shows the Consolidation Plans and Development Atlas Map.

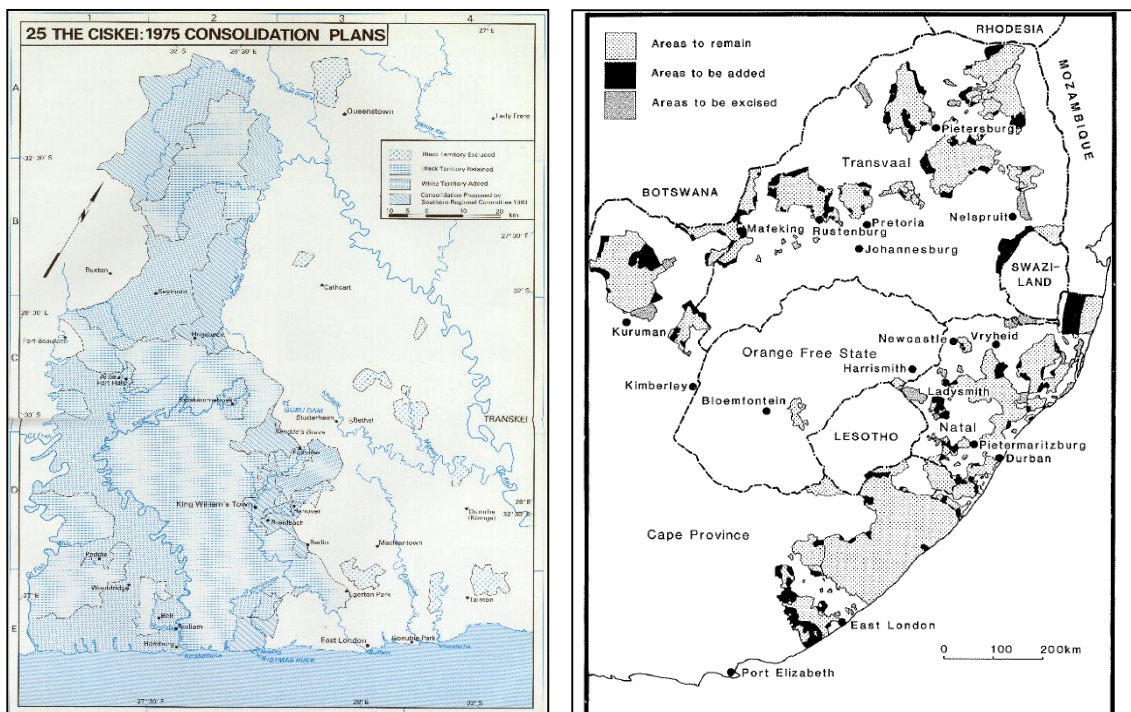


Figure 3.5 Consolidation Plans and Development Atlas Map 1975

3.4 Geo-processing

Geo-processing defined as any GIS operation that used to manipulate spatial data. A typical geo-processing operation takes an input dataset, performs an operation on that dataset, and returns the result of the operation as an output dataset. Data conversion, topology and feature selection analysis are common geo-processing operations. Geo-processing allows to define, manage, and analyse geographic information used to make decisions (Environmental Systems Research Institute, 2014).

In this research there were three geo-processing operations used to convert the geographic data from raster to vector formats, as illustrated in Figure 3.5 below. Gregory (2005) explained the importance of conversion methods with regards to implementing GIS in historical research.

The importance of the conversion of raster data to vector format is to make the extraction of the point, line and polygon easy from the scanned data (Gregory 2005).

Balletti (2006) emphasizes the importance of geo-processing in analysing historical data. The process of obtaining historical information through the reading of spatial changes as depicted in early maps and historical mapping in general, is of great importance in the cartographic heritage approach. In the study of the development of a territory, historical cartography plays an important role.

Maps provide information related to the spatial reference with respect to the time they are referred to. In most cases, due to the lack of geometric referencing and other relevant information about their projective properties, historical maps are difficult to be inserted into a GIS environment (Balletti, 2006).

The digitizing and polygon attribution methods used by Thorne, et al. (2008) in the study of vegetation change over sixty years in the central Sierra Nevada, California, USA, was adapted and used in this study, the digitizing process was described in section 3.4.2.

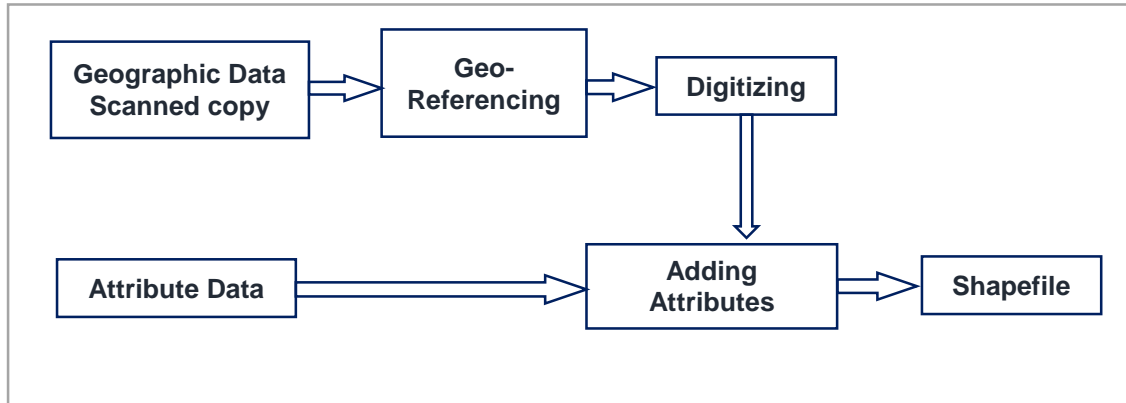


Figure 3.6: the steps used to produce a shapefile from hardcopy maps

3.4.1 Georeferencing

Geo-referencing is defined as a process of assigning real-world coordinates to each pixel of the raster. In this case the historical maps of Ciskei was projected into the earth coordinate system or map projection.

A geometric transformation was applied to the historical maps, using points of known coordinates. These points are called control points. “Control points are locations that can be accurately identified on the raster dataset and in real world coordinates” (Environmental Systems Research Institute, 2014).

The South African provinces polygon layer was used as a source map for the first part of the geo-referencing process. The first map that was geo-referenced was the 1913 key map of the Union of SA, because it is the base map of the study. The method of geo-referencing discussed by Aljoufie, et al. (2013) in the study of spatial temporal analysis of urban growth and transportation in Jeddah City was helpful in deciding on the geo-referencing method. To prepare the base data for analysis, they adopted an image-to-image registration strategy to geo-reference the various data sets using a polynomial model second-order function in ERDAS IMAGINE. ArcGIS georeferencing tool was used in Ciskei case as it is shown in figure 3.7.

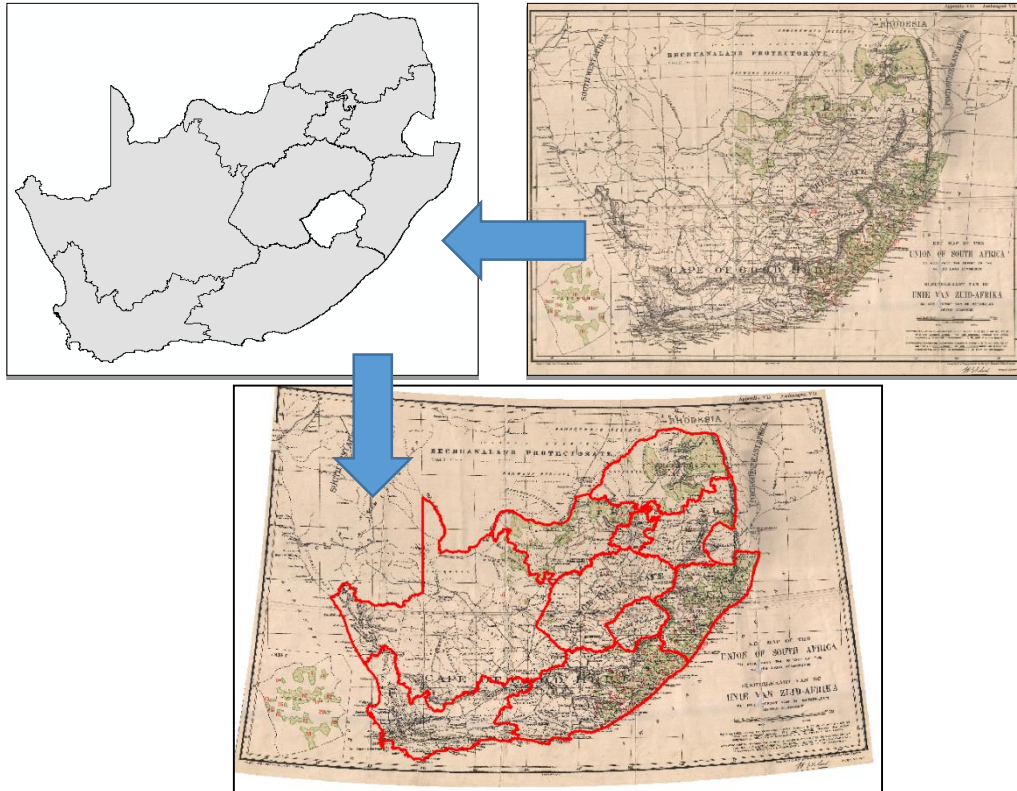


Figure 3. 7: Illustration of the Georeferencing process

Zaletnyik's (2004) study of polynomial coordinate transformations with neural networks, demonstrated that with polynomial transformation better results can be obtained in a big area than with the traditional methods, such as affine and Helmert transformations.

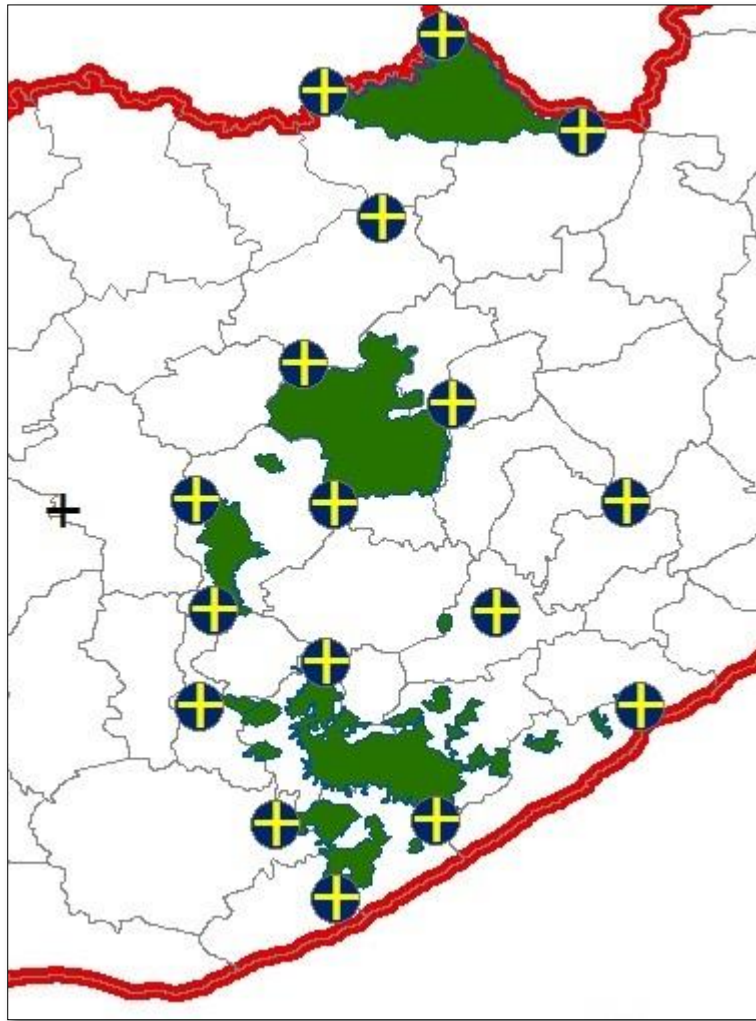


Figure 3.8 Control points used for geometric transformations in 1913 Ciskei map

The geo-reference tool in ArcGIS 10.1 was used for this process. Seventeen points in the South Africa 1913 map were chosen as control points, as shown in figure 3.8. These were easily identifiable in both the 'new' and 'old' maps. In a similar way, the 1935 Magisterial Districts map was geo-referenced by overlaying the new layers over each other.

The geo-referencing process was done for all the magisterial districts and scanned historical maps. After the geo-reference, the data was ready for digitizing to create shapefiles. The accuracy of the geo-referencing was adequate for the purpose of this research. This conclusion was arrived at because the outlines of the Ciskei on the final static and animated maps corresponded (when inspecting the maps visually) with the outlines of the reference data. This visual criterion was deemed to be the most important because the final maps would be viewed at the full extent of the Ciskei. Zooming in to a section of the Ciskei would not be important for the purposes of this

research, so a rigorous spatial accuracy analysis was not conducted. To give an indication of the accuracy of the geo-referencing, consider the geo-referenced image of the 1936 map of Ciskei shown in figure 3.8.

A check of the locations of the towns within the Ciskei was done by comparing the coordinates of specific town points in the geo-referenced map, with the town points in a reference layer provided by CD: NGI. The differences in Y and X co-ordinates is shown in Table 3.2.

Table 3. 2 The differences in Y and X co-ordinates of town points

Town	ΔY km	ΔX km
King Williams Town	0.3	0.5
East London	1.4	1.7
Fort Beaufort	0.1	0.1

One can see that the maximum displacement is 1.7 in X and 1.4 km in Y, which, for the purposes of displaying a map approximately 450km in extent at a scale of 1: 2 500 000, is sufficient.

3.4.2 Digitizing

Digitizing is a process that produces a digital copy (shapefile) of a scanned map. Digitizing extracts certain features from the source and creates point, line, and polygon layers from them. Points are digitized by clicking on the features that are required. Lines are digitized by tracing along the lines and clicking at points where there is a significant change in the line's direction. Polygons are created by creating a topographic feature on top of historical data (Environmental Systems Research Institute, 2014).

In this research the geo-referenced historical maps were used to create the shapefiles. The legislation and its time were used as an attribute data. This integration produced a shapefile layer compatible to the Time Slider tool. Figure 3.9 shows the shapefiles creation process.

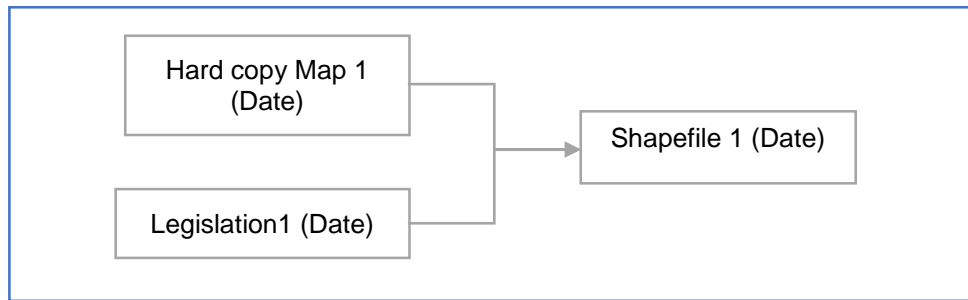


Figure 3. 9: The shapefiles creation process

Digitizing can be done either directly from the map using a digitizing tablet, or from the scanned map, then digitizing on screen – known as heads-up digitizing (Environmental Systems Research Institute, 2014). The heads-up method was used to digitize the historical maps of the Ciskei. In this section each map was digitized and created as a separate shapefile for each year as follows:

To create the shapefile of Ciskei for 1913, the districts mentioned in the 1913 Act's report from the magisterial district shapefile was selected. Then the outline boundary of Ciskei in the 1913 key map was digitized to create the 1913 Ciskei polygon layer.

The selected districts were compared with the 1913 Ciskei shapefile (described in section 3.2.2). There were inconsistencies between the map and the report. An example of an inconsistency is shown below:

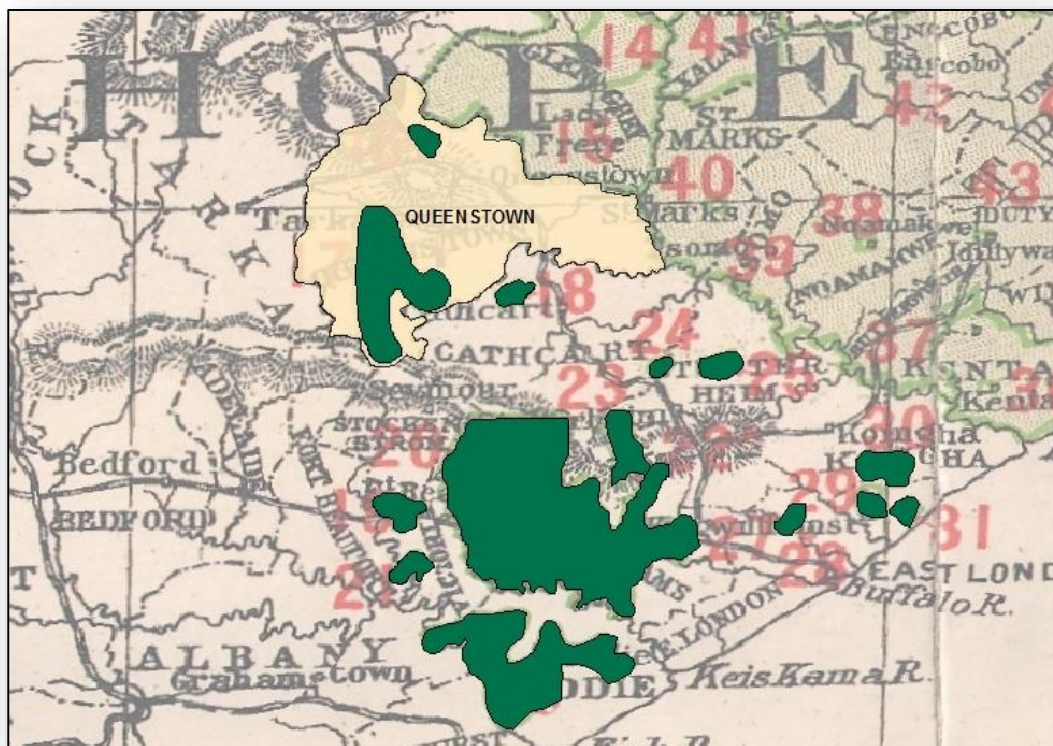


Figure 3. 10: Inconsistencies between 1913 map and report

Figure 3.10 shows the boundaries of the Queenstown magisterial district, compared with the outline of the Queenstown section of the Ciskei from the key map, shown in green. One can see that the outline of Queenstown is inconsistent between both maps. Bergh and Visagie (1985, p. 24) contained a map of the Ciskei territories. This map shows the Scheduled areas in act No. 27 of 1913 as amended, and the Released areas in act No. 18 of 1936 as amended. The scheduled areas were digitized to generate the 1913 polygon layer.

The second map was found in the Atlas of Apartheid (Christopher, 1994). It was redrawn from official 1:250,000 Topo-Cadastral maps (Government Printer, various dates). This map represents the areas designated under the 1913 and 1936 Land Acts. The released areas described in Bergh and Visagie (1985, p. 24) map was digitized

and compared with the map generated from the Atlas of Apartheid. The 1936 Act provided for the extension of the Black areas by 6.2 million hectares. The extensions of the Ciskei were digitized to produce the Ciskei 1913 shapefile.



Figure 3.11: The 1936 polygon layer digitized from (Bergh and Visagie, 1985, p. 24)

The reason for the comparison was to produce an accurate shapefile. This became the 1936 Ciskei polygon Layer.

Territorial consolidation of the scattered reserves was suggested in the Tomlinson Commission report in 1955. The suggested plans involved the high commission territories and a radical redrawing of the map of South Africa as the then existing areas

were considered to offer no foundation for community growth. Christopher (1994, p. 74) shows the Tomlinson Commission consolidation plans, which was sourced from the South Africa 1955 summary of the report of the Commission for The Socioeconomic Development of the Bantu areas within the Union of South Africa, this map was digitized from the Atlas of Apartheid to create the 1955 polygon shapefile of Ciskei.

The Atlas of Apartheid (Christopher, 1994, p. 90) shows the decentralization policies in 1960-73. The map was generated from statistics in Malan & P.S. Hattingh (1973). The map shows the Homelands and metropolitan areas. The Homeland areas and Ciskei boundary were digitized. This map became the 1960 shapefile layer.

From NGI the Development Atlas Map in scale 1:3,500,000 printed by Government Printer 1966 was found, compiled and drawn by the Natural Resources Development Council, Department of Planning. This map represents the areas defined in the Group Areas act No. 36 of 1966. See appendix D. The Ciskei polygon was digitized to create a 1966 shapefile.

Christopher (1994, p. 75) shows a map of the consolidation plans in 1973. The boundaries of all the Homelands are represented in this map which is entitled "Redrawing of the Map of the Black Areas of South Africa". This map was digitized to create the 1973 polygon layer of the Ciskei.

The Ciskei 1975 Consolidation Plans digitized from Christopher (1994, p. 76). These plans described the black territory excluded, the black territory retained, the white territory added and the consolidation proposed by the Southern Regional Committee 1980. The black territory retained and the white territory added were digitized to create the 1975 Ciskei polygon layer. The same consolidation plans were found in Christopher (1994). It is described the Homelands Consolidation Plans in South Africa 1975. I digitized the areas to remain and the areas to be added to create the 1975 polygon of the Ciskei. I chose the polygon produced from the Ciskei Consolidation plans to be the 1975 polygon layer, because it was matched with the map in the (Bergh and Visagie, 1985, p. 25).

From NGI I found the Development Atlas Map in scale 1:3,500,000 printed by the Government Printer (1976), compiled and drawn by the Natural Resources Development Council, Department of Planning. In this year the district of Herschel and Glen Grey were excised from the Ciskei and ceded to Transkei (Steward, 2008). Act No. 100 of 1976 Status of the Transkei, granted independence to the Transkei. From this map, I generated the Ciskei 1976 polygon layer.

The 1978 polygon layer was generated from The Atlas of Apartheid (Christopher, 1994, p. 86). The original figure in the book describes the South African Homelands and their capitals.

1980: Consolidation proposed by Southern Regional Committee 1980 in Bergh and Visagie (1985, p. 25), was used to generate the 1980 polygon layer.

In the Atlas of Apartheid (Christopher, p. 93) described the Deconcentration points, 1985, which was based on the map published by the Development Bank of Southern Africa. I digitized this map to create the 1985 polygon layer of Ciskei.

3.4.3 Adding attribute data

This was usually a more straightforward process than capturing spatial data. Attribute data can be captured by scanning and optical character recognition (OCR), or by typing. These can either be typed in directly against spatial features in the GIS software, or captured separately and joined to the spatial data using a relational join. In this study, the attribute data was captured directly against the spatial features in ArcGIS software (Environmental Systems Research Institute, 2014). In Ciskei study the attribute data was captured by typing.

This section describes the type of the attribute data used in this research. In section 3.2, a description was given on how the raw data was collected. This section describes how that raw data was cleaned and selected to be linked to the spatial data. The data used in this part to produce time series animation, is the time. By using the methods of handling time in GIS as described by Gregory (2005), the attribute tables were created.

GIS data has two parts – features and attributes. Attribute Table contains data about each feature. Attribute data is data containing information that can be linked to the spatial data. For example, matching date and time in the spatial data (maps).

The shapefile of the Ciskei was created in different years as described in section 3.4.2. The attribute table was designed to contain the following fields: Name, Date, and Description). To be able to be combined in the animation, all the layers for each year have to have the same attribute schema. The purpose of the Date column was to be able to generate the time series animation using Time Slider tool in ArcGIS. The adding attribute table process was done in ArcGIS software. Figure 3.12 below shows the attribute table of the 1936 shapefile layer of Ciskei as an example of all other shapefiles.

FID	Shape	id	date	Name	Legislation
15	Polygon	0	01/01/1936	Ciskei	1913 Scheduled Areas (Act No 27 of 1913)
16	Polygon	0	01/01/1936	Ciskei	1913 Scheduled Areas (Act No 27 of 1913)
17	Polygon	0	01/01/1936	Ciskei	1913 Scheduled Areas (Act No 27 of 1913)
18	Polygon	0	01/01/1936	Ciskei	1913 Scheduled Areas (Act No 27 of 1913)
19	Polygon	0	01/01/1936	Ciskei	1936 Released Areas (Act No 18 of 1936)
20	Polygon	0	01/01/1936	Ciskei	1936 Released Areas (Act No 18 of 1936)
21	Polygon	0	01/01/1936	Ciskei	1936 Released Areas (Act No 18 of 1936)
22	Polygon	0	01/01/1936	Ciskei	1936 Released Areas (Act No 18 of 1936)

Figure 3. 12 Attribute table of the 1936 shapefile layer in ArcGIS

3.4.4 Merge

In this stage of Geo-processing stage, the shapefiles created contain the time field. Each year between 1913 and 1994 was to be represented as a separate layer. There were thus only eight layers that represented the change.

The merge tools in ArcGIS and QGIS software were used to merge the separate layers in one shapefile to be used in the Time Slider tool. Two shapefiles were created, the first shapefile representing all the respective polygons for the years between 1913 and 1994. This shapefile was used to generate a time series video animation. The second shapefile was created by merging the only eight layers that contained the change. This shapefile was used to generate the Static maps which were used in the video animation.

3.5 Time Series animation and Static map

This section describes the tools and the methods that were used to create the video animation and Static map to show the development of Ciskei boundary over time. To generate a video animation, the Camtasia software was used to capture the time series animation generated by time slider tool. The factors discussed by Harrower (2003) in section 2.4.1 were considered in the design of the Ciskei animation.

Time series video animation was created in this stage to show the change in the boundaries over time. The time scale was considered as main reference in this video

as described in section 3.4.3. After the interview with CD: NGI a few edits were made because they were only interested in seeing the amount of change in the boundaries and the time of change. The geographic features (river, towns and district boundary) were considered as reference scale as well as Time.

A combination of all three of Bertin's (1983) methods of graphically displaying data that changes over time were utilised for this study. These methods were described in section 2.4.

3.5.1 Static Map

In ArcGIS for every relevant shapefile, a map was generated in the map layout. For example, a 1913 map was created and exported. This was then repeated for the remaining seven time periods, namely 1913, 1936, 1955, 1966, 1975, 1976, 1980 and 1994. In providing an effective visualisation, considering the amount of information to display to the map reader, an A2 size sheet was selected to represent all the information for each year. See Appendix E for the final static map.

The change of the geographic boundaries between 1913 and 1994 was the only layer showing the change over time. The boundary in each year was classified into three colours: the red colour represents the Ciskei, the yellow colour represents the area added to Ciskei and the blue colour represents the area excluded from Ciskei. These types of graphics called small multiples, allow map users to distinguish the change over time (Fish, 2010).

Beside the Ciskei boundary, each map contained five layers (towns, rivers, provincial boundaries, districts municipalities' boundaries and the boundary of Transkei as it was in 1994.) These layers displayed over the South Africa Earth set satellite image one kilometre resolution. These additional layers provided contextual information for the viewer. In addition, each map contained information such as the legislation affected by the boundary, the time, the area of Ciskei and the perimeter.

According to CD: NGI (2014), in order to maintain a legible map sequence, only one map legend would suffice. By implementing it in this manner, the map-reader may be attentive to each snapshot. The map legend was therefore placed after the sequencing of the snapshots along with the provinces inset indicating the boundary of Ciskei.

3.5.2 Time slider and animated maps

The Time Slider window provides controls that allow visualizing temporal data in ArcGIS. The Time Slider tool was used to display the merge layers. A time series

animation was generated from the merge layer that contained all the years from 1913 to 1994.

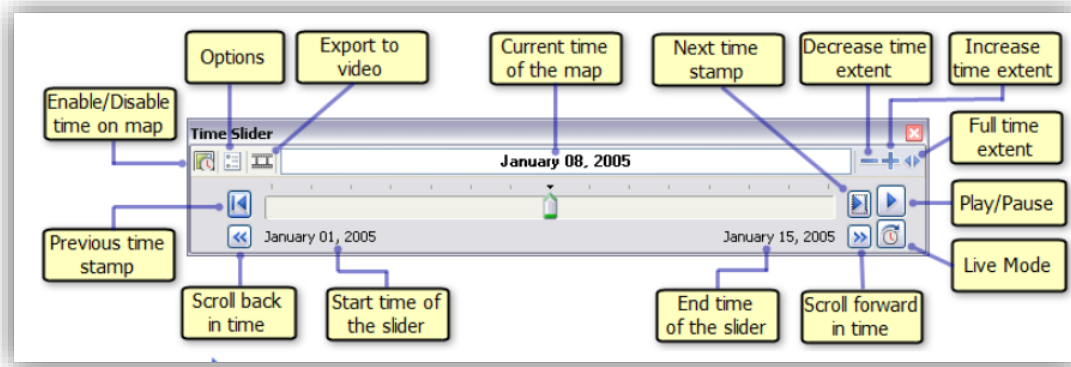


Figure 3. 13: Time Slider tools ArcGIS 10 (Environmental Systems Research Institute, 2014)

An alternative to the Time Slider tool, is the Time Manager Plugin in QGIS. It has time controls that can be used to animate vector features based on a time attribute. There is also an experimental raster layer support. Time Manager was tried, but was not ultimately used because of a problem with the plugin. It could not handle data that was dated before 1970 (QGIS, 2014), so it was decided that it was not appropriate for this research, and hence excluded.

All the shapefile data contained a time attribute linking all features to the specific time period of the source data. As mentioned previously, GIS system providers have developed add-ons in the last few years, such as QGIS time manager and ArcGIS time slider. These can render data that contains time attributes as a time series animation. Once the shapefiles were added to the time slider, a time series animation was created rendering data from 1913 to 1994. The reason for creating an animation not showing any GIS interface, was to make it easy to be understood by the map-readers who are not experienced in GIS technology nor exposed to it in a regular basis. In the event of the interface being more complex, the abovementioned map-readers might abandon the map as they could feel intimidated, rather than because they do not have the ability to understand the map (Harrower, 2003).

The factors and solution mentioned by Harrower (2003) in section 2.4 were considered in the Ciskei animation. In particular, the concept of 'attention' was applied by classifying the Ciskei shapefile to three colours. The red colour represented the area of Ciskei, the blue colour represented the area excluded and the area added to Ciskei was represented by the yellow colour. For example, two frames of the AM and SM depicting how change is handled with these colours, is shown in Figure 3.14:

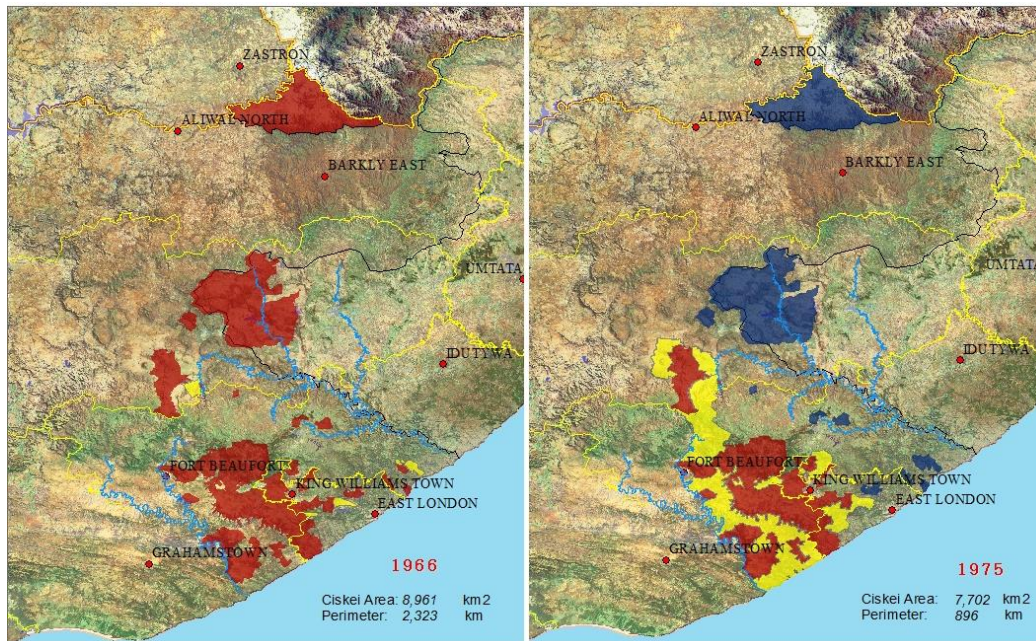


Figure 3. 14 The spatial change of Ciskei between 1966 -1975

In figure 3.14, the blue area in 1975 was part of the Ciskei in 1966, but was removed as a result of the Consolidation Plans (1973-1975). This area, comprising the districts of Herschel and Glen Grey, became part of Transkei. The yellow areas were added to the Ciskei between 1973 and 1975. The red areas did not change, but remained part of the Ciskei.

Map-readers will be more likely to notice significant events by systematic and logical placement of map information (Harrower 2003). To apply this solution to the Ciskei animation, the information showing the area and perimeter change was placed and stayed in the lower right corner. This also applied to the information that show the change of date (in the lower right corner) and the legislation, which was situated in the upper left corner. The placement of the text did not change, and the font and colour stayed the same during the animation. This helped the map-reader with where to look or focus their attention whilst the animation played. Moreover, the narration was used to direct the map-reader's attention.

One of the many faults of animated maps is that it tries to do too much and in turn not assisting the map viewer in gaining from it. "Burdening the user with more information than they can process in real-time undermines the map's design and may confuse or mislead the reader." (Harrower, 2003, p. 64). The possible solution in this case is regulating the animation speed at key points. In the Ciskei animation, eight seconds was given to each frame as this was sufficient time for the viewer to observe all the important information in that frame and detect the change from the previous frame.

The 1980 frame was more than eight seconds because there was more information needed to be conveyed, such as commentary on the independence of the Ciskei.

A total of eight images were exported from the time slider. The significance and advantage of exporting the imagery from the Time Slider is that the data is geo-referenced and provides for a smooth transition for visualisation. These images were inserted into video editing software. The exact same entities of colour and specification of the map data were exported from Time Slider as was used for the static map, to hold true for the animated testing and eliminate any advantage of one display over the other. The only difference would be that the information would be shown differently in an animated map, as with a static map. A map legend accompanies the data.

In the animation, information is presented as it appears in the time series. Transitions are placed between snapshots to ease viewing and played fast enough to show change and reduce change blindness as mentioned in the literature. The total length of the animation was 4:24 minutes. Consideration was given to the amount of data presented and duration specifications, as highlighted in section 2.4.1. See Appendix F for a hyperlink⁴ to the time series video animation.

3.6 Participants

One of the objectives of this research was to evaluate animated and static time series maps with regard to spatial change and information detection. Methods and the design used for this study were based on the literature from the previous chapters. The design of the questionnaire and the number of participants were based on Dawood and Motala (2015) as this study was the extension of their research.

For the purposes of this study, geospatial participants were considered people who were employed within the geospatial industry, or senior undergraduate students who were studying towards a qualification in either GIS or Surveying. These were geospatial users, when compared to non-geospatial participants. People who worked in the geospatial industry were employees of the Surveyor-General: East London. Non-experts were considered people who have not worked with GIS before

There were a total of 40 participants. 20 were employed in the geospatial industry and familiar with what change detection in mapping entails. The remaining 20 were not

⁴ The video can be accessed at https://www.youtube.com/watch?v=OLX_XIZ1wKA

within the geospatial industry and therefore not working on a day-to-day basis within a spatial environment, nor with geospatial data. A breakdown of the number of participants participating in the survey as shown in Table 3.3:

Table 3.3. A breakdown of the number of participants

Questionnaire Representation 40 Participants			
static printed map 20 participants		animated map 20 participants	
10 participants in the geospatial industry	10 participants not in the geospatial industry	10 participants in the geospatial industry	10 participants not in the geospatial industry

3.6.1 Geospatial industry participants

Geospatial participants were considered people who were employed within the geospatial industry, or senior undergraduate students who were studying towards a qualification in either GIS or Surveying. These participants were employed at the Surveyor-General Office in East London and were all skilled in the use of GIS technology. All of them worked with spatial data on a daily basis.

3.6.2 Non-geospatial participants

Non-geospatial participants were considered people who have not worked with GIS before. These were postgraduate students at University of Western Cape. None of these people were employed or familiar with work in the geospatial industry. Seven of these participants were not from South Africa .The remaining three were from the Eastern Cape Province in South Africa.

3.7 Interviews

To obtain the benefits of the time series mapping of Ciskei, interviews were conducted with relevant government agencies, as this research can be of benefit to them. The first interview was conducted with Department of Rural Development and Land Reform staff represented by the Chief Director: National Geospatial Information CD: NGI in Mowbray. NGI is the national mapping agency of South Africa, and part of the Department of Rural Development and Land Reform. The second interview was conducted with the Surveyor-General in the East London office. The SGO's duties in terms of Land Act No. 8 of 1997, is to provide a national cadastral survey management

system in support of an equitable and sustainable land dispensation that promotes socio-economic development. The questionnaire was given to the SGO staff at the same time. The third interview was recommended by CD, NGI and SGO. Their recommendation was to conduct an interview with Land Restitution Support, which is a government agency responsible for the settlement of land restitution claims under the Restitution Land Rights Act 22 of 1994, as amended, and also for providing settlement support to restitution beneficiaries. The interview was conducted with the Chief Director: Land Restitution Support.

A brief introduction was given to the participants before the interview and questionnaire. This solution is mentioned by Harrower (2003): "A brief introduction can be deployed to increase user confidence, which can be less than 30 seconds, in providing an understanding before the data is viewed," Participants would therefore be more confident in viewing the animation. Moreno (2003) outlined nine principals for designing effective animated graphics. One of these principals is to include pre-training (e.g. a narrated introduction) to familiarize viewers with important terms and ideas.

The technique and steps of interview, discussed by Gretchen et al. (2012), were followed to conduct the interview. Henning divides the interview research into three phases:

- Finding the respondents and setting up the interview in accordance with the overall research design.
- Conducting and recording the interview.
- Reflecting on the interview and working with, or analysing and interpreting, the data.

In the interview, the animated and Static map were presented and discussed before the interview. The instructions stated by Creswell (2013) were taken into consideration during the interview.

The following are some example of questions that were asked during the interview: 1) what is the need for research on the effects of apartheid legislation that directly affected the creation of boundaries that separated the different racial groups during apartheid? 2) How will the time series mapping of the Ciskei be of benefit to NGI/ SGO? 3) Can the Static maps and animated maps assist you in land reform process and the services that you provide to your client? 4) From the fact that Ciskei falls into (Chris Hani, Amathole and Buffalo City) municipalities – how can this help you?

The answers and analysis of the interviews are stated in section 4.6.

3.8 Questionnaire

The questions were developed using Peuquet's (1994) triad – mentioned in section 2.5.2. Similar to the questionnaire developed by Dawood and Motala (2015), this questionnaire contained two “what” questions, two “when” questions and two “where” questions. The design of the questionnaire was an adaptation of Dawood's and Motala's (2015) research.

The “what” questions were:

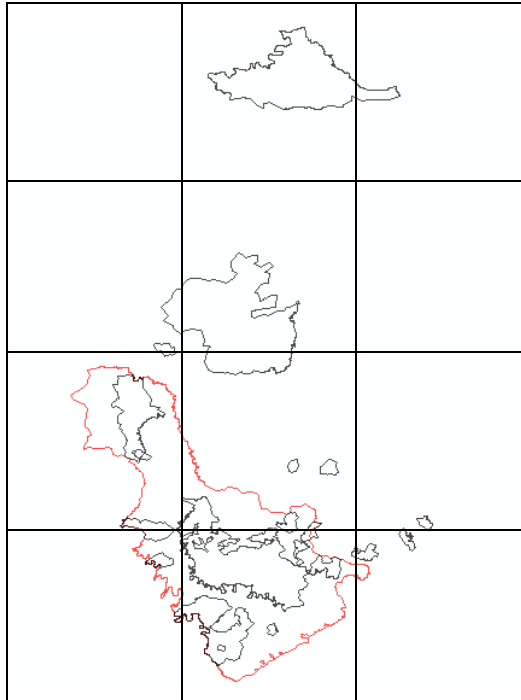
1. What was the act that declared Ciskei as an Independent State?
 - The Status of Ciskei Act No 110 of 1981
 - Representation between RSA and Self Governing Territories Act 46 of 1959
 - Native Land Act 27 of 1913
2. What year was there the most drastic changes to the Ciskei boundary?
 - 1936
 - 1955
 - 1975
 - 1980

The “when” questions were:

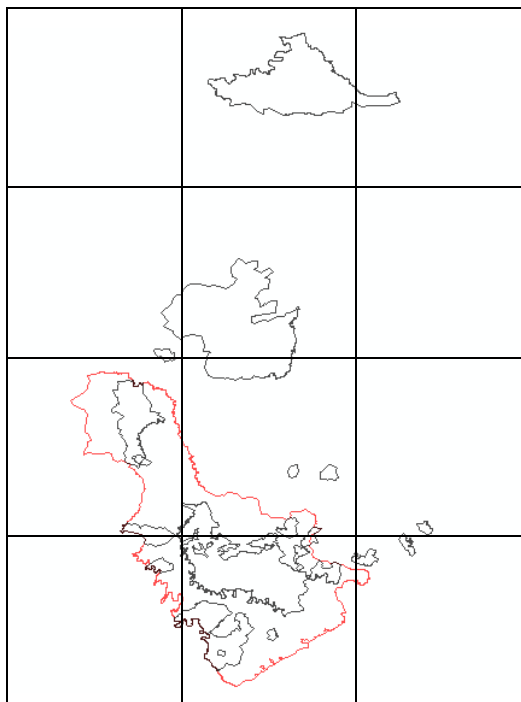
1. When was Ciskei established?
 - 1913
 - 1951
 - 1981
 - 1994
2. When did Ciskei become a single consolidated area?
 - 1975
 - 1973
 - 1976
 - 1980

The “where” questions were:

1. Where is King William's Town located? Place a cross (X) in the correct block:



2. Where was the Herschel district located in 1966? Place a cross (X) in the correct block:



The questions that were developed were simple enough for the map viewer to understand, and tested their change detection ability.

The questionnaire was made up of ten structured questions, with two of the questions being pre-test questions. The pre-test questions were explained so that it was clearly understood by the participants before they answered them. The same sets of questions

as found in Appendix B, were answered by both groups that viewed the printed Static map and the animated map.

Participants were asked if they would like to partake in a research study beforehand, and testing was done when they were able to avail themselves. Verbal and written instructions in the questionnaire were given to the participants prior to the survey test that the static/Static map that is to be presented is a series of maps of Ciskei. Three minutes were given to view the map, after which it would be required to partake in a questionnaire. The questionnaire was on an anonymous basis and kept as confidential. Consideration and attention had to be given to all the changes being displayed, such as the area and perimeter change over time and legislation in each of the time periods. 20 participants viewed the Static map of Ciskei whilst another 20 viewed the animation. The animation was presented on a laptop with a projector.

Chapter 4: Results and Analysis

4.1 Introduction

This chapter covers the quantitative as well as the qualitative results. The results obtained from the research are interpreted and evaluated. Section 4.2 covers the development of the boundary of Ciskei Homeland. Eight static maps were produced to show the area, perimeter and spatial change over time as well as the appropriate apartheid land legislations that affected the boundary of Ciskei Homeland during the period between 1913 and 1994. Figure 4.1 is a snapshot of the A2 map size (Appendix E) representing the change of Ciskei over time. This map was used during the interview and questionnaire process conducted at CD: NGI and the Surveyor-General in the East London. The process of displaying of the Static map and Static map is described in the previous Chapter.

Section 4.3 and section 4.4 covers the Static map and Static map results. The data was captured from the questionnaire. The data collection process is discussed in the previous Chapter, section 3.7. Section 4.4 represents the results of the individual's familiarity with the history of the Ciskei. The interview data analysis is presented in section 4.7. The data collected from the interviews conducted with the CD: NGI in Mowbray, the Surveyor-General in East London and CD: Land Restitution Support.

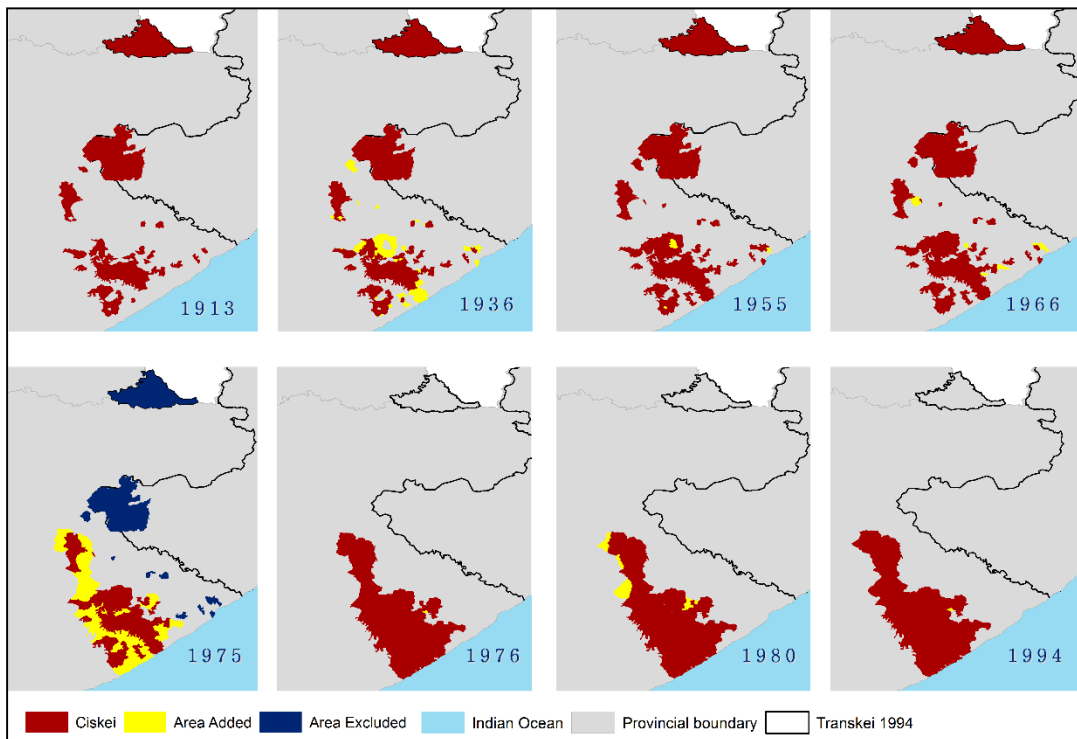


Figure 4. 1 Time series map of Ciskei between 1913 and 1994

4.2 Spatial change of Ciskei

Figure 4.2 and 4.3 shows how the area and perimeter of Ciskei changed between 1913 and 1994. The area and perimeter was calculated from the vector shapefiles that were created for each time period. The shapefile creation process was described in section 3.4. All the areas were measured in square kilometres, and all the perimeters were measured in kilometres for each of the relevant time periods. The areas and perimeters were calculated using the Calculate Geometry Tools in ArcGIS10x.

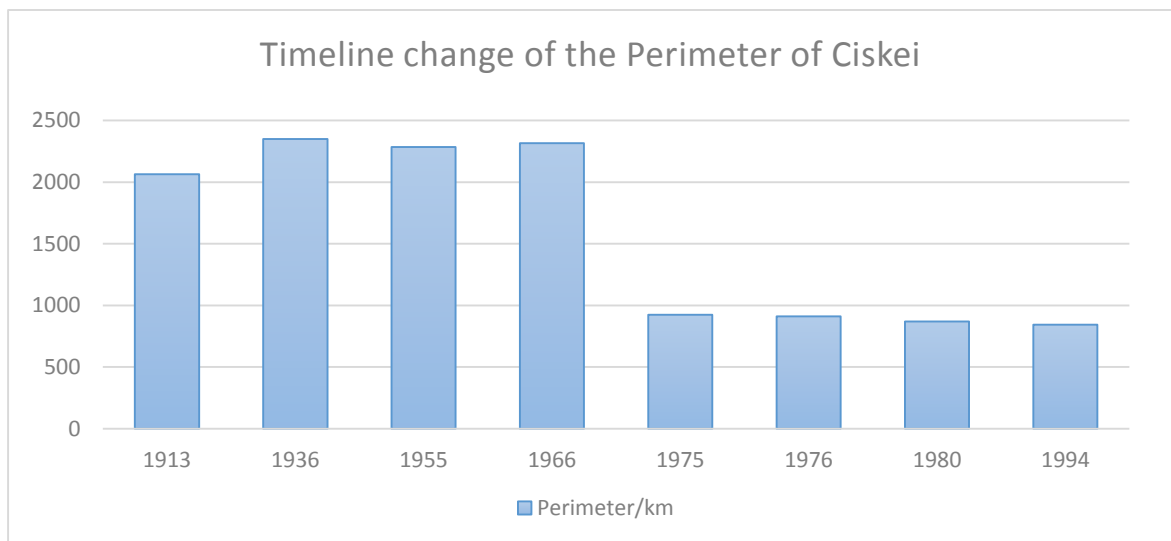


Figure 4. 2 Change of the Perimeter between 1913 and 1994

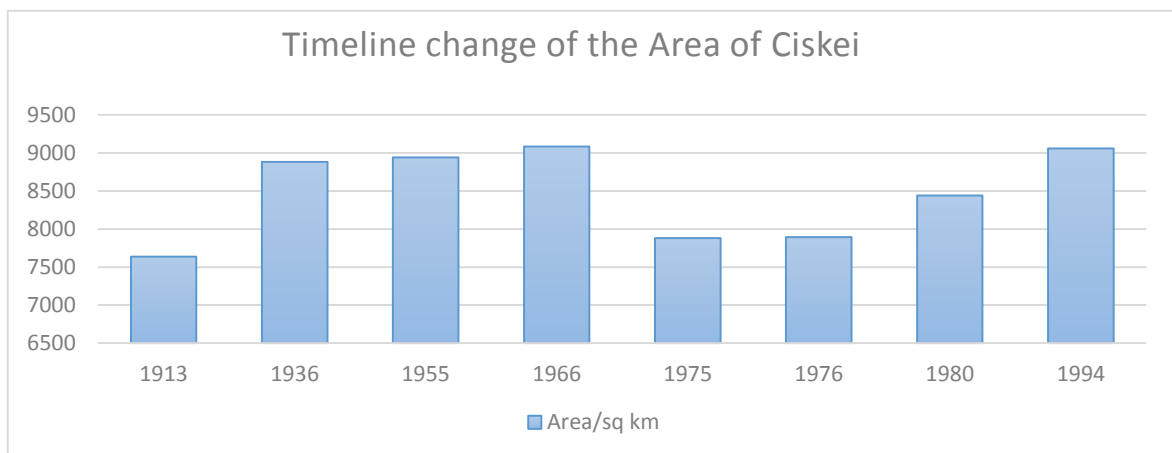


Figure 4. 3 Change of the Area between 1913 and 1994

Figure 4.2 show that the perimeter of Ciskei Homeland reduced from 2064 km in 1913 to 843 km in 1994. The Static map in Appendix E show that the Ciskei consisted of a number of areas in 1913. As a result of the consolidation plans between 1973 and 1976, Ciskei was converted to one spatial unit, surrounded by an 843 km border. This decrease in perimeter made the Ciskei and its inhabitants more manageable by the apartheid state.

Figure 4.3 shows the change in area of the Ciskei between 1913 and 1994. The area increased in 1936 with the promulgation of the Development Trust and Land Act, and then decreased substantially between 1973 and 1975 as a result of the Consolidation Plans. Through the changes over time, the Ciskei went from a spatially fragmented entity to a single spatial unit.

As mentioned in section 2.5.4, the apartheid government made it legal for blacks to become citizens of their independent Homelands. The Bantu Homelands Citizenship Act of 1970 was passed, which allowed blacks living throughout South Africa to be legal citizens in the Homeland designated for their particular ethnic group. This demonstrates the reasons behind the consolidation plans between 1973 -1976 – to make Ciskei one single consolidated area, so it was easy to control the movement of black people from and to the Homeland. Figure 4.4 shows the extent of spatial change brought about by the consolidation plans.

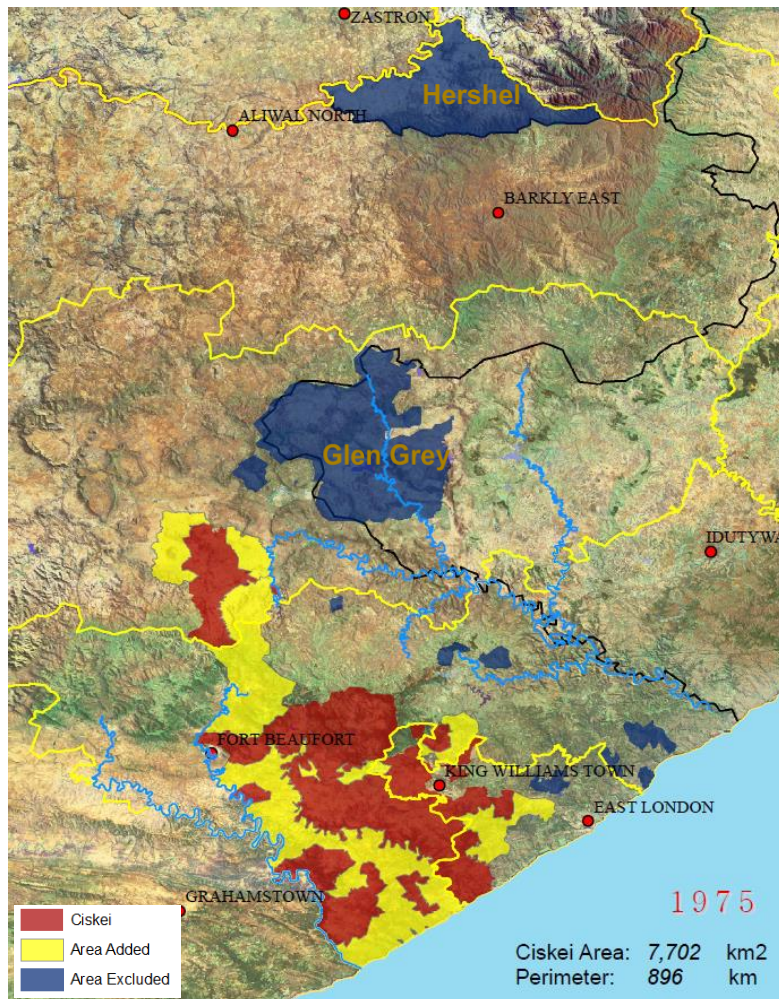


Figure 4. 4 The consolidation plans 1973-1976

Figure 4.4 clearly shows how the area of Ciskei was reduced from 8,971 square kilometre in 1970, to 7,702 square kilometre in 1975. The blue colour represents the areas that were excluded from Ciskei. Both Herschel and Glen Grey districts were incorporated into the Transkei Homeland. According to Stewart (2008), the people who lived in these two districts were moved into Ciskei because they wanted to keep their South African citizenship, but unfortunately they lost it after the Ciskei independence was legislated by South Africa in 1981. The other excluded areas became part of the Republic of South Africa. The yellow colour represents the areas added to the Ciskei. The border of the Ciskei reduced from 2,323 kilometres to 896 kilometres as a result of the consolidation plans.

The forced removal of black people to the Ciskei Homeland created a populated area of high density during the apartheid era. Even though Ciskei does not exist today, its legacy can be seen in the pattern of the current populated area in Eastern Cape. Figure

4.5 shows the Ciskei boundary as it was in 1994, and the current populated area in and around Ciskei (Statistics South Africa, 2011).

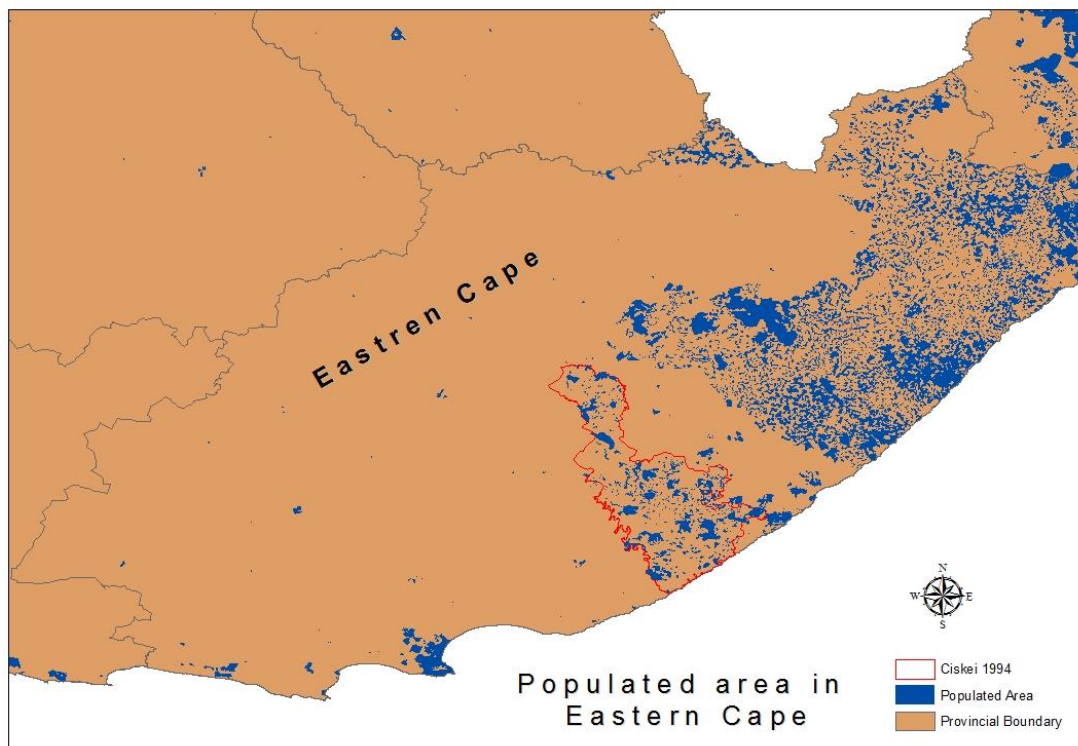


Figure 4. 5 The populated area in Eastern Cape (2011) with the Ciskei boundary in 1994.

The total population of Eastern Cape Province including Ciskei and Transkei is 6,562,053. The population of Ciskei according to 2011 census population is 702,891. This was calculated as a summation of the population of the areas were under Ciskei in 1994. Black people represented 97% of the total population. The population density in Ciskei is 77.5 persons per square kilometre. The population density of South Africa is 39 person per square kilometre (Statistics South Africa, 2011). By comparing the population densities in South Africa with the Ciskei population density, one can get an idea of the concentration of the people in the Ciskei.

4.3 Animated and Static map results

In this section of the results, comparison of answers of the questionnaire (Appendix B) about the animated map (Appendix F) and static map (Appendix E), and the number of participants along with the percentage answered in each respect, is shown.

4.3.1 “Where” Questions

Figure 4.6 and 4.7 show the “where” questions and the spread of answers that were given for them. The grey coloured block represents the correct answer. The red numbers represent participants who observed the SM, and black numbers represents participants who observed the AM.

Where is King William’s Town located? Place a cross (X) in the correct block:

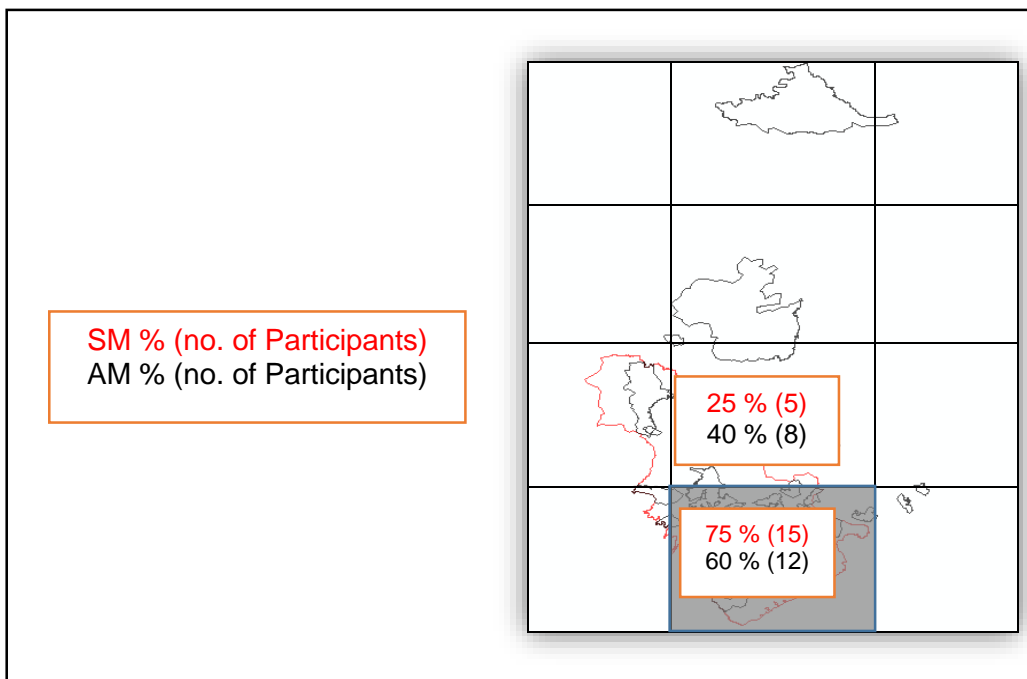


Figure 4. 6 Results of SM and AM Question 3

Where was the Herschel district located in 1966? Place a cross (X) in the correct block:

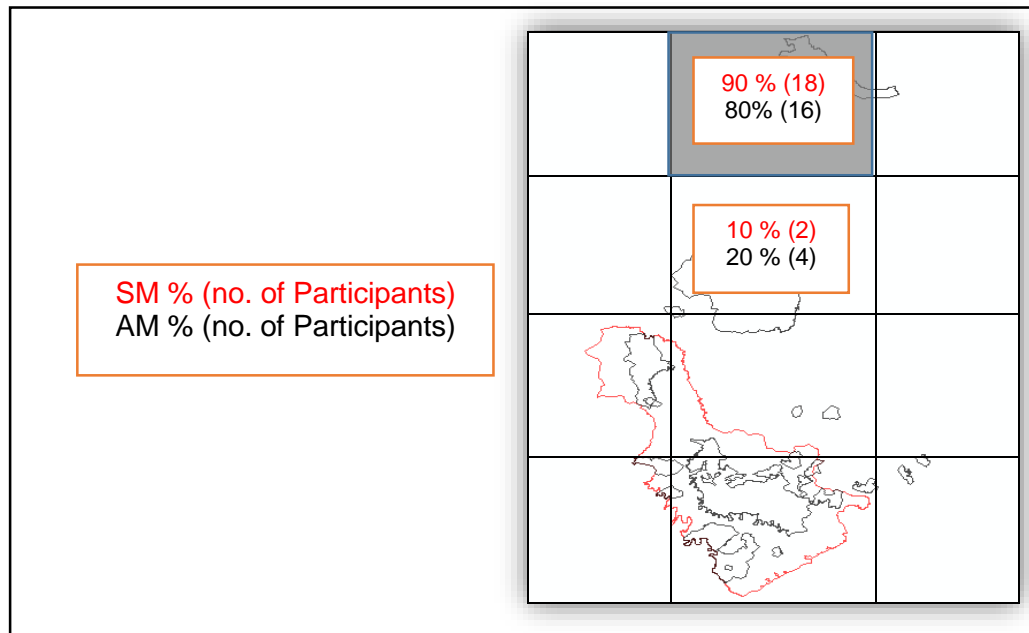


Figure 4. 7 Results of SM and AM Question 4

The results in figure 4.6 show that the Static map has surpassed the Static map results albeit by 5%. In figure 4.5, with a 90% correct answer, the Static map result is better than that of the animated map's 80%. The participants of the SM display showed greater success, thereby showcasing that the SM is best used for locating spatial features. In explaining this difference, the result could be attributed to the restrictions of animated maps explained in section 2.4.1. In particular one of the Static map restrictions is Complexity - Harrower (2003) mentioned that one of the many faults of animated maps is that it tries to do too much and in turn fails to allow the map-reader to gain from it. "Burdening the user with more information than they can process in real-time, undermines the map's design and may confuse or mislead the reader." (Harrower, 2003, p. 64).

The figures 4.8 to 4.13 display the results of the participant answer selection. These figures display the difference in the map reader's answers between the SM and AM.

4.3.2 "When" Questions

Figures 4.8 and 4.9 represent the answers that were received for the "when" questions. The figures in red show the percentages of the correct answers obtained (for example, in Figure 4.8, the correct answer is 1913).

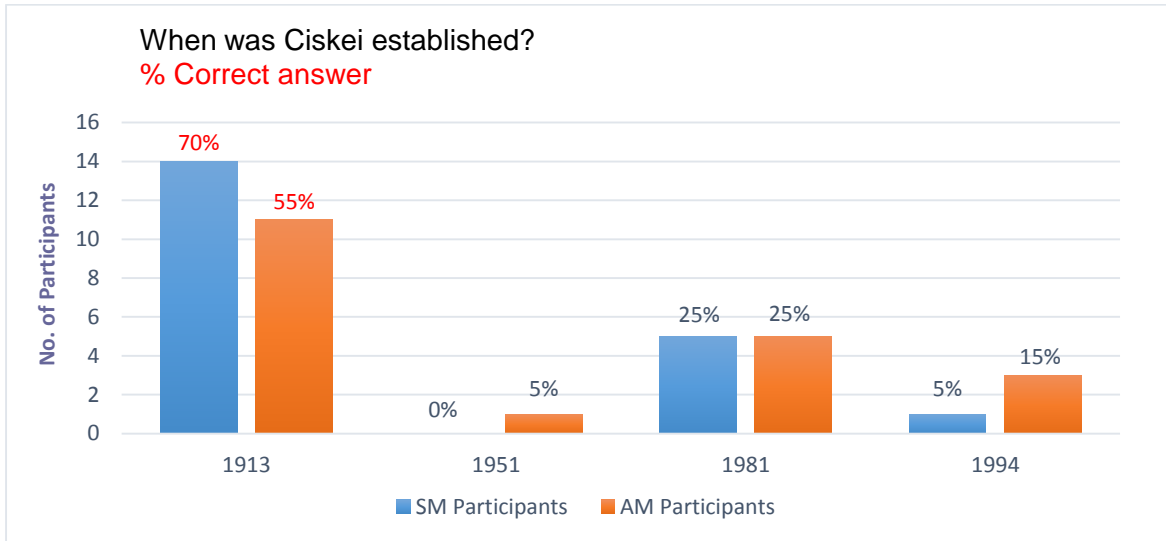


Figure 4. 8 Results of SM and AM Question 5

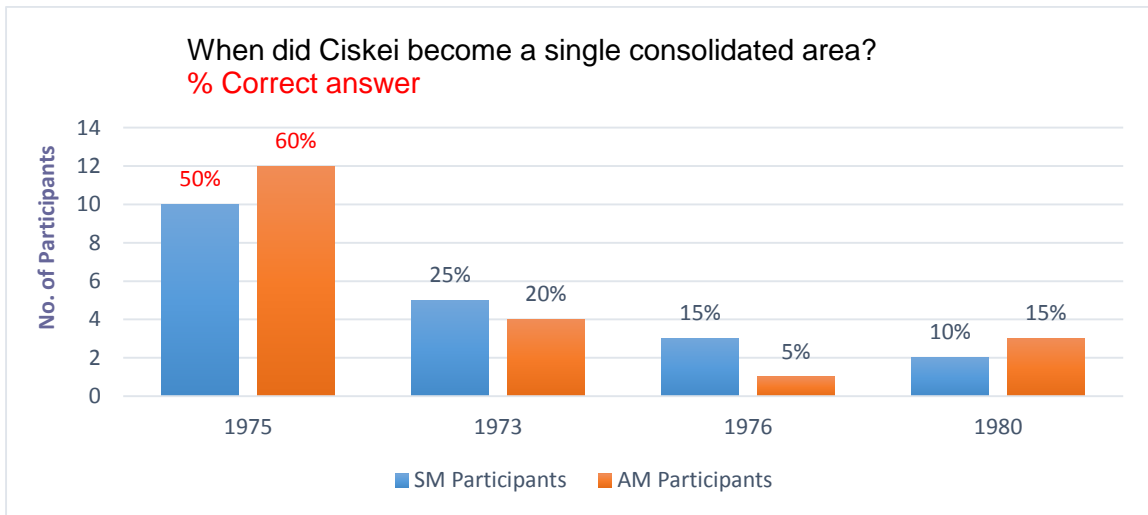


Figure 4. 9 Results of SM and AM Question 6

Of the two “when” questions, figure 4.8 and 4.9, there is no clear advantage of either the SM or the AM.

4.3.3 “What” Questions

Figures 4.10 and 4.11 represent the answers that were received for the “what” questions. The figures in red show the percentages of the correct answers obtained.

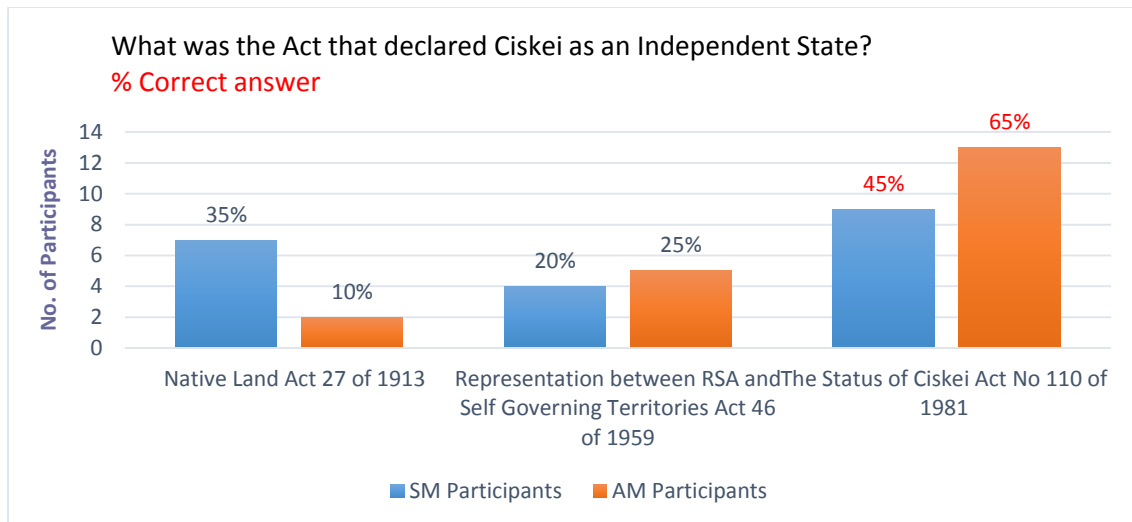


Figure 4. 10 Results of SM and AM Question 7

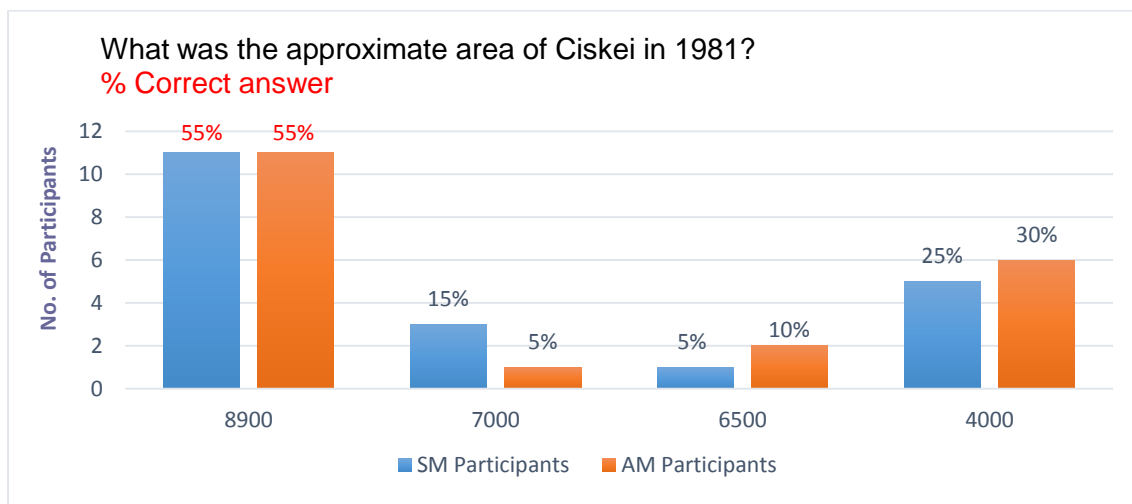


Figure 4. 11 Results of SM and AM Question 8

The (what) question type, figure 4.10 and 4.11 has seen strengths in both displays. The first 'what' question type, figure 4.10, shows that 65% of participants answered correctly for the AM, as opposed to the 45% of the SM. However, the second 'what' question type as presented in figure 4.11, shows that both sets of participants have equally answered 55% correctly. Therefore, preference in this regard has been given to both displays. In this instance, the AM has an overall edge. It is interesting to note that a large percentage of the AM respondents (35%) answered incorrectly in Figure 4.10 they thought that the Native Land Act was the correct answer. This is because people know the history of Ciskei as an independent Homeland, and they don't know

much about the geographic history this is confirmed by the interview with CD: NGI (2015). In section 4.6.

4.3.4 “Spatial change” Questions

There were two questions which were associated with spatial change between time periods, represented by figure 4.12 and 4.13.

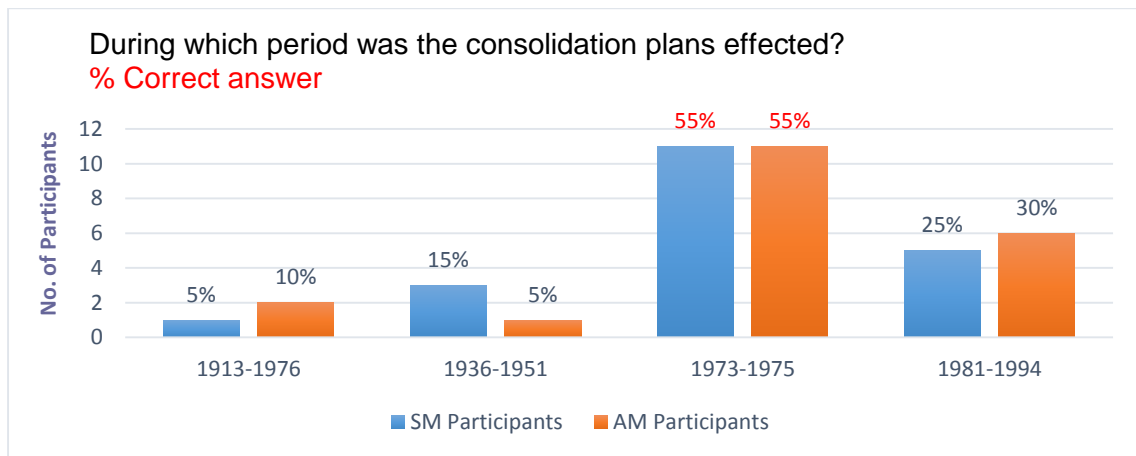


Figure 4. 12 Results of SM and AM Question 9

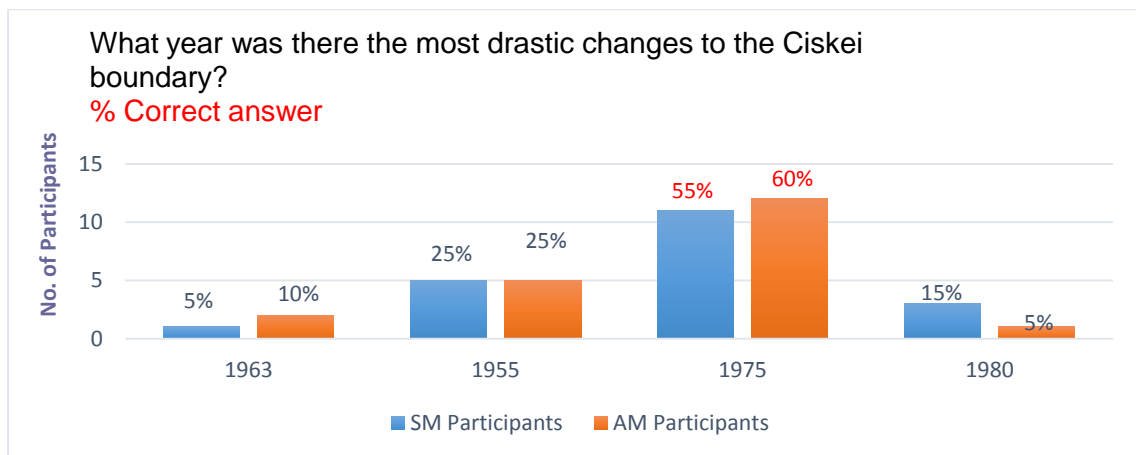


Figure 4. 13 Results of SM and AM Question 10

Observers of both map displays answered equally correct at 55% of the consolidation plans as shown in figure 4.12. It seems to present that there is no advantage of the SM over the AM and vice versa.

4.4 Participants: Geospatial and non-geospatial results

The results and answer selection of the geospatial participants and the non-geospatial participants that observed the AM and SM are displayed in this section. In figure 4.14 and 4.15, the grey coloured block represents the correct answer. The red numbers represent the geospatial participants. The black numbers represents the non-geospatial participants. These figures display the difference in the participant type location based answers between the SM and AM.

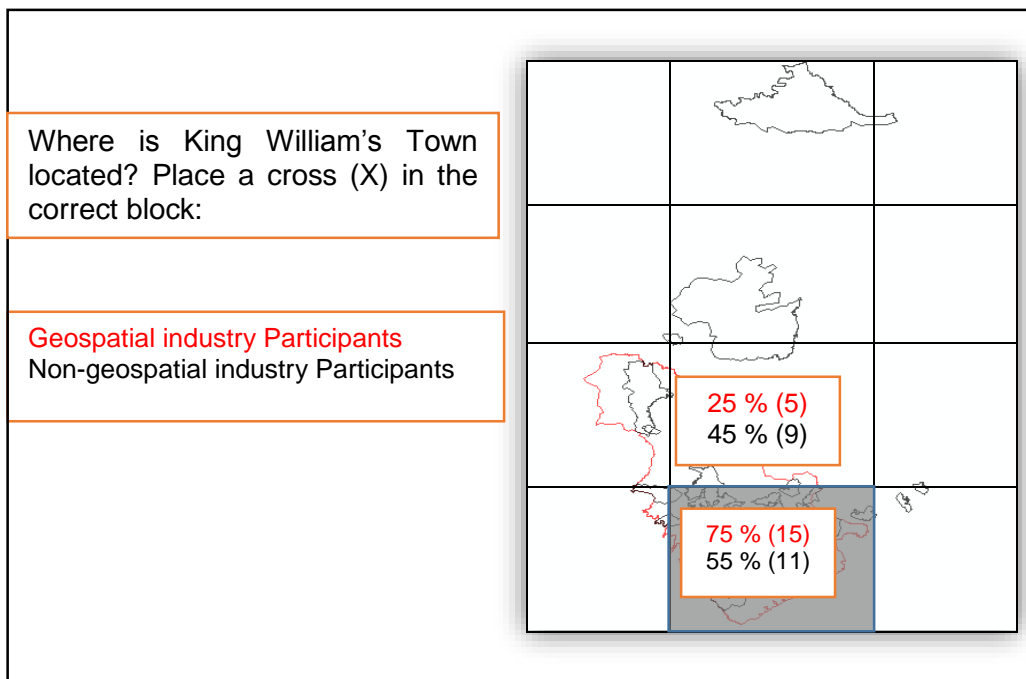


Figure 4. 14 Results the geospatial industry and the non-geospatial industry. Question 3

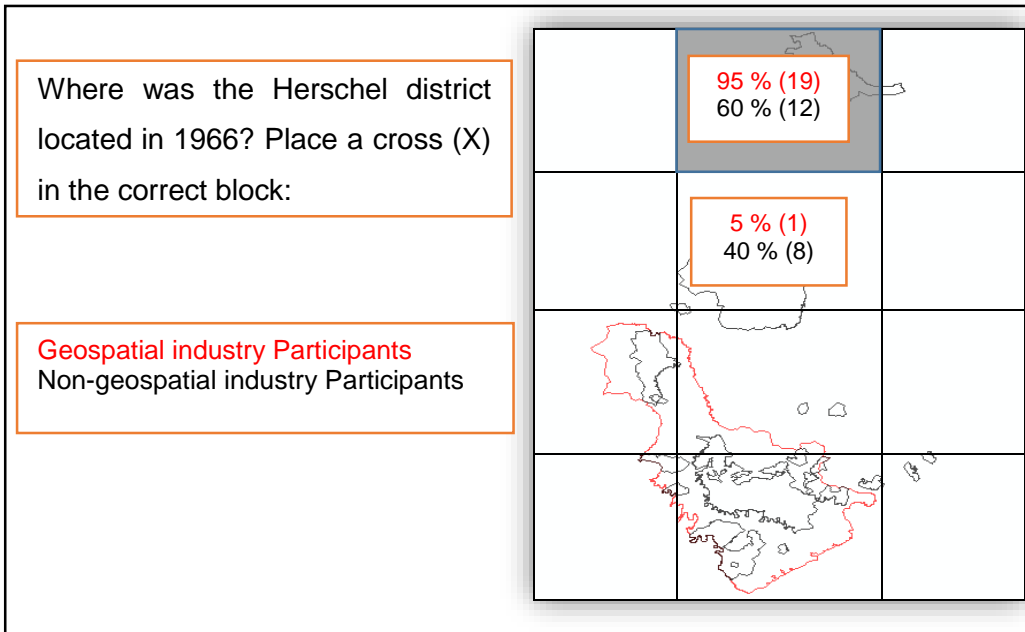


Figure 4. 15 Results of the geospatial industry and the non-geospatial industry. Question 4

The figures 4.16 to 4.21 display the results of the participant answer selection. These figures display the difference in the map reader's answers between geospatial industry and the non-geospatial industry, where the red percentage represents the correct answer.

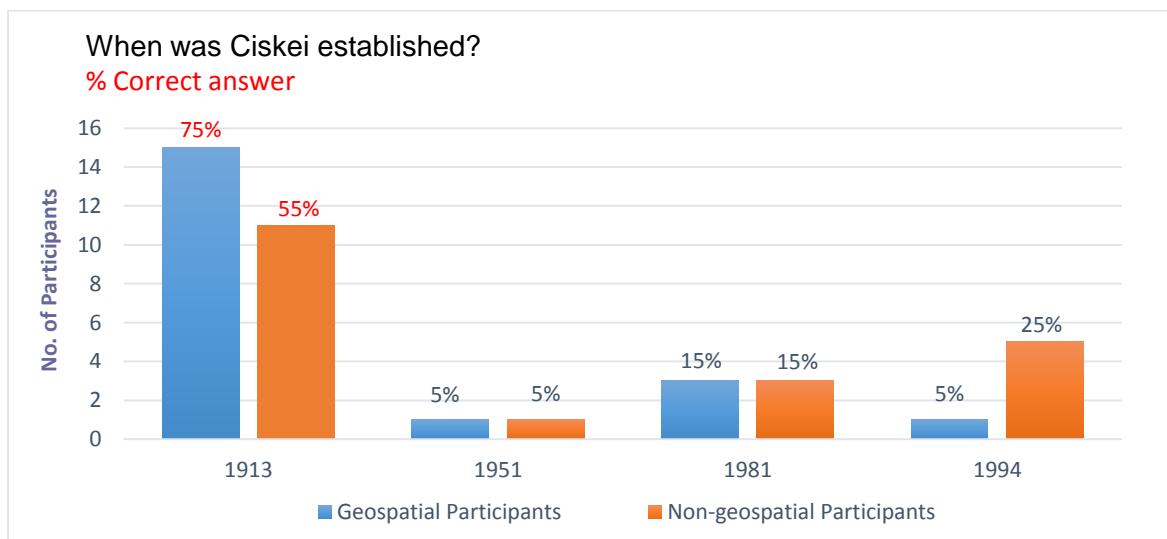


Figure 4. 16 Results of the geospatial industry and the non-geospatial industry. Question 5

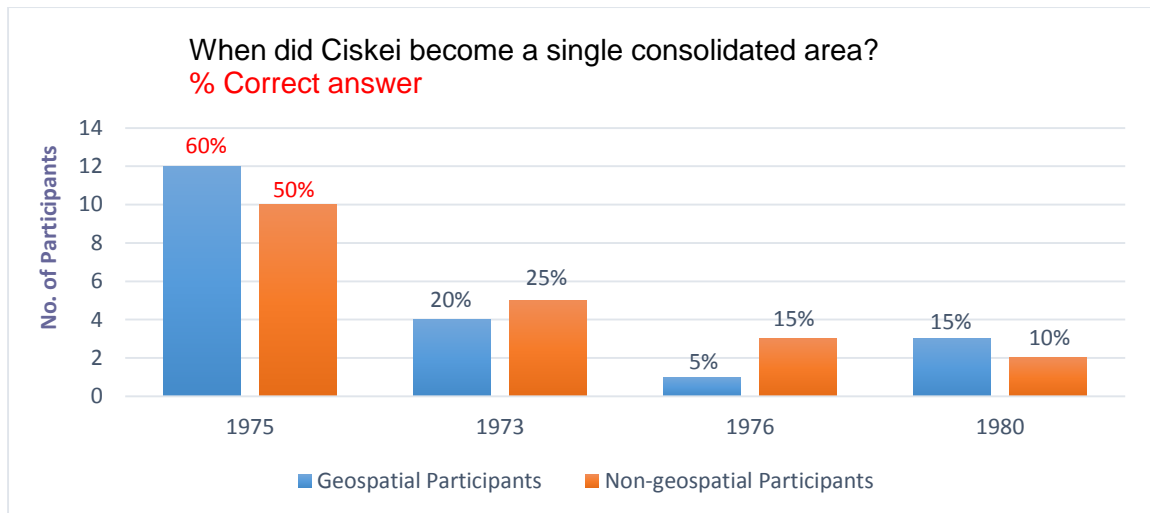


Figure 4. 17 Results of the geospatial industry and the non-geospatial industry. Question 6

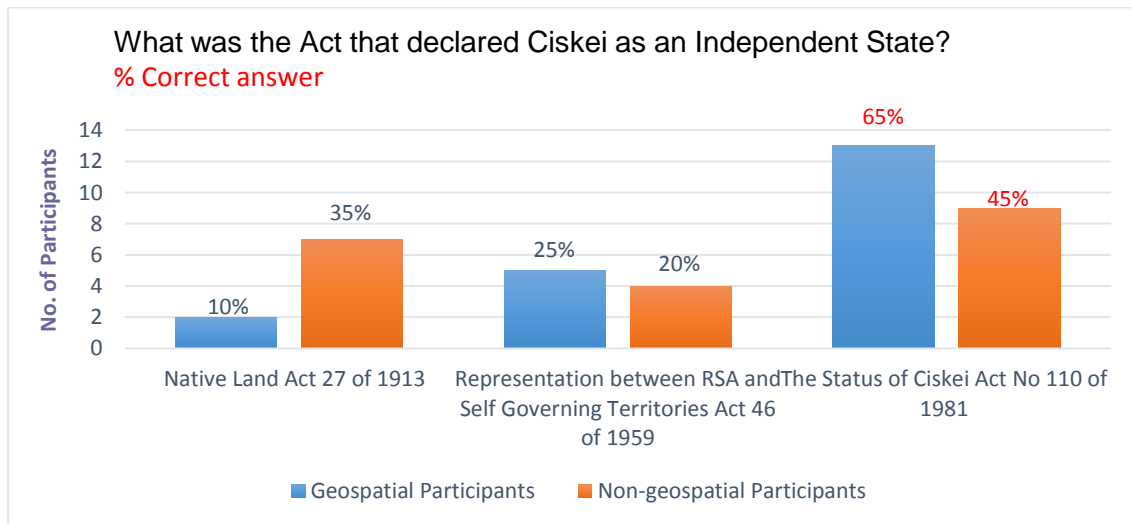


Figure 4. 18 Results of the geospatial industry and the non-geospatial industry. Question 7.

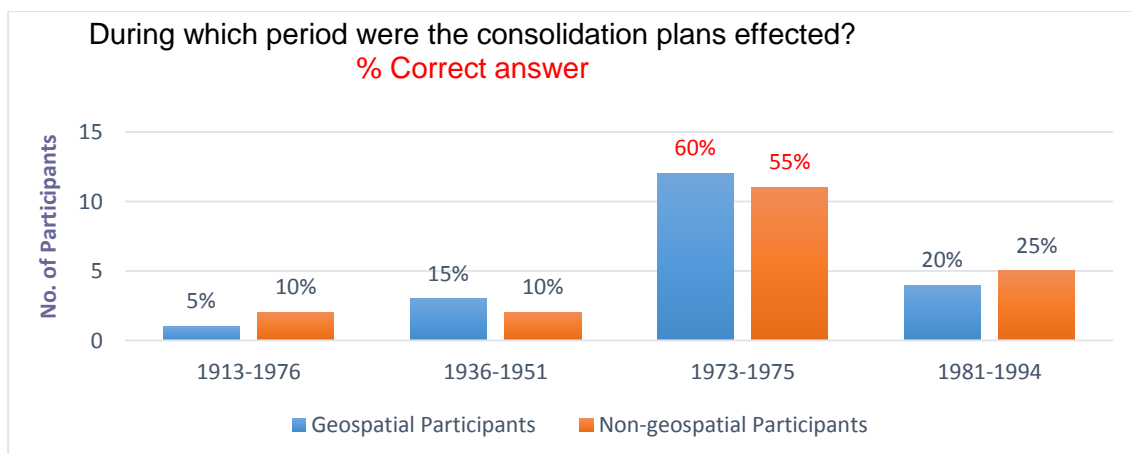


Figure 4. 19 Results of the geospatial industry and the non-geospatial industry. Question 8

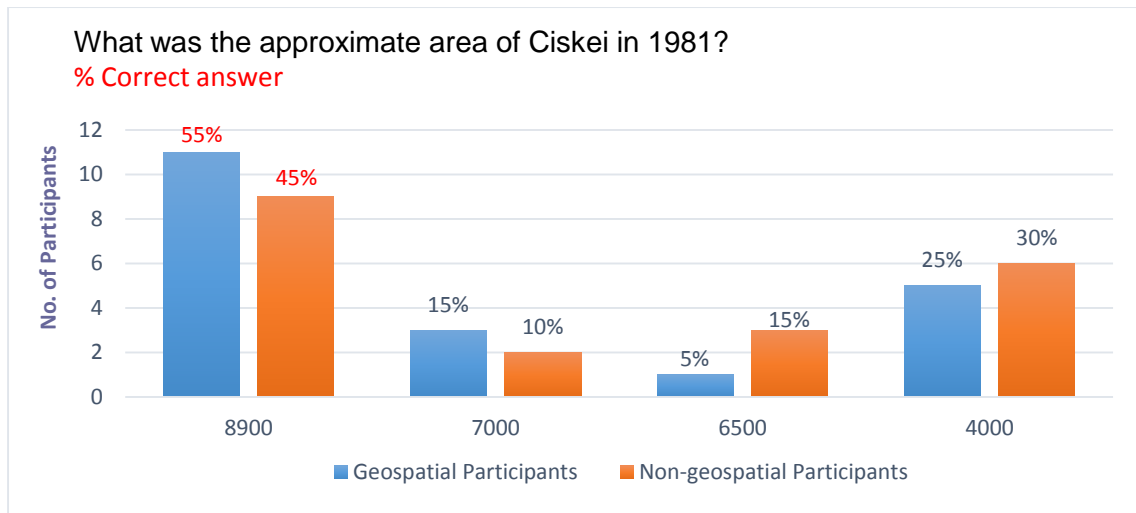


Figure 4. 20 Results of the geospatial industry and the non-geospatial industry. Question 9.

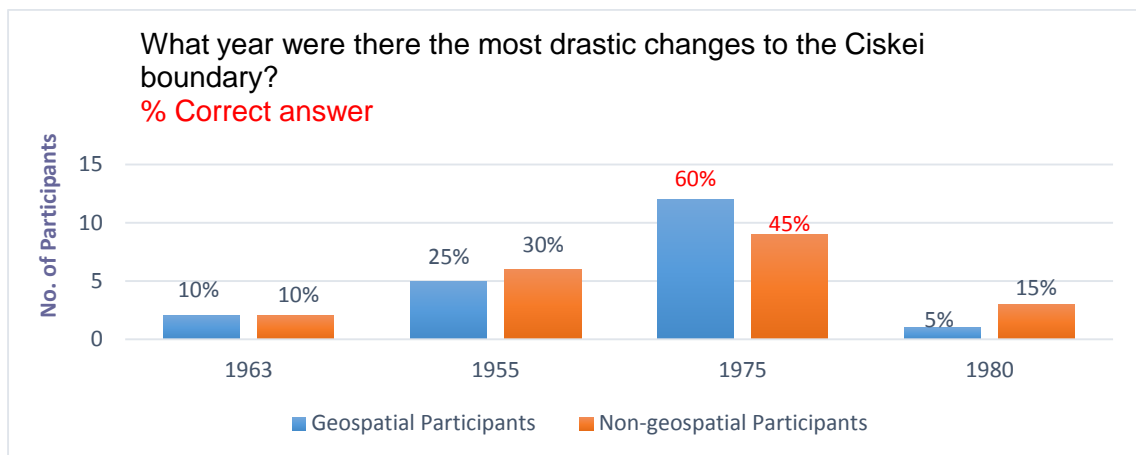


Figure 4. 21 Results of the geospatial industry and the non-geospatial industry. Question 10

Overall results shows that the geospatial participants clearly perform better than the non- geospatial, as observed above. This is expected, considering that the geospatial experts would have been accustomed to observing data represented as maps.

4.5 Individuals familiar with the change and history of Ciskei

The results of questions (1) and (2) in the questionnaire Appendix B, show the participants who had noted that they are familiar with the change and history of Ciskei. The collaboration between individuals' familiarity and knowledge of the Ciskei is shown in the Table 4.1.

Table 4.1 The results of Question 1 and Question 2.

Question	Yes	No
Q1. Are you familiar with the history of Ciskei?	27%	73%
Q2. Prior to today's meeting, were you aware that the boundary of Ciskei changed over time?	17%	83%

Most of the participants were not familiar with the history of the Ciskei (73%), nor were they aware of the fact that the Ciskei boundaries changed over time (83%). After taking part in the research, a significant percentage (57%) of the total participants answered the spatial change questions correctly. This indicates a new awareness of the changing nature of the Ciskei.

4.6 Interview Results

As mentioned in the previous chapter in section 3.7, an interview was conducted with the CD: NGI, Surveyor-General (SG) - East London and CD: Land Restitution Support. The purpose of the interviews was to investigate the benefit to governmental organisations, of the animated and Static maps. The results of the interview data were analysed, and the broad themes that were extracted are interrogated in the following points:

4.6.1 Needs for Historical research of the Homelands

The need is not just for NGI but for geospatial practitioners in general to show the value of how geospatial information can be used to illustrate to politicians and other decision-makers how apartheid legislation affected land ownership patterns and land use. There are elements of truth in the claim, but the overall picture is considerably more complex, with important implications for land policy. Over-simplified accounts of how land is distributed misrepresents the current dispensation. It is often claimed that:

1. In 1994, as a result of colonial dispossession and apartheid, 87% of the land was owned by whites and only 13% by blacks. By 2012, post-apartheid land reform had transferred 7.95 million hectares into black ownership (Nkwinti 2012), which is equivalent, at best, to 7.5% of formerly white-owned land. Whites as a social category still own most of the country's land and redressing racial imbalances in land ownership is land reform's most urgent priority.
2. The post-apartheid state currently owns a quarter of the country and redistributing this should be land reform's first priority. When this is added to the 7.95 million hectares already acquired through land reform, plus the significant

though unknown amount of land blacks are buying privately, the discrepancies between white and black ownership are sharply reduced and in some provinces may even be equitable (PLAAS, 2013).

Table 4.2 Distribution of total area of South Africa (Statistics South Africa, 2009)

Total area of South Africa			
67% white commercial agricultural land	15% black communal areas (mostly state-owned)	10% other state land	8% remainder, including urban areas
	1% former 'coloured' reserves 2% Ingonyama Trust (former KwaZulu) 2% other customary lands held in trust by the state 10% ex 'Homelands' other than KwaZulu	1% other provincial including schools, hospitals, agricultural; 1.6% other national including Home Affairs Justice, Agriculture; 0.4% Military, Police, Prisons; 7% conservation areas	2% metro 6% other, including non-metro urban areas

3. The 87:13 ratio of white to black ownership of land originates from an apartheid proposal based on the Land Acts of 1913 and 1936 that had not been completely implemented by 1994. Under apartheid, South Africa was divided between a core of about 85% of the country deemed white politically, and a periphery of ten ethnically defined back Homelands, plus a number of small coloured reserves. Race-based land dispossession and relocation caused suffering and hardship for millions of black South Africans (PLAAS, 2013) but failed to realise the master plan. Table 4.3 gives a breakdown of the land by race groups, according the 2009 census results. Throughout the twentieth century growing numbers of 'Africans' and most Coloureds' continued to live in so-called white South Africa, with varying levels of tenure security: on white owned farms and conservation lands, in urban areas, and even on a small number of black-owned properties that escaped forced removals. Therefore this time series mapping tells a lot because it provides a sense of the complex history of the Ciskei over time. It also reveals the extent to which people were affected (Parker, 2015).

The Surveyor-General's office of East London suggested research, and mapping before 1913 of the red areas in the map in figure 4.22 would provide a better understanding of the history of the Ciskei. The majority of these areas were actually surveyed farms. White farmers allowed blacks to camp and squat in return for rent. As a result, some farms became owned by black people. By the time the 1913 Act came into being, all these areas were incorporated into scheduled areas and formed the Ciskei. Therefore, many of these areas started out between 1860 and 1890. The Fish River was the boundary between the white Cape Colony and the area known as 'British Kafir area'. However, the years 1835 to 1913 represented a very fluid period in history, when these areas were rarely disputed. Ultimately the border shifted to the Kei River and these areas became part of the white Cape Colony. The border was Transkei and these areas emerged as a result of people moving back (Surveyor General's Office- East London, 2015).

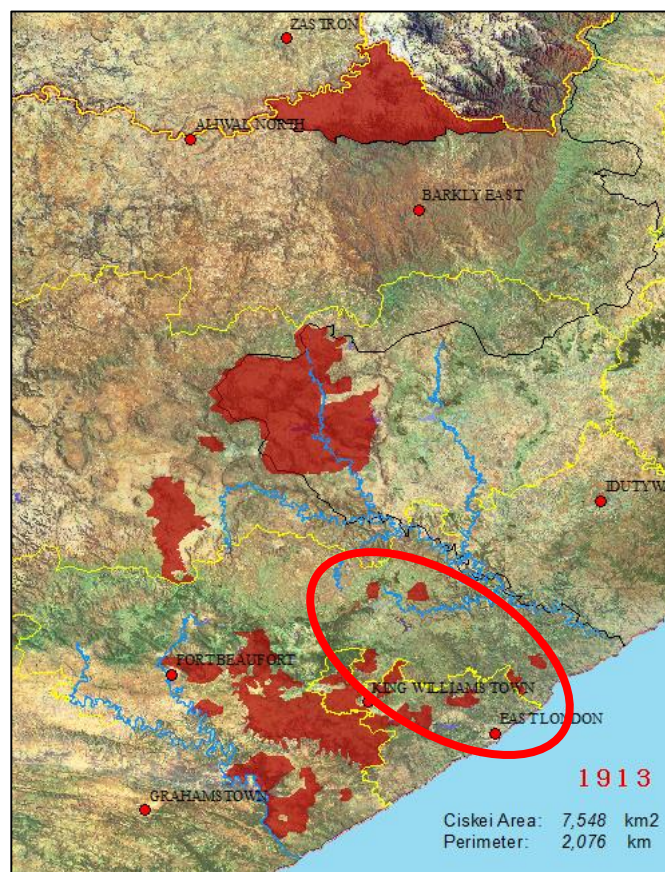


Figure 4. 22 the 1913 map showing the areas between Ciskei and Kei River

4.6.2 Land reform and infrastructural development

For the Department of Rural Development and Land Reform to focus on development priorities, it is important to know the history of the Ciskei. For example, if the previous Ciskei fell in one district municipality, then more attention needed to be focused there. But, because of the fact that Ciskei fell into the Chris Hani, Amathole and Buffalo City municipalities, there would be greater levels of inequality, historically poor services, or underdevelopment, in those areas (Parker, 2015).

Estimates from the 2009 Census Statistics indicate that the Eastern Cape population is estimated to have increased by 200 000 from 6.3 million to 6.5 million. This makes the Eastern Cape the third most populous province in the country after Gauteng (21.5%) and Kwazulu-Natal (21.1%). The province still has a relatively large total population living in the rural areas. Some 43% of the population can be categorised as being poor. Analysis of poverty data collected in 2006 indicated that a minimum of R881.5 million would be required per annum to alleviate poverty in the Eastern Cape (Parker, 2015).

The DRDLR prioritizes its district municipalities, so this will be one of the facts that informs which district municipality or what part of a district needs to be focused on when the DRDLR prioritizes services (Parker, 2015).

The Eastern Cape identified priority issues addressed in the 2010/2011 financial year – based on the objectives of the Eastern Cape Rural Development Strategy. The EC programme has the following focus: 1) Early Childhood Development 2) Rural Development 3) Land Reform (National Development Agency, 2008).

Local Municipalities identified by War on Poverty Programme (WOP) include the target areas shown on Table 4.4:

Table 4. 3: Target areas identified by WOP (National Development Agency, 2008)

District Municipality	Local Municipality
OR Tambo	Nyandeni Ingquza hill Mbizana Ntabankulu
Chris Hani	Intsika Yethu Engcobo
Ukhahlamba	Elundini
Amathole	Ngqushwa Mbashe Mnquma
Alfred Nzo	Umzimvubu

These areas are targeted based on the following criteria:

- 1 Density of poverty
- 2 Government prioritized projects
- 3 LED priorities of local and district municipalities
- 4 NDA visibility at local municipality level

If, for example, the whole of the Chris Hani district was a well-developed white commercial agricultural area, the plan of action and resource prioritization would be different from a plan that entailed primarily subsistence agriculture in that area.

Therefore, in the Ciskei area there was largely subsistence agriculture, a lack of development, and no infrastructure which would normally have been there during the apartheid era for white commercial interests. It is very important to be able to identify in which district municipalities these factors occurred (Parker, 2015).

According to Williams- Wynn (2015), one of the most important things required is to determine which areas were subject to Homeland legislation, as current town planning practice must be informed by it. For example, large areas of Buffalo City Metropolitan

Municipality were formerly part of Ciskei. All of those areas have different town planning legislations. Certain areas have exemptions from act 15 of 1985, and other areas are subject to exemption from act 7 of 1987. Whether iurban or rural, appropriate approvals are needed in terms of the Land Survey Act. Therefore, the boundaries of Ciskei are still very important to provincial planning legislation.

4.6.3 Land Restitution Support

In terms of land restitution, the Ciskei time series maps are key to what is needed for assistance with historical claims for certain areas, as the maps have the ability to easily prove whether the land was inside or outside Ciskei. Therefore, either people would have been placed or removed from other places to Ciskei, or the claim was an original land prior to the 1913 Land Act. It is of particular importance that land restitution support has access to this time series map, so that the position of a specific area in which people are claiming can be identified and determined (Williams- Wynn, 2015).

The need to conduct the historical research for land restitution purposes is very important (see point 4.6.1 above) because, firstly, most of the claims are after 1913; secondly, many of the claims are related to where the removals took place. This study focuses only on the areas where people were forced to stay – i.e. “Homelands”. Historical research needs to be done on the displaced areas (from which people were forced to move), and is mentioned in the Recommendations section. Accurate maps of removals areas will help Land Restitution Support to apply appropriate resources to the areas being claimed. This research must be done before 2019, because the land claims process closes in 2019. The removals maps may help to anticipate where to put maximum pressure in terms of claims being lodged. The Chief Director: Land Restitution Support is about to tender to have this type of historical mapping done so that they can have a clear map system of where the dispossession took place. The fact that a person lived in a Homeland does not, in itself, make him/her a restitution claimant. They could have been there already, but if they had been forced to move from elsewhere, then they could be a potential claimant. Therefore it is very important to know the place of dispossession – not only the Homelands maps. (CD: land restitution support, 2015).

4.6.4 The advantages of Static and animated maps

The interviewees expressed their views on the advantages of both types of maps, and the highlights are captured below:

The Static map will help the DRDLR in terms of land reform. Ciskeian history generally speaks about areas where there was subsistence agriculture. Therefore the Static map helps the decision-makers to decide whether they need land tenure reform or land ownership of the farms in those areas. Specifically for land restitution, this is very important, because the areas were first excluded and then transformed from black to white ownership or vice versa. Also, for those areas which were excluded, such as Herschel and Glen Grey, people will automatically be subject to the land claims because those people were replaced.

The animation highlights the historical story, the spatial change as well as the reasons that caused the change. It tells the full story through time. From a Static map it is not easy to picture what is happening over time, while it is demonstrated very well in animated map. The major advantages of animation are that it shows changes as well as what the causes of those changes were.

Most certainly Static maps are most useful to have on hand and to view with the clients of the Surveyor-General, e.g. land surveyors. Also, they are extremely helpful for research purposes, because Static maps can be used in presentations and research papers. The Historical information in the video was presented perfectly. It is useful for people with limited time available. The static maps, on the other hand, are better when it comes to scale and measurement of the areas and certain other points that might be of interest to a person. (Williams- Wynn, 2015).

4.7 Conclusion

In light of the comparative analysis of this particular study, both the animated and Static map have advantages over each other, but neither one of them has an overall clear advantage. This confirms to an extent that previous studies conducted in this regard also concluded that there is no complete evidence that animated representations are more beneficial than static multiple representations, as mentioned in section 2.4.

The majority of participants selected the correct answer. In this particular section the focus was placed on the selection of the correct answer for the AM and the SM. This indicates which map display is better at depicting change and information in this study. In providing a concise analysis between these map displays, a breakdown of the data was necessary. As highlighted in Table 4.2, the data was analysed in respect of the geographic experience as mentioned by Peuquet (1994) in section 2.5.

Table 4. 4 Overall correct results of animated and Static map in relation to the triad assembly of questions and spatial change

Questions		SM	AM
Triad question types	What was the approximate area of Ciskei in 1981?	45%	65%
	What was the Act that declared Ciskei as an Independent State?	55%	55%
	When was Ciskei established?	70%	65%
	When did Ciskei become a single consolidated area?	55%	55%
	Where is King William's Town located?	75%	60%
	Where was the Herschel district located in 1966?	90%	80%
Spatial change	During which period was the consolidation plans effected?	55%	55%
	What year was there the most drastic changes to the Ciskei boundary?	55%	60%

The questionnaire divided into two types of questions, namely triad questions and spatial change question types. Two questions each were based on the triad question types and two were spatial change questions, as shown in Table 4.2. The percentage in Table 5.1 is represented in relation to the strengths of each of the AM and SM types. The overall result was then provided for the map display, which yielded the better results in respect to the geographic experience of each map.

Chapter 5: Conclusion and Recommendations

5.1 Introduction

This chapter is a summary of the developments and findings of the research. The research problems have been addressed and the objectives have been met with the evidence shown in this research.

5.2 Conclusion on the Study

The objectives of this study were to investigate the spatial change of the Ciskei Homeland, as well as to create a time series mapping to present the change over time. Qualitative and quantitative methods were used to answer the research questions. The animated maps (Appendix F) and the Static maps (Appendix E), show the establishment of Ciskei and how the boundary changed over time with the apartheid legislations that caused the change.

From the comparative analysis of the questionnaire data, both the animated and Static maps have advantages over each other but neither one of them has an overall clear advantage (see Table 4.2). This confirms to an extent that previous studies conducted in this regard have also concluded that there is no conclusive evidence that animated representations are more beneficial than static multiple representations, as mentioned in section 2.4.

In order to better understand the usefulness of such a study, interviews were conducted with key stakeholders from government departments. From the qualitative analysis of the interviews, several key findings were made. The first finding was an emphasis on the importance of conducting spatial historical research in order to better understand the impact of colonialism and apartheid on the South African geopolitical landscape. Secondly, such a study helps various government departments to prioritise resource allocation. Thirdly, this analysis would assist in supporting the land claims process. Lastly, general comments about the usefulness of Static and animated maps were noted.

5.3 Recommendations for future work

These recommendations are offered for future related research:

An important aspect that could be added to this research is actual cadastral data and the farm boundaries. In this case, the greater scale may be required to be able to identify the individual farms. The individual farms may be useful spatially in the identification process where people were moved back and forth. In this respect, a more accurate geo-referencing exercise would have to be adopted if detail at this level would be required.

In terms of land restitution, to make the Ciskei time series maps very effective and useful, some research needs to be done of the history before 1913, because it is very useful for land restitution and land reform to know where people have come from and how much land they lost.

The time series imagery would be recommended to be added to the time series mapping of Ciskei. It makes this study very useful mainly for the land reform support. For example to look at an area excluded from Ciskei compared with the area that remained part of Ciskei, in order to see the difference in development in terms of infrastructure and agriculture.

Conduct further qualitative research, to include more interviewees, in order to obtain a more detailed understanding of the benefits of Static and animated mapping.

This study can be extended to include a spatio-temporal analysis of the Ciskei area before 1913, as well as the areas from which people were displaced.

References

- Acevedo, W. & Masuoka, P. 1997. Time-series animation techniques for visualizing urban growth. *Computers & Geosciences*, 23(4): 423–435.
- Aljoufie, M., Zuidgeest, M., Brussel, M. & van Maarseveen, M. 2013. Spatial-temporal analysis of urban growth and transportation in Jeddah City, Saudi Arabia. *Cities*, 31: 57–68.
- Andrienko, N. & Andrienko, G. 2006. *Exploratory Analysis of Spatial and Temporal Data: A Systematic Approach*. Springer Science & Business Media.
- Andrienko, N., Andrienko, G. & Gatalisky, P. 2000. Visualization of spatio-temporal information in the Internet. In *Database and Expert Systems Applications, 2000. Proceedings. 11th International Workshop on IEEE*: 577–585.
- Aigner, W., Miksch, S., Müller, W., Schumann, H. & Tominski, C. 2007. Visualizing time-oriented data- a systematic view. *Computers & Graphics*, 31(3): 401–409.
- Arguel, A. & Jamet, E. 2009. Using video and static pictures to improve learning of procedural contents. *Computers in human behaviour*, 25(2): 354–359.
- Aslam Parker. 2015. Interview with Chief Director of National Geo-spatial Information on August 2015, Cape Town.
- Balletti, C. 2006. Geo-reference in the analysis of the geometric content of early maps. , 1(1).
- Becker, T. 2009. *Visualizing time series data using web map service time dimension and SVG interactive animation*.
- Bergh, J.S. & Visagie, J.C. 1985. *The Eastern Cape frontier zone 1660-1980*. Durban: Butterworths.
- Bertin, J. 1983. *Semiology of Graphics: Diagrams, Networks, Maps*. University of Wisconsin Press.

- Blok, C.A. 2005. Dynamic visualization variables in animation to support monitoring of spatial phenomena. *Netherlands Geographical Studies*; 328.
- Campbell, C.S. & Egbert, S.L. 1990. Animated cartography/thirty years of scratching the surface. *Cartographica: The International Journal for Geographic Information and Geo-visualization*, 27(2): 24–46.
- Chief Surveyor General. 2015. Chief Surveyor General. *Mission*. <http://csg.dla.gov.za/> 21 July 2016.
- Chris Williams- Wynn. 2015. Interview with Surveyor-General in east London office on July 2015, East London.
- Christopher, A.J. 1991. Changing patterns of group-area proclamations in South Africa, 1950–1989. *Political Geography Quarterly*, 10(3): 240–253.
- Christopher, A.J. 1994. *The Atlas of Apartheid*. Witwatersrand University Press Publications.
- Clark, R.E. 1994. Media will never influence learning. *Educational Technology Research and Development*, 42(2): 21–29.
- Creswell, J.W. 2013. *Research design: Qualitative, quantitative, and mixed methods approaches*. Sage publications.
- David Smit. 2015. Interview with Chief Director: land restitution support, Western Cape on September 2015, Cape Town.
- Dawood, N. & Motala, S. 2015. Evaluating an animated and static time series map of District Six: A visual and cognitive approach. *South African Journal of Geomatics*, 4(3): 189.
- Department of Planning. 1966. Development Atlas Map.
- Department of Planning and Environment. 1976. Development Atlas Map.

Dorling, D. 1992. Stretching Space and Splicing Time: From Cartographic Animation to Interactive Visualization. *Cartography and Geographic Information Systems*, 19(4): 215–227.

Environmental Systems Research Institute. 2014. Using the Time Slider window ArcGIS for Desktop (online) Available at:
<http://desktop.arcgis.com/en/arcmap/10.3/map/time/using-the-time-slider>

Environmental Systems Research Institute. 2014. Calculate Geometry in Table Fields. *ArcGIS Resources*. (Online) Available at:
<http://www.esri.com/news/arcwatch/0108/tip.html>.

Environmental Systems Research Institute. 2014a. Digitizing lines and snapping. *ArcGIS Resources*. (Online) Available at:
<http://resources.arcgis.com/en/help/main/10.1/index.html#//01m60000001z000000>.

Environmental Systems Research Institute. 2014b. Georeferencing tools. *ArcGIS Resources*. (Online) Available at:
<http://resources.arcgis.com/en/help/main/10.1/index.html#//009t000000mp000000>.

Environmental Systems Research Institute. 2014c. The principles of geostatistical analysis. (Online) Available at:
http://maps.unomaha.edu/Peterson/gisII/ESRImanuals/Ch3_Principles.pdf.

Environmental Systems Research Institute. 2014d. What is Geoprocessing? *ArcGIS Resources*. (Online) Available at:
<http://resources.arcgis.com/en/help/main/10.1/index.html#//002s00000001000000>.

Environmental Systems Research Institute. 2014. What is geostatistics: (Online) Available at.:
<http://www.geovariances.com/en/geostatistics-what-is-geostatistics-ar36>.

- Feinberg, H.M. 1993. The 1913 Native Land Act in South Africa: Politics, Race, and Segregation in the Early 20th Century. *The International Journal of African Historical Studies*, 26(1): 65–109.
- Feinberg, H.M. & Horn, A. 2009. South African Territorial Segregation: New Data on African Farm Purchases, 1913–1936. *The Journal of African History*, 50(01): 41–60.
- Fish, C. 2010. *Change Detection in animated Choropleth Maps*. Submitted to Michigan State University in partial fulfillment of the requirements for the degree of MASTER OF SCIENCE. Michigan State University.
- Fuhrmann, S., Ahonen-Rainio, P., Edsall, R., Fabrikant, O., Koua, E., Tolon, C., Ware, C. & Wilson, S. 2005. Making Useful and Useable Geovisualization: Design and Evaluation Issues. *Exploring Geovisualization*. <http://scholars.unh.edu/ccom/162>.
- Government Republic of South Africa. 1916. Key Map of the Union of SA to Accompany Report of Natives Land Commission.
- Government Republic of South Africa. 1980. Borders of Particular States Extension Act No. 2 of 1980. *Government Gazette (6905)*.
- Government Republic of South Africa. 1997a. Regulations Promulgated in terms of section 10 of the land survey Act No. 8 of 1997. *Land Affairs*.
- Government Republic of South Africa. 1981. Status of Ciskei Act No. 110 of 1981. *Government Gazette (7891)*.
- Government Republic of South Africa. 1976. Status of the Transkei Act No. 100 of 1976. *Government Gazette (5198)*.
- Government Republic of South Africa. 1997b. Survey Act No. 8 of 1997. *Land Affairs*.
- Government Republic of South Africa. 1972. The Ciskei Declaration as self-governing territory and constitution of Legislative Assembly Proclamations No. R. 187, 1972. *Government Gazette (3622)*.

- Gregory, I.N. 2005. *A guide to using GIS in historical research*. 2nd Edition. Belfast: Centre for Data Digitization and Analysis, Queens University.
- Gretchen, B., Rossman, Sharon, F. & Rallis. 2012. *An introduction to Qualitative research*. 3rd ed. Library of congress in publication data.
- Hansen, H.S. & Henning, S. 2001. A time-series animation of urban growth in Copenhagen metropolitan area. In *ScanGIS*. Citeseer: 225–235.
- Harrower, M. 2003. Tips for designing effective animated maps. *Cartographic Perspectives*, (44): 63–65.
- Harrower, M. 2007. Unclassed animated choropleth maps. *The Cartographic Journal*, 44(4): 313–320.
- Harrower, M. 2008. The Cognitive Limits of animated maps. *Cartographica: The International Journal for Geographic Information and Geo-visualization*, 42(4): 349–357.
- Höffler, T.N. & Leutner, D. 2007. Instructional animation versus static pictures: A meta-analysis. *Learning and Instruction*, 17(6): 722–738.
- Hogeweg, M. 2009. *Spatio-temporal visualisation and analysis*. Dissertation submitted in part fulfilment of requirements for the Degree of Master of Science in Geographical Information Systems. University of Salford.
- Institute for poverty land and agrarian studies. 2013. The Distribution of Land in South Africa: An Overview | plaas.org.za. The Distribution of Land in South Africa: An Overview. (Online) Available at: <http://www.plaas.org.za/plaas-publication/FC01>.
- Karl, D. 1992. Cartographic animation: potential and research issues. *Cartographic Perspectives*, (13): 3–9.
- Koussoullakou, A., and Kraak, M. J. 1992. Spatio-temporal maps and cartographic communication. *The Cartographic Journal*, 29(2), 101-108.

- Kraak, M. J., 2000. Visualisation of the time dimension. *Time in GIS: Issues in spatio-temporal modelling*, 47, 27–35.
- Lahiff, E. & Scoones, I. 2001. *The politics of land reform in southern Africa*. Sustainable Livelihoods in Southern Africa Program, University of Sussex.
- Lemon, A. 1978. *Homelands Consolidation plans Apartheid a geography of separation*. Saxon House.
- Lexis Nexis. 2012. Gazettes Online (1910 - 2004). *My Lexis Nexis Library*. <http://www.mylexisnexus.co.za/Index.aspx>.
- Malan & P.S. Hatingh. 1973. *Black Homelands in South Africa*. Africa Institute.
- Mayer, R.E. & Moreno, R. 2002. Animation as an Aid to Multimedia Learning. *Educational Psychology Review*, 14(1): 87–99.
- Mennis, J. L., Peuquet, D. J., and Qian, L. 2000. A conceptual framework for incorporating cognitive principles into geographical database representation. *International Journal of Geographical Information Science*, 14(6), 501-520.
- Monmonier, M. 1990. Strategies for the visualization of geographic time-series data. *Cartographica: The International Journal for Geographic Information and Geo-visualization*, 27(1): 30–45.
- National Development Agency Annual Report 2008/09 | South African Government. (Online). Available at: <http://www.gov.za/documents/national-development-agency-annual-report-200809>.
- Nkwinti, G, 2012. *Speech by the Minister of Rural Development and Land Reform*, 2012 Policy Speech.
- Peterson, M. 1995. Interactive and animated Cartography. *Faculty Books and Monographs*.

Peuquet, D.J. 1994. It's about Time: A Conceptual Framework for the Representation of Temporal Dynamics in Geographic Information Systems. *Annals of the Association of American Geographers*, 84(3): 441–461.

Peuquet, D.J. & Duan, N. 1995. An event-based spatiotemporal data model (ESTDM) for temporal analysis of geographical data. *International journal of geographical information systems*, 9(1): 7–24.

QGIS, 2014. Plugin: TimeManager. *QGIS Python Plugins Repository*. (Online).

Available at:

<http://plugins.qgis.org/plugins/timemanager/>.

Ross, R., Mager, A.K. & Nasson, B. 2011. *The Cambridge History of South Africa: Volume 2, 1885–1994*. Cambridge University Press.

South African History Online. 2011. The Ciskei Homeland is established. (Online)

Available at:

<http://www.sahistory.org.za/dated-event/ciskei-Homeland-established>

[Accessed 1 September 2015].

South African History Online. 2011. The Homelands. (Online) Available at:

<http://www.sahistory.org.za/special-features/Homelands>

[Accessed 3 September 2015].

Sonneborn, L. 2010. *The End of Apartheid in South Africa*. Infobase Publishing.

Statistics South Africa. 2011 Census Statistics South Africa.

http://www.statssa.gov.za/?page_id=3839 19 September 2015.

Steward, C. 2008. *The role of Brigadier Oupa Gqozo in Ciskei*. Rhodes University.

The Union of South Africa. 1951. Black Authorities Act No 68 of 1951. *Government Gazette*.

The Union of South Africa. 1936. Development Trust and Land Act No18 of 1936. *Government Gazette*.

- The Union of South Africa. 1966. Group Areas Act No. 36 of 1966. *Government Gazette (1576)*: 3–68.
- The Union of South Africa. 1927. Land Survey Act No. 9 of 1927. *Government Gazette (1618)*: v.
- The Union of South Africa. 1944. Magistrates' Courts Act No. 32 of 1944. *Government Gazette (3346)*: viii.
- The Union of South Africa. 1927. Native administration Act No. 38 of 1927. *Government Gazette (1645)*: xxxv.
- The Union of South Africa. 17 June 1959. Representation between Republic of South Africa and Self Governing Territories Act No. 46 of 1959. *Government Gazette*.
- The Union of South Africa. 1971. Self-Governing Territories Constitution Act No. 21 of 1971. *Government Gazette*.
- The Union of South Africa. 1913. The Native Land Act No. 27 of 1913. *Government Gazette*: 446.
- The Union of South Africa. 1923. The Native (Urban Areas) Act No. 21 of 1923. *Government Gazette (1326)*: i–xxxvii.
- Thorne, J.H., Morgan, B.J. & Kennedy, J.A. 2008. Vegetation change over sixty years in the central Sierra Nevada, California, USA. *Madroño*, 55(3): 223–237.
- Tomlinson. 1955. *Summary of the report of the commission for the socio-Economic Development of the Bantu areas within Union of South Africa*. Government Printer.
- Tufte, E.R. & Graves-Morris, P.R. 1983. *The visual display of quantitative information*. Graphics press Cheshire, CT.
- Turdukulov, U.D. & Kraak, M.J. 2007. Exploratory graphics, memory and image features: testing their relations. *ISPRS Journal of Photogrammetry and Remote Sensing*.

Tyner, J.A. 2010. *Principles of Map Design*. Guilford Press.

UK Essays. 2015. The History of the Homelands History Essay. *UK Essays*. (Online).

Available at:

<http://www.ukessays.com/essays/history/the-history-of-the-Homelands-history-essay.php> [Accessed 3 September 2015].

University Of Texas at Austin CRWR. 2006. Representing time and space in GIS.

University Of Texas at Austin CRWR.

Zaletnyik, P. 2004. Coordinate transformation with neural networks and with polynomials in Hungary. In *International Symposium on Modern technologies, education, and professional practice in geodesy and related fields*. 4–5.

Appendices

Appendix A: The Native Land Act No. 27 of 1913

**Act No. 26
of 1913.**

(2) Within the division of Calitzdorp the said assistant resident magistrate shall possess all the powers and jurisdiction, and shall carry out all the duties and obligations, conferred or imposed by the said Act No. 40 of 1889 or by any other law upon the civil commissioner, but he shall not thereby acquire the status of a civil commissioner.

Provisions of
Act No. 24 of
1858 to apply
to new
divisions.

5. The provisions of Act No. 24 of 1858 of the Cape of Good Hope shall, so far as the same are applicable, apply *mutatis mutandis* to the divisions of Calitzdorp, Oudtshoorn and Ladismith as constituted under this Act as if they were named in the Schedule to Act No. 13 of 1857.

Short title.

6. This Act may be cited for all purposes as the New Fiscal Divisions (Cape) Act, 1913.

Schedule.

AREA TO BE CONSTITUTED THE NEW FISCAL DIVISION OF CALITZDORP

(1) The area which at the commencement of this Act is co-terminous with the magisterial sub-district of Calitzdorp, in the magisterial district and fiscal division of Oudtshoorn.

(2) So much of the following area as is not included in the said sub-district but is at the commencement of this Act in the magisterial district and fiscal division of Oudtshoorn, namely, the area comprising the farms Cangoberg, Kruisrivier, Buffelskloof, Uitvlugt, and part of Langverwacht.

(3) That portion of the division of Ladismith which at the commencement of this Act is included in the fiscal division of Ladismith and comprises the following farms :—Huisrivier, Cloete, Crown, Halfcrown, Tijgerkloof, Danielskraal (including the Outspan), Triangle, Rietvallei, Oudehuiskloof, Spitskop and Groenfontein.

Act No. 27
of 1913.

[Date of commencement—
19th June, 1913.*

Act 1913.

ACT

To make further provision as to the purchase and leasing of land by Natives and other Persons in the several parts of the Union and for other purposes in connection with the ownership and occupation of Land by Natives and other Persons.

(1932) IV PD 241

(Assented to 16th June, 1913).

(Signed by the Governor-General in English).

BE IT ENACTED by the King's Most Excellent Majesty, the Senate and the House of Assembly of the Union of South Africa, as follows :—

* The Act was first published in *Gazette Extraordinary* No. 380 of the 19th June, 1913.

Act No. 27 of 1913.

64
51-32
20

Restriction as to transactions relating to land for which natives and other persons possessing land in a community.

1. (1) From and after the commencement of this Act, land outside the scheduled native areas shall, ~~with the exception of the land to which the provisions of the Natives Land Act, 1913, shall have made any provision,~~ be subject to the following provisions, that is to say:—

Except with the approval of the Governor-General—

- (a) a native shall not enter into any agreement or transaction for the purchase, hire, or other acquisition from a person other than a native, of any such land or of any right thereto, interest therein, or servitude thereover; and
- (b) a person other than a native shall not enter into any agreement or transaction for the purchase, hire, or other acquisition from a native of any such land or of any right thereto, interest therein, or servitude thereover.

(2) From and after the commencement of this Act, no person other than a native shall purchase, hire or in any other manner whatever acquire any land in a scheduled native area or enter into any agreement or transaction for the purchase, hire or other acquisition, direct or indirect, of any such land or of any right thereto or interest therein or servitude thereover, except with the approval of the Governor-General.

v act 18/1936
257

(3) A statement showing the number of approvals granted by the Governor-General under subsections (1) and (2) of this section and giving the names and addresses of the persons to whom such approvals were granted, the reasons for granting the same, and the situation of the lands in respect of which they were granted, shall, within six weeks after the commencement of each ordinary session of Parliament, be laid upon the Tables of both Houses of Parliament.

(4) Every agreement or any other transaction whatever entered into in contravention of this section shall be null and void *ab initio*.

Appointment and functions of a commission of enquiry.

v act 16/1913

2. (1) As soon as may be after the commencement of this Act the Governor-General shall appoint a commission whose functions shall be to enquire and report—

- (a) what areas should be set apart as areas within which natives shall not be permitted to acquire or hire land or interests in land;
- (b) what areas should be set apart as areas within which persons other than natives shall not be permitted to acquire or hire land or interests in land.

The commission shall submit with any such report—

- (i) descriptions of the boundaries of any area which it proposes should be so set apart; and
- (ii) a map or maps showing every such area.

(2) The commission shall proceed with and complete its enquiry and present its reports and recommendations to the Minister within two years after the commencement of this

Act No. 27
of 1913.

Membership
of the
commission
and matters
incidental to
its enquiry
and report.

Expropria-
tion of
private land
for the estab-
lishment of a
non-native or
an additional
native area.

(A32) N P D 659
Penalties and
legal
proceedings.
1916 T. P. D. 362

Act, and may present *interim* reports and recommendations: Provided that Parliament may by resolution extend (if necessary) the time for the completion of the commission's enquiry. All such reports and recommendations shall be laid by the Minister, as soon as possible after the receipt thereof, upon the Tables of both Houses of Parliament.

3. (1) The commission shall consist of not less than five persons and if any member of the commission die or resign or, owing to absence or any other reason, is unable to act, his place shall be filled by the Governor-General.

(2) The commission may delegate to any of its members the carrying out of any part of an enquiry which under this Act it is appointed to hold and may appoint persons to assist it or to act as assessors thereto or with any members thereof delegated as aforesaid, and may regulate its own procedure.

(3) The reports and recommendations of the majority of the commission shall be deemed to be the reports and recommendations of the commission: Provided that any recommendations of any member who dissents from the majority of the commission shall, if signed by him, be included in any such report aforesaid.

(4) The commission or any member thereof or any person acting as assistant, or assessor, or secretary thereto may enter upon any land for the purposes of its enquiries and obtain thereon the information necessary to prosecute the enquiries. The commission shall without fee or other charge have access to the records and registers relating to land in any public office or in the office of any divisional council or other local authority.

4. (1) For the purposes of establishing any such area as is described in section *two* the Governor-General may, out of moneys which Parliament may vote for the purpose, acquire any land or interest in land.

(2) In default of agreement with the owners of the land or the holders of interests therein the provisions of the law in force in the Province in which such land or interest in land is situate relating to the expropriation of land for public purposes shall apply and if in any Province there be no such law, the provisions of Proclamation No. 5 of 1902 of the Transvaal and any amendment thereof shall *mutatis mutandis* apply.

5. (1) Any person who is a party to any attempted purchase, sale, hire or lease, or to any agreement or transaction which is in contravention of this Act or any regulation made thereunder shall be guilty of an offence and liable on conviction to a fine not exceeding one hundred pounds or, in default of payment, to imprisonment with or without hard labour for a period not exceeding six months, and if the act constituting the offence be a continuing one, the offender shall be liable to a further fine not exceeding five pounds for every day during which that act continues.

(2) In the event of such an offence being committed by a company, corporation, or other body of persons (not being

**Act No. 27
of 1913.**

a firm or partnership), every director, secretary, or manager of such company, corporation, or body who is within the Union shall be liable to prosecution and punishment and, in the event of any such offence being committed by a firm or partnership, every member of the firm or partnership who is within the Union shall be liable to prosecution and punishment.

Application
of Act.

1916 T.P.D. 362

V Act
18/1/26
S 50.

8. In so far as the occupation by natives of land outside the scheduled native areas may be affected by this Act, the provisions thereof shall be construed as being in addition to and not in substitution for any law in force at the commencement thereof relating to such occupation; but in the event of a conflict between the provisions of this Act and the provisions of any such law, the provisions of this Act shall, save as is specially provided therein, prevail:

Provided that—

(a) nothing in any such law or in this Act shall be construed as restricting the number of natives who, as farm labourers, may reside on any farm in the Transvaal;

(b) in any proceedings for a contravention of this Act the burden of proving that a native is a farm labourer shall be upon the accused;

(1932) T.P.D. 159

(c) until Parliament, acting upon the report of the said commission, has made other provision, no native resident on any farm in the Transvaal or Natal shall be liable to penalties or to be removed from such farm under any law, if at the commencement of this Act he or the head of his family is registered for taxation or other purposes in the department of Native Affairs as being resident on such farm, nor shall the owner of any such farm be liable to the penalties imposed by section five in respect of the occupation of the land by such native; but nothing herein contained shall affect any right possessed by law by an owner or lessee of a farm to remove any native therefrom.

x
As to
repeal
see
act
18/26
S 50
Status and
legal position
of certain
persons under
article twenty
of Law No. 4
of 1895, and
Chapter
XXXIV. of
the Orange
Free State
laws.

7. (1) Chapter XXXIV of the Orange Free State Law Book and Law No. 4 of 1895 of the Orange Free State shall remain of full force and effect, subject to the modifications and interpretations in this section provided, and sub-section (1) (a) of the next succeeding section shall not apply to the Orange Free State.

(2) Those heads of families, with their families, who are described in article twenty of Law No. 4 of 1895 of the Orange Free State shall in the circumstances described in that article be deemed to fall under the provisions of Ordinance No. 7 of 1904 of that Province or of any other law hereafter enacted amending or substituted for that Ordinance.

**Act No. 27
of 1913.**

(3) Whenever in Chapter XXXIV of the Orange Free State Law Book the expressions "lease" and "leasing" are used, those expressions shall be construed as including or referring to an agreement or arrangement whereby a person, in consideration of his being permitted to occupy land, renders or promises to render to any person a share of the produce thereof, or any valuable consideration of any kind whatever other than his own labour or services or the labour or services of any of his family.

Savings.

8. (1) Nothing in this Act contained shall be construed as,—

- V Act 19
S 50 1926
- (a) preventing the continuation or renewal (until Parliament acting upon the report of the said commission has made other provision) of any agreement or arrangement lawfully entered into and in existence at the commencement of this Act which is a hiring or leasing of land as defined in this Act; or
- (b) invalidating or affecting in any manner whatever any agreement or any other transaction for the purchase of land lawfully entered into prior to the commencement of this Act, or as prohibiting any person from purchasing at any sale held by order of a competent court any land which was hypothecated by a mortgage bond passed before the commencement of this Act; or
- (c) prohibiting the acquisition at any time of land or interests in land by devolution or succession on death, whether under a will or on intestacy; or
- (d) preventing the due registration in the proper deeds office (whenever registration is necessary) of documents giving effect to any such agreement, transaction, devolution or succession as is in this section mentioned; or
- (e) prohibiting any person from claiming, acquiring, or holding any such servitude as under Chapter VII, of the Irrigation and Conservation of Waters Act, 1912, he is specially entitled to claim, acquire, or hold; or
- V Act 18
1926 S 50
- (f) in any way altering the law in force at the commencement of this Act relating to the acquisition of rights to minerals precious or base metals or precious stones; or
- new sec 9
Act 46/37 s. 34.
- (g) applying to land within the limits in which a municipal council, town council, town board, village management board, or health committee or other local authority exercises jurisdiction; or
- Repealed
Act 46/37 Sec 24.
- (h) applying to land held at the commencement of this Act by any society carrying on, with the approval of the Governor-General, educational or missionary work amongst natives; or
- (i) prohibiting the acquisition by natives from any person whatever of land or interests in land in any township lawfully established prior to the commencement

Act No. 27
of 1913.

of this Act, provided it is a condition of the acquisition that no land or interest in land in such township has at any time been or shall in future be, transferred except to a native or coloured person; or

- v Act 18/1936
S 50
- (j) permitting the allocation of land or its diversion from the purposes for which it was set apart if, under section *one hundred and forty-seven* of the South Africa Act, 1909, or any other law, such land could not be alienated or so diverted except under the authority of an Act of Parliament; or
- (k) in any way modifying the provisions of any law whereby mortgages of or charges over land may be created to secure advances out of public moneys for specific purposes mentioned in such law and the interest on such advances, or whereunder the mortgagee or person having the charge may enter and take possession of the land so mortgaged or charged, except that in any sale of such land in accordance with such law the provisions of this Act shall be observed.

v Act 18
1936 S
50

(2) Nothing in this Act contained which imposes restrictions upon the acquisition by any person of land or rights thereto, interests therein, or servitudes thereover, shall be in force in the Province of the Cape of Good Hope, if and for so long as such person would, by such restrictions, be prevented from acquiring or holding a qualification whereunder he is or may become entitled to be registered as a voter at parliamentary elections in any electoral division in the said Province.

Regulations:

9. The Governor-General may make regulations for preventing the overcrowding of huts and other dwellings in the towns, native villages and settlements and other places in which natives are congregated in areas not under the jurisdiction of any local authority, the sanitation of such places and for the maintenance of the health of the inhabitants thereof.

Interpretation of terms:

v Act
18/1936
S 50

10. In this Act, unless inconsistent with the context,—
“scheduled native area” shall mean any area described in the Schedule to this Act;

“native” shall mean any person, male or female, who is a member of an aboriginal race or tribe of Africa; and shall further include any company or other body of persons, corporate or unincorporate, if the persons who have a controlling interest therein are natives;

“interest in land” shall include, in addition to other interests in land, the interest which a mortgagee of, or person having a charge over, land acquires under a mortgage bond or charge;

Act No. 27
of 1913.

“Minister” shall mean the Minister of Native Affairs;
“farm labourer” shall mean a native who resides on a farm and is *bona fide*, but not necessarily continuously, employed by the owner or lessee thereof in domestic service or in farming operations:
Provided that—

- (a) if such native reside on one farm and is employed on another farm of the same owner or lessee he shall be deemed to have resided, and to have been employed, on one and the same farm;
- (b) such native shall not be deemed to be *bona fide* employed unless he renders ninety days service at least in one calendar year on the farm occupied by the owner or lessee or on another farm of the owner or lessee and no rent or valuable consideration of any kind, other than service, is given by him to the owner or lessee in respect of residence on such farm or farms.

A person shall be deemed for the purposes of this Act to hire land if, in consideration of his being permitted to occupy that land or any portion thereof—

- (a) he pays or promises to pay to any person a rent in money; or
- (b) he renders or promises to render to any person a share of the produce of that land, or any valuable consideration of any kind whatever other than his own labour or services or the labour or services of his family.

Short title.

11. This Act may be cited for all purposes as the Natives Land Act, 1913.

Schedule of Native Areas.

I. CAPE OF GOOD HOPE.

(A) CAPE PROVINCE, EXCLUDING THE TRANSKEIAN TERRITORIES.

Barkly West District.

Native Area.

Majisgoro Location (comprising Farms N.W. 29, N.W. 28, N.W. 27, N.W. 30, N.W. 26, and N.W. 25)

Sinalon Location (comprising Farms N.W. 31 and N.W. 32.)

Seodin Location (Farm N.W. 34.)

Farms N.W. 44, N.W. 42 and N.W. 43.)

Mamotla Location (comprising Farms N.W. 33, N.W. 29 and N.W. 21)

Mayen Location (comprising Farms H.V. 32 and H.V. 59—temporarily.)

Cape District.

Uitvlugt (or Ndaleni Location)—as surveyed.

East London District.

Newlands Location.

St. Luke's Mission.

Portions of farms 12 B. and 11 B. falling in this district and forming part of the Mosephants Location.

Kwaders Location (comprising Farms 2 W, 3 W, 4 W, 5 W, 12 W, and 13 W.)

Mreotshe Location (being that piece of land formerly part of Potsdam Commowage lying to the Northwest of the line laid down in 1907 by the Departmental Commission on the occupation of land by Natives in unreserved areas.)

**Act No. 27
of 1913.***Fort Beaufort District.*

Houldtown Fingo Location.

Glen Grey District.

The whole district, except the Lady Freese Municipal area.

Hay District.

Skeynfontein and Greenwater Locations (comprising Farms A. 18, A. 19, A. 20, M. 40, M. 60, M. 61 and M. 62.

Heidelberg District.

Bavianstrand Location (Farm N.W. 71.)

Boompants Location (Farms N.W. 1, N.W. 2 and N.W. 3.)

Schmidtsdrift [Farm R. 27 (exclusive of outspan.)]

Plaatsdrift (Farms R. 26 and R. 29).

Sironel (Farms R. 30, R. 31 and R. 25).

Heunsaarpoort District.

Reserve at Palmiet held under deed of reservation dated 30th October, 1858 Palmiet River.

Fingo Reserve held under deed of reservation dated 15th November, 1851.

Dorskruis Fingo Reserve held under deed of reservation dated 30th October, 1858.

Snyklip Fingo Reserve held under deed of reservation dated 30th October, 1858.

Wittekleibosch Fingo Reserve held under deed of reservation dated 30th October, 1858.

Herschel District.

The whole district, except Herschel township, Commonage Reserve and Luncheon's Neck Police Reserve.

Karuman District.

Lower Karuman Native Reserve and Extension.

Bethelheletsa Native Reserve.

Munyeling Native Reserve.

Komo Native Reserve.

Sunnuwani Native Reserve.

Groot Vlaktefontein Native Reserve.

Gathlose Native Reserve.

Marumane Native Reserve.

King William's Town District.

Mt. Coke Mission Farm and Commonage—as surveyed.

Farm A called Umonam (granted to J. W. Kama.)

Farm B (granted to W. S. Kama.)

Farm C (granted to W. Kama, Senior, Chief.)

Farm D (granted to S. Kama.)

Lots A and B (granted to J. MacLean and others in trust for G. & E. Sandilli.)

Land adjoining A and B granted to J. MacLean for Victoria Sandilli.

Lots A and B (granted to J. MacLean in trust for Emma and G. Sandilli.)

St. Matthews Mission Station.

Ebenezer Mhlambiso's Location, as surveyed.

Zibi's Location, as surveyed.

Zali's Location, as surveyed.

Quma's Location, as surveyed.

Siwani's Location, unsurveyed.

Mxoli's Location, unsurveyed.

Mongolwane's Location, unsurveyed.

Mkaneylwa's Location, unsurveyed.

Tomyella's Location, as defined by Commission in 1896.

Jali's Location, unsurveyed.

Tiso's Location, unsurveyed.

Lot 2, near Middelbush, granted on the 4th November, 1865, to Robert Cumming.

Lot A, near Middelbush, granted on the 12th October, 1897, to Daniel Dwanys.

**Act No. 27
of 1913.**

Nowame's Location, unsurveyed.
 Jan Vantree's Location (as defined by survey.)
 Mjafa's Location (as defined by limits of Forest Reserve and surveyed areas adjoining.)
 Kama's Location, unsurveyed.
 Knapp's Hope Mission Station, as surveyed.
 Pentel Mission Station, as surveyed.
 Ungqakwebe or Masingata's Village and Commonage, as surveyed.
 Joseph William's Location, as surveyed.
 Pirie Location, as surveyed.
 Mbem's Location, as surveyed.
 Ann Shaw Location as surveyed.
 Ann Shaw Wesleyan Mission Glebe,
 Burn-hill Village and Commonage as defined by survey.
 Qwasha's Location, unsurveyed.
 Dikidikana Commonage, as surveyed.
 Regu Commonage, as defined by surrounding surveys.
 Mnganzu's or Hlanganu's Location, unsurveyed.
 Mphlani's Location, as defined by Cape Government Notice No. 867 of 1906.
 Jaffe's Location, as surveyed.
 Peolten Village and Commonage as defined by survey.
 Lungwini, as surveyed.
 Balasi Native Location as defined by survey.

Kangha District.

Mooiplaats Location (portion)

Mafeking District.

Molopo Native Reserve, as defined by survey and rivers Molopo and Ramathlabama.
 Setlingoli Native Reserve, as defined by adjoining surveys and boundary of Cape Province.
 Mosita Native Reserve, held under title dated 9th September, 1893.

Port Elizabeth District.

New Brighton Location (Farms Cradock Place and Deal Party as defined by Proclamation.)

Peddie District.

Zulu's or Tyefu's Location, as defined by survey.
 Kaulala's Location, defined mainly but not wholly by adjoining surveys.
 Kwenkweni's Location, defined partly but not wholly by adjoining surveys.
 Matsemela's Location, defined partly by adjoining surveys.
 Jokuwoti's Location, defined partly by adjoining surveys.
 Pato's Kop Fingo Location, as surveyed.
 D'Urban Mission Station, as surveyed.
 Newtondale Mission Station.
 Nyamiso's Location, defined partly by survey.

Queenstown District.

Oxkraal and Kamastone Locations, as defined by surveys and exclusive of the surveyed area of the Kathog Outspan.
 Leseyton Mission Station as surveyed.

Sutherland District.

Warthburg Reserve (inclusive of Warthburg Mission Station), as surveyed.
 Umgwall Reserve (inclusive of Umgwall Mission Station), as surveyed.

Tang District.

The Tang Native Reserve, as surveyed.
 Kaukwe Native Reserve, as defined by survey.

Victoria East District.

Mabandla's, Mgalo's and Melini's Locations, including common grazing ground, as defined by survey.
 Gagn and Ely Fingo Locations, as surveyed.
 Victoria Fingo Location, as defined by surrounding surveys.
 Auckland Fingo Location, and extension as surveyed.

Act No. 27
of 1913.

Vryburg District.

Mosokwen Native Reserve, as defined by survey.		
Honning Vlei Native Reserve	do.	do.
Mudebing Native Reserve	do.	do.
Madenkham Native Reserve	do.	do.
Genesis Native Reserve	do.	do.
Gamarons Native Reserve	do.	do.
Detalping Native Reserve	do.	do.
Kcang Native Reserve	do.	do.
Motlon Native Reserve	do.	do.
Klein Cwaten Native Reserve	do.	do.
Takwanen Native Reserve	do.	do.
Kgoekgole Native Reserve	do.	do.
Magonat Native Reserve	do.	do.
Gupitla Native Reserve	do.	do.
Linopen Native Reserve	do.	do.
Jachbedrani Native Reserve.	do.	do.

Wadebosc District.

Umhlanga Location (Farms Uitskijk, Vlakke Fontein and Rietspruit.)

(B) TRANSKEIAN TERRITORIES.

The whole of each of the following Districts outside the limits of the respective town commonages.

1. Bheana.
2. Elliotdale.
3. Engosbo.
4. Flagstaff.
5. Idutywa.
6. Libole.
7. Luikiesiki.
8. Mt. Ayliff.
9. Mt. Fletcher.
10. Mt. Frere.
11. Mpanzuli.
12. Ngqeleni.
13. Nqamakwe.
14. St. Mark's.
15. Tabankulu.
16. Tsomo.
17. Willowvale.
18. Qumbu.
19. Tsolo.

2. *Butterworth District.*

The whole district except Butterworth municipal area, Ibeka Forest Reserve and granted farms in the Entshambe Ward.

3. *Kentani District.*

The whole of the district with the exception of the Kentani Town Commonage and plantation, and Lots 1, 2, 3 and 4 Kei Mouth Reserve.

4. *Matatiele District.*

Moiketse Location Reserve, as defined by surveyed farms adjoining.

George Moshesh's, N'Kan's, Tsita Moshesh's and Mahlangule's Locations, as defined partly by surveyed farms adjoining and partly by boundary of Basutoland.

Anahlul Location Reserve, as defined by surveyed farms and by boundary of district.

Sibi's, Bomhlagwana, Baputi's, Magiana's and Khmapu's Locations, as defined by surveyed farms, the Matatiele Commonage and the Police Reserve.

Hlangwini Location, as defined by surveyed farms and boundary of Basutoland.

Kaka Location Reserve, as defined by surveyed farms and boundary of district.

Farms Polygon and Simpson, as surveyed.

5. *Mount Currie.*

Makoba's Location, as surveyed.

See addition
S.G. 51+40 p 1.

Act No. 27
of 1913.

6. Port St. John's District.

The whole district except the surveyed area specially required for European occupation.

7. Umata District.

The whole district outside the limits of the Umata Town Commonage and surveyed farms.

8. Ucwizakaba District.

Location Reserve Bangunyama and Fama, as defined by surveyed farms.
Sonduba's Location Reserve.

Gugwini Location Reserve.

Locations of Sobelm, Dusa, Mtambo and Bumbulwana.

Locations of Simon, Josana, Singapuzisi Ebo, John, Sigongana, Dulini and Meezeli, as surveyed.

Unkeli Location Reserve, as surveyed.

9. Cala District.

The whole of the district outside the limits of the Cala Town Commonage and Cala Reserve.

II (a.) NATAL.

District.	Location.	Area in Acres.
Umgeni	Zwartkop	59,028
Umlazi	Umlazi	160,025
Richmond		
Inanda		
Umgeni	Inanda... ..	211,600
Umlazi		
New Hanover		
Camperdown		
Erantakop	Tugela	182,700
Impofana	Impofana	107,700
Impofana		
Umvoti	Umvoti	313,800
Mapumulo		
Inanda		
Helipmakoor	Klip River	268,988
Impofana		
Polela	Upper Umkomazi No. 1	48,460
"	" " " 2	52,300
"	" " " 3	7,600
Ixopo	" " " 4	8,000
Pelika	" " " 5	10,000
Ixopo	" " " 6	7,600
"	" " " 7	19,000
"	" " " 8	35,500
"	Alexander No. 1	20,970
Alexandra	" " 2	27,040
"	" " 3	12,690
"	" " 4	21,300
"	Boula	4,364
Lower Umzimkulu	Alexandra No. 5	8,200
"	" " 6	55,000
Alfred	Alfred No. 1	32,000
"	" " 2	35,000
"	" " 3	35,000
"	" " 4	14,000
Alfred	Alfred No. 6a... ..	12,723
"	" " 8	700
"	" " 9	200
"	" " 10	189

additional
handwritten
G.G. 20/10/13
114.

Act No. 27
of 1913.

District.	Location.	Area in Acres
Alfred	Tom Fynn's	7,544
"	Umbono's	4,413
"	Umbhula's	11,953
"	Sakayedwa's	3,000
Lower Umsinkulu	Patwa's	6,251
"	Alfred No. 1	27,000
"	" " 5	16,000
"	" " 7	10
"	Nomngqul's	2,388
East coast	Drakensberg No. 1	56,000
"	" " 2	40,700
"	Putuli Trust	13,054
Impendhle	Impendhle	26,000
Bergville	Upper Tugela	289,700
Umlazi	Umtuzi Trust	7,077
Richmond	Tilongos	1,412
Polela	Maguswana	3,000
Ngqahle	R. of Mosiphas	1,838

District.	Mission Reserve.	Area in Acres.
Mapumulo	Mapumulo	8,195
"	Umpumulo	12,000
"	Isidambeni	5,500
Richmond	Indaleni	5,604
Umlazi	Umlazi	7,521
"	Ifumi	7,498
"	Amantlontoli	8,077
Alexandra	Umtwalume	12,922
"	Amahlongwa	6,905
"	Ifafa	6,200
Umvoti	Etembeni	4,800
Bergville	Komane	5,476
Inanda	Umsunduzi	5,503
"	Inanda	11,700
"	Itafamasi	5,500
Camperdown	Table Mountain	5,628
Krantskop	Ehlanseni	11,000
Lower Tugela	Umvoti (Charlottadale) abort	7,086
Isopo	St. Michael's	6,200

II. (5) ZULULAND.

Reserve No. 1. In extent 60,000 Acres.

" " 2. "	29,000	"
" " 3. "	192,000	"
" " 4. "	58,100	"
" " 5. "	117,000	"
" " 6. "	12,000	"
" " 7A. "	10,000	"
" " 7B. "	17,000	"
" " 8. "	26,000	"
" " 9. "	93,000	"
" " 10. "	27,000	"
" " 11. "	182,000	"
" " 12. "	675,000	"
" " 13. "	34,000	"
" " 14. "	610,000	"
" " 15. "	10,000	"
" " 16. "	306,000	"
" " 17. "	111,000	"
" " 18. "	267,000	"
" " 19. "	396,000	"
" " 20. "	303,000	"
" " 21. "	220,000	"

Act No. 27
of 1913.

III. TRANSVAAL.

Name.	Farm.	Area.
(1) ZOUTPANSBERG.		
		Morgen. Sq. Rds.
Chibase ...	Chibase 2,663	31,104 576
Khaku ...	Khaku 2,690	3,141 430
Kibi ...	Randolph 2,238	1,021 182
	Witfontein 2,237	971 152
		1,992 334
Knobnussen	Locatie van de Knobnussen ... 1,921	37,171 600
	Molenje 2,678	12,119 488
	Schiel 2,320	1,516 331
		50,808 160
Kutama ...	Kutama's Location 2,627	8,625 412
Legalie ...	Bergpinats 2,400	1,540 332
	Brits 805	1,229 461
	Doornloop 1,519	1,098 355
	Driehoek 902	608 258
	Rietfontein 907	1,720 40
	Sterkwater 806	760 350
		6,905 194
Lomondo ...	Lomondo 2,659	6,025 151
Maako ...	Portion Thabina Valley ... 2,553	540 209
	Mamatseeri 2,551	3,620 3
	Marabona 2,320	1,662 253
	Sunnyside 2,519	391 430
	Rita 2,518	452 48
	Meim 2,555	1,824 497
		7,901 347
Mabin alias Mantje	Arthursrust 2,019	4,895 495
	Unsurveyed Government Ground	1,000 0
		5,895 495
Machibaan Mafefe ...	Locatie van Machibaan ... 2,404	10,704 410
	Government Ground near Ha-	
	nertsburg.	
	Lots Nos. 287	628 126
		288 310 583
		289 421 318
		290 586 267
		291 167 60
		292 428 582
		293 578 396
		294 619 147
	Horngras 2,375	1,435 406
	Adjoining Government Ground	693 263
		5,765 143
Mogoboys	Portion Thabina Valley ... 2,353	1,423 358
	Yesemite 2,552	1,882 538
	Long Valley 2,526	2,473 514
	Uplands 2,554	1,158 223
		6,938 463

Act No. 27
of 1913.

Name.	Farm.	Area.	Morgen. Sq. Rds.	
ZOUTPANSBERG— <i>continued.</i>				
Makuba ...	Makuba's Location ...	2,479	500	0
Makuleka ...	Makuleka's Location ...	...	1,000	0
Makushane ...	Makushane's Location ...	...	500	0
Makubeech ...	Rietbokvlei ...	2,235	1,488	219
	Zuurbult ...	2,236	1,382	559
	Leena ...	2,225	2,127	417
	Sandheuwel ...	2,232	929	546
	Oog van Brakrivier ...	2,255	1,547	82
	Kierielager ...	2,254	1,027	297
	Stadford ...	2,253	1,401	68
	Karlphats ...	2,233	1,177	493
	Knoppiesdoorn ...	2,23	1,076	211
			12,176	492
	Bognafurum ...	1,070	2,540	225
Malepe ...	Malepe's Location ...	2,479	7,325	465
	Zamenloop ...	345	7,877	539
			15,303	404
Malietsie ...	Locatie van Malietsie ...	...	48,033	380
	Vanwater ...	618	547	439
	Eerstgeuk ...	644	788	244
	Opgaaf ...	1,618	1,169	584
Malimo ...	Thovaleskraal ...	2,014	1,581	585
	Uitsicht ...	2,017	944	484
			2,526	389
Mamabul ...	Syferfontein ...	103	4,333	564
Mamareema ...	Donkerhoek ...	1,951	1,656	343
Mamabisa ...	Geraldine ...	806	1,692	67
Mamathola ...	Muckle Glen ...	2,558	1,864	405
Mamutwa ...	Mamutwa's Location ...	2,673	8,101	588
Mashishimale ...	Mashishimale's Location ...	...	500	0
Matabata ...	Govt. ground near Haenertsburg			
	Lots	277	421	414
		278	488	61
		259	686	309
		260	426	325
			2,025	509
Matala ...	Matala's Location ...	1,929	32,924	511
Matok ...	De Kaffersdrift ...	194	2,860	420
	Portien Matok ...	1,986	1,217	440
	Klipbok ...	1,832	432	229
	Uitsyk ...	1,833	511	327
			5,081	210
	Leeuwkraal ...	196	4,164	537
Mhinga ...	Mhinga's Location ...	...	4,000	0
Modjadje ...	Modjadje's Location ...	2,666	20,878	227
Mohlaba ...	Mohlaba's Location ...	2,473	12,428	357
Modiba ...	Portien Ooverwacht ...	253	121	563
Mphatlale...	Locatie van Mphatlale	...	13,689	20
	Dwaalkop ...	538	924	541
	Vogelstruisvlakte ...	543	1,142	441
	Zuiping ...	552	1,493	294

Act No. 27
of 1913.

Name.	Farm.	Area.		
(1) ZOUTPANSBERG— <i>continued.</i>				
Mphahlele— <i>contd.</i>	Doerloop	674	206	252
	Vleiplaats	1,969	1,285	165
	Frankoppies... ..	607	1,094	210
	Koppiesdam	609	756	221
	Stofpoort	550	762	595
	Portion Koppieskmal... ..	2,405	845	398
	Doornvlei	612	1,098	14
	S.E. portion Molegat	1,060	42	586
			24,917	97
Mpefu ...	Mpefu's Location	2,064	15,500	0
Pafuri ...	Mapapodi	1,861	21,913	463
Paswane ...	Paswane's Location		6,000	0
Ramagoep	Locatie van Ramagoep	1,534	9,177	187
	Matjiesgoedfontein	205	838	59
Ramputa ...	Ramputa's Locatie		9,000	0
Segalo ...	Segalo's Locatie		500	0
Segip ...	Segip's Locatie	2,665	3,706	52
Sekorero ...	Bokhalva	2,577	1,956	311
	Moltke	185	2,578	123
			4,534	434
Senthimula	Senthimula's Location	2,628	12,417	416
Shikundu...	Shikundu's Locatie		5,000	0
Silwana ...	Silwana's Location		500	0
Tabane ...	Locatie van Tabane	2,403	5,911	0
Tengwe ...	Tengwe's Location		4,000	0
Tonondwe...	Tonondwe	2,661	6,355	329
Tshulac ...	Schoonheid, now Locatie van Chune.	1,529	2,425	160
(2) WATERBERG.				
Bakeberg Masibi.	Malokong	2,114	2,176	87
	Malokongskop	1,332	1,682	162
	Hellek Briksteen	2,102	2,385	575
	Vliegekraan	2,250	2,245	279
	Vogelstruisfontein	593	2,156	570
	Vriesland	1,704	2,263	525
	Schoonoord	1,640	2,778	470
	Portion Bellevue	1,705	325	0
	" Inhambane	1,335	278	234
	" Mozambique	1,336	309	0
	" Groningen	1,349	2,147	59
	South portion Haakdoornstraat...	661	1,671	469
	North portion Haakdoornstraat...	661	1,671	468
			22,683	298
Marcus Masibi.	Portion Groningen	1,349	169	231
	" Inhambane	1,335	872	309
	" Mozambique	1,336	810	122
	Moord Kopje	1,528	2,425	46
	Molendras	1,546	1,483	485
	Commandedrift	1,609	1,967	408
	Gevoel	1,535	1,730	111
	Portion Knapdaar	1,548	566	0
	" Sandvloot	1,526	2,109	103
	Zwartfontein	1,542	2,356	194
		14,481	290	

Act No. 27
of 1913.

Name.	Farm.	Area.	Morgen.	Sq. Rd.
(2) WATERBURG <i>continued.</i>				
Solomon Marabo, Valtyn Maksjan.	Landsberghoek	1,533	3,180	219
	Mucalenskop	2,324	1,905	300
	Turfgruit	2,324	1,157	100
	Rietfontein	1,562	2,591	45
	Portion—Sandhoek	1,026	2,531	100
	" Troelstra	1,031	452	311
	" Krugdaar	1,518	1,848	41
			16,277	300
Zebedee ...	Zebedee's Location	2,381	28,661	110
Scika ...	Beauty	2,228	2,897	176
	Lily	2,318	2,112	205
			6,010	21
Shongwane	Pic van Tonolite	1,107	1,055	0
(3) MIDDELBURG.				
Hlakuli ...	Brakfontein	157	1,709	312
Hugula ...	Portion Vlakplaat	107	778	289
	" Voornitsicht	328	125	198
	Do Oude Stad van Eekwatie	218	2,911	261
	Lekkerland	213	2,296	132
			8,325	280
Pokwane ...	Scho	536	2,828	429
	Rietfontein	435	4,075	583
			6,901	412
Rampula Kopani ...	Portion Rietkloof	509	2,149	217
	Mooifontein	356	2,657	576
	Hoogeloozen	361	2,882	166
	Stad van Mashruen	367	2,625	83
			10,185	225
(4) LYDENBURG.				
Vokukani ...	Government Ground	No. 13	291	374
	Erensvegt	1,189	2,292	186
	Hoeratsop	1,176	2,180	311
	Goedverwacht	1,375	2,126	311
	Oriskop	1,065	2,252	332
	Paradys	1,485	2,228	212
	Geenstude	1,117	2,511	197
	Puys	1,125	1,026	171
	Korenvelden	1,139	1,261	291
	Avontuur	1,129	2,725	41
	Schoonard	894	2,625	285
	Government Ground	approximately	25,500	
	Government Ground (Mogmet Hoght)		2,231	211
	Diamond	1,007	2,222	380
	Goedgemeend	1,091	2,225	376
	Greenland	895	2,027	138
	Enraam	180	2,073	47
	Zeevelden	1,100	2,628	265

Act No. 27
of 1913.

Name.	Farm.			Area.		
				Morgen.	Sq. Rls.	
(4) LYDENBURG— <i>continued</i> .						
Sekukuni	Moskoo	...	...	1,137	3,172	68
<i>contd.</i>	Middelbin	...	...	1,138	2,956	475
	Vlakplants	...	...	1,304	3,611	82
	Scheepers Rust	...	...	17	3,109	326
	Doornveld	...	...	1,100	2,819	402
	Mooihoek	...	...	1,124	2,899	322
	Loordkraal	...	...	1,124	3,162	195
	Duikensluis	...	...	1,125	3,411	168
	Groblers Vrede	...	...	18	3,613	33
Approximately				129,174		562
(5) MARICO.						
Mailou	Mailou's location	...	...	51	125,879	333
	Dam van Metsige	...	...	205	3,319	150
	Matjieskraal	...	...	205	1,826	315
Mabalane and Pella Thebe Suping	(See Rustenburg).				1,154	109
	Vink Rivier	...	...	132	991	329
	Portion Hartiesfontein	...	...	105		
					3,115	438
(6) LICHTENBURG.						
Machabé	Driefontein	...	...	88	1,195	215
	Poffontein	...	...	254	3,009	340
	Rietkraal	...	...	290	2,78	162
	Uitgeput	...	...	200	305	177
					10,341	263
Kunana Putfontein	Remainder Kunana Location	...	...	79	46,778	537
	Portion Poffontein	...	...	79	1,864	71
	"	...	...	79	328	377
	"	...	...	79	185	12
	"	...	...	79	1,158	128
	"	...	...	79	1,006	324
					4,602	512
Rooijantjes- fontein Western	Portion Rooijantjesfontein	...	...	51	3,161	315
	" Koppiesfontein	...	...	18	1,920	72
	" Rhenosterdoorn	...	...	67	3,176	316
					10,261	333
(7) RUSTENBURG.						
August Mokhatla	Stylrift	...	...	361	3,252	8
	Hartbeestpruit	...	...	614	3,187	0
	Goedgedacht	...	...	368	2,155	320
	Goedgedacht	...	...	169	2,903	389
	Kleinboornspruit	...	...	255	2,921	104
	Doornpruit	...	...	878	2,983	294
	Uitvalgrond	...	...	103	1,021	87
	Turffontein	...	...	307	3,319	330
	Portion Boerfontein	...	...	132	1,581	396
	Boschfontein	...	...	480	2,213	490
	Turffontein	...	...	297	1,029	316

Appendix B: Questionnaire

Questionnaire: animated and static map Instructions:

Once the animation/static map has been viewed, please answer this questionnaire. The questionnaire is for research purposes for a dissertation at the Cape Peninsula University of Technology. The questionnaire is on an anonymous basis and kept as confidential.

Consideration has to be given to all the changes being displayed, such as the:

- Spatial change over time and
- Information in each of the time periods

Do you work in a Geomatics or related field? Yes No

Choose the most relevant answer

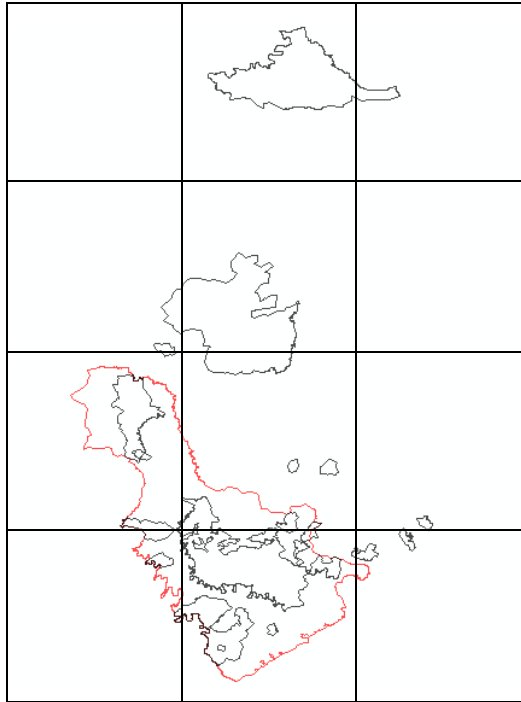
Pre-test questions:

3. Are you familiar with the history of Ciskei?
 Yes
 No

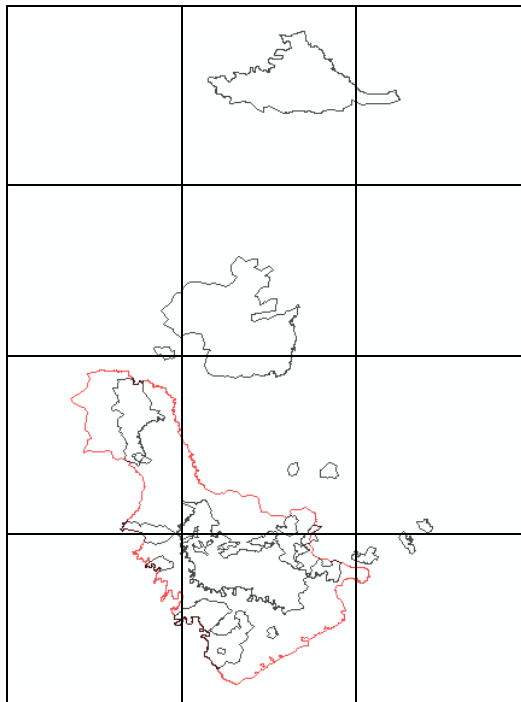
4. Prior to today's meeting, were you aware that the boundary of Ciskei changed over time?
 Yes
 No

Test Questions:

5. Where is King William's Town located? Place a cross (X) in the correct block:



6. Where was the Herschel district located in 1966? Place a cross (X) in the correct block:



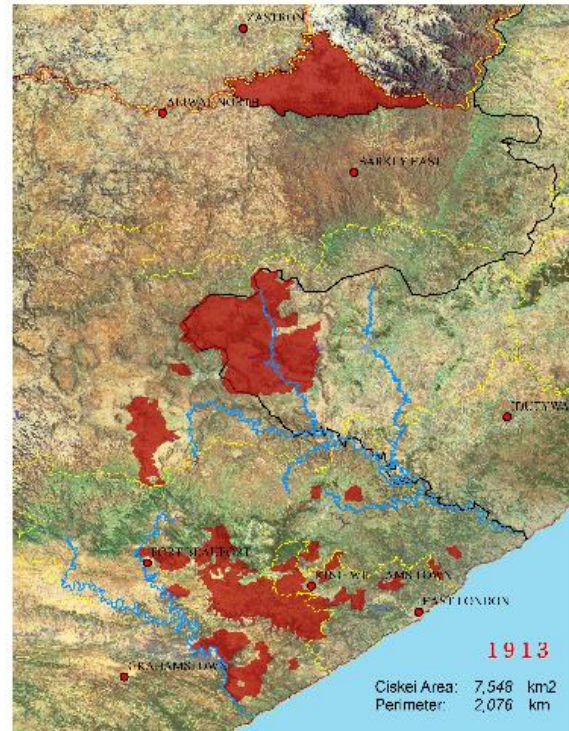
7. When was Ciskei established?
- 1913
 - 1951
 - 1981
 - 1994
8. When did Ciskei become a single consolidated area?
- 1975
 - 1973
 - 1976
 - 1980
9. What was the act that declared Ciskei as an Independent State?
- The Status of Ciskei Act No 110 of 1981
 - Representation between RSA and Self Governing Territories Act 46 of 1959
 - Native Land Act 27 of 1913
10. During which period was the consolidation plans effected?
- 1913 – 1976
 - 1936 – 1951
 - 1973 – 1975
 - 1981 – 1994
11. What was the approximate area of Ciskei in 1981?
- 8,900 km
 - 7,000 km
 - 6,500 km
 - 4,000 km
12. What year was there the most drastic changes to the Ciskei boundary?
- 1936
 - 1955
 - 1975
 - 1980

Appendix C: Key Map of the Union of SA to Accompany Report of Natives Land Commission 1916.

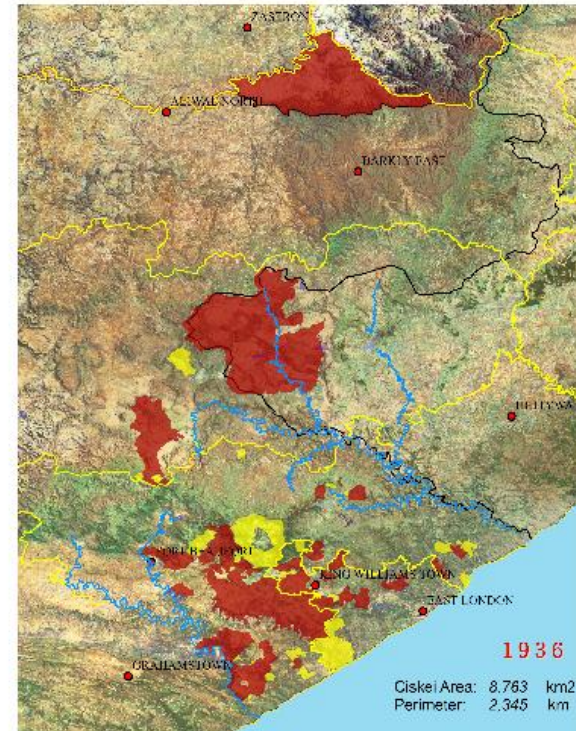
Appendix D: The Development Atlas, printed by Government Printer 1966.

Appendix E: Static maps

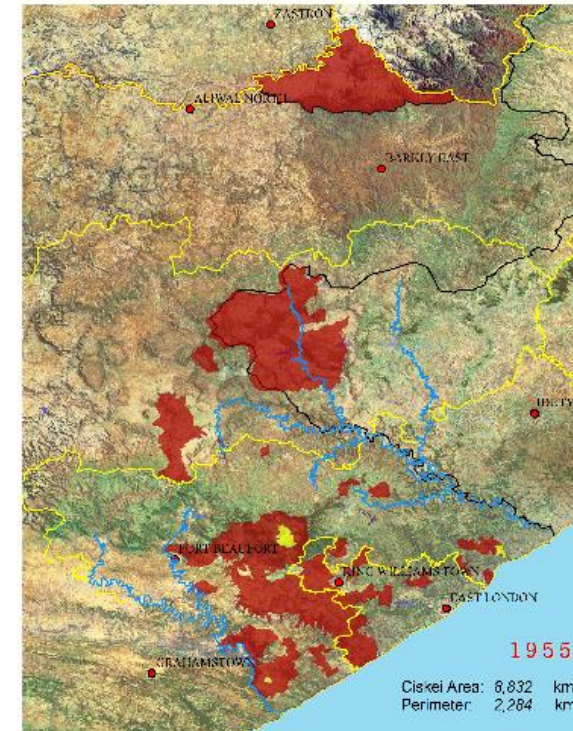
Native Land Act 27 of 1913



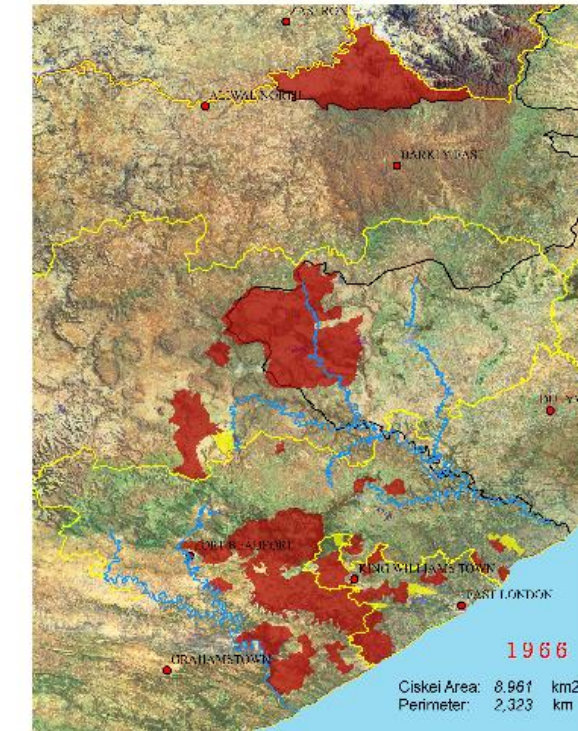
Development Trust and Land Act 18 of 1936



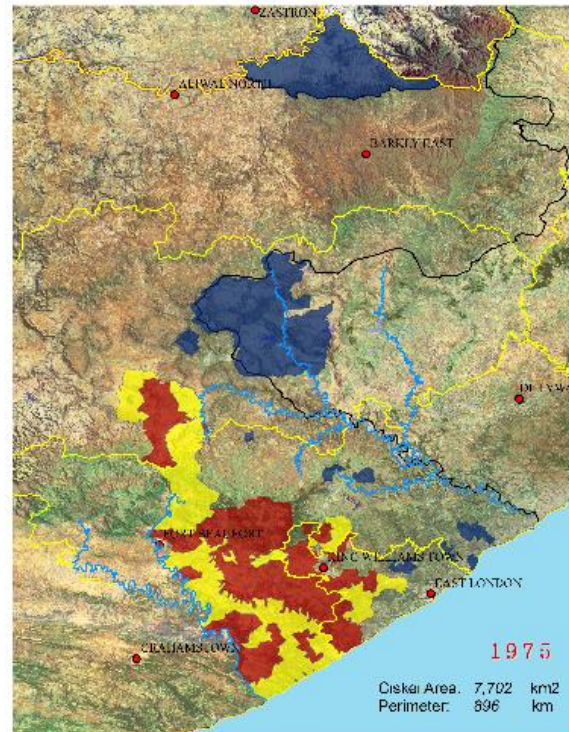
Bantu Black Authorities Act 68 of 1951



Representation between RSA and Self Governing Territories Act 46 of 1959



Consolidation Plans 1973-1976



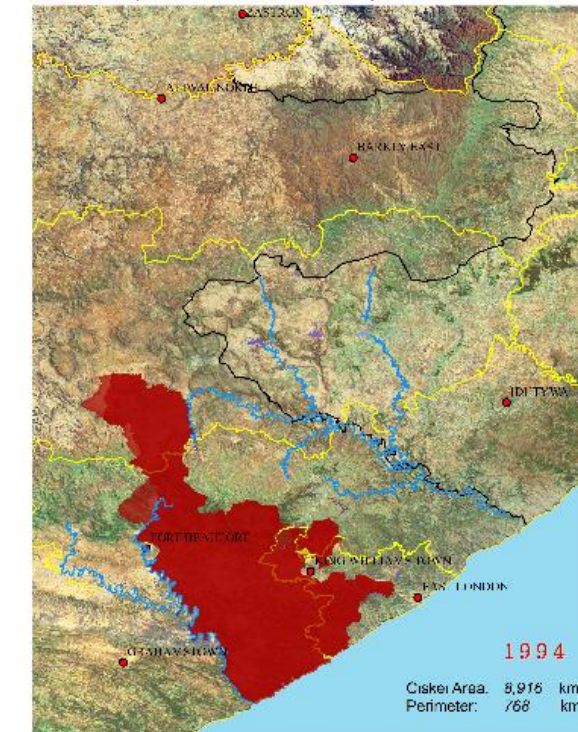
Status of the Transkei Act No. 100 of 1976



The Status of Ciskei Act No 110 of 1981



Ciskei Reincorporated into South Africa on 27 April 1994

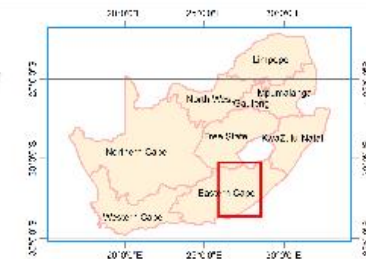
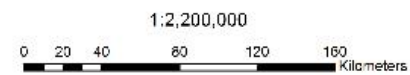


Prepared by: Salim Ali
Department of
Civil Engineering and Surveying
CPUT 2015
11/11/2014

The South African Native Land Act, 27 of 1913, shaped land policies in South Africa. It transferred the black reserves (homelands) throughout the country, one of which was Ciskei.

Ciskei and all of the other homelands were reincorporated into South Africa on 27 April 1994, after the first post-apartheid elections. Along with Transkei, Ciskei became part of the new Eastern Cape Province.

The Development of Ciskei Homeland 1913-1994



- Towns
- River
- Indian Ocean
- District Municipalities
- Transkei 1994
- Ciskei
- Area Added
- Area Excluded
- Provincial boundary



Coordinate System
GCS_WGS_1984

Appendix F: Ciskei time series animation (animated map).

https://www.youtube.com/watch?v=OLX_XIZ1wKA