

**The determination, protection and management of
high potential agricultural land in South Africa
with special reference to Gauteng**

by

Anneliza Collett

Submitted in partial fulfilment of the requirements for the degree
M.Sc (Plant Science)

in the

**Faculty of Natural & Agricultural Science
University of Pretoria
Pretoria**

Study Leader: Prof. GJ Bredenkamp

August 2008



DECLARATION

I, Anneliza Collett declare that the thesis, which I hereby submit for the degree M.Sc (Plant Science) at the University of Pretoria, is my own work and has not previously been submitted by me for a degree at this or any other tertiary institution.

SIGNATURE:

DATE: 31 January 2009

O LORD, our Lord,
how majestic is your name in all the earth!
You have set your glory above the heavens.
Out of the mouths of babies and infants,
you have established strength because of your foes,
to still the enemy and the avenger.
When I look at your heavens, the work of your fingers,
the moon and the stars, which you have set in place,
what is man that you are mindful of him,
and the son of man that you care for him?
Yet you have made him a little lower than the heavenly beings
and crowned him with glory and honour.
You have given him dominion over the works of your hands;
you have put all things under his feet,
all sheep and oxen,
and also the beasts of the field,
the birds of the heavens, and the fish of the sea,
whatever passes along the paths of the seas.
O LORD, our Lord,
how majestic is your name in all the earth!

Psalm 8



DEDICATION

*With love and appreciation to Kevin,
Andrew, Charl and my parents*

ACKNOWLEDGEMENTS

My praise and thanks to the Lord, for his guidance and direction, without whom neither I nor this study would have been conceived. No dissertation is written by the hand of the author alone. Therefore I would like to express my sincere appreciation and thanks to those whose hearts and hands have touched the pages of my work

- Prof George Bredenkamp, my study leader, for his patience, assistance and guidance
- The Gauteng Department of Agriculture, Conservation and Environment, for allowing me to manage the project on the identification of high potential agricultural land
- The National Department of Agriculture, for giving me the opportunity to extend this very important aspect on a national scale
- Kevin, my husband, for his love, understanding, patience and support
- Andrew and Charl, my sons, for their love, exuberance and joy
- Frans and Poppie, my parents, for their encouragement, support and assistance, especially the proof reading and technical advice
- Francois, my brother, for assisting me with the printing of this manuscript
- My colleagues, especially Hein Lindemann, for allowing me to live the dream, Dirk Pretorius, for his technical input, and Annette Stoltz, for sharing this dream
- Hermann Strydom, of EnviroGIS, for his knowledge and support in conducting the zoning of agricultural land projects, and understanding why this study had to be done
- lauma Cooper, for critically and professionally editing the manuscript

SUMMARY

Humankind's survival is dependant on the sustainable availability and subsequent management of natural resources. Humans are central to ensuring the sustainable use of the natural resources and the administration of future development. South Africa is one of the signatories of the 1992 Rio Declaration on Environment and Development. This Declaration stipulates that development should occur in a way that it will fulfil the developmental and environmental needs of current as well as future generations (Aventis CropScience 2000:2).

South Africa is continuously exposed to extremes, not only from an environmental perspective, but also from a land use and management perspective. The country is exposed to a wide range of climatic conditions as well as varied soil and terrain characteristics. Limited high potential agricultural land is available for cultivation purposes and the management and protection of this land is crucial for continued food security. The wide variety of animal and plant species unique to South Africa should all be protected. Continued pressure has negatively impacted on the natural resources and in several instances resulted in their loss.

The management of these resources has received much attention over the years and many research projects have focused on a better understanding of the resources and how they should be managed. One of the primary requirements in the effective management of natural resources is accurate information. The development of Geographical Information Systems (GIS) as well as spatial data sets and information systems focusing on natural resources have contributed to improved monitoring and management thereof. Through the use of GIS, improved, modelled data sets and decision support systems could be developed that assisted in the decision making, management and monitoring of the resources.

The optimal utilization of South Africa's resources has, to a large extent, contributed to the country becoming independent in terms of food production and therefore currently regarded as food secure. The commercial agricultural sector has adapted to risks through

effective cultivation practices and the optimal utilization of the land's resources. At the same time, however, the country's land reform programme has given new farmers access to land, but through this process exposed them to challenges they are not equipped to deal with. Moreover, in some instances, agricultural production has also impacted negatively on the environment.

For South Africa as a developing country, there is great emphasis on residential, industrial and economic development and the advancement of citizens through job creation and the alleviation of poverty. These developments are mostly financially driven without proper consideration as to their impact on the environment. Legislation, strategic objectives and policies have raised awareness of ensuring that environmental assessments should form part of any proposed development. Nevertheless, these directives are not fully implemented.

The Gauteng Province, of special reference to this study, is regarded as the economic hub of the country and is therefore continuously faced with development pressures. However, this province also has a disproportional amount of high potential agricultural land.

Against this background, the study focused on current legislation, policies and decision support systems in the protection and management of agricultural land for future production.



STRUCTURE OF THE STUDY

The scope of this study was very wide, due to the complexity involved in the protection and management of agricultural land. Specific reference was made to Gauteng, but it was necessary to review the national scenario, as land is regarded as a national asset and food security not only affects Gauteng, but also the whole of South Africa.

Several aspects had to be addressed in order to illustrate a comprehensive picture of the *status quo* and the importance of effective land use planning and the protection of agricultural land for continuous food security. In conducting the study, references were made to the current legislation, as well as strategic objectives on both national and provincial level. It further included research on the natural resource base of the country and Gauteng, as well as available land capability studies, supported by sufficient information systems.

In view of the above motivation, it was therefore not possible to restrict the study to a limited number of pages.

ABBREVIATIONS

- AEC - Agricultural Ecological Cell
- AEZ - Agro Ecological Zones
- AGIS - Agricultural Geo-referenced Information System
- AH - Agricultural hubs
- ALSI - Agricultural land suitability index
- API - Agricultural profitability index
- ARC - Agricultural Research Council
- BRU's - Bio-resource Units
- BSI - Biophysical suitability index
- CARA - Conservation of Agricultural Resources Act, 1983 (Act no 43 of 1983)
- CEC - Committee of Environmental Coordination
- CMA - Catchment Management Agencies
- CoJ - City of Johannesburg
- C-Plan - Conservation Plan
- CTMM - City of Tshwane Metropolitan Municipality
- DEAT - Department of Environmental Affairs and Tourism
- DFA - Development Facilitation Act, 1995 (Act no 67 of 1995)
- DLA - Department of Land Affairs
- DoA - National Department of Agriculture
- DPSIR - Drivers-Pressures-State-Impacts-Responses
- DTM - Digital Terrain Model
- DWAF - Department of Water Affairs and Forestry
- EIA's - Environmental Impact Assessment regulations
- EIP's - Environmental Implementation Plans
- EMF's - Environmental Management Frameworks
- EMM - Ekurhuleni Metropolitan Municipality
- EPIA - Directorate: Environmental Protection and Impact Assessment
- FAO - Food and Agricultural Organization of the United Nations

- GADS - Gauteng Agricultural Development Strategy
- GAPA - Gauteng Agricultural Potential Atlas, Version 2 and 3
- GDACE - Gauteng Department of Agriculture, Conservation and Environment
- GDP - Gross Domestic Product
- GDS - Gauteng Growth and Development Strategy
- GGP - Gross Geographic Product
- GIS - Geographic Information Systems
- GOSP - Gauteng Open Space Plan
- GSSD - Gauteng Strategy for Sustainable Development
- ha - hectare
- ha/lsu - hectare per livestock unit
- HU - Heat units
- IDP's - Integrated Development Plans
- ISCW - Institute for Soil, Climate and Water
- JPOI - Johannesburg Plan of Implementation
- l/s - litres per second
- LARP - Land and Agrarian Reform Programme
- LCCS - Land Cover Classification System
- LRAD - Land Redistribution for Agricultural Development
- lsu - livestock unit
- LUSM - Land Use and Soil Management
- MEC - Member of the Executive Council
- mm - millimetre(s)
- MSSA - Marketing Surveys and Statistical Analysis
- NAFU - National African Farmers' Union
- NAMC - National Agricultural Marketing Council
- NEMA - National Environmental Management Act, 107 of 1998
- NEPAD - New Partnership for African Development
- NSSD - National Strategy on Sustainable Development
- PDI's - Previously Disadvantage Individuals

- PWV - Pretoria-Witwatersrand-Vereeniging
- RAMSAR Convention - Convention on Wetlands of International Importance (taken from its place of adoption in Iran, 1971)
- RDP - Reconstruction and Development Programme
- SA - South Africa
- SABS - South Africa Bureau of Standards
- SADC - Southern Africa Development Cooperation
- SANS - South African National Standard
- SCA - Supreme Court of Appeal
- SDF's - Spatial Development Frameworks
- SIS - Settlement Implementation Support
- SLAG - Settlement Land Acquisition Grants
- SoER - State of the Environment Report
- SRI - Suitability rating index
- SUAR - Sustainable Utilization of Agricultural Resources
- SUPAR - Sustainable Utilization and Protection of Agricultural Resources
- UN - United Nations
- UNCCD - United Nations Convention to Combat Desertification
- UNCED - United Nations Conference on Environment and Development
- vs. - versus
- WESSA - Wildlife and Environmental Society of South Africa
- WSSD - World Summit on Sustainable Development
- WUA - Water User Associations
- < - smaller than
- > - larger than
- °C - Celsius



TABLE OF CONTENTS

CHAPTER 1

ORIENTATION TO THE STUDY

1.1	INTRODUCTION.....	1
1.2	BACKGROUND TO THE STUDY.....	4
1.3	RESEARCH PROBLEM.....	6
1.4	PURPOSE OF THE STUDY.....	7
1.5	RESEARCH OBJECTIVES.....	7
1.6	BASIC ASSUMPTION UNDERLYING THE STUDY.....	8
1.7	SIGNIFICANCE OF THE STUDY.....	8
1.8	DATA COLLECTION.....	8
1.9	OUTLINE OF THE STUDY.....	9
1.10	CONCLUSION.....	9

CHAPTER 2

THE STUDY AREA

2.1	INTRODUCTION.....	10
2.2	DEMOGRAPHY OF SOUTH AFRICA.....	10
2.3	INFRASTRUCTURE AND EMPLOYMENT.....	14
2.4	CONCLUSION.....	17

CHAPTER 3

SUSTAINABLE DEVELOPMENT AND LAND

3.1	SUSTAINABLE DEVELOPMENT.....	18
3.2	URBANIZATION.....	26
3.3	LAND.....	33
3.4	FOOD SECURITY.....	39
3.5	CONCLUSION.....	42

CHAPTER 4

AGRICULTURE AND LAND USE

4.1	INTRODUCTION.....	43
4.2	LAND COVER VS. LAND USE.....	43
4.3	LAND COVER IN SOUTH AFRICA.....	44
4.4	THE AGRICULTURAL SECTOR IN SOUTH AFRICA.....	47
4.4.1	Agricultural land use.....	49
4.4.1.1	Statistics: different views.....	49
4.4.1.2	Statistics: Crops and livestock.....	51
4.4.2	Economic factors.....	52
4.5	AGRICULTURE IN GAUTENG.....	55
4.6	LAND COVER IN GAUTENG.....	62
4.7	CONCLUSION.....	69

CHAPTER 5

STRATEGIC OBJECTIVES IN THE SOUTH AFRICAN SUSTAINABLE DEVELOPMENT PRIORITIES WITH SPECIAL FOCUS ON AGRICULTURE

5.1	INTRODUCTION.....	70
5.2	NATIONAL POLICIES AND STRATEGIC OBJECTIVES WITH THE FOCUS ON AGRICULTURE.....	73
5.2.1	White Paper on Agriculture, 1995.....	73
5.2.2	Agricultural policy in South Africa: A discussion document, 1998.....	78
5.2.3	Strategic Plan for South African Agriculture, 2001.....	86
5.2.4	National Department of Agriculture Strategic Plan.....	89
5.2.5	Department of Agriculture's Incentive-based Framework to Promote Sustainable Utilization of Natural Resources in Agriculture: A discussion document, April 2006.....	92
5.2.6	Department of Land Affairs, Strategic Plan, 2006 – 2009.....	93
5.2.7	Combined initiatives between the Departments of Agriculture and Land Affairs.....	94
5.2.8	White Paper on Spatial Planning and Land Use Management, 2001.....	97



5.2.9	National Strategy for Sustainable Development (NSSD).....	100
5.2.10	White Paper on Environmental Management policy.....	102
5.3	GAUTENG PROVINCIAL GOVERNMENT POLICIES AND STRATEGIC OBJECTIVES WITH THE FOCUS ON AGRICULTURE.....	104
5.3.1	Gauteng Government strategic objectives.....	104
5.3.2	Gauteng Growth and Development Strategy (GDS).....	105
5.3.3	Gauteng Strategy for Sustainable Development (GSSD).....	107
5.3.3.1	State of play assessment.....	108
5.3.3.2	Vision, principles and priorities.....	110
5.3.4	Gauteng Department of Agriculture, Conservation and Environment (GDACE) Strategic Plan, 2004 – 2009.....	112
5.3.5	Gauteng Agricultural Development Strategy (GADS), 2006.....	116
5.3.6	Gauteng Environmental Implementation Plan, 2001 – 2004.....	118
5.4	CONCLUSION.....	119

CHAPTER 6

NATIONAL AND PROVINCIAL LEGISLATION AND POLICIES

6.1	INTRODUCTION.....	120
6.2	NATIONAL ACTS.....	120
6.3	NATIONAL BILLS.....	146
6.4	NATIONAL POLICIES.....	151
6.5	GAUTENG PROVINCE'S ACTS AND POLICIES.....	156
6.6	POLICY TRENDS.....	160
6.7	POLICIES OUTSIDE SOUTH AFRICA FOCUSED ON THE PROTECTION OF AGRICULTURAL LAND.....	161
6.8	THE MUNICIPAL ENVIRONMENT (LOCAL GOVERNMENT).....	162
6.9	CONCLUSION.....	168

CHAPTER 7

THE STATUS OF NATURAL RESOURCES

7.1	INTRODUCTION.....	169
-----	-------------------	-----



7.2	THE ENVIRONMENT AND ITS NATURAL RESOURCES.....	169
7.3	STATUS QUO OF THE NATURAL RESOURCES (ENVIRONMENT).....	171
7.4	SOILS.....	174
7.5	CLIMATE.....	193
7.6	GEOLOGY.....	199
7.7	VEGETATION AND BIODIVERSITY.....	202
7.8	WATER.....	217
7.9	THE WAY FORWARD.....	222
7.9.1	Spatial information management.....	222
7.9.2	Agricultural Geo-referenced Information System (AGIS).....	225
7.10	CONCLUSION.....	226

CHAPTER 8

AGRICULTURAL POTENTIAL

8.1	INTRODUCTION.....	227
8.2	HIGH POTENTIAL AGRICULTURAL LAND.....	227
8.3	IDENTIFICATION AND EVALUATION OF HIGH POTENTIAL AGRICULTURAL LAND.....	229
8.3.1	Land evaluation and capability.....	230
8.3.2	Prime or high potential agricultural land.....	239
8.3.3	Unique agricultural land.....	243
8.4	AVAILABILITY OF INFORMATION OR DECISION SUPPORT SYSTEMS ON LAND CAPABILITY OR AGRICULTURAL POTENTIAL.....	245
8.5	ZONING OF AGRICULTURAL LAND.....	280
8.6	LAND USE PLANNING.....	283
8.6.1	Crop suitability.....	287
8.6.2	Minimum farm size.....	291
8.7	CONCLUSION.....	293



CHAPTER 9

CONCLUSIONS AND RECOMMENDATIONS

9.1	INTRODUCTION.....	294
9.2	AGRICULTURAL LAND AND ITS ROLE IN SUSTAINABLE DEVELOPMENT.....	294
9.3	IMPROVED COMMUNICATION.....	300
9.4	IDENTIFICATION AND ZONING OF AGRICULTURAL POTENTIAL LAND.....	301
9.5	EVALUATION REQUIRED FOR MANAGING AGRICULTURAL LAND.....	303
9.6	STRATEGIC OBJECTIVES.....	305
9.7	LEGISLATION AND POLICES.....	307
9.8	LAND USE PLANNING AND MANAGEMENT.....	310
9.9	KNOWLEDGE AND INFORMATION MANAGEMENT.....	313
9.10	CONCLUSION.....	315
	REFERENCES.....	317

LIST OF TABLES

Table 4.1	Land cover classes for Gauteng.....	67
Table 7.1	Expanded legend of the generalized soil patterns.....	180
Table 7.2	Detailed description of the qualifying soil forms in the favourable classes.....	183
Table 7.3	Extent of wind and water erosion in South Africa	189
Table 7.4	Groundwater resources in South Africa.....	217
Table 8.1	Land capability classes for South Africa.....	237
Table 8.2	Land capability classes.....	270
Table 8.3	Demarcated land cover classes.....	270
Table 8.4	Land cover and land capability matrix.....	271
Table 8.5	Land capability classes for Gauteng as a percentage of the province.....	271
Table 8.6	Derived agricultural potential zones for Gauteng.....	272
Table 8.7	Final agricultural potential zones for Gauteng.....	273
Table 8.8	Classification of high potential agricultural land in Gauteng.....	278
Table 8.9	Crop suitability ratings for Gauteng.....	288
Table 8.10	Suitability percentages for each identified crop.....	289
Table 9.1	Recommended interactive processes in land use management.....	312

LIST OF FIGURES

Figure 2.1	Map of the Republic of South Africa.....	11
Figure 2.2	Local government structure within the Gauteng Provincial Government... ..	13
Figure 2.3	Infrastructural layout of Gauteng.....	15
Figure 3.1	Division of land use within an urban concept.....	29
Figure 3.2	Urban development boundaries of Gauteng.....	32
Figure 3.3	Interaction between humans and the environment	39
Figure 4.1	National Land Cover Classification for South Africa, 2000.....	48
Figure 4.2	Classification of cultivated land in Gauteng.....	57
Figure 4.3	Smallholdings distribution in Gauteng province.....	60
Figure 4.4	Representation of Quick Bird images used for the land cover classification in Gauteng.....	64
Figure 4.5	Land cover classification in Gauteng.....	66
Figure 7.1	Land types distribution in South Africa.....	177
Figure 7.2	Detailed land type distribution in Gauteng.....	178
Figure 7.3	Generalized soil patterns of South Africa.....	179
Figure 7.4	Distribution of soils with a favourable structure in South Africa.....	182
Figure 7.5	Detailed soil classification of the former PWV region (now central part) of Gauteng.....	185
Figure 7.6	Locality of soils with beneficial water retaining layers below the rooting zone.....	187
Figure 7.7	Areas susceptible to water erosion in South Africa.....	192
Figure 7.8	Annual rainfall map of South Africa.....	196
Figure 7.9	South Africa's aridity zones.....	197
Figure 7.10	Maximum and minimum temperature distribution of South Africa.....	198
Figure 7.11	Geology of South Africa.....	200
Figure 7.12	Slope percentage distribution found in South Africa.....	201
Figure 7.13	Acocks veld types of South Africa.....	204
Figure 7.14	Vegetation types for South Africa according to Vegmap, 2006.....	205

Figure 7.15	Vegetation habitat types of Gauteng.....	206
Figure 7.16	Gauteng protected areas and reserves.....	208
Figure 7.17	Ecological sensitive classified areas in Gauteng.....	211
Figure 7.18	Grazing capacity index or potential, 1993.....	214
Figure 7.19	Alien plant distribution in Gauteng.....	216
Figure 7.20	Water sources in South Africa.....	221
Figure 8.1	Agricultural rainfall stations distribution in South Africa.....	248
Figure 8.2	Land capability classification for South Africa	250
Figure 8.3	Agricultural soil potential for Gauteng from the Gauteng Resource Audit.....	253
Figure 8.4	Rain fed maize potential areas in Gauteng identified in GAPA 2.....	255
Figure 8.5	General irrigated crop potential areas in Gauteng identified in GAPA 2.....	256
Figure 8.6	Agricultural potential areas in Gauteng identified in GAPA 2.....	257
Figure 8.7	Grazing potential areas in Gauteng identified in GAPA 2.....	258
Figure 8.8	Distribution of sample points from the four soils data sets used.....	261
Figure 8.9	Data transformation depicting soil depth.....	265
Figure 8.10	Data transformation depicting water erosion.....	265
Figure 8.11	Data transformation depicting crusting hazard.....	266
Figure 8.12	Issues and concerns for soil moisture availability.....	267
Figure 8.13	Issues and concerns for moisture supply capacity.....	268
Figure 8.14	Issues and concerns of mechanical limitations.....	269
Figure 8.15	Land capability classes for Gauteng.....	272
Figure 8.16	Final agricultural potential zones for Gauteng.....	273
Figure 8.17	Zoning of agricultural land in Gauteng.....	275
Figure 8.18	Zoning of high potential agricultural land in Gauteng.....	279
Figure 8.19	Interactions of effective land use planning.....	286
Figure 8.20	Maize suitability in Gauteng.....	290
Figure 9.1	Demarcated agricultural land in South Africa, according to Act 70 of 1970.....	298
Figure 9.2	Demarcated agricultural land in Gauteng, according to Act 70 of 1970.....	299

ORIENTATION TO THE STUDY

1.1 INTRODUCTION

Agriculture and its related activities are a cornerstone of any developing country. Not only is agriculture an economic asset, as it assists in the creation of jobs and alleviation of poverty, but it is also crucial in feeding a nation, which is essential for the well being and growth of its citizens.

South Africa is a beautiful country with a diversity of fauna and flora not found elsewhere in the world. It is also a country characterized by extreme climatic conditions, with an annual rainfall varying from less than 200 mm in the western parts to more than 1000 mm in the eastern parts (Agricultural Research Council – Institute for Soil, Climate and Water [ARC–ISCW] 2004:7). Therefore, certain areas can almost be classified as desert, whilst others tend to be more tropical.

The variance in climate and topography enables the country to produce almost any kind of crop under applicable conditions, management and cultivation practices. The variance in the climate and types of soil places heavy demands on the producers, bearing in mind that the country has a limited amount of high potential agricultural land for sustained crop production.

Knowledge of the land, the shortcomings and possibilities forms the basis of any successful and sustainable farming production. Over the years research in agriculture together with the practical experience gained by farmers has enabled South Africa, notwithstanding the harsh environmental conditions, to become largely self-sufficient in its agricultural production and even resulted in surpluses being made available for export (Department of Agriculture [DoA] 1994:1).

In determining the role of agriculture in any country, it should be taken into consideration that agricultural production is also influenced by global trends and production factors, international and local prices, and fluctuations in domestic supply

and demand. It is critical for a country to manage these fluctuations and work towards retaining its production capability to adhere to its food requirements. No country can afford to be too reliant on imports, or it could become a “hostage” to the demands of the supplying nation.

South Africa is also regarded as a developing country with a large urbanized population. There is tremendous pressure for current and future developments and the expansion of industries to facilitate the current growth. This results in a high demand for available land.

In managing the pressures on land, it is important to conduct land use in a way that it optimally adheres to the potential of the land. Consequently, it is imperative that all available land with the potential for producing sustained high crop yields, thus land with a high agricultural production potential, as well as land with a potential carrying capacity for livestock, be effectively utilized and protected for agricultural use. This will result in the continuous production of food, thereby addressing food security, and will further contribute to job creation, generation of income, and the upliftment of the community in general. Agricultural production or the use of land for any other purpose should nevertheless not be conducted in a way that it could result in the degradation or loss of the available natural resources.

Gauteng, the smallest but most densely populated of the nine provinces of the Republic of South Africa, plays a major role in addressing the demands on land. As a result of its locality, the presence of mines and industries as well as its well-developed infrastructure, the province has a large urbanized component. It is estimated that 97% of the population of Gauteng lives in urban areas (Statistics South Africa 2000:9). This places tremendous pressure on the remaining available land for possible agricultural production to be used for housing or other developmental uses.

Only approximately 4% of South Africa’s land is classified as having a high agricultural potential. In 2002, the Gauteng Department of Agriculture, Conservation and Environment (GDACE) determined that approximately 28.7% of the above-mentioned 4% high potential agricultural land could be found in Gauteng. The Department concluded that this land needs to be protected and reserved for agricultural use

(GDACE 2004a:44). The protection of this land was subsequently incorporated as one of the strategic objectives of the Branch: Agriculture within GDACE (GDACE 2004b:10).

The mentioned high potential agricultural land is made up of 15.1% high potential and 13.6% moderate to high potential land (28.7%), although both were regarded as equally important. In 2002, 28.2% of the identified 28.7% high potential agricultural land was cultivated, with 40.7% of the 28.7% classified as natural grassland and the remainder utilized for other land uses (GDACE 2004a:44).

In 2006, GDACE conducted an updated study of high potential agricultural land in the province and concluded that of the previously determined 28.7%, only 17.37% high potential agricultural land is still available for possible production (GDACE 2006b:47). GDACE did not update the cultivated areas, occurring on the high potential agricultural land. In view of the above statistics Gauteng, then, has an important role in the protection of the still available high potential agricultural land.

The conflict between the potential of the land for production purposes and food security versus the pressure for land that can be used to supply housing to the growing population of Gauteng makes heavy demands on the availability of land. The effective utilization of the land should be based on its potential. This has become a highly contentious issue between the protectors of high potential agricultural land and the developers focusing on the same land for development and financial gain. This matter is further complicated by the limited existing research, especially on a detailed level, on identifying land that needs to be protected with supporting norms, standards or specific guidelines (both provincially and nationally). This information and guidelines should be readily available to guide role-players in this crucial aspect.

Against this background, the present study focused on current national and provincial strategic planning, policies and legislation in place to protect agricultural land, especially high potential agricultural land. The emphasis was on current information and procedures available for the identification of agricultural land that requires protection, with particular reference to Gauteng.

1.2 BACKGROUND TO THE STUDY

Economic pressure and service delivery requirements in terms of housing, industries and supporting infrastructure exert severe pressure on the availability of land. Consequently, agricultural land, specifically the limited high potential agricultural land, which should be protected for exclusive use by the agricultural sector, is under constant threat. The threat of this land being utilized for purposes other than agriculture is increasing. A strategic objective of the Gauteng Provincial Government is the protection of high potential agricultural land and the effective and sustainable utilization thereof. At the same time, this land should be retained without compromising its possible economic value.

On a generic spectrum, in South Africa at present, land not yet developed or zoned under an approved town-planning scheme is by default regarded as “agricultural land”. The management of land still regarded as agricultural land is conducted according to the Sub-division of Agricultural Land Act, 70 of 1970. Generally speaking, land that falls outside the municipal boundaries as determined prior to 1994, as well as land identified under certain town-planning schemes and guide plans, resides under the jurisdiction of Act 70 of 1970. There are instances where land external to the 1994 boundaries has been excluded from agricultural land, either through the consent of the Minister of Agriculture or through a notice in the *Government Gazette*. State land, including the former homelands, and national proclaimed protected areas are excluded from the Act until the land is transferred to private ownership, after which it will again fall under the jurisdiction of Act 70 of 1970. The Act not only manages the sub-division of agricultural land, but also includes proposed changes to land use for incorporation into existing towns, the registering of share block and sectional title schemes as well as servitudes and the leasing of agricultural land (South Africa 1970:1). The administration and management of Act 70 of 1970 is the responsibility of the national Department of Agriculture (DoA) with inputs from the provincial Departments of Agriculture.

The administration, management and land use of the remainder of the land excluded from Act 70 of 1970 resides under the auspices of local and district municipalities and is mostly utilized for development purposes. In instances where vacant land has not yet been developed or utilized for a specific purpose, it can still be used for agricultural purposes until such time as it is required for another land use. Its close proximity to

urbanized areas makes it ideally suited for urban agriculture and food security, community-type projects.

From an environmental perspective, all proposed changes to land use or actions that would result in the amendment of the current status of the land, reside under the jurisdiction of the National Environment Management Act (NEMA), 107 of 1998. The planning of land use, especially land not regarded as agricultural land, as stipulated in Act 70 of 1970, is determined through the compilation of municipal Integrated Development Plans (IDP's), Spatial Development Frameworks (SDF's) and Environmental Management Frameworks (EMF's). However, there is uncertainty as to the exact land that resides under the jurisdiction of Act 70 of 1970 and the land that falls under the auspices of local authorities. Many IDP's and SDF's include development plans for land that has not yet been formally excluded from the jurisdiction of Act 70 of 1970.

The Directorate of Environmental Planning and Impact Assessment (EPIA) within GDACE has the mandate, as prescribed under NEMA, to review, evaluate and subsequently either approve or disapprove a proposed change of land use on any given portion of land within Gauteng. The Environmental Impact Assessment (EIA) Regulations stipulate decision-making requirements. At the same time, the EPIA Directorate relies on the input and recommendations from the line-function directorates within GDACE such as Agriculture and Conservation when it comes to applications that involve their area of expertise. The Branch: Agriculture, for example, is responsible for evaluating proposed development applications that fall on high potential agricultural land as was identified within the Gauteng Agricultural Potential Atlas Version 2 and 3 (GAPA).

The Branch: Agriculture evaluates each application received on merit. The evaluation is conducted with the aid of current decision support geographic information data sets such as GAPA, on site field visits, detailed soil surveys and site evaluations as well as expert inputs against a set of agricultural-related requirements. The evaluation may result in either a recommendation or objection for a development to proceed. The decision-making process is further supported by the draft Gauteng policy on the protection of high potential agricultural land.

This approach is time consuming and impacts heavily on available capacity. It is also currently at the centre of a huge controversy, as the various role-players in this process do not have the same expectations in terms of the outcome. Many people regard Gauteng as an urbanized province where agricultural production has no role to play.

There are also limited national legislation, policies and strategies that the Gauteng provincial policy can refer to for additional support. For the Branch: Agriculture, its strategic objective is to protect high potential agricultural land in order to meet the demand for food security of all people in Gauteng (and the Republic of South Africa). This strategic objective is supported by the national Department of Agriculture through its draft policy on the same topic (DoA 2006d).

By contrast, the local authorities aim to develop the land, within their sphere of jurisdiction, as they are equally responsible for the economic growth and infrastructure development of Gauteng. Other Government departments within the Gauteng Provincial Government, such as the Departments of Housing and of Transport and Public Works, have different objectives and deliverables in terms of the demands for housing and infrastructure development, like building roads that have to be met.

Private individuals/investors are also involved in the development of land, as a main source of income. Many of these individuals do not regard high potential land as a non-renewable resource that needs to be protected for future use.

1.3 RESEARCH PROBLEM

In view of the huge demand for land for development purposes, the conservation of agricultural land, specifically the identified high potential agricultural land within Gauteng, is essential to meet food security and job creation targets, among other things. In order to investigate and explore the research problem, this study wished to answer the following question:

How should high potential agricultural land in Gauteng be identified, utilized and protected against the pressures of development?



1.4 PURPOSE OF THE STUDY

The aim of the study was to

- Identify and evaluate current strategic objectives, legislation, policies, products, data and decision support tools, both nationally and provincially, available for the protection of agricultural land, especially high potential agricultural land.
- Address the evaluation criteria thereof, specifically from an agricultural as well as a natural resource point of view.

The study further investigated possibilities to streamline the evaluation process in Gauteng and address criteria when applying for change of land use that would have an impact on agricultural land that should be protected for agricultural use.

Although the study made special reference to Gauteng, continuous incorporation, comparison and referral was made to the national *status quo*, including available legislation, policies and other supporting documentation as well as decision support tools. The rationale for this approach was that to date most of the current documentation and information on the management of agricultural land and the protection of high potential agricultural land has been made available on a national level. Furthermore agricultural land is regarded as a national asset.

1.5 RESEARCH OBJECTIVES

The objectives of the study were to

- Evaluate and discuss the importance of protecting high potential agricultural land for the exclusive use of agricultural production.
- Analyse and discuss existing legislation, policies and strategic objectives both on a national and provincial level that may impact on the protection of agricultural land.
- Determine the status of the agricultural natural resources on a national and provincial level.
- Establish land use and the agricultural potential of all land in Gauteng.

- Develop criteria to be used as guidelines in the compilation of a specialist agricultural study as part of an EIA, in order to make an informed decision on the preferred land use.
- Propose recommendations to protect high potential agricultural land.

1.6 BASIC ASSUMPTION UNDERLYING THE STUDY

The basic assumption of this study was that it would generate knowledge on the importance of the protection of agricultural land, especially high potential agricultural land for agricultural production, and the processes involved in the application thereof. This, in turn, could further result in a more cost-effective and time-effective procedure as well as improved communication and relations between all parties involved.

1.7 SIGNIFICANCE OF THE STUDY

Although various data sets and decision support tools are available (reference will be made to these during the study) that can be used as guidelines for recommendation purposes on the protection of agricultural land, the scale of these tools is sometimes very coarse (1: 50 000 and 1: 250 000 or more) and may differ from the situation on the ground. This may result in an uninformed and incorrect recommendation.

Interested and involved role-players are generally unaware of the products or decision support tools currently available to guide and assist in the process as well as the criteria used. At present the process for application of development in general is a very long and logistical one. This leads to frustration and possible future legal action by the applicant.

1.8 DATA COLLECTION

Data was collected by

- Making use of geographic information data sets on the status of agricultural natural resources and current land cover/land use.
- Reviewing related national, provincial and local level legislation, policies, guidelines and strategic objectives.

- Including an overview of land capability modelled information, land use evaluations and land use planning methodology, factors influencing the determination of agricultural potential as well as current decision support tools and the impact thereof, with the underlying principle of sustainable development.

1.9 OUTLINE OF THE STUDY

Chapter 1 outlines the research problem; background to, purpose, objectives and significance of the study, and the data-collection methods.

Chapter 2 describes the study area, including demography, infrastructure and employment.

Chapter 3 discusses sustainable development and land.

Chapter 4 discusses agriculture and land use.

Chapter 5 covers strategic objectives within the South African sustainable development priorities, with particular reference to agriculture.

Chapter 6 examines national and provincial legislation and policies on agriculture.

Chapter 7 describes the status of natural resources in South Africa.

Chapter 8 discusses land capability evaluation methodology and the agricultural potential of all land in Gauteng.

Chapter 9 concludes the study, develops criteria as guidelines for informed decisions on preferred land use, and makes recommendations to protect high potential agricultural land and future research.

1.10 CONCLUSION

This chapter described the research problem; background to, rationale for, purpose, objectives and significance of the study, as well as data collection and outlined the study.

Chapter 2 describes the study area.

THE STUDY AREA

2.1 INTRODUCTION

For the purposes of this study, the researcher focused on the province of Gauteng, within the provincial boundaries in place in 2005. In order to illustrate the importance of this study within the national context, however, constant reference will be made to the South African scenario.

2.2 DEMOGRAPHY OF SOUTH AFRICA

The Republic of South Africa consists of nine provinces, each with its own unique characteristics (see figure 2.1).

The total land area of South Africa consists of 1 398 088 km². The nine provinces with their percentage of the total land area are the Northern Cape (29.7%), Eastern Cape (13.9%), Western Cape (10.6%), Free State (10.6%), Limpopo (formerly known as the Northern Province) (10.2%), KwaZulu Natal (7.6%), Mpumalanga (6.5%), North West (9.5%) and Gauteng (1.4%) (Statistics South Africa 2005:3-4).

Its own democratically elected Cabinet, responsible for the compilation of its provincial legislation and policies in adherence to the national legislation, policies and strategic objectives, manages each of the provinces. Certain critical functions are only managed at national level, such as the country's water resources, whilst others are either co-managed by both the national and provincial spheres of government or delegated to a provincial and/or local level. In the case of functions co-managed by more than one sphere of government, the national government mostly takes responsibility for the compilation of the national legislation, policies, guidelines and strategic objectives whilst on a provincial or local level, the strategic directions are executed within their area of jurisdiction.

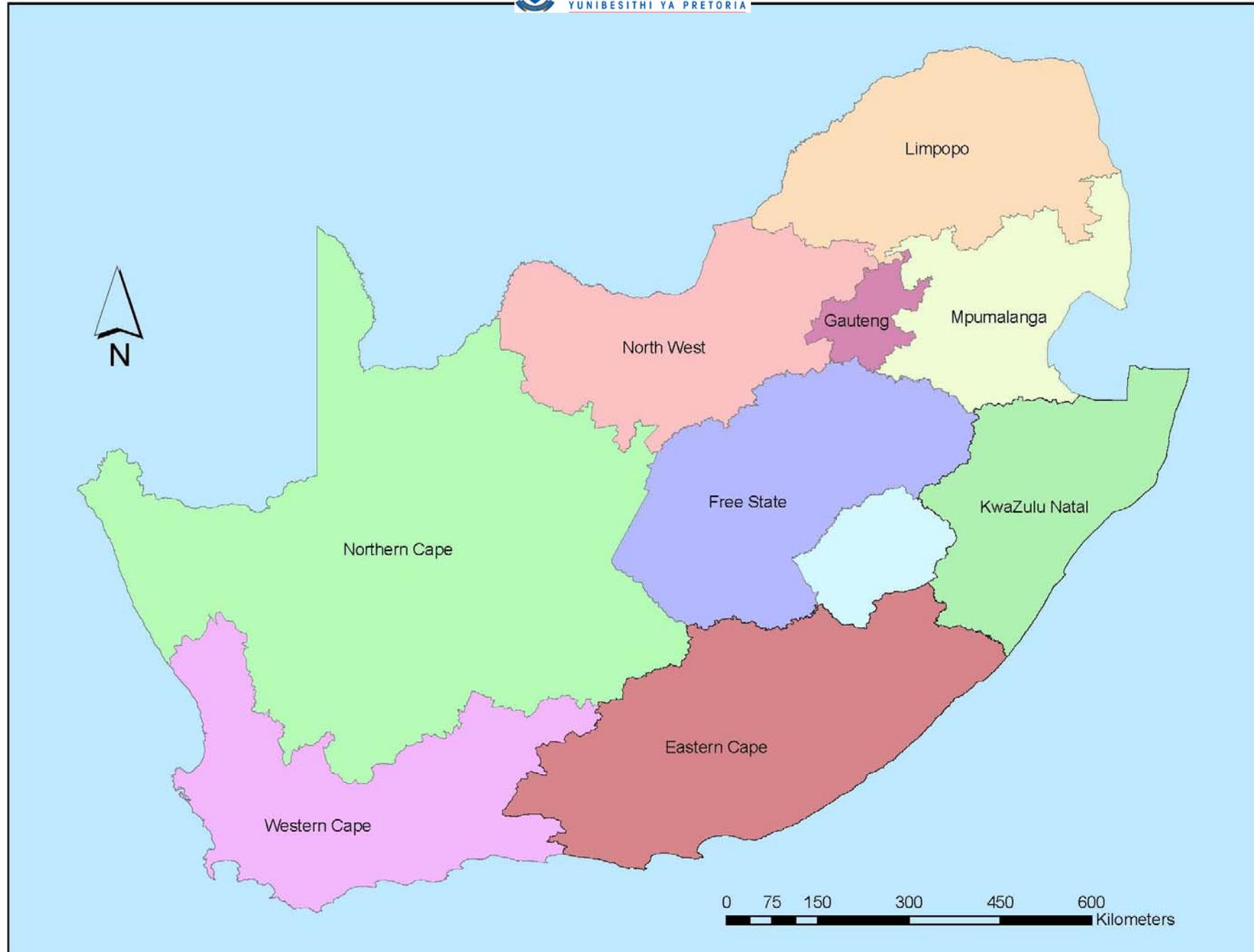


Figure 2.1 Map of the Republic of South Africa

Gauteng comprises 18 939 km² in total and is the smallest of the nine provinces, taking up 1.4% of the country's total land cover. However, it has a population of 9 018 000 million, which translates to 19.2% of the total South African population. Only KwaZulu Natal has a larger population of 20.6% of the total population. According to Statistics South Africa (2005:10), the total population of Gauteng increased by 0.2% from 2004 to 2005 – the highest increase of all the provinces. This is mostly due to the influx of migrants from other provinces or from outside the country. The province also has a higher than average population density with 519 people per km².

According to Statistics South Africa (2000:9), 97% of the province's population lives in urban areas, whilst only 3% resides in non-urban areas. Consequently, Gauteng can be regarded as the most urbanized province in the country with an estimated 17% of its land use being classified as "urban"-related land uses (GDACE 2004a:13).

Three of the country's six metropolitan municipalities are located in Gauteng, namely the City of Johannesburg Metropolitan Municipality, the City of Tshwane Metropolitan Municipality and the Ekurhuleni Metropolitan Municipality. There are three district municipalities, each consisting of a number of local municipalities: the Metsweding District Municipality consisting of the Nokeng Tsa Taemane and Kungweni Local Municipalities, the West Rand District Municipality consisting of the West Rand, Mogale City, Randfontein, Merafong and Westonaria Local Municipalities, and the Sedibeng District Municipality consisting of the Lesedi, Midvaal and Emfuleni Local Municipalities (see figure 2.2).

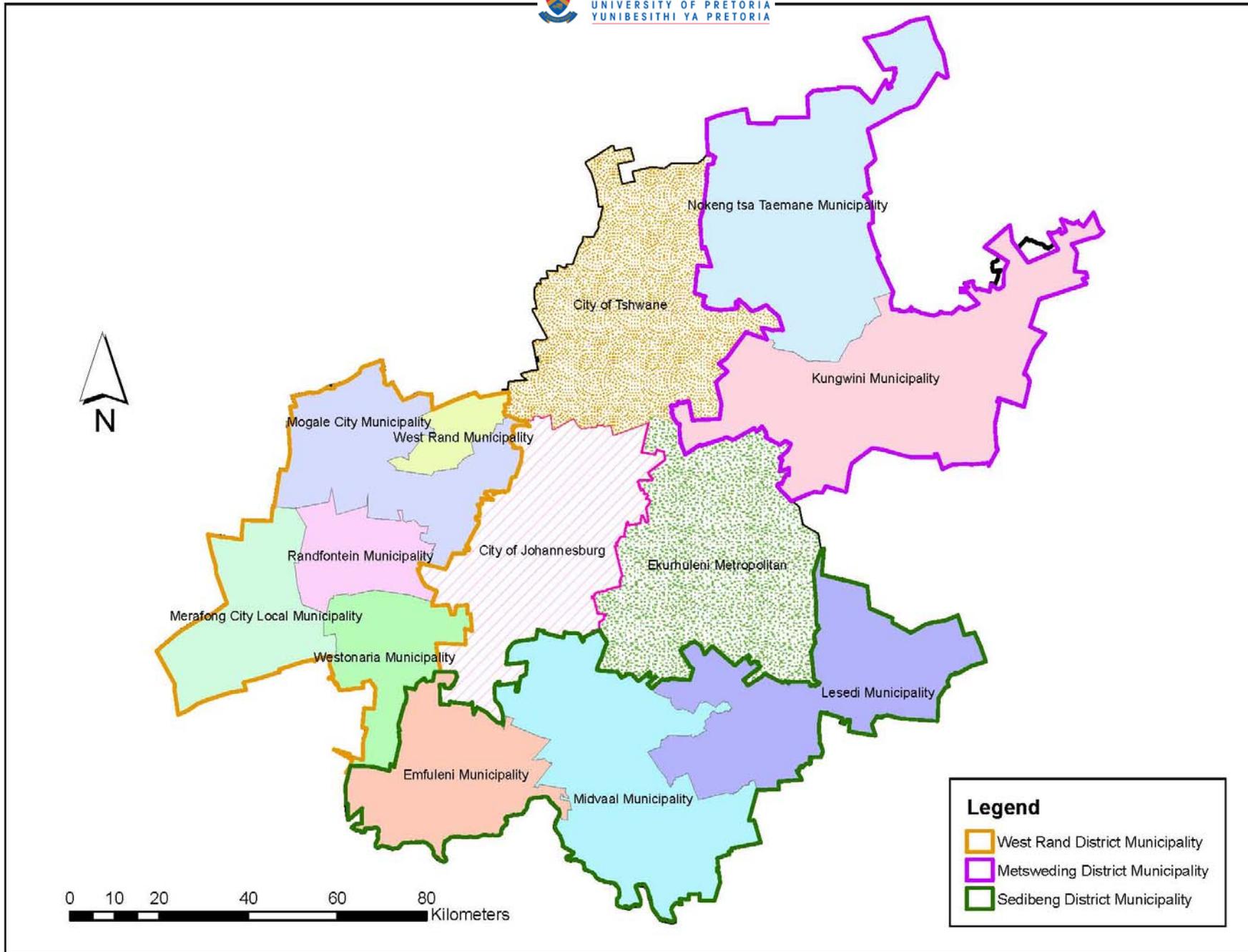


Figure 2.2 The local government structure within the Gauteng Provincial Government

On a provincial management level, the Gauteng Provincial Government consists of a number of strategic provincial departments responsible for the management of the province. Directly related to this study are the responsibilities assigned to the Gauteng Department of Agriculture, Conservation and Environment (GDACE). The outcome of decisions taken by other provincial departments, such as the Departments of Housing, Public Roads and Transport and Provincial and Local Government, nevertheless have an impact on the GDACE's core functions. In certain instances, these decisions can be contradictory.

2.3 INFRASTRUCTURE AND EMPLOYMENT

Gauteng has a well-developed infrastructure that includes major road networks, railway lines, an international airport and a number of smaller airports (see figure 2.3). The smallness of the province makes it possible to travel between its furthest points within two to three hours.

The two major cities located in the province are Pretoria and Johannesburg. Pretoria houses the national government buildings and the Reserve Bank, whilst Johannesburg is the location of the provincial governmental departments and the Stock Exchange. These cities boast three major universities and several other educational institutions. The head office of the Agricultural Research Council (ARC) and most of the ARC's research institutes are located in Pretoria. The country's two major fresh produce markets are also found in Johannesburg and Pretoria.

Gauteng's well-developed infrastructure and institutional capacity enable it to provide for the large demand for employment opportunities, to a certain extent.

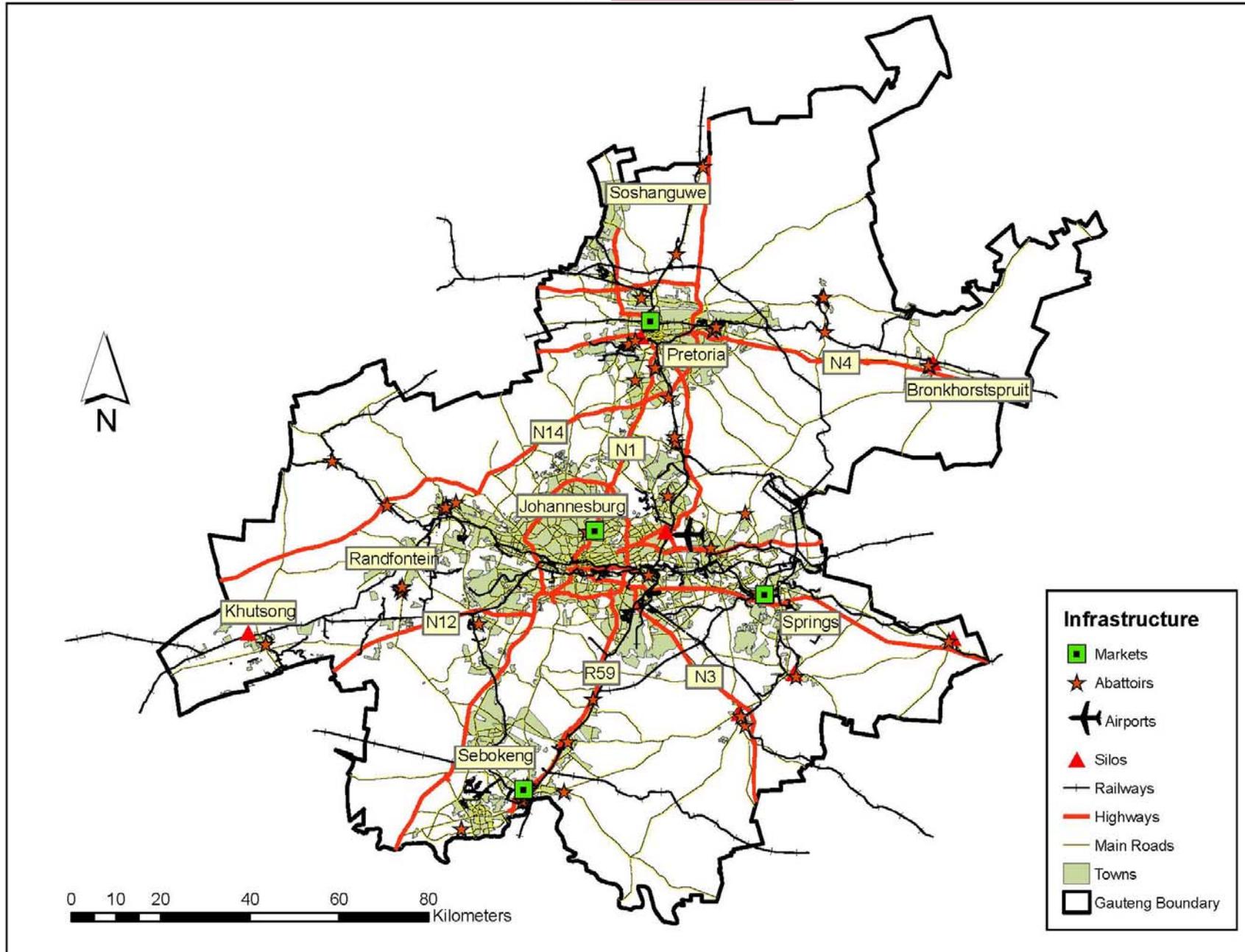


Figure 2.3 Infrastructural layout of Gauteng

Gauteng provides employment to 3 070 000 out of the total of 11 643 000 employed people in South Africa. This is the province with the highest number of employed people in the country, followed by KwaZulu Natal, which provides employment to 2 092 000 people (Statistics South Africa 2005:42). This scenario is repeated in nearly every employment category. It is only in the category of skilled agriculture and fishery works that Gauteng does not have the highest employment figures. With an employment total of 9 000 people in the skilled agricultural and fishery sector and 63 000 in the agricultural, hunting, forestry and fishing industry, Gauteng is the second lowest with only the Northern Cape having a lower figure.

The mining industry employs 87 000 people whilst the manufacturing and construction industries employ a total of 518 000 and 215 000 people, respectively in Gauteng (Statistics South Africa 2005:46). According to the Census 2001 (Statistics South Africa 2003:51), Gauteng has a total of 25.8% unemployed people, whilst the economically inactive population is 29.2%. The major industries located in the province have a large impact on electricity consumption, as Gauteng consumed 52 531 gigawatt-hours of electricity, the highest in the country.

All the above-mentioned resulted in an increased demand for housing in the province. Gauteng has the highest number of houses on a separate stand or yard or farm as well as flats or apartment blocks, and cluster or semi-detached houses. The same scenario exists in the case of informal dwellings. However, the average number of persons per household found in Gauteng is estimated at 3.2, which is the lowest in the country. The average for the country is 3.8 with Limpopo province having the highest at 4.3 (Statistics South Africa 2003:66-72).

As a result of the high population in the province, there is insufficient housing to meet the needs of the population. The current backlog is estimated to be about half a million, and continuously increasing, with about one in four homes described as shacks and one in three with only two rooms or less (GDACE 2004c:3).

About 24% of the population in the province lives in informal dwellings and 48% of children live in very poor conditions. Many households (630 000) lack access to clean water; 700 000 households lack sanitation and 850 000 lack electricity (GDACE 2006a:5).

The above statistics are seen in comparison with the picture painted of Gauteng as the economic hub of the country. From 1995 to 2002 the economic growth of the province averaged 3.3% per annum, well above the national average of 2.7% (GDACE 2004a:14). The Gauteng Provincial Government has set a target of a six percent economic growth rate for the province.

The Gross Domestic Product (GDP) at market prices amounts to R 1 374 476 million for the country with agriculture, forestry and fishing contributing R 41 323 million. The main contributor is finance, real estate and business services (R 247 514 million) followed by the manufacturing sector (R 246 467 million) (Statistics South Africa 2005:119). Gauteng's contribution to the national GDP increased from 32.6% in 1995 to 33.9% in 2002 (GDACE 2004a:14).

2.4 CONCLUSION

This chapter briefly described the demography of South Africa, and Gauteng's infrastructure, employment rate and contribution to the GDP.

Chapter 3 discusses sustainable development and land.

SUSTAINABLE DEVELOPMENT AND LAND

3.1 SUSTAINABLE DEVELOPMENT

Sustainable development is nothing new. Some years ago the concept of sustainable development was mainly focused on ensuring access to basic services and the alleviation of poverty. It thus had a very strong social inclination with limited focus on the protection of the environment. In many instances this approach resulted in the rapid degradation of the world's natural resources. It was therefore realized that sustainable development is a much broader concept that should focus on the interaction between the environment, society and the economy. These three principles interact in a complementary as well as an interdependent manner.

Underlying the aspect of economic growth in sustainable development, is society's belief in improving its well being and eradicating poverty through the effective utilization of natural resources. In terms of the social aspect, the focus is on the interaction between people and nature and people's aim to improve access to health services and education, continuous food security and basic human rights. The environmental principle involves the conservation and enhancement of the natural resources base and ecosystems (Department of Agriculture [DoA] undated:2).

The sustainable management of natural resources as an integral component of the environment is thus one of the requirements of sustainable development and should be seen on an equal footing as the social and economic requirements. Conflict between environmental management and economic growth is a matter of major concern in sustainable development. This is caused by the increased demand for the utilization of natural resources by uses that may have a detrimental effect on the environment. This is mainly a result of ineffective land use planning and limited integration of environmental planning within the overall development plan, as well as the subsequent management and implementation of the land use plan. Environmental management should form part of development planning.

In developing countries, such as South Africa, where the emphasis is on economic growth and social upliftment, the actions to achieve these objectives are in many instances handled on a trade-off basis at the expense of the environment in favour of delivery of services.

There is a need to understand that current developments that address the needs of the poor, as well as the delivery of basic services that are not environmentally sustainable, will in the long term result in poorer communities and have a negative impact on survival. According to the United Nations Development Programme's Human Poverty Index, (cited by the Department of Environmental Affairs and Tourism 2006b:7) the rate of poverty in South Africa increased from 16.4% in 1995 to 31.7% in 2002, which meant that 1.7 million people were living on less than US \$1 per day. The latest research indicates that income poverty has decreased due to the increase in social grants and job creation.

The Wildlife and Environmental Society of South Africa (WESSA) (2001:3) emphasises that the well being of future generations depends on the current one and that we should therefore limit the consumption of non-renewable resources. This is essential for the survival of all people and for the security, equity and dignity of all communities.

In 1972, the United Nations (UN) Conference on the Human Environment (cited by the Department of Environmental Affairs and Tourism 2006a:4-8), pointed out that economic growth, if not carefully monitored, would overshoot the earth's ability to renew and maintain its resources to ensure future life and development. This concern was confirmed by the fact that in 2001 the global ecological footprint (people's natural resource consumption) was 2.2 global ha per person, whilst the productive area of the biosphere was estimated at an average of 1.8 global ha per person – translating into the fact that earth's resources are being spent faster than they are generated. In the South African context, the ecological footprint is 2.8 global ha per person, higher than the world's average, ranking South Africa 42nd out of 148 countries. Between 1991 and 2001, there was an increase of the per capita footprint by 2% and a decrease of the bio-capacity per capita by 4%. It can be concluded that there is an increase in pressures on the environment and that we have not yet been able to deal with these pressures effectively.

In its publication, *Our Common Future* in 1987, the World Commission on Environment and Development drew the world's attention to the concept of sustainable development, which formed the foundation for the 1992 UN Rio Earth Summit. The outcome of the summit was compiled in the non-binding Agenda 21 that acted as a blueprint for principles on sustainable development with the sustainable use of resources as one of the basic priorities. The principles stipulated in Agenda 21 (Aventis CropScience 2000:2) include:

- Human beings are the centre of concerns for sustainable development.
- States have the right to use their resources but it should not be done in such a way that it will have an impact on the environment of other countries.
- Development should be conducted in such a way that it will meet the development and environmental needs of current as well as future generations.
- To ensure sustainable development, the protection of the environment should form an integral part of the developing process.
- All states have the responsibility to alleviate poverty.
- Priority will be given to the needs and requirements of developing countries.
- All states shall work in a partnership to protect and restore the resources of the earth.
- Unsustainable patterns of production and consumption should be reduced.
- Scientific and technological knowledge should be exchanged.
- Environmental management should involve all relevant role-players.
- Women and the youth should form part of this process.

More than 178 countries, including South Africa, as well as the United Nations Conference on Environment and Development (UNCED), adopted Agenda 21.

The Gauteng Provincial Government (2006a:1) defines sustainable development as development “that meets the needs of the present without compromising the ability of future generations to meet their own needs”. It is about improving human well-being through the effective management of economic, social and environmental assets over time. In 1992 the United Nations stated that sustainable development would not be achieved if the protection of the environment did not form part of the development processes (Aventis CropScience 2000:1).

In 1989, the UN Food and Agricultural Organization (FAO) (cited in the UN FAO 1997:1), defined sustainable agriculture and rural development as “the management and the conservation of the natural resource base and the orientation of technical and institutional change in such a manner as to ensure the attainment and continued satisfaction of human needs for present and future generations. Such sustainable development (in agriculture, forestry and fisheries sectors) conserves land, water, plant and animal genetic resources, is environmentally non-degrading, technically appropriate, economically viable and socially acceptable.”

The World Conservation Strategy regards respect and care for community life, an improved quality of life, conserving the earth’s vitality and diversity, minimization of the depletion of non-renewable natural resources, thus keeping within the earth’s carry capacity, the changing of personal attitudes and practices, the enabling of communities to care for their environment, a national framework for integrated development and conservation and lastly, forging global alliance, as the principles to achieve sustainable living (WESSA 2001:1).

South Africa hosted the 2002 World Summit on Sustainable Development (WSSD) as a follow-up of the Rio Earth Summit. The outcome of the summit was the Johannesburg Plan of Implementation (JPOI), which identified 37 specified targets. The JPOI regards poverty eradication, improved patterns of consumption and production, protection of the natural resource base and the strengthening of institutional frameworks on a national level, as the most important objectives of sustainable development. Furthermore, states “should take immediate steps to make progress in the formulation and elaboration of strategies for sustainable development and begin their implementation by 2005” (Gauteng Provincial Government 2006b:3).

The JPOI Response Strategy emphasizes that conflict on the use of natural resources and the degradation of the environment will have an impact on the prosperity of developed nations. The environment and development objectives cannot be separated. A shared vision in terms of long-term sustainability is required (JPOI 2003:2).

Based on the work and awareness raised through the 1992 Rio Earth Summit as well as the WSSD, the concept and importance of sustainable development is now accepted worldwide. Its impact can also be seen in southern Africa. The New Partnership for

Africa's Development (NEPAD) also identified sustainable growth and development as one of the primary objectives, with the establishment of conditions for sustainable development and increased investment in agriculture and the environment as one of the priority areas (Department of Foreign Affairs 2004).

In the South African context, the National Environmental Management Act, 107 of 1998 (South Africa 1998a:8) defines sustainable development as “the integration of social, economic and environmental factors into planning, implementation and decision-making so as to ensure that development serves present and future generations”.

As a further response to the WSSD, the JPOI established that a framework should be developed through stakeholder participation, on the implementation of sustainable development in South Africa. This is also supported by a Strategy on sustainable development that includes clear priorities, outcomes, deadlines and timeframes, whilst the Sustainable development action plan should be facilitated by strong institutional arrangements that are focused on sustainable development (JPOI 2003:10). Implementation targets identified include poverty eradication, consumption and production, management of natural resources, globalisation, health, small island states and the expansion to the Southern Africa Development Cooperation (SADC) and Africa as a whole. The JPOI (2003:25) states that South Africa “is committed to the sustainable development agenda, in all spheres of governmental actions – a commitment that will be converted into action to address the needs evident in all facets of life”.

Environmental priority issues identified include the atmosphere, biodiversity and ecosystem health, the economy and the impact on resource consumption, environmental governance, human settlements (including urban growth and waste management), human vulnerability and food security, water availability and quality, land use and productivity (including land degradation due to unsuitable agricultural practices), land reform and access to land, deforestation, marine and coastal systems, and the well being of the population (which includes addressing increasing unemployment) (Department of Environmental Affairs and Tourism 2006a:12-13).

Gauteng has identified a number of strengths and opportunities with regard to sustainable development. It recognizes that there is an increased awareness in all

spheres of government regarding sustainable development and that there are noteworthy policies and legislation in place to give substance to this topic. The province also has a powerful economy with the potential to address challenges and it is centrally located with intensive support structures that allow the province to play a leadership role in the country (Gauteng Provincial Government 2006b:9).

There are nevertheless major challenges that have to be faced in the province. Sustainable development is still being addressed on an ad hoc basis. There is limited communication between and capacity building among the various role-players, resulting in a lack of integration of policies, the high level of informal settlements, the uneven distribution of resources and social imbalances, conflicting land uses, inappropriate zoning, and sustainable land utilization. Added to this are financial constraints, a constant threat to the conservation of natural resources, and insufficient understanding of the principle of sustainable development (Gauteng Provincial Government 2006b:11).

In the agricultural field more emphasis should also be placed on sustainability, a concept that in many instances, is still far from the minds of farmers. Farmers are dependent on the natural environment for producing food and should therefore ensure that the resources are not depleted or pushed beyond their limits. Sustainability in the context of agriculture is critical against its contribution to food security. However, farming has become a business venture and farmers have to manage the high level of risk involved against financial survival, which sometimes leaves little room for conservation practices.

In conventional farming, certain production practices, particularly if not managed properly, will have a detrimental effect on the environment. Examples include the excessive use of herbicides and pesticides impacting on the quality of the water resources, the use of selective cultivation methods that are not suitable for the area concerned, cultivation of areas that are not suitable for agricultural production and the possible loss of biodiversity, irrigation practices on soils not suitable for the purpose and the lack of soil conservation practices. Some years ago commercial farmers were supported in the construction of soil conservation structures, such as the establishment of contours, through government subsidies. This support is no longer in practice although the Conservation of Agricultural Resources Act, 43 of 1983 still makes provision for government support in terms of on-farm conservation practices. Newly

settled farmers in particular are completely ignorant when it comes to conservation practices, mainly due to no exposure to or awareness of these matters.

There has been some change towards conservation farming practices as farmers become more aware of the importance thereof. Many farmers have also started to focus on organic farming. The management requirements and risks involved in terms of organic farming are very high and the profit margins considerably lower, although the public demand for these products has increased tremendously in the last few years. However, a great deal of research is still needed on this topic.

The drive towards sustainable agriculture should be seen as a system that will be able to be productive in the future. Botha and Ikerd (1995:17-18) regard sustainability as a continuous direction, rather than a destination. Agriculture should be seen as shifting the ecological balance to favour humanity in terms of food production. It can therefore be seen that sustainable agriculture has to be to the benefit of mankind. A degradation of natural resources will result in a degrading agricultural sector and thus negatively influence human survival. At the same time, this should all be seen within the concept of being economically viable and socially responsible. In many instances society has to pay for possible success in reaching these objectives. Should agriculture not be sustainable, it will place stress on a nation that may ultimately result in stress on the rest of the world.

Bie, Baldascini and Tscirley (1996:2) state that sustainable agriculture consists of the integration of economic, social and environmental information in the development and planning processes of which this will have an impact on the net farm productivity.

Bearing in mind the controversial issue of access to land in South Africa (see section 3.3), a question that needs to be addressed, is the minimum farm size required. This question needs to be answered against the current controversial Sub-division of Agricultural Land Act, 70 of 1970. This, then, leads to what is regarded as a viable farm. Aihoon, Cherry and Kieser (2007a:1) define a viable farm as “a farm where existing or potential farming activities will enable a minimum required net farm income to be generated based on prevailing operating costs, including interest on capital and capital replacement but excluding capital redemption”. It should be noted that in this context viability is regarded as an economic concept with no consideration to social or

environmental issues. Yet Aihoon *et al.* (2007a:1) define a sustainable farm as “a farm where the existing and potential farming activities, considered in concert with the participants and the environment, are such that the farm remains viable in the foreseeable future and in harmony with its social and environmental context when operated on a stand alone basis and without extraneous intervention”.

It can therefore be concluded that sustainability is an important factor in the agricultural sector, but the issue of minimum farm size should be seen as a relative concept that is more related to economic viability than environmental sustainability. To be viable, smaller farms normally require optimal resource utilization that should be supported by a high level of stringent management practices. Given the mentioned, the impact of cultivation practices is thus not dependant on farm size, but should be rather seen against the impact of these practices on the natural resource base. In the current guidelines for evaluation of applications pertaining to the sub-division of agricultural land, both the impact of the proposed sub-division on the natural resources as well as the economic viability thereof are considered.

Agricultural sustainability forms a building block for future success, but success can only be achieved through wise and effective land use. Not only should the natural resources be used optimally and sustainably, the land user must also be able to make a living from the land portion, especially in the absence of any other source of income. Threats to sustainable land use include population growth, the matter of poverty and food security, competition for natural resources, land degradation such as soil erosion, soil acidity, soil compaction and crusting, soil infertility, soil pollution and desertification, as well as water and biodiversity degradation (Van der Merwe 1995:4-6).

In 2002, Cielito F. Habito, the Secretary of Socio-economic Planning in the Philippines, said: “Sustainable development is not something governments or international bodies do to people. It is something people do to themselves and for their children” (Department of Environmental Affairs and Tourism 2006a:4).

Existing industries polluting the air will lead to limited fresh air for breathing. New houses built on wetlands may result in flooding, the loss of water resources and the loss of the last surviving members of plant or animal families that will result in a loss of biodiversity and genetic material. If non-renewable resources are lost through current

practices, how will a better life for future generations be ensured? Utilization of natural resources should not go beyond the capacity of the environment. It is therefore vital that sustainable development practices be followed to allow a better life for all, especially to the advancement of poorer communities.

Sustainable development is a long-term process with a number of active role-players. It should acknowledge and apply the horizontal linkages through interactions across the various relevant sectors and vertical linkages, through the various spheres of government, as well as the private sector.

Every country has the responsibility to ensure the implementation of sustainable development through the development and implementation of legislation and policies. For sustainability to be enforced, the political buy-in, for the right reasons, from the administrators of a country is essential. In South Africa, to date, legislation, policies and regulations that address sustainable development practices have been developed, but few have been successfully enforced / implemented.

3.2 URBANIZATION

Urbanization is a phenomenon that influences the way a town or area develops. A general trend that can be seen is the movement of people towards the city regions. Social and political factors can drive population and migratory patterns. This, in turn, has an influence on the utilization of the natural resources.

Globally, 40% of the world's population lived in urban areas in the year 2000 compared to 27% in 1972. Following this trend, it is estimated that 60% of the total population will live in urban areas by the year 2030. In the South African context, 58% of the population was urbanized in 2006 in comparison with 53% in 1996 (Department of Environmental Affairs and Tourism 2006a:236). There is also a rapid expansion of informal settlements, especially around urban and peri-urban centres.

In 1997, urban expansion was estimated to have impacted on about 30 000 ha of agricultural land per annum (Department of Environmental Affairs and Tourism 1997: 41).

In the United States of America (USA), the loss of agricultural land at the urban edge of towns occurred unnoticed, due to the fact that these lands were managed on a local level (Miller 1979:292). This trend can also be noticed in South Africa. As will be seen from the current legislation, discussed later, the emphasis is more towards municipalities taking responsibility for the management of land at local level. This, in turn, raises its own concerns, as there is simply not enough capacity or expertise within municipalities to address the issue of food security. Municipal emphasis is on infrastructure and residential development.

Meyer (1998:29) cites Calitz's estimation that the South African population is expected to increase from 38.9 million to 57.5 million in the year 2010. Linking this growth to the increased trend of urbanisation, the urban population can also be expected to increase. This results in urban expansion and placing ever-increasing pressure on land that should rather be utilized for agricultural production. According to Meyer (1998:29), the urban population is expected to increase from 22.2 million, or 57% of the total population, to 42.3 million (73%) in 2010.

Gauteng is especially exposed to the influx of people due to its location and economic growth priorities. Most of the people are in search of employment, but this subsequently also involves the further demand for housing. Meyer (1998:12) estimates that up to 900 000 people move to and from Gauteng annually. Furthermore, the estimated increase in the Gauteng metropolitan areas would lead to an increase of 17.5 million people from 1998 to 2010 (Meyer 1998:29). This would result in increasing demand for agricultural products and subsequently impact on markets.

Linked to urbanization is the aspect of urban sprawl and "leap frog" developments. As urban areas grow and become more densely populated, people start to require open spaces. This leads to people moving to more undeveloped land located at the edges of towns, commonly known as the urban edge or urban fringes, and escaping the densely populated areas, a phenomenon called urban sprawl. In the urban areas, certain provinces, such as Gauteng, have developed a density policy that dictates the number of housing units to be developed on a residential property within a specific area. The purpose of such policies is to address the housing requirements, in support of higher density areas, that will limit the expansion of towns unnecessarily. The effects of urban

sprawl can also be seen in an increase in infrastructure cost, a degraded environment and a loss of a “sense of place”.

Yet the above-mentioned effects do not stop growth at the edges of towns. People looking for a more rural lifestyle are continually developing new areas on the outskirts of towns. These areas are mostly not densely populated, surrounded by large open spaces, but still close enough to benefit from infrastructure development and basic service delivery. This causes open spaces where development still could have occurred within the urban areas. The open undeveloped areas within towns (excluding parks and recreational areas) stay neglected and unused, as new townships develop on the urban edges.

In most cases, these areas located at the urban edges of towns are between 1 and 5 ha and are referred to as “rural residential”. In some towns these areas are also referred to as agricultural holdings that were formerly part of agricultural farms. In very few instances these portions of land are used solely for agricultural purposes, except for the occasional vegetable garden or people keeping a few head of livestock for their own use (see figure 3.1). Due to development pressures experienced on this land, however, sub-division has been allowed, resulting in the loss of agricultural land, in some cases high potential agricultural land.

These movements impact heavily on agricultural activities located adjacent to such rural residential developments. Higher-income people, who do not prefer agricultural activities adjacent to their homes, inhabit many of these developments. Activities associated with farming are not always suitable to residential requirements. In reviewing development trends in South Africa, it is widely assumed that farmland cannot exist next to a residential development, as is the case in many European countries. Many negative perceptions are usually associated with farming such as dust pollution, utilization of herbicides and pesticides, fertilizers, water pollution, smells and noise. At the same time, these perceptions are not raised about other kinds of developments such as industries and commercial activities, which in themselves also have a negative effect on the environment and the surrounding land uses. Agriculture and its negative effects are mostly seen in isolation.

Heimlich and Anderson (2001:15) refer to the US House of Representatives, who in 1980 regarded urban sprawl as “when you cannot tell where the country ends and a community begins” and the Pennsylvania 21st Century Environment Commission who regarded it as a situation “that wastes land needlessly”. Urban sprawl has also been regarded as a geographic separation of essential services or as a low-density development that uses a lot of land (Heimlich & Anderson 2001:15).

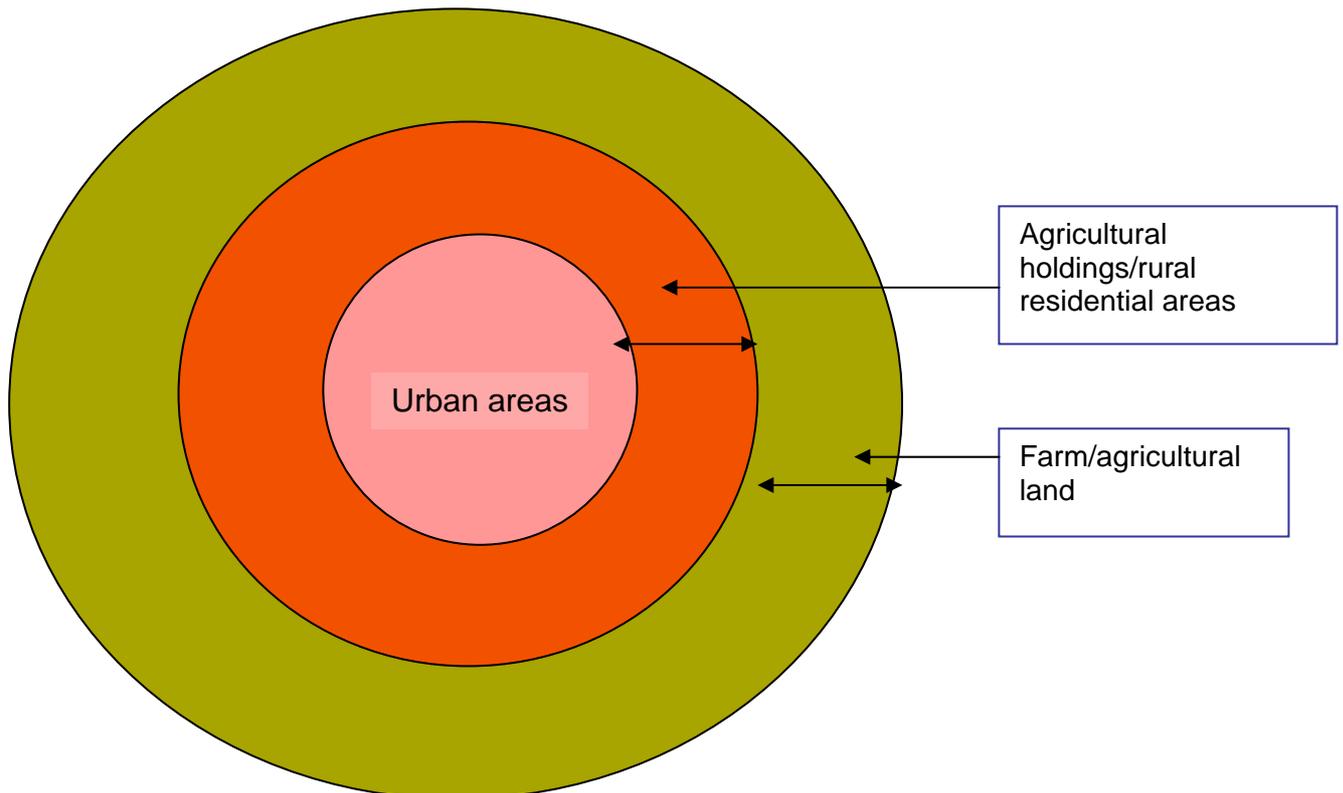


Figure 3.1 Division of land use within an urban concept

In 2002, the Gauteng Provincial Government developed an urban edge for the provincial developed areas that was aimed at supporting development guidelines (see figure 3.2). The intent of the urban edge boundaries was that no development should be allowed outside the boundary. This principle is not applied consistently, however. A Land cover study conducted in 2005 with the aid of Quick Bird remote sensing imagery identified, with concern, the amount of development that has occurred outside of the urban development boundary. It was also found that requests for the expansion of the boundaries are driven by proposed new developments, mostly high cost residential developments, outside of the urban edge, irrespective of the still vacant land within the

urban boundaries. These requests are evaluated with little or no consideration of their impact on agricultural land and, in particular, the loss of high potential agricultural land. The 2004 Gauteng State of the Environment Report states that 17% of the province is made up of urban land uses. However only 16% of the province's area resides within the urban edge boundary (Department of Agriculture, Conservation and Environment 2004a:43).

The determination and/or change of the provincial urban development boundary is also not conducted by taking into consideration the impact on other legislation, such as Act 70 of 1970. For example, instances where municipalities determined these boundaries, without consultation with the national Department of Agriculture (DoA) who administrates Act 70 of 1970, are known to have happened. The areas located within the newly established urban development boundary may still resort under Act 70 of 1970 and are therefore still regarded as agricultural land. Conflict arises when municipalities incorporate this land in their Integrated Development Plans (IDP's) and Spatial Development Frameworks (SDF's) without exempting it from Act 70 of 1970. This makes any change of land use illegal and means that no new title deed can be registered on the property without the consent of the DoA, exempting it from Act 70 of 1970. There have been cases where the DoA was not in favour of exempting the land from this Act due to its agricultural potential, thereby causing a conflict of interest between the two spheres of government.

The USA promotes the concept of "smart growth" aimed at reducing these conflicts. This includes the involvement of a number of land use policies intended to influence the pattern and density of development. It involves the principle of locating new development towards city centres and older suburbs, instead of placing it closer to the urban fringe, with supporting transport and a pedestrian-friendly environment. Mixed land use development is encouraged as well as the preservation of farmland, open spaces and environmental resources. Included in this principle is the proclamation of urban development boundaries or growth areas (Nickerson 2001:24).

Unlike the South African situation, farming areas are located in close proximity to urban areas. According to the USA 1997 census, about one third of all farms are located in metro areas, controlling 39% of the farm assets. Admittedly, these farmers continually have to make decisions in view of the changing surrounding environment and are

experiencing the pressure for land due to increased urbanization. These farms are also seen as important in addressing the increasing demand for agricultural products and, in some cases, are protected through the establishment of farmland trusts. Farmland should however, remain in active agricultural use (Nickerson 2001:24-27).

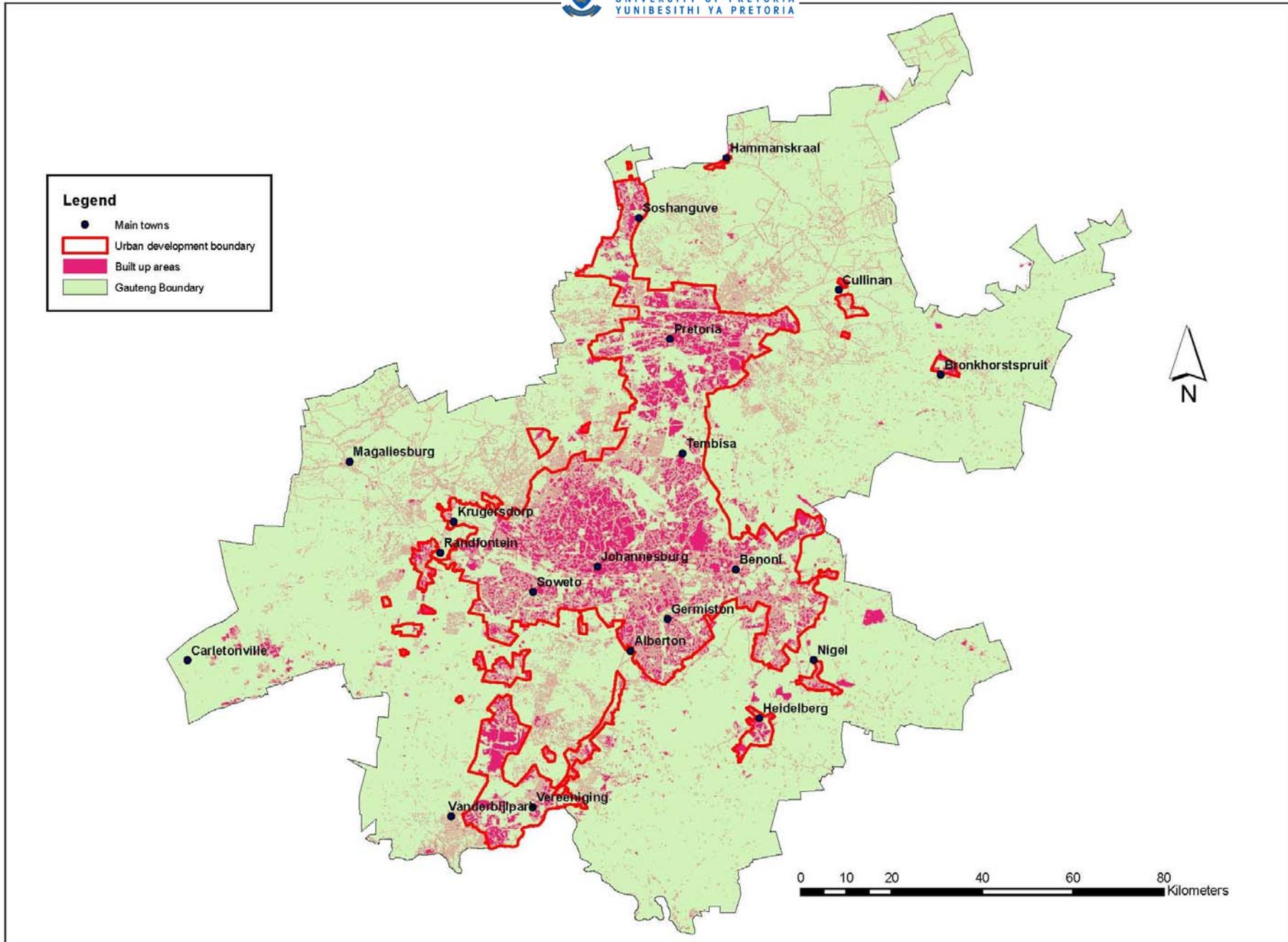


Figure 3.2 Urban development boundaries of Gauteng

3.3 LAND

Throughout the centuries and throughout the world land is more valuable than gold. Many wars have been fought, won or lost and many have died to gain access to land.

South Africa is no exception to this rule. The struggle for land in this country began when the first settlers set foot in the Cape and started to move northwards, hoping for better lives. Today, over three hundred years later, and after years of apartheid, there is an ever-increasing urgency to gain access to land. For many years the majority of farmland was in the hands of mostly white commercial farmers. In many cases farms were passed on from father to son and in doing so, the son was privileged to learn from the father all that was needed to ensure that the production practices followed, were the most suited for the land concerned. Provision was made to protect the potential and status of the natural resources. For many farmers, farming was their sole source of income. Support structures, mostly through government intervention and subsidies were also put in place to assist the farmer. The outcome was a rather well preserved environment and sustained high crop yields. Farming was a high priority and was regarded as a major contributor to the economy and supplied work to many people. It should be mentioned, however, that some years ago pressures on agricultural land and economic growth were not as pertinent as they are today.

In South Africa, the Native Land Act, 27 of 1913 prohibited black people from owning land outside the demarcated native reserves. These reserves took up about 8.3% of the land areas. The promulgation of the Native Trust and Land Act of 1936 placed ownership of land within the native reserves in the hands of tribal chiefs, who often exceeded their authority. In 1950, through the Group Areas Act of 1950, black people owning land outside the native reserves and that were exempted from the previous legislation, were taken of their land and moved to the demarcated homelands. Approximately 3.5 million people were removed between the years 1960 – 1980 (Bosman 2007:3).

In 1994, South Africa held its first democratic elections and there was a huge paradigm shift as a new political dispensation came into force and together with this change, a renewed focus on land ownership. It was then estimated that about 80% of agricultural land was in the hands of white South Africans, the minority group in the country (less

than 10% of the population is white) (Bosman 2007:3). However, according to the Land and Agricultural Policy Centre, at provincial level about 80% of the high potential agricultural land in the Eastern Cape was in the hands of black farmers, whilst white farmers focused mainly on livestock farming located in semi-arid areas of the province (Laker 2004a:viii).

Land became a tool to gain political power. Under the current political dispensation, land redistribution and restitution processes were implemented. The primary objective behind this land reform process is “the enhancement of the quality of life of rural black South Africans in particular and all South Africans in general. All land reform policies and strategies must be aimed at achieving this objective” (Laker 2004a:x).

Through a land claim process, land restitution concentrated on the return of land to people previously removed from the land after 1913. The primary purpose of land redistribution is giving access to land to previously disadvantaged people, thereby increasing black ownership of land. Targets have been set to change 30% of agricultural land ownership from white to black farmers in the country by 2014.

To date, limited land has been transferred. Most land claims received were of an urban nature with only 28% located in rural areas. In many instances, the settlement was in the form of financial compensation (Department of Environmental Affairs and Tourism 2006a:95).

The Settlement Land Acquisition Grants (SLAG), which entailed a cash allowance of R16 000 to purchase and develop agricultural land, supported the land redistribution process. In 2002, the Land Redistribution for Agricultural Development (LRAD) programme replaced the SLAG programme. The LRAD programme granted government subsidies based on a commitment, whether in capital or in kind, by the applicant.

Moreover, provision was made to ensure the security of tenure for people through the introduction of the Labour Tenants Act, 3 of 1996, the Extension of Tenure Act, 62 of 1997, the Prevention of Illegal Eviction from Unlawful Occupation of Land Act, 19 of 1998 and the Communal Land Rights Act, 11 of 2004.

No expropriation took place in the first three years of the new government and the principle of “willing buyer, willing seller” was followed. In 1997, however, the first farms were expropriated under the Restitution of Land Rights Act, 2 of 1994, but not for the sake of land redistribution. At the Land Summit held in 2005 it was found that the “willing buyer, willing seller” principle should be forfeited due to the slow pace of land reform, the rising price of land and the inadequate success of reform of high quality land near markets (Bosman 2007:4).

This process is still under investigation. In its new Strategy for Proactive Land Acquisition, the Department of Land Affairs has been empowered to obtain high quality land that is located in agricultural nodes. The aim is to establish agricultural development corridors as part of its area-based planning and development projects and it is to form part of the Integrated Sustainable Rural Development Strategy (Bosman 2007:13). This entails the identification of suitable land for agricultural purposes that to date have not yet been negotiated upon.

The general perception of this process though is that beneficiaries from the land reform programme want to return to rural areas. The Centre for Development and Enterprise found that only a few black people wanted to farm. Only about 2% of the people involved in the survey wanted to live in rural areas. The remainder of the interviewees wanted to live in urban areas, where 57% of the respondents regarded a job (work) as a priority and 41% required a house in an urban area (Van Eeden 2005:17). Furthermore, only an estimated 9% of black people, not currently involved in farming, would like to become involved in agriculture in future. About 15% of farm workers would like to own a farm, and only about 2% of black South Africans regarded rural land as a priority. Most black South Africans (35%) regarded urban land and housing as important, while 60% regarded services and infrastructure, normally associated with urban areas, as a need (Bosman 2007:15).

The outcome of the above would have a major influence on the production of the land. Should the new landowners not have any intention to farm the land, in fact, it would result in current or future productive land lying fallow, possible degradation over time and a decrease in food supplies. This would threaten food security and also increase the possibility of urbanization. It is estimated that the demand for land for non-

agricultural purposes will increase from 6.4 million ha in 1985 to 9 million ha in 2040, mostly for urban and forestry purposes (Department of Agriculture 2005a:19).

The national and provincial Departments of Agriculture and, to a certain extent, the Department of Land Affairs are responsible for supporting farmers in their quest for success after settlement, mainly through their extension services. For several reasons, this task has not reached its objectives. One possible reason is that the land reform programme has omitted the basic principles of farming. In many instances, farmers are being settled on land that has no agricultural potential, including land for cultivation purposes or grazing. Land is either not suitable for crop production or the size of the farm cannot be regarded as a viable farming unit. In some cases, large commercial farms are converted into “family farms” with people being settled on a farm, without careful consideration of the viability of the land to support the new inhabitants. Ownership of the land then becomes a problem, as land has to be subdivided into smaller pieces. Such actions have led to the proposed repeal of the Sub-division of Agricultural Land Act, 70 of 1970, which was seen as a legal stumbling block. The repeal of the Act was never accented, however.

Many people who were settled on the land either had limited exposure to farming or had not previously been exposed to any farming practices. Some were not interested in farming at all. Lack of financial and farming support as well as limited knowledge of farming practices and natural resource management led to many of these newly settled farmers leaving their farms disillusioned and with their hopes shattered. The concern is that farming is frequently perceived as an easy career with limited risk and that quickly earns a high income, but that is not the case.

The current success or non-success of the land reform programme has recently been the topic of wide discussion. The general opinion is that, to date, the land reform programme has not been a success. According to Laker (2004a:xviii), land reform resulted in the under utilization of formerly productive crop areas and the destruction of perennial orchards. Laker (2004a:xi) maintains that land reform is a success only if the people who received the land are able to make effective use of the land, so that poverty is alleviated and food security improved.

Another factor, not always taken into consideration by policy and decision makers, is that many of the new emerging farmers are starting with a disadvantage. As mentioned, in some instances the land has limited potential, the size of land is restricted, access to finance is practically impossible, and knowledge of farming is lacking. Sometimes there is also conflict between group members or unwillingness between neighbour farmers to work together, for example the cohesive marketing of the produce to obtain better prices.

A review of the transfer of land ownership and comparison of the transfer of 30% of high potential agricultural land versus 30% of low potential agricultural land indicates that in both cases the transfer would result in about 24.3 million ha. In 1995, high potential agricultural land had an estimated value of R1 163 /ha with a possible net farm income potential of R180 /ha. This relates to a farm of 33 ha on which 729 000 families could be settled, based on the poverty level income of R6 000 per annum for a family of five adults. A low potential farm has an average value of R78 /ha with an estimated income of R12 /ha, resulting in a farm size of 500 ha on which 48 600 families could be settled. The benefits for settling on high potential agricultural land therefore are about 15 times more, thus increasing the success potential of land redistribution. However, the cost would be higher as well. Resettling on high potential agricultural land is in the area of R28.3 billion in comparison with R1.9 billion on low potential land – a cost that Government has to justify. Resettling on low potential land alone would result in sustainable agricultural goals not being met. A balance should therefore be found between resettlement on high and low potential agricultural land (*Financial Mail* 1995:98).

In 2005/2006, a committee was established to review the current situation with regard to land owned by foreigners in South Africa. The committee found that 76.2% of the total land surface is privately held, 20.4% is held by the state, and 3.4% is in trust on behalf of the state. It was very difficult to establish the amount of land owned by foreigners, but preliminary findings indicated that individual foreigners own about 0.6% farmland and about 2% of agricultural holdings. This figure does not include ownership by companies, trusts and corporations. Among the concerns raised were the number of golf estates being developed and only marketed abroad, the number of commercial farms being converted to game farms and the impact thereof on food security, as well as on land reform. Organised agriculture recommended that high potential agricultural land should

be excluded from foreign ownership. One of the recommendations of the committee was that there should be harmonization in the zoning of land, as well as the change of land use approval procedures. Zoning of land for land use purposes was regarded as a priority (Department of Land Affairs 2006a:7).

Growth in the industrial and manufacturing sector puts further pressure on land with an increase in pollution and waste management. Another factor is mining and its related activities. Sustained rehabilitation of mining land is limited and previously mined land has limited opportunities for future economic use. The Gauteng Provincial Government estimated that between 15 000 and 16 000 hectares of land is sterile due to tailing dams and is not suitable for human settlement development (GDACE 2004a:41). This land also has no production potential and much of it could previously be regarded as high potential agricultural land.

Human settlement and its associated infrastructure developments, such as roads, also contribute to land pressures. Roads not well planned lead to fragmentation of land and the loss of biodiversity.

Taking into consideration that Gauteng is the smallest province, but with the highest population, the largest economic growth and a disproportionate amount of high potential agricultural land, it is understandable that there is tremendous pressure for land in the province.

In reviewing the above, it can be concluded that many activities are driven under the umbrella of correcting the mistakes of the past, required economic growth, the advancement of the human race, and a better life for all. However, the tremendous impact these activities may have on the available natural resource base and the prioritisation required for the protection and utilization of land, is of great concern. Consequently, the question of why we need high potential agricultural land is still relevant. The answer is that food has to be produced, for which land is needed. To produce food, land requires natural resources, such as fertile soil, water and the correct climate (see figure 3.3).

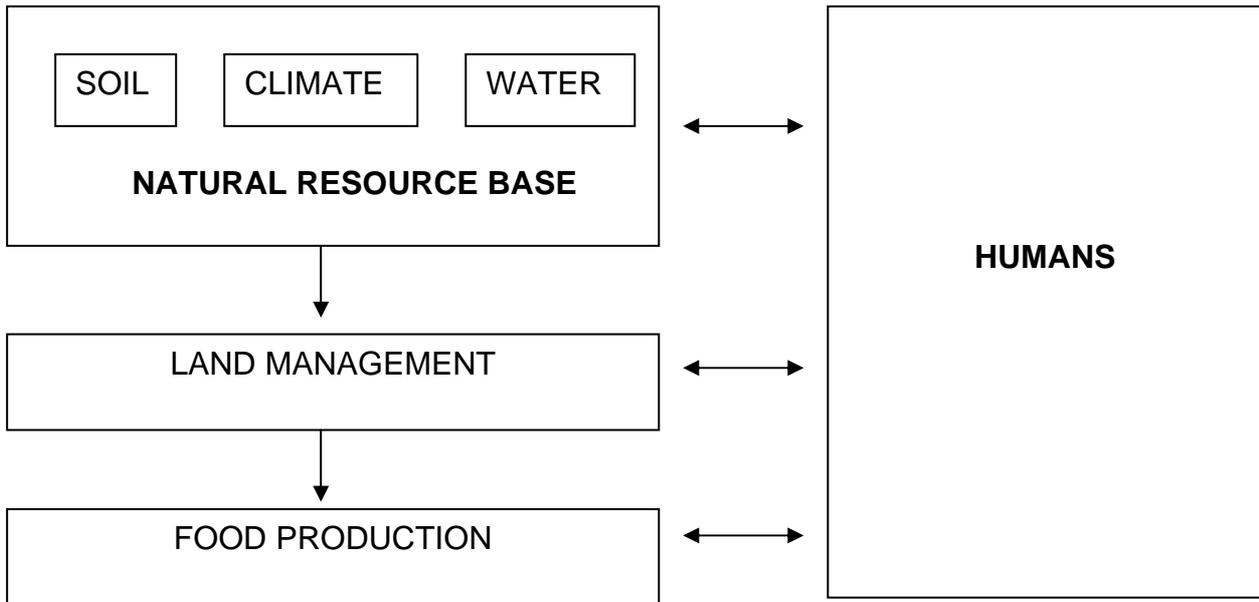


Figure 3.3 Interaction between humans and the environment

Van der Merwe (1995:2) states succinctly that land is one of the major components of un-sustainability and may be the cause of increased poverty.

3.4 FOOD SECURITY

Any country needs to strive to be food secure and can therefore not be 100% reliant on the import of food.

There is no consensus on the definition of food security. The most widely used one is the World Bank's (1986) definition of food security as "access by all people at all times to enough food for an active, healthy life" (Fraser, Nomakhaya & van Averbek 2003:171).

Meyer (1998:108) cites Barraclough's (1991) view that a food security system should be characterized by

- The ability to produce, store or import enough food for the population
- Limit vulnerability to market fluctuations
- Reliable access to food
- Protection of ecological resources and the improvement thereof over time (sustainability)
- Access to food by all groups

The global demand for food is expected to double by the year 2030. In order to meet this demand more land and water will be required for an increase in crop production (Del Mar Lopez, Mitchell & Thomlinson 2001:49). Although intensification of production, due to advances in the field of agriculture, has resulted in increased production, the consequences to the environment and the sustainability thereof are a matter of concern. According to Meyer (1998:118), the long-term sustainability of food supply is dependent on the relation among natural resources, demographic trends, applied technology and the agricultural research ability.

Food security is the single most important factor that should drive agricultural production. Taking into consideration that South Africa has about 14 million hectares of arable land and that the international norm is 0.4 ha of arable land required to feed a person, it amounts to South Africa only being able to feed about 35 million people. However, not all the arable land is currently under production, mainly due to economic reasons as well as the uncertainty regarding land reform. Currently about 12.2 million ha is under cultivation. This figure includes planted pastures (which do not directly contribute to food security). With this in mind, against a population of 48 million people, the present norm for South Africa is 0.25 ha per person, which is well below the international norm. The USA, by comparison, has 350 million people but enough arable land to feed 800 million people (Laker 1995b:2).

It is estimated that half of the people in South Africa are poor with the poverty rate higher in rural than in urban areas. Moreover, the poverty rate is much higher amongst female-headed than male-headed households (Department of Agriculture 2004a:39). Poverty causes food insecurity, which leads to hunger and malnutrition, and thus has a negative effect on people's health. Food insecurity contributes to human vulnerability. Environmental change, such as drought, land degradation and a resulting increase in food prices, impacts on food security. In South Africa, an estimated 14.3 million people are vulnerable to food insecurity (Department of Environmental Affairs and Tourism 2006b:9).

Related to poverty and food insecurity is malnutrition. This is seen especially in children where impaired growth is used as an indicator. Many families in the rural areas rely on agricultural production to generate some form of income, even if it is only the production of food for the household. Much of the time this limited production takes place on land

that is not suitable for agricultural production, due to limitations in the soil and terrain. This, then, has a further impact on the quality and nutritional value of the crop produced.

Agriculture has to strive to make food more affordable to all households. This can only be done through increased production by farming on suitable land, resulting in optimal utilization of the potential of the land and the limitation of potential input costs. The impact will be the delivery of a more affordable product. Hence, in terms of food security, it is crucial to identify suitable arable land and expand production to currently unused land. Intensified support should be given to accessibility of land and the effective, but correct, utilization of the land, thereby effectively utilizing the country's natural resource base.

An increase in production will result in improved nutritional status, which, again, will create additional jobs and alleviate poverty, thereby improving socio and economic conditions. The proposed increase in production should also be effectively absorbed in the further processing and distribution of the product, however, to allow the producer to also benefit from the increase in production.

Food insecurity is also linked to population growth. Omosa (1998:2) points out that there are two schools of thought on food security in relation to population growth. The one holds that once population growth increases above food production, it will result in an agricultural crisis. The other maintains that population growth will stimulate agricultural production and thus food production.

Regarding the impact of deregulation on household food security, the National Agricultural Marketing Council (NAMC) in 2002 reported that the availability of cash is the single most important factor in determining food security. Agriculture, then, has to grow from subsistence farming, if it wants to make any impact on food security and poverty alleviation (Department of Agriculture 2004a:41).

To date, the South African agricultural sector has played a vital role in building the country, but it has the potential to play an ever-increasing role in food security. For a country to be self-sufficient and able to meet its demand, it must produce sufficient food or be able to earn foreign exchange to import food. Equally important is the fact that the

population of the country must also be able to either produce the food themselves or earn enough to afford food.

3.5 CONCLUSION

This chapter discussed sustainable development and land, including the interaction between the environment, society and the economy, sustainable management of natural resources, urbanization, the value, redistribution and restitution of land, food security, poverty, food insecurity, malnutrition, and population growth. The chapter emphasised the vital role that the South African agricultural sector has played in building the country as well as its potential to play an ever-increasing role in food security.

Chapter 4 deals with agriculture and land use.

AGRICULTURE AND LAND USE

4.1 INTRODUCTION

One of the primary objectives of this study was the identification of agricultural land that should be protected for agricultural production in Gauteng. This should be done on an informed and scientific basis. However, one of the external factors that impact on the final outcome of this process and the subsequent future planning of land use, is the current land use and land cover.

4.2 LAND COVER VS LAND USE

Certain land use practices can potentially impact on resources, such as flora and fauna, as well as soils, and changes to these lead to ecosystem changes. The relationship between these resources plays a significant role in resource planning and management.

Di Gregorio (2005:1) emphasises that the availability, quality and characteristics of land play an important role in determining the primary productivity of terrestrial ecosystems. Land is a source that cannot be replaced. The inherent characteristics of the natural resource base are reflected in its land use and land cover.

The differentiation line between land cover and land use is very faint and in many instances the difference between these two terms is not clearly defined or understood. In Land Cover Classification Systems, especially when identification is done at a detailed level, land use types sometimes become the attribute value of a land cover class. In many instances, the identification of land cover classes does not reflect the current land use of the class. From a planning perspective, this distinction is very important. For example, a tract of land identified as a land cover class “Grassland” may have the potential to be utilized for agricultural purposes depending on its potential. However, the land concerned may currently be utilized for a landing strip or have been incorporated within a protected area with the result that it is not available for agricultural

purposes. Inaccurate interpretation may thus result in the miscalculation of utilizable land.

Di Gregorio (2005:1) describes land cover as “the observed (bio)physical cover of the earth surface”, whilst “land use is characterized by arrangements, activities and inputs people undertake in a certain land cover type to produce, change or maintain it”. Land cover usually refers to vegetation and man-made features, whilst land use is the interaction between the land cover and the actions of people on the land. People as main users of the land alter the environment so that it is oriented to their needs.

Land cover classes are described by two main attributes, namely environmental (soil, climate, vegetation landform) and specific technical attributes that further define specific technical disciplines.

The importance of an appropriate Land Cover Classification System is that it should be scale and source independent, that is, the classification system used should be applicable at all levels of use. It should be mentioned, however, that studies to determine land use are very costly and time consuming and depend on human interpretation. The use of satellite imagery, aerial photography and supported by ground-truthing exercises have proved to be the most cost-effective methodology. Both satellite imagery and aerial photography have advantages and disadvantages, depending on the required outcome by the user.

The methodology of e-Cognition has recently emerged as a more advanced and automated process of identifying land uses. E-Cognition makes use of the spectral signature of objects (object orientation) within applicable satellite bands in identifying land use. Although this methodology is still being refined, it may provide the quickest answer within the shortest time, provided it is conducted by a skilled expert with considerable experience.

4.3 LAND COVER IN SOUTH AFRICA

Productivity and condition of land depend on the current land use. For effective land use planning and sustainable environmental management, it is important to determine the current use of the land as well as the state of the natural resources. This would allow for

effective future planning and evaluation of the *status quo* and to either re-apply or, where necessary, implement corrective measures in land use options that are focused on the improvement of the state of the natural resources, whichever may be applicable.

In 1995, South Africa embarked on the development of a standardized land cover spatial dataset for the country, through the use of Landsat Thematic Mapper satellite imagery. The final data was released in a 1: 250 000 scale vector data set. The Land Cover Classification scheme was developed in such a way that it would accommodate the requirements of a large number of potential users with the aim of conforming, as far as possible, to existing national and international databases. As part of the process, a high-level national Land Cover Classification standard, SANS 1877, was developed in 2004 (SABS 2004:1).

The study was repeated with the use of satellite images for the year 2000 with the first data sets released in 2005. To date, the final project document has not been finalized and the complete data set not yet released in the public domain. The previous classification scheme was revised for this release to accommodate more classes. The methodology included image processing, through digital processing of raster data with a minimum mapping unit of 1 ha. Accuracy assessment was based on field sample point data. The scale of the data was refined to a 1:50 000 scale.

Level 1 of the Land Cover Classification System consisted of classes that included forest, woodland, thicket, bush land, shrub forest and high fynbos, shrub land and low fynbos, herb land, grassland, forest plantations, waterbodies, wetland, barren land, cultivation, built-up land and mines and quarries. Each of the classes were defined and described in detail. In some cases, the Level 1 classes were further defined into Level 2 or 3 classes. For example, the class “Cultivated” was divided into permanent crops - commercial (irrigation, dry land and sugarcane) and temporary crops - commercial and semi-commercial/subsistence (irrigated, dry land). Barren land consisted of bare rock or soil and degraded land and was used to describe natural bare land and erosion types. Built-up land was divided into residential, commercial and industrial/transport with the residential class focusing on various forms of residential types.

According to the 2000 National Land Cover Classification (calculated from the National Land Cover Map; Department of Environmental Affairs and Tourism 2006a:88), the percentage area for the categories is as follows:

- Bare and degraded areas 4.4%
- Cultivated areas 10.5%
- Grasslands 20%
- Indigenous forests 0.4%
- Mines 0.2%
- Forest plantations 1.4%
- Shrub lands and herb lands 34.7%
- Urban areas 1.5%
- Waterbodies 0.6%
- Wetlands 0.7%
- Woodlands and bush lands 25.7%

Of the cultivated areas (10.5% in total), 82% is used for commercial purposes, 6.2% is permanently under cultivation, whilst 85% is under dry land cultivation. Soil erosion has left 0.7 million ha degraded and 0.2 million ha has been degraded by mining activities. Urban areas can be divided into 1 million ha of formal suburbs and townships whilst 0.23 million ha is classified as informal settlements (Department of Environmental Affairs and Tourism 2006a:89). Figure 4.1 illustrates the Land Cover Classification for South Africa.

Since 2000 no new national land cover data set has been developed although a continuous need has been expressed for the updating of the data. Certain parts of the country, such as Gauteng, KwaZulu Natal and certain areas of the Western Cape, have been updated on an *ad hoc* basis, whilst the updating of a the land cover data set for North West Province is currently underway.

Under the leadership of the Department of Land Affairs, consultation has also begun with the Department of Agriculture (DoA), Department of Environmental Affairs and Tourism (DEAT), Department of Water Affairs and Forestry (DWAFF), ESKOM and other involved role-players to improve the current Land Cover Classification System. The newly proposed Land Cover Classification System (LCCS) is based on the LCCS

developed by the FAO and still needs to be finalized. Discussions have also commenced on developing a policy on the development and updating of land cover data sets, including planning on a proposed national update of the current data set.

4.4 THE AGRICULTURAL SECTOR IN SOUTH AFRICA

Agricultural production and its related activities – processing and distribution – are regarded as a core and primary factor in contributing to economic growth in South Africa. The contribution of agriculture to the economy is not only seen in the light of primary production, but also in terms of its contribution on a secondary and tertiary level.

Meyer (1998:101) classifies the role of agriculture in the following categories:

- Food supply and food security
- Earner of foreign exchange
- Provider of employment
- Economic linkages and multipliers

It is generally accepted that the agricultural sector, irrespective of the level of expertise, can contribute to all of the above categories.

Agriculture has a major role to play in ensuring food production and the alleviation of poverty. As a country, South Africa is food secure, producing most of its staple food and exporting the surplus and only importing when necessary. Preliminary figures released in 2004 indicated that the agricultural sector imported to the value of R16 340 800 000, but exported R22 074 300 000, including both processed and unprocessed products (Department of Agriculture 2006b:86).

The 2002 Census of commercial agriculture found that there were 45 818 commercial farming units in South Africa, which was a decrease of 12 162 farming units as determined in the last Census of agriculture in 1993 (Statistics South Africa & Department of Agriculture 2005:1). About 22 390 units had a turnover of over R300 000 per annum, whilst 23 428 had a turnover of under R300 000.

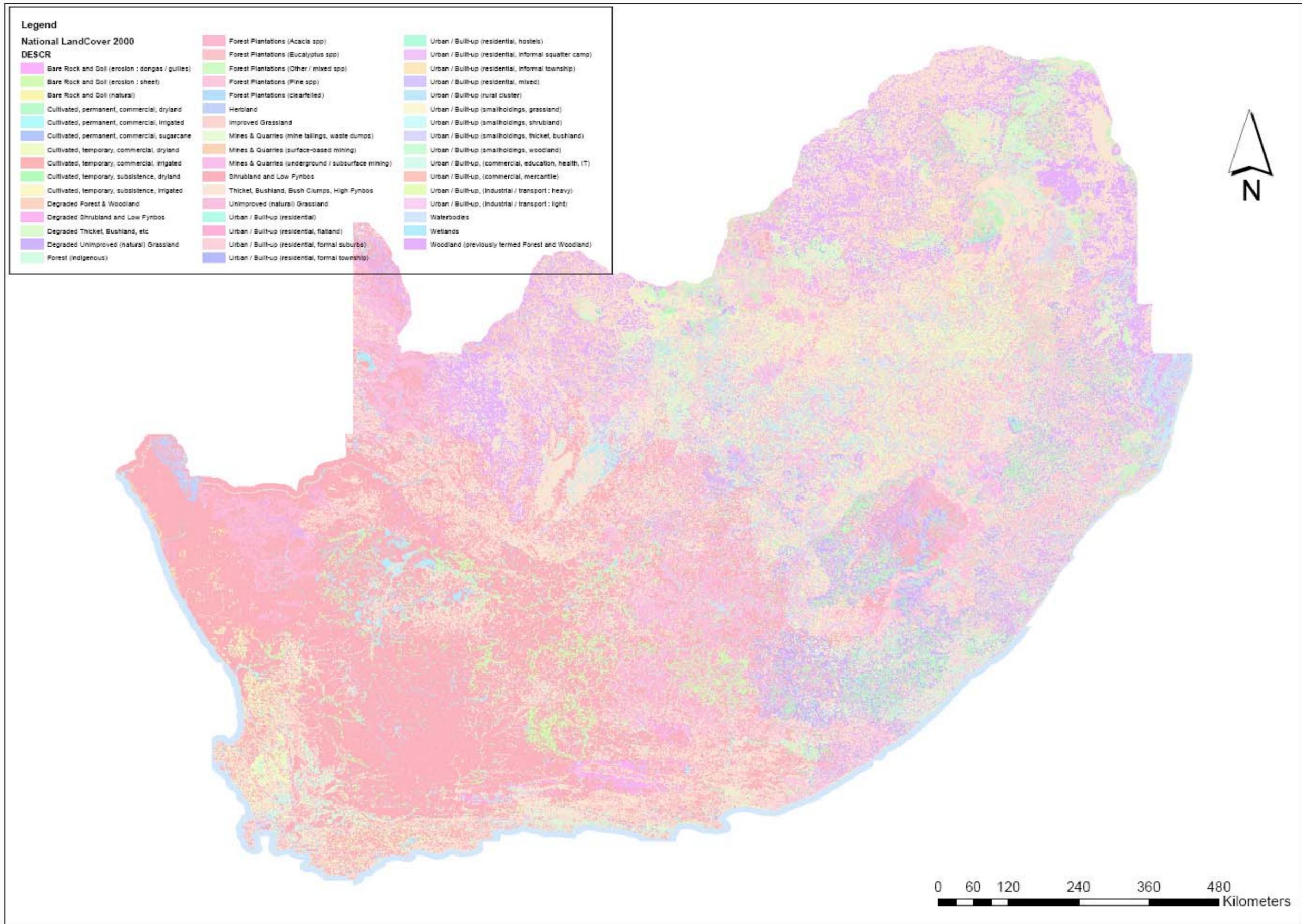


Figure 4.1 National Land Cover Classification for South Africa, 2000

Support for the agricultural sector especially by decision and policy makers is vital in ensuring that the sector continues its contribution to society. In many instances, however, agriculture is losing ground against urban development pressure, increased input costs and land reform action.

4.4.1 Agricultural land use

Statistics on the status of agriculture in South Africa have been released at various times by different sources, some of them contradictory to others. There is presently no formal process to monitor these indicators on a continual basis. Nevertheless, it can be concluded that the agricultural sector is one of the largest land users in the country.

In 1999, it was estimated that on an international level, pastures and crops took up about 37% of the earth's surface with approximately two thirds of water use utilized for agriculture (FAO undated:1).

4.4.1.1 Statistics: different views

The Department of Agriculture (2006b:3-5) cites the Development Bank of South Africa's 1991 statistics of land utilization in South Africa, indicating that about 82% of the total area of South Africa is regarded as farmland, 13, 7% is potentially arable land, 68.6% is grazing land, 9.6% is conserved, 1.2% is utilized for forestry, and 6.9% for other land uses. Thirty-two point six percent (32.6%) of the total area of the Free State consists of potentially arable land, followed by 28.3% of the North West Province, and 23.4% of Gauteng. In addition, about 44.2% of the Gauteng surface is used as commercial agricultural farmland.

In 1994, the total area of South Africa comprised 106 760 000 ha, where agriculture and forestry used 96 million ha (90.7%) of the total land area (Department of Agriculture 1994:5). Of the agriculture and forestry areas, a total of 8 675 000 ha was then estimated to be under cultivation, 1 151 000 ha under forestry and woods, and 1 196 000 ha consisted of established pasture. Approximately 70 595 000 ha was classified as natural veld that varied from semi-desert vegetation to highly productive grasslands found in the high rainfall areas (Department of Agriculture 1994:5).

With reference to the Development Bank of South Africa's 1996 figures, Meyer (1998:22) indicates that grazing land took up 59.1%, nature conservation 9.6%, forestry 1.1% and non-agricultural land 2.5% of the country's surface. Furthermore, the total possible arable land in South Africa is 15.8 million ha or 13%. According to Meyer (1998:22), 80.9% of the country consists of farmland of which commercial agriculture occupies 105.2 million ha and developing agriculture 17.1 million ha.

According to the National Land Cover 2000 statistics, about 80% of the country's surface is used for agricultural purposes as well as for subsistence livelihoods, although only 11% is regarded as having a potential for cultivation. Grazing takes up the remaining 69%. A significant decrease in areas planted was identified from 1987. Maize cultivation declined from 4.1 million ha to 2.9 million ha (29%) whilst wheat cultivation declined by 53%. However, the total maize production increased from 1.7 ton/ha in 1987 to 3.3 ton/ha in 2004 and the wheat production from 1.2 ton/ha in 1985 to 2.1 ton/ha in 2004. According to the Department of Environmental Affairs and Tourism (2006a:90), this is a result of farmers using resources more optimally and following more intensified production practices as well as the availability of new technologies.

According to the 2004 Strategic Plan of the Department of Agriculture (2004a:34), about 81% of land in South Africa is used for agriculture, whilst natural areas take up about 9%. Furthermore, 83% of the agricultural land is used for grazing purposes, 17% is used for crop production, 2% is used for forestry, and 12% is conserved.

About 100.6 million ha of the total 122 million ha that covers South Africa, can be regarded as suitable for agriculture. Only 14% of the agricultural land can be used for production (arable farming), whilst 84% can be used for grazing and 2% for forestry and nature conservation. High potential agricultural land comprises only 22% of the total agricultural land. The total percentage of high potential agricultural land is estimated at between 3 and 4% of the country's total land. It is further estimated that 1.35 million ha of agricultural land is under irrigation. Agriculture is regarded as the largest consumer of water in the country. About 50% of South Africa's water is used for agricultural purposes (Department of Agriculture 2004a:11).

According to the Department of Environmental Affairs and Tourism (2006b:93), in terms of animal production, stocking densities have exceeded the long-term grazing capacity

norms. Cattle numbers increased from 12.6 million in 1994 to 13.5 million in 2004. There is a major difference between stocking densities in communal or rural areas as opposed to commercial farming areas. Degradation and over grazing as a result of over-stocking is evident in the communal rangeland areas.

Seventy percent (70%) of the total land area in seven of the nine provinces is utilized for agricultural purposes. The high potential agricultural land is mostly situated in the eastern part of the country, which includes KwaZulu Natal, Mpumalanga and parts of Gauteng. The Western Cape, Eastern Cape and Free State have mostly medium potential agricultural land whilst the western parts of the country can be regarded as semi-arid (Department of Agriculture 2004a:11). Large areas of marginal or low potential areas are also being cultivated, resulting in crop failure with a possible subsequent degradation of the land (Department of Environmental Affairs and Tourism 2006a:89).

Vink (2003:16) estimates that about 1.3 million ha of potentially arable land are not used and that within the next thirty years the loss of arable land will exceed the remaining potential for cultivation of new land.

4.4.1.2 Statistics: Crops and livestock

Maize, sunflower, sugar cane, wheat and oilseeds are among the major crops planted in South Africa. Maize is mainly produced in the summer rainfall areas, sugar cane mostly in KwaZulu Natal and the Lowveld areas of Mpumalanga, summer wheat in the Free State, and winter wheat in the Western Cape. The grain industry is an important industry in South Africa with Grain South Africa representing about 17 000 grain producers. The country is regarded as the main maize producer in the Southern Africa Development Cooperation (SADC) (Agriculture and Land Affairs 2005:7).

In terms of horticultural production, all major fruit groups are planted (deciduous, citrus and subtropical) as well as vegetables and flowers, with the locality depending on the growing requirements of the crop. Most of the fruit produced and about 5% of vegetable production is exported (Department of Agriculture 2004a:11).

Livestock farming is found in all parts of the country and is the largest agricultural sector. It includes dairy farming, stock farming (cattle, sheep and goats) as well as poultry and pig farming. South Africa also has a very large and active game farming, aquaculture and bee-keeping industry.

In terms of international trade, South Africa is a net exporter of maize and sugar but a net importer of wheat and meat. Meat importation is mostly from Botswana and Namibia.

It is difficult to determine the reason for the conflicting figures mentioned above. The dates of releasing the statistical data might have an impact. Survey methodology, technology used and the survey objectives could also impact on the outcome.

4.4.2 Economic factors

According to the Department of Agriculture (2001:1), primary agriculture contributed 4.5% to the Gross Domestic Product (GDP) and another 9% in terms of the larger agro-food complex. However, the percentage contribution of agriculture to the GDP declined to 3.2% (or R34 billion) in 2002 with a further decline to 2.6% in 2004. It is of concern that in 1965 the contribution of agriculture to the GDP was 9.12% (Department of Agriculture 2004a:12).

The gross value of agricultural production for the year 2004/2005 amounted to R67 828 900 000 for field crops, horticulture and animal production combined (Department of Agriculture 2006b:78).

However, the agricultural growth rate is not keeping up with other economic sectors. Agriculture and its related activities form an integral part of the economy through direct or indirect links. The relatively low contribution of agriculture to the GDP, in comparison with other sectors might create the impression that this sector has only a limited potential, but does not take the forward and backward linkages and the associate impacts into consideration. Nor does it take into consideration the sector's important role in terms of earning foreign exchange as well as economic linkages and the creation of employment opportunities.

The formal agricultural sector is a major contributor to job creation. The agricultural sector employs about 1 million farm workers or 11% of the total formal sector, whilst an additional million people benefit through the involvement of the small farmer in the sector (Department of Agriculture 2001:1). This results in about 25% of the South African population relying on the agricultural sector, not taking into consideration other economic linkages. A total of 960 000 people are estimated to be actively involved in agriculture.

Meyer (1998:55) points out that, for every R1 million value added, the agricultural sector uses more workers than any other sector in the economy. In 2002, farm employees and domestic servants on farms were calculated at 940 800. In 2005, the workers in the agriculture, hunting, forestry and fishing industries were set at 925 000 and in skilled agriculture at 302 000 (Department of Agriculture 2006b:4).

According to the 1998 agricultural policy in South Africa, the number of jobs created in the agricultural sector per unit of investment was higher in comparison with other economic sectors, but the overall employment opportunities in the agricultural sector had declined in recent years, mainly due to the fact that at the time of the policy creation, legislation on the security of employment did not have a significant impact (Department of Agriculture 1998:8). It should be noted that growth in the agricultural sector would have a significant impact on job creation.

During the 2005/06 financial year, the gross income of farmers decreased due to a decline in the producer prices of crops such as cotton, summer grains, winter cereals, and oilseeds. Input costs and services also increased, resulting in a lower net farm income with the expectation that the situation would not improve in the 2006/07 financial year (Department of Agriculture 2006c:8).

It is well known that South African farmers receive very limited support from the state in comparison with other countries. This encourages the latter to increase their productivity and focus on production methods that will ensure sustainable production and optimal utilization of their resources. There are about 50 000 large commercial farmers in South Africa and 240 000 small farmers and another 3 million farmers in communal areas, producing food for own consumption. In 2000, about 7% of South African exports were agricultural products (Department of Agriculture 2006b:92).

Many South Africans live in extreme poverty. In 1998 an estimated 16 million people lived in poverty, mainly in rural areas with households headed by females (Department of Agriculture 1998:7). Men leave the rural areas seeking employment opportunities in the urban areas, many of them re-locating to Gauteng. Most rural households are involved in a form of agriculture in order to improve their income or to produce food for the household, resulting in improved nutrition. Agriculture thus forms a core component of the communities' daily tasks. This involvement emphasises the integral part of agriculture in the social structure of the country.

In a provincial context, the contribution of agriculture is based on the provinces' own internal structure and priorities, demands and available resources including natural resources, as each province functions as an independent entity.

Two mainstream agricultural sectors exist in South Africa, namely the commercial agricultural sector and the emerging or developing agricultural sector. The commercial agricultural sector has developed into a well-organized sector over the years, facing harsh environmental conditions, but still managing to make a success of their farming enterprises. The effectiveness of this sector can be seen in the fact that South Africa has managed to meet its food consumption requirements for many years. The emerging or developing agricultural sector has only recently been afforded the opportunity to have access to land. This sector is still embarking on the long road to becoming commercial farmers, aiming to contribute to the country's economy.

In reviewing the above main agricultural sectors in South Africa, the unique categories of farmers found in the country should be noted. These categories are still much debated and no formal classification exists in this regard. Laker (2004a:9-12) divides farmers into subsistence, food plot or "backyard", emerging, and commercial farmers. Subsistence farmers (also known as small-scale or resource poor farmers) produce food mostly for household use and, where possible, sell the excess as a form of additional income. Food plot or "backyard" farmers mostly have vegetable gardens around homesteads. There are also emerging farmers and the commercial farmer. Emerging farmers are farmers that mostly gain access to land via the land reform or redistribution programme and need the most support as they are regarded as the farmers of tomorrow. Commercial farmers are successful, established farmers.

According to Meyer (1998:26), a total of 17.1 million ha (13.9%) can be regarded as developing farming areas but women mostly occupy this land, more for social security than for agricultural production.

The developing agricultural sector faces many obstacles, including financial constraints, lack of infrastructure and access to resources, and a grave lack of appropriate agricultural knowledge and experience. The developing agricultural sector does not cultivate the land on a continuous basis and in many instances also not according to best agricultural practices. For example, over-grazing may result in the further deterioration of veld condition. Ultimately, this land may be lost to agriculture, as other land uses may become more viable in the long term.

Clearly, then, not all the farmland in South Africa can be regarded as homogenous and can therefore not generate the same income. The size of a farm, using every hectare to its fullest potential, should be such that it will secure a sustainable livelihood for its owner (Theunissen 2005:28).

4.5 AGRICULTURE IN GAUTENG

Agriculture in Gauteng is not generally regarded as a major industry due to its limited contribution to the GDP and the opposing contribution of other sectors, such as mining and commercial activities. Many people do not associate agricultural activities with the province. However, in evaluating the current land cover in the province, the level of development occurring in the province is also overestimated. Gauteng is widely regarded as a “built-up” province, and this misconception is frequently used as a guiding tool when it comes to planning in the province. Contrary to this belief, Gauteng has a well-established and sustainable agricultural sector.

According to GDACE (2004b:15), of the 774 265 ha of total farmland in Gauteng, only 438 623 ha (23.4%) is regarded as potentially arable land and 390 000 ha is grazing land. About 67% or 293 571 ha is cultivated. Figure 4.2 indicates the cultivated land in the province. The expansion of irrigation within the province is limited, due to the competing demand for water for human consumption.

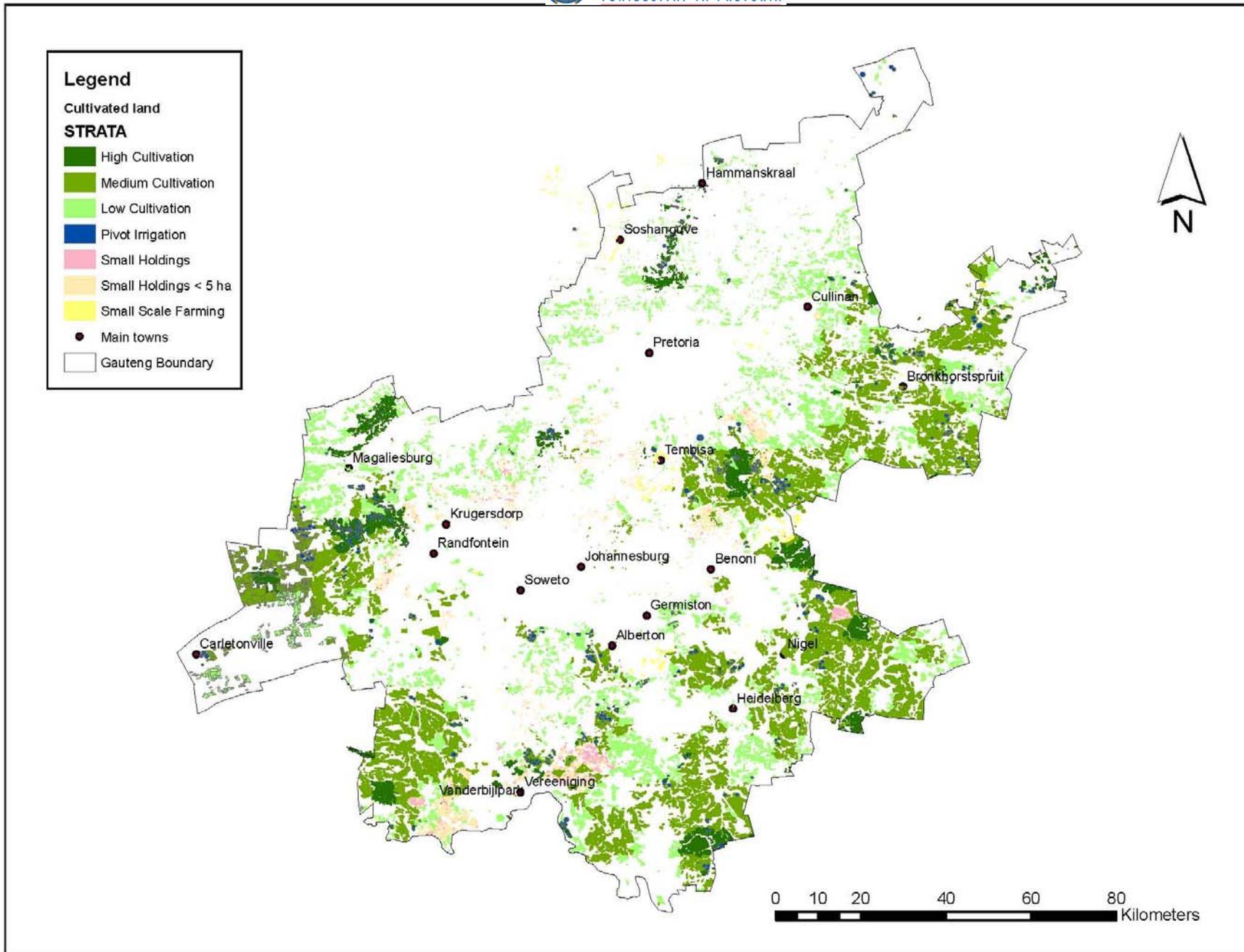
Gauteng has the important advantage of a large amount of high potential agricultural land. About 28% of the province's area is regarded as high potential agricultural land, of which 3.3% is located within the urban edge (GDACE 2002). In 2002, only 16.4% of land in the province was cultivated (GDACE 2004a:44).

The 2002 Census of commercial agriculture determined that 65 767 ha under dry land conditions and 5 846 ha under irrigation was planted with summer cereals. The production derived under dry land was 214 686 ton and under irrigation 29 761 ton. A total of 5 338 ha of vegetables were planted that produced 134 525 ton (Statistics South Africa & Department of Agriculture 2005).

According to the Crop Estimates Committee, farmers intended to plant 2 500 ha wheat in the 2005 season. The 2004 production figures showed that 250 ha of dry land wheat and 2 250 ha of irrigated wheat was planted. Thirteen thousand (13 000) ha was planted with maize and 3 500 ha with sorghum (Department of Agriculture 2005b:1-4).

The 2002 Census of commercial agriculture also determined that there were 945 commercial farmers in the province, consisting of 767 males and 178 females. Three hundred and forty nine (349) additional family members are involved in the farming operations (Statistics South Africa & Department of Agriculture 2005). The emerging commercial farms are estimated at 9.7% and established commercial farmers at 5.1% of the total of the country (Marketing Surveys & Statistical Analysis 2003:44).

The total estimated commercial farming units amounted to 2 206 and generated a gross farming income of R 3 753 332. This can be broken down further into field crops generating 2.3% of the total field crops income in South Africa, horticulture 5.7%, animal and animal products 11.7% and other products 5.1% of the total. The gross farming income earned from horticultural products in Gauteng was R811 240 000; that is, higher than the Free State, Northwest and KwaZulu Natal. A gross farming income of R 384 056 000 was derived from field crops (Statistics South Africa & Department of Agriculture 2005:1).



The gross farming income derived from animal and animal products was R2 486 728 000, which compares favourably with other provinces. According to the Department of Agriculture (2004b:1), a total of 269 000 cattle, 84 000 sheep, 173 000 pigs and 9 000 goats can be found in the province.

Gauteng farmers experienced losses to the amount of R92 168 000 that is the lowest amount in comparison with other provinces. The losses included stock theft, lifting and stealing of tools, burglary, predators, absence arising from injury or crime, building equipment and pilfering and stealing of crops (Statistics South Africa & Department of Agriculture 2005:23).

In 2002, the agricultural sector in the province employs about 29 537 paid workers, including 20 815 full-time workers and 8 722 casual and part-time workers. This relates to the fact that in Gauteng, the number of workers in the agricultural sector as a percentage of the total workforce in South Africa is 3.1% (Statistics South Africa & Department of Agriculture 2005:3).

In Gauteng smallholdings are commonly found on the outskirts of the developed town boundaries where they form a buffer between intensive urban development and agricultural production areas (see figure 4.3). In many instances, urban development has encroached on smallholdings, resulting in smallholdings being an awkward urban/farming mixture. There are approximately 30 000 smallholdings in the province and their average size is about 8.47 ha. These smallholdings are located in areas zoned for agriculture, smallholdings or commercial use and range from very poor to very prosperous. An audit on smallholdings in 2002 found that only about 24% of smallholding owners are involved in agricultural activities. Very few of the smallholders rely on agriculture as their sole source of income, with many of them only engaged in agricultural activities for household use. Most of the smallholdings are utilized as either a place of residence or for another source of income, such as manufacturing or small businesses. Consequently, these areas are not utilized to their full potential, especially since a significant portion of this land is located on high potential agricultural land. The expansion of development on the urban edge exerts significant pressure on the smallholdings.

The intensity of farming activities that do occur on smallholdings should be noted. Many smallholders involved in agriculture farm on a very intensive scale, mostly with garden vegetables and cut flowers. Tunnel production is a preferred production practice. Smallholders are also taking advantage of high value niche market crops, organic farming or hydroponic production methods. Boreholes are used as the main source of water. Smallholdings are also used as nurseries or in terms of animal production for piggeries, broilers or layer chicken production or abattoirs (GDACE and Land Affairs 2002).

In terms of agricultural infrastructure, Gauteng has two major fresh produce markets, namely the Johannesburg Fresh Produce Market that handles 32% and the Pretoria Fresh Produce Market that handles 16%, of all fresh produce marketed through formal channels (GDACE 2004b:21). The dense population of the province acts also an offset point for the selling of fresh produce.

Gauteng also houses a number of processing plants and industries that complement the forward linkages of the agricultural sector, thus increasing the role agriculture has to play in the context of the province.

The presence of a number of tertiary learning institutes, the national Department of Agriculture, the Agricultural Research Council (ARC), as well as governmental and non-governmental organizations ensures easy access to agricultural information, needed by existing or future farmers. This is further supported by a well-established road and rail infrastructure, as well as the presence of an international airport with the required infrastructure for the export of agricultural produce.

The fact that agriculture in the province is not regarded as a major industry, as the focus of the province is more on other industries and fields of development, has resulted in a conflict of land use between agriculture, urbanization and environmental conservation. People flock to the province hoping to find employment, but because of work scarcity become involved in agricultural practices as an interim arrangement until a more “rewarding” job opportunity arises. The sustainability of agricultural production is thus limited, particularly in the case of small-scale farming.

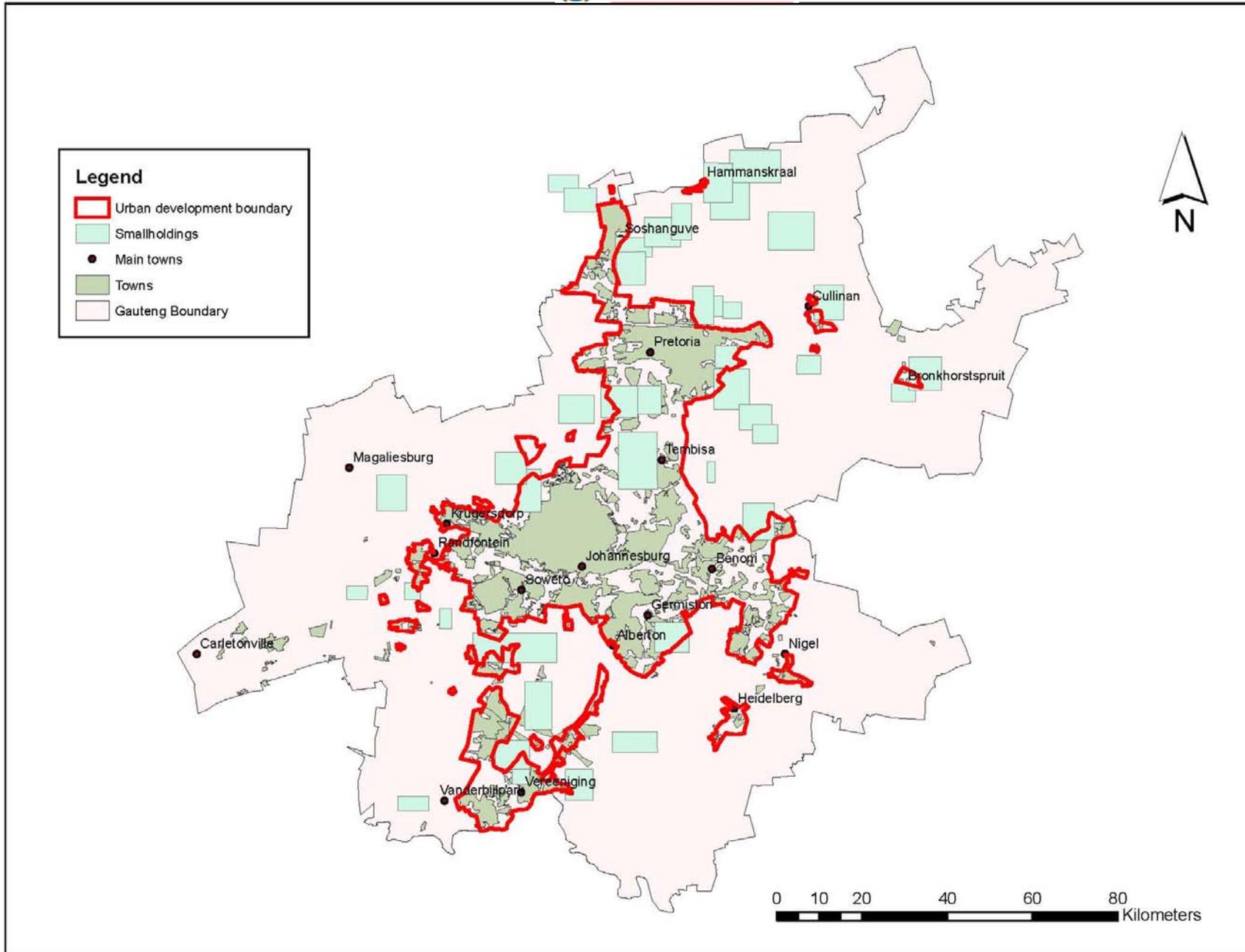


Figure 4.3 Smallholdings distribution in Gauteng province

Van Rooyen, De Waal, Gouws, van Zeyl, Rust, Kriek and McCrystal (1995:i) found that in evaluating the resource potential of the province, as well as its then existing infrastructure, basic agricultural production is a viable option. Van Rooyen *et al.* (1995:i) emphasize that the land uses are not best suited for the potential of the land and recommend urgent policy changes to allow for an optimal contribution of agriculture to the economy of the province.

Land uses in the province are mostly driven by urban and industrial needs with high land values with which agriculture and conservation cannot compete. However, food security is a basic need of all land users and although Gauteng is regarded as the economic hub of the country, many areas are exposed to poverty and malnutrition. Van Rooyen *et al.* (1995) raise the question whether agriculture and conservation can co-exist within the urbanized character of the province.

The answer to this question is an overwhelming confirmation. The province has more than enough available land for these priorities to co-exist. The presence of a large amount of high potential agricultural land and a well-established infrastructure further supports this confirmation. What is required is a comprehensive spatial plan in identifying possible farming areas and suitable farming practices, as well as high value commodities that will not only address the issue of conflicting land uses, but also food security and job creation. This statement once again emphasizes the underlying principle of this study.

Van Rooyen *et al.* (1995:iii) recommend developing a vision in which agriculture and conservation should form a synergistic relationship with urban land uses, whereby urban activities should rather complement agriculture and conservation. Farmers on every scale (commercial, small scale and household food producers) should have a clearly demarcated role in this vision. Furthermore, it is essential that a process of integrated environmental management be followed in all planning processes (Van Rooyen *et al.* 1995:iii). An appropriate zoning system with land capability classes clearly identifying areas earmarked for urban development (urban core), mixed land uses and areas most suited for agricultural purposes is recommended. This does not mean that agricultural production, even on a small scale, cannot be practised within the urban core.

Planning principles and criteria should be developed and adhered to by all levels of Government. Key elements should include sustainable use of the natural resources, and the protection of zoned high potential agricultural land. Urban sprawl should not be allowed.

4.6 LAND COVER IN GAUTENG

As mentioned earlier, land cover and land use form a crucial aspect in land use planning and environmental management. At the same time, the scale on which land cover/use is determined is also important. For effective planning and utilization, a more detailed analysis is required that will focus on a smaller area of interest, especially in a land hunger province like Gauteng.

In 2003, a land use task team, consisting of representatives from key departments, was established in Gauteng. The task team reviewed the current land use in the province by analysing the 2000 national land cover information, identified possible areas for development for low-cost housing and compared the outcome thereof with the relevant costing.

In evaluating the availability of land within the urban edge and excluding land that falls within a buffer zone of hazardous land use, high ecological as well as agricultural potential areas, geotechnical constraints and a slope of more than 6%, planned infrastructure, as well as areas more than 25 kilometres away from major transport routes, it was found that there are 97 418 ha of land available in the province for development. The task team followed a policy approach to prevent urban sprawl or “leapfrog” development, to protect land with a high agricultural potential and a high ecological and agricultural heritage as well as a social value, and to ensure optimal utilization of high potential agricultural land.

Based on their calculations, the task team established that the total land required for 281 000 households (the number of households was calculated by using the township establishment needs of 30 000 people at 3.2 people per household) with a low density development option of 10 850 hectares and with a high density development option of 4 600 hectares, is more than sufficient to address the housing needs of the province (Gauteng Provincial Government 2004a).

The study concluded that urban sprawl has undesirable economic, social and environmental consequences and leads to the escalation of long-term costs in development of houses. It is more desirable to optimise the use of existing infrastructure and a developed urban structure is more beneficial than a peripheral, edge area (Gauteng Provincial Government 2004a).

Based on the work done by the land use task team, GDACE and the Branch: Agriculture, in particular, nevertheless felt that a more comprehensive land use/land cover study is required. This would guide the unit, from an agricultural perspective, on what strategic role agriculture in the province should follow, taking into consideration the amount of available or more specifically, suitable agricultural land in the province.

In determining the land cover in the province, the Quick Bird satellite imagery with a 60 cm resolution was used. This imagery has a 67 to 72-centimetre resolution for the panchromatic and a 2.44 to 2.88-metre resolution for the multi-spectral images (GDACE 2005b:7). A total of 858 images were classified for Gauteng (see figure 4.4).

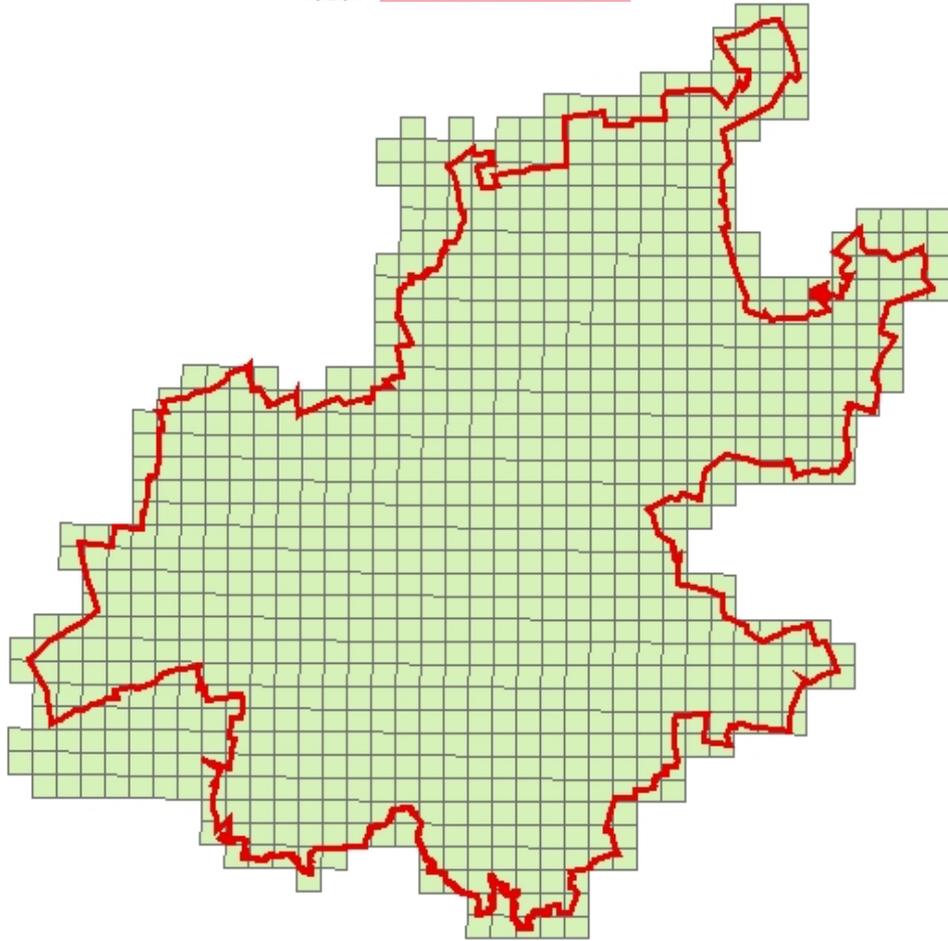


Figure 4.4 Representation of Quick Bird images used for the land cover classification in Gauteng

The use of high-resolution satellite imagery is relatively cheap in comparison with traditional aerial photography and has the option of repeated coverage. It also allows for very accurate ground control data. Cloud cover could have an influence in acquiring an image for a specific area. When using remote sensing imagery for land cover mapping, a number of crucial factors need to be taken into consideration, including accuracy in terms of scale needs attributing an object, topology as well as consistency in scale, source, projection and classification.

The scale of the product released was 1: 10 000 with a minimum polygon size of about 1 ha and was based on a visual interpretation of the colour-enhanced images that is, human interpretation. This procedure was followed due to the absence of the near infrared band required for vegetation classification. Although this was a time-consuming

process, the accuracy levels are higher for applied studies of this kind (GDACE 2005b:22-24).

A total of 1115 randomly selected field sample points to improve and verify the accuracy of the data set supported the above. It was concluded that a 91.37% match was found for the Level I Land Cover Classification. Deviations were explained in terms of the scale of the classification (1:10 000) versus the scale of the field point sampling (1: 2 000), the interpretation by the operator (barren land vs. cultivated land not planted) and the accuracy of the field sample points (GDACE 2005b:30).

In complying with the national standards for land cover, care was taken to align the classification with the national standards (specific cross-reference was made to Level I and II of the National Land Cover Classification). However, additional classes were added to allow for a more detailed assessment of the land cover and, to a certain extent, land use (Level III and IV), but these classes were amalgamated upwards to comply with the national standards (see figure 4.5).

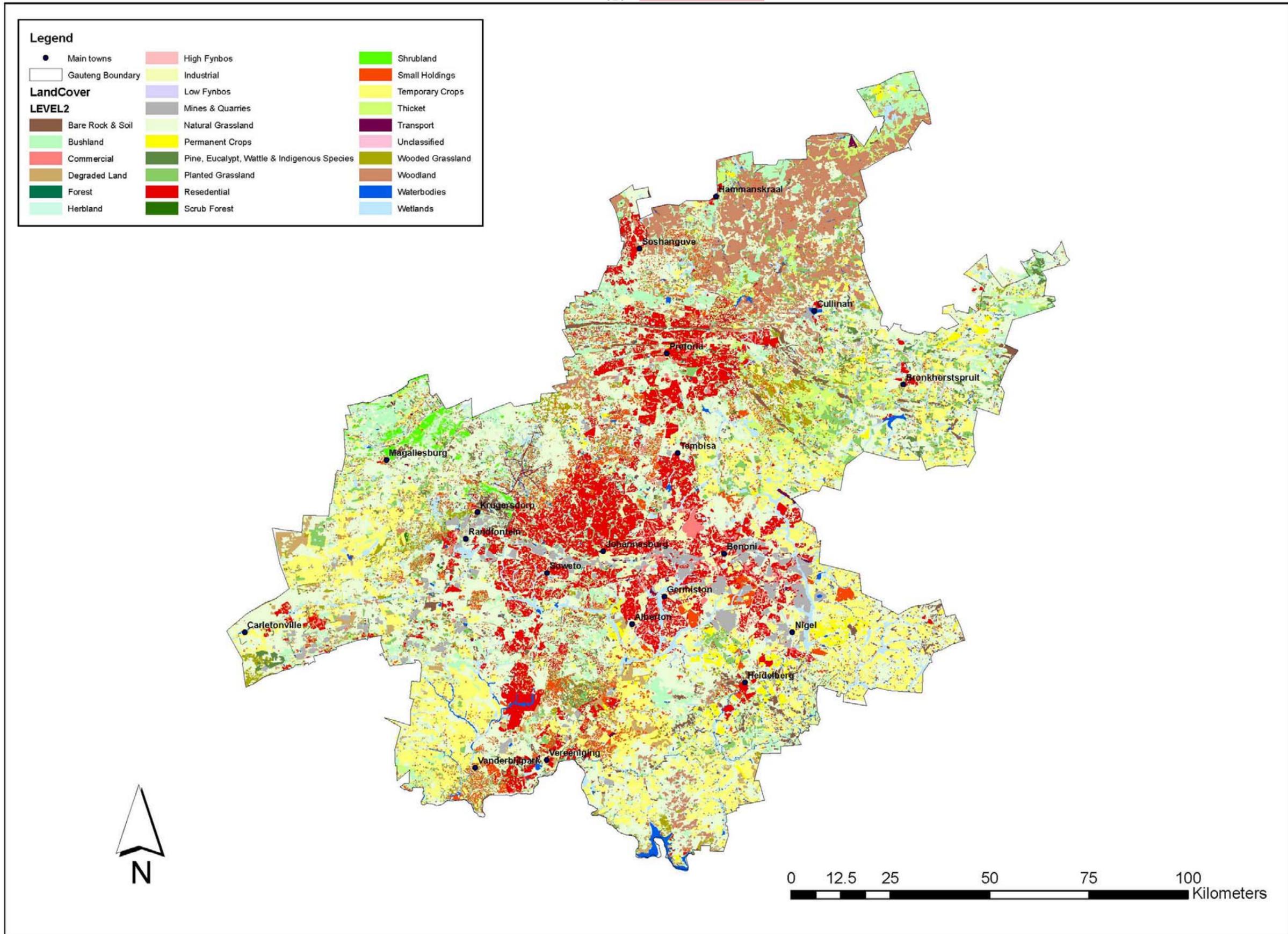


Figure 4.5 Land cover classification in Gauteng

Table 4.1 summarises the results of the Land cover study (GDACE 2005b:30- 31).

Table 4.1 Land cover classes for Gauteng

GAUTENG PROVINCE		
Land use classification	Hectares	%
Natural grassland	691326.44	40.90
Urban/built-up	198266.67	11.73
Cultivated, temporary, commercial, dry land/rain fed	154674.67	9.15
Woodland	115444.14	6.83
Bush land	107572.29	6.36
Planted grassland	59093.89	3.50
Thicket	52281.53	3.09
Cultivated, temporary, commercial, irrigated	46779.34	2.77
Wetlands	30427.86	1.80
Degraded natural grassland	27900.18	1.65
Underground/subsurface-/surface-based mining	21931.52	1.30
Bare rock/soil - natural	21366.90	1.26
Cultivated, temporary, semi-commercial/subsistence, dry land	20835.56	1.23
Wooded grassland	16101.32	0.95
Pine, Eucalyptus, Wattle	13297.47	0.79
Cultivated, permanent, commercial, dry land/rain fed	11718.07	0.69
Mine tailings/waste dump	9893.61	0.59
Residential - formal township	9555.17	0.57
Dams	9176.93	0.54
Shrub land	8754.88	0.52
Smallholdings - natural grassland	7169.96	0.42
Road infrastructure	6400.96	0.38
Residential - formal suburb	5690.72	0.34
Cultivated, permanent, commercial, irrigated	5447.18	0.32
Pans	5136.68	0.30
Bare rock/soil - dongas/gullies	3978.60	0.24
Degraded thicket, bush land, bush clumps and high fynbos	3970.95	0.23
Degraded forest and woodland	3187.65	0.19
Industrial - transport light	2959.88	0.18



Land use classification	Hectares	%
Rivers	2429.39	0.14
Industrial - transport heavy	2389.75	0.14
Residential - mixed	2280.63	0.13
Residential - rural-cluster	1871.77	0.11
Bare rock/soil - sheet erosion	1551.91	0.09
Commercial - Education, Health, IT	1501.74	0.09
Cultivated, temporary, semi-commercial/subsistence, irrigated	1425.33	0.08
Smallholdings - thicket, bush land, bush clumps	1292.96	0.08
Residential - flatlands	872.81	0.05
Cemeteries	755.71	0.04
Smallholdings - woodland	509.36	0.03
Residential - hostels	502.64	0.03
Residential - informal squatter	448.16	0.03
Commercial - mercantile	389.84	0.02
Cultivated, permanent, commercial, sugarcane	385.15	0.02
Shrub forest	330.49	0.02
Clear felled	311.20	0.02
Canals	310.04	0.02
Railway lines	150.36	0.01
Residential - informal township	97.81	0.01
Forest	79.77	0.00
Smallholdings – shrub land and low fynbos	45.50	0.00
Low fynbos	0.40	0.00
TOTAL:	1690273.74	100.00

It should be noted from the above that, contrary to popular belief, only 11.73% of Gauteng consists of urban or built up land. Were other land cover classes, consisting of some form of structure that deviates from natural or cultivated land, added to the above, the total percentage would amount to about 16% of the total land surface. About 40.9% consists of natural grassland, whilst agricultural related land cover comprises about 17% of the land surface. A higher percentage of agriculturally related activities therefore occur in the province in comparison with urban land cover activities. The remainder of the province is made up of smaller areas of other land cover classes.

4.7 CONCLUSION

This chapter discussed agriculture and land use, including land cover vs. land use, land cover in South Africa, the agricultural sector in South Africa, statistics on agricultural land use, crops and livestock; economic factors, and agriculture and land cover in Gauteng. Gauteng has the important advantage of a large amount of high potential agricultural land, some of which is located within the urban edge. It was found that, contrary to popular belief, only between 11.73% and 16% of Gauteng consists of urban or built up land and other land cover classes.

Chapter 5 examines strategic objectives in the South African sustainable development priorities with special reference to agriculture.

STRATEGIC OBJECTIVES IN THE SOUTH AFRICAN SUSTAINABLE DEVELOPMENT PRIORITIES WITH SPECIAL FOCUS ON AGRICULTURE

5.1 INTRODUCTION

Between 1994 and 2004 major political changes evolved in South Africa, resulting in the world looking at South Africa with new, though still critical eyes. One of the main areas of change identified in correcting the mistakes of the past was the imbalance existing in various fields within the country and the development of constructive means to correct those. The development and upliftment of previously disadvantaged communities and empowering them through various opportunities was therefore strongly emphasised.

The long-term vision for the country identified in the Growth, Employment and Redistribution policy, focused on a competitive and fast growing economy with sufficient jobs for all, a redistribution of income, especially in favour of the poor, and a secure and productive environment (South Africa 1996b:1). A growth rate of 6% and the creation of 400 000 jobs per annum by the year 2000 were set as targets.

Various industries could be expanded to create opportunities in achieving the mentioned targets. One such opportunity identified was in the field of agriculture. Agriculture has the possibility to contribute to the economy not only during the production cycle, but also in the processing and distribution phases. A number of important factors have to be taken into consideration, however, in achieving this objective.

Meyer (1998:2) emphasizes that large imbalances exist between agriculture and other economic sectors, as well as within the agricultural sector between the commercial and development sectors. A comparison of statistical information on agriculture with other economic sectors leads to the conclusion that agriculture is normally not seen as a major contributor to the economy, or regarded in the same light as the mining or textile industries. However, its contribution to the creation of jobs and impact on the alleviation of poverty should not go unnoticed.

The Reconstruction and Development Programme (RDP) focused on balancing efficiency and equity as well as having an effect on regional development policies such as agriculture (South Africa 1994a:1). The implementation of these policies makes demands on renewable natural resources and on the human resources and physical infrastructure. The demand and supply of agricultural commodities impact not only on national but on provincial and household levels, too.

Directly or indirectly, agriculture affects people's lives. However, suitable land is required for any agricultural related activity. Since the change of the political dispensation in 1994, the issue of access to land and in particular land reform, has been at the forefront of many discussions. The White Paper on Land Policy referred to the Constitution, which stipulates in the Bill of Rights that existing property rights are guaranteed, but that Government also has the responsibility to ensure equitable access to land, security of tenure and to address the issue of the dispossession of land that occurred after 1913 (Department of Land Affairs undated:1). Land administration (including land reform and land survey) is a function assigned to the Ministry of Agriculture and Land Affairs. Concurrent activities related to land reform, such as agriculture, environment, conservation of soil and urban and rural development, are shared between national and provincial governments, whilst local governments also have a responsibility in terms of land use planning.

The goal of land reform in South Africa is embedded in the underlying principle of addressing the legacies of the past pertaining to land reform and ensuring security of tenure and certainty of rights for all South Africans. Underlying this statement is the support to economic growth and the alleviation of poverty entrusted upon the provincial departments. All these aspects should be properly managed, because if not correctly implemented they could result in a more negative impact on small-scale farmers in particular. Meyer (1998: xvi) stresses that land reform will not necessarily be a success through the dispossession of land, but suggests that a balance be struck between efficient land requirements, the political arena and the fair redistribution of land to a structure of sustainable agricultural land use. At the same time, this statement is clouded by the awareness that there is a worldwide trend of increasing urbanization and the loss of farmland to residential developments.

Sustainable use of agricultural land needs to be managed to ensure continuous food security, a responsibility entrusted upon the South African Government. Meyer (1998:xvi) stresses further that many people living in rural areas are still food insecure because worldwide gains in the availability of food have not been matched by a corresponding access thereto. An estimated 16 million South Africans live in poverty, especially in the rural areas, and most of these are also female-headed households (Department of Agriculture 1998:7).

The production of food should not be “someone else’s” responsibility. People should be empowered to produce their own food, irrespective of its insignificance in the bigger economic scene. This might be seen as a drop in the proverbial bucket, but it is a step in the right direction. There is a Chinese saying: “Give a man a fish and you feed him for a day. Teach him how to fish and you feed him for a lifetime”. The teaching process, seen against the background of land reform and the evolvement of new farmers, forms a significant and essential step in sustainable food production, but should be accompanied by a lesson on the importance of conservation as well as optimal use of natural resources.

It is against this background that this study emphasizes the importance of knowledge and application of basic principles on the conservation of natural resources as a strategic objective of any country wishing to remain sustainable in its food production.

Sustainable food production in the long term can only be assured through the identification of land with a high agricultural potential and its protection through strategic initiatives such as the zoning of land and policies and legislation for exclusive agricultural use. It should also include the identification of the preferred land use and agricultural practices on the land as supported by current economic trends.

A concern that is mentioned and discussed throughout this study is the contrast or contradiction between various policies, strategies and legislation that exists not only within the same sphere of government, but also between the three spheres of government. Section 146 of the Constitution of South Africa Act, 108 of 1996 prescribes how such conflicts should be resolved, but it is imperative that legislation and other enforcing documents be harmonized to avoid possible conflict (South Africa 1996a:60-61). Close cooperation is needed between the various spheres of government

and their respective functionalities and responsibilities to ensure effective and integrated land use and the protection and management of the environment.

5.2 NATIONAL POLICIES AND STRATEGIC OBJECTIVES WITH THE FOCUS ON AGRICULTURE

Since the 1990s many policies and strategic documents have been developed, mostly by organs of state, aimed at identifying the role of agriculture in South Africa, its contribution to the economy and weighing it up against other economic sectors.

Initially many of the policies and strategic documents addressed the inequities of the past and focused on formulating methods to undo the injustice thereof. The policies focused on the establishment or enlargement of small-scale and/or sustainable farmers or farming units, with less emphasis on the commercial agricultural sector, but with the request that support be given by this sector to the newcomer farmers. This process should be conducted in such a way that it will have a limited influence on agriculture's contribution to the economy, but rather empower a section of the population previously excluded from this activity.

However, many of these documents commonly acknowledged that all these changes should not happen to the detriment of our natural resources. It was constantly stated that whatever the activity, the protection of our natural resources as underlying factor should be taken into consideration, either via policies, legislation or incentives.

This section presents a summary of reviewed policies and strategic objectives of major role-players, highlighting matters pertaining to mainly the protection of our natural resources and related issues.

5.2.1 White Paper on Agriculture, 1995

The *White Paper on Agriculture* was one of the first policy papers developed under the new political dispensation, within the Government of National Unity and was signed by Minister Al van Niekerk in 1995. The Minister gave the committee appointed to compile the White Paper two requirements, namely that it had to reflect successful agricultural

principles and had to adhere to the Reconstruction and Development Programme (RDP) (Department of Agriculture 1995:v).

As per guidance from the Interim Constitution, agriculture was seen as mostly a provincial function, but both national and provincial Departments of Agriculture have to develop their own policies, taking into consideration that agriculture could not be divided into compartments, but should rather be seen from a holistic management perspective. A national policy on agriculture was thus also important (Department of Agriculture 1995:v).

The White Paper focused on principles and aimed to reflect the needs of all role-players in the field of agriculture, recognizing it as a primary component of the national economy. Specific reference is made in the White Paper to the scarcity of agricultural resources especially high potential agricultural land and the demand of non-agricultural uses on agricultural land. It states further that agricultural land should be utilized by agriculture to ensure sustainable production (Department of Agriculture 1995:1).

Another key focal point of the White Paper is the increased technical and financial assistance to small-scale farmers in ensuring food security at both national and household level. An important aspect included was the issue of marketing and the revision of the then existing marketing schemes (Department of Agriculture 1995:2).

The vision that emerged for agriculture in the new South Africa was of a “highly efficient and economically viable market-directed farming sector, characterized by a wide range of farm sizes, which will be regarded as the economic and social pivot of rural South Africa and which will influence the rest of the economy and society” (Department of Agriculture 1995:2).

In achieving this vision, several critical policy goals had to be pursued that included the development of economically viable commercial farmers, using the family farm as a basis, increased access to agriculture via land reform, and appropriate support services and financial support aimed specifically at the small-scale and beginner farmer. The goals also included increased trade, corrective agricultural production leading to the conservation of the natural resources, and an increased role of agriculture in the Southern African region (Department of Agriculture 1995:3). The mission of the

agricultural policy was to ensure “equitable access to agriculture and promote the contribution of agriculture to the development of all communities, society at large and the national economy, in order to enhance income, food security, employment and the quality of life in a sustainable manner” (Department of Agriculture 1995:4).

The policy defines agriculture as follows: “Agriculture involves the sustainable and productive utilization of natural resources and other inputs by people for plant and/or animal production purposes, either for own consumption or for marketing” (Department of Agriculture 1995:4). With reference to sustainable agriculture, the policy refers to “farming systems which are productive, economically viable and environmentally sound over time” (Department of Agriculture 1995:4).

The following policy areas were identified: production, marketing, sustainable utilization of natural resources, and financing.

- **Production**

Due to the variance in the South African climate it is important for any farmer to optimally utilize his/her resources through capitalization of advance production systems. This will ensure that the farmer will develop a competitive advantage over time. It is the role of Government to ensure a secure environment and adequate information and support. Government needs to improve national and household food security from encouraging urban food gardens, small-scale production through to large-scale production systems. Where economically viable, production systems should favour labour intensive practices (Department of Agriculture 1995:6).

- **Marketing**

The marketing section focused mostly on accessibility to markets by all participants, but with limited intervention from Government. International trade opportunities should be encouraged (Department of Agriculture 1995:8).

- **Sustainable utilization of natural resources**

Considerable effort went into the importance of protecting the natural resource base of the country. It was clearly stated that all South Africans should accept responsibility of the country's natural resources that are essential for the future well being of generations to come. Farmers, as the principle users of the land, irrespective of small or large scale, are responsible for producing food for the nation, but not at the cost of the natural resource base. This can only be done through effective land use planning (Department of Agriculture 1995:13-15).

The White Paper acknowledges the threat of residential and industrial developments on agricultural land and clearly states that urban and rural planning should be conducted in an integrated manner and not fragmented. The loss of agricultural land should be minimized. Furthermore, mismanaged or degraded land should be rehabilitated at the cost of the land user, as it may be due to incorrect farming and/or irrigation techniques. The use of marginal land will be discouraged as it may lead to increased degrading that may be irreparable (Department of Agriculture 1995:14).

Government will also take responsibility for continuous interaction between researchers and extension officials to ensure the transfer of knowledge and technologies in managing natural resources.

Lastly, Government will take responsibility for determining the pricing of natural resources (especially water use) to limit possible abuse thereof (Department of Agriculture 1995:15).

- **Financing**

All farmers should have equitable access to appropriate financing with interest rates being market related (Department of Agriculture 1995:16).

Other policy areas identified and addressed in the White Paper included institutional infrastructure, timely information, especially on physical conditions such as veld condition for management purposes, pest management, agricultural production and

food supplies as well as agricultural technology, research, extension and training (Department of Agriculture 1995:17-24).

General principles underlying the White Paper are that agriculture has the responsibility of ensuring national food security and forms an integral economic driving force in rural areas. Farming systems should be sustainable and adaptable over time. Agricultural practices should take cognisance of the limited and variable natural resources and the risks associated therewith and the issue of security of tenure as well as the impact thereof on the status of the natural resources (Department of Agriculture 1995:25- 31).

The White Paper, to a large extent, addresses all major aspects in the field of agriculture. It has a specific focus on increasing the participation of small-scale farmers and the impact that this sector may have on the economy as well as on household food security. The important role of the commercial agricultural sector has not been neglected. The White Paper also emphasizes the importance of corrective farming practices, appropriate land use and integrated planning and the impact of agriculture on the development of a sustainable economy in South Africa.

All of the above is balanced against the fact that any agricultural activity should be conducted in such a way that the country's limited natural resources should be conserved and managed accordingly. The responsibility rests with the land users, but Government has the responsibility to intervene where and when necessary. The White Paper specifically states the importance of protecting high potential agricultural land and the effective utilization thereof.

However, the White Paper was based on principles and addressed areas where policies should be developed on either national or provincial scale for further implementation. In the case of natural resources management and the preservation of high potential agricultural land, very few such policies have been developed. With regard to Gauteng, as the area of interest for this study, no formal policy has yet been published on this topic.

5.2.2 Agricultural policy in South Africa: A discussion document, 1998

In 1998, four years after the change of the political dispensation, a completely renewed agricultural policy was developed by the national Department of Agriculture, signed by the then minister of Agriculture, Minister Derek Hanekom, and published as a discussion document. This policy followed on the 1995 White Paper on Agriculture. In the foreword, Minister Hanekom emphasizes that agriculture is one of the building blocks of a strong economy that will assist in the creation of jobs and reduction of poverty, whilst protecting the natural resources (Department of Agriculture 1998:v).

The policy states that the responsibility of maintaining the future of South Africa's natural resources is the responsibility of all its citizens. Users of the land and water must have the incentive, knowledge and necessary resources that will allow sustainable utilization thereof (Department of Agriculture 1998:vi). It was envisaged that support would be given to community-based natural resource management with the added legislation that would prevent the abuse of the resources.

The policy regards the contribution of agriculture to the economy as much higher than quoted. This assumption is based on the influence of periods of drought or high rainfall on the economy and the calculation of agriculture's contribution is concluded as far more complex. Low yields affect the contribution to the GDP by 0.5 to 2%. However, although a relatively small sector, agriculture's contribution is further influenced by the backward and forward linkages with various sectors. What should always be taken into consideration in calculating this contribution is not only agriculture's contribution to food production and food security, but also the employment it creates both full- and part-time (Department of Agriculture 1998:5).

The policy further acknowledges that agriculture has met the demands on food consumption through its domestic production for some items. However, it states that the growing population will lead to an increase in the demand for food, particularly for items such as wheat, meat and dairy products and, to a lesser extent, maize (Department of Agriculture 1998:9).



- **The role of Government**

The policy sees the role of Government as creating an environment for the development of the agricultural sector through Government support structures, the building of partnerships with both the private sector and farmer organizations, and accountability for the services. Government will not take responsibility for direct subsidizing, but the focus will rather be on the provision of basic agricultural research, the supply of market information, relevant legislation and the protection of the environment through regulating environmentally damaging practices or resource conservation (Department of Agriculture 1998:10).

Three strategic aims were identified, namely building a competitive agricultural sector; increasing the number of successful smallholding farmers, and the preservation of natural resources by ensuring the development of policies and the establishment of institutions (Department of Agriculture 1998:12).

- *Building a competitive agricultural sector both nationally and internationally* will focus on the following:
 - The deregulation of markets and assisting farmers in addressing the challenges that may arise from the deregulation.
 - The improvement of export opportunities, whilst protecting producers and consumers from abuse.
 - Government's assistance to farmers in coping with risks that form an integral part of agriculture.
- *Increasing the number of successful smallholding farmers* will be achieved by focusing on the improvement of agricultural research and making it accessible to more farmers. The improvement of accessibility of rural finance and an increase in the growth of farmer organizations for further support to farmers will be a priority. Additional support to livestock farmers, especially in communal areas and the re-structuring of agricultural parastatals to improve their support to small-scale farmers as well as an increased investment in rural areas, will be another focal point.

- *The preservation of natural resources* by ensuring the development of policies and the establishment of institutions
 - This will focus mainly on the development of an agricultural conservation policy for water, land and biodiversity. It will strive for the efficient use of water through irrigation development, management and the re-distribution of water.
 - Focusing on land, a policy will be developed that will result in the sustainable utilization of agricultural natural resources, but with the responsibility residing with farmers and communities. A national land care programme will also be initiated. However, the policy will be drafted on the principle of meeting internationally agreed standards and commitments.

- **Reforming markets**

The policy put great emphasis on the reforming of markets in order to make them more accessible (Department of Agriculture 1998:14-19). The aim in reforming markets is to increase productivity and efficiency and to allow for opportunities for easier access to markets by small- and medium-scale farmers (Department of Agriculture 1998:14). Many of these objectives were captured in the *Marketing of Agricultural Products Act, 47 of 1996*, which again stipulates that Government will only intervene if food security or employment is affected negatively. Government will closely monitor activities that involve competition, determination of input and output prices, and market access, especially looking at transport infrastructure in rural areas. It will also monitor the quality of produce, the use of production systems and access to and format of market information, with special focus on the small- and medium-scale farmer (Department of Agriculture 1998:16).

The policy also has a vision to create new international trade opportunities for farmers. It states that a static comparison will be conducted on the country's natural resource base (soil, climate and water), whilst a dynamic comparison will be done based on infrastructure, skills and technological innovation (Department of Agriculture 1998:19).

- **Risk management**

The policy acknowledges the high risks associated with agricultural practices, especially in relation to the country's limited rainfall and the possibilities of drought, hail, fire, pests and diseases (Department of Agriculture 1998: 33). It is the view of Government not to supply drought relief but rather to promote other possibilities of reducing the risk. The hope is expressed that this view will limit farmers' dependency on the environment and damage to crop production, and encourages them to rather revert to other land use practices.

Four tasks were identified to assist, namely the promotion of technologies and practices, determined through research on topics such as water harvesting and fodder enhancement that will aim at reducing risks, provision of timely and accurate information on climate and market trends, preventative action against major hazards, and lastly, the provision of information to farmers on matters such as taxation advantage and insurance that may result in coping with income shortfalls (Department of Agriculture 1998:33).

- **Research**

The policy has a clear focus on strengthening agricultural research and the linkage of the research topics to agricultural policies (Department of Agriculture 1998:38-40). The main elements in achieving this goal include a focus on trade and marketing, food security and drought, and extension with the specific aim of addressing the requirements of the small-scale and resource poor farmers. It also includes the supply of public funding for research on areas like food security, public health, the protection of the environment and the improvement and protection of plant and animal science as well as the sharing of information (Department of Agriculture 1998:38-39).

Research priorities were identified in the following areas (Department of Agriculture 1998: 40):

- Land care as well as soil and water management that impact on development planning, especially in the former homelands

- Appropriate livestock management, especially on rangeland management
- Integrated farming systems with the focus on low external input agriculture
- Adaptive research in various fields focusing on constraints that small-scale farmers have to face
- Irrigation farming and the improvement of productivity
- Land reform programmes and the impact thereof on household income and the environment
- Environmental management that includes, as a high priority, matters relating to environmental pollution, pesticide residues and the impact of invasive plants as well as the use of water.

However, it is imperative that the outcome of these research topics be made available to extension staff as the first point of contact between the farmer and Government.

- **Livestock farmers**

The policy specifically mentions the role of the livestock farmers and identifies areas of improvement, such as sustainable management of areas involved in livestock farming, enhancement of the overall productivity of this sector and the improvement of support services (Department of Agriculture 1998:58). Of major concern is the impact of stock numbers on the condition of the veld or the degradation thereof and to what extent the veld can be economically recovered (Department of Agriculture 1998:58). The management of the grazing capacity allocated to an area is crucial for the sustainability of the sector.

- **Conserving natural resources**

The policy identifies three main areas in this section, namely efficient irrigation, promoting sustainable resource use, and international obligations (Department of Agriculture 1998:67-76).

- *Irrigation*

The policy states specifically that the management of water resources is the responsibility of the Department of Water Affairs and Forestry (DWAF). However, agriculture is a major user of water resources. More than 50% of water in South Africa is used for irrigation purposes indicating that 1.5 million ha or 8% of suitable arable land is under irrigation (Department of Agriculture 1998: 66). In view of the mentioned it was recommended that a detailed irrigation policy be developed that should be linked to the water policy.

Management of water resources will ensure the sustainable utilization of the country's resources. The allocation thereof should be guided by economic considerations.

Water rights should be applied on high value labour intensive crops and provision should be made for the trading of saved water allocations (Department of Agriculture 1998: 67). Water allocations should be regularly reviewed by DWAF, but with the involvement of the Department of Agriculture (DoA) and where applicable delegations to the Catchment Management Agencies (CMA's) and Water User Associations (WUA).

- *Sustainable resource use*

The principle of this section of the policy states that it is Government's responsibility to ensure the sustainable use of the country's natural resources and that the resources are used within its capacity with the minimization of risks. It states further that the initial custodian of the land is the land user and that the responsible parties should be held liable for any damage to the environment. Government should develop policies that will ensure these actions.

However, there are a number of factors that pose a major threat to the sustainable use of the natural resources. These threats include degradation of the resources, population growth and overcrowding of the communal farming sector. Also regarded as threats are the impact of technology, lack of appropriate information on conservation technologies, no effective zoning of land use,

especially on land that has a high agricultural potential, which is lost to other land uses in areas where it is economically viable to be retained for agricultural use, and the inefficient use of water resources (Department of Agriculture 1998:71).

The policy commits itself to ensuring the conservation and protection of the natural resources. It further ensures the coordination between the various role-players in support of conservation as well as the enhancement of integrated production and conservation (Department of Agriculture 1998:72). These should be achieved through the establishment of community-based LandCare programmes with continuous effort to rehabilitate degraded land following an economic assessment. It also promotes awareness and education on LandCare and the amendment or replacement of the *Conservation of Agricultural Resources Act, 43 of 1983* and the *Fertilizers, Farm Feeds, Agricultural Remedies and Stock Remedies Act, 36 of 1947*.

At the time of developing the policy, the *Sub-division of Agricultural Land Act, 70 of 1970* was in the process of being repealed, but to date the Repeal Act has not been accented and has therefore not been implemented. It is stated that Act 70 of 1970 was developed to prevent the sub-division of agricultural land into unviable economic units as well as the use of high potential agricultural land for any other use. However, at time of the policy development, Government believed that this was not environmentally or economically possible. It is stated that the use of agricultural land for other uses, for example eco-tourism, may result in improved resource management. Attention should be given to effective land use planning and the long-term and efficient use of agricultural resources should not be compromised for short-term commercial interests (Department of Agriculture 1998: 72).

The balancing of the use of incentives for sustainable resource use versus the fact that farmers themselves should take responsibility for conserving the resource requires a more detailed analysis (Department of Agriculture 1998:73).



- *International obligations*

Even though agriculture has many positive advantages, it can also have a negative impact on the environment by posing a threat to biodiversity and natural areas as well as wetlands. South Africa supports a number of international agreements on conservation and the protection of the environment, such as the Convention to Combat Desertification and the Ramsar Convention on Wetlands (Department of Agriculture 1998:75, 76). The Department of Agriculture will continue to meet its obligations to these agreements.

Although the policy was developed a number of years ago, it acknowledges the importance of a prosperous agricultural sector in building a growing economy and, in this case, a very newly elected democratic economy. There was more focus on the role of agriculture in comparison to the broader South African community.

However, as this policy was developed soon after South Africa's new democracy, it focused, to a large extent, more on addressing the imbalances of the past through rectification of skewed land use patterns. Land tenure, access to finance, creation of job opportunities and market access, other supporting structures, and the creation of opportunities for newcomer farmers were also discussed. The policy's main point of departure is the creating of farming opportunities for small- and medium-scale farmers on a much bigger scale than stated in the White Paper on Agriculture in 1995 as well as allowing them the right to farm, supported by increased economic participation.

In many instances, the intention of the policy was for Government to only intervene where a public good could be achieved and where this action could not have been achieved through the involvement of the private sector and individual farmers (Department of Agriculture 1998:10).

What is lacking in the policy is a detailed analysis of the resource base of the country that will give a better, fact driven, foundation for determining secondary and tertiary actions that are completely reliant on primary factors. In addressing strategic issues, limited attention was given to sustainable agricultural production and the protection of the natural resource base of the country as well as the effective utilization thereof. A cause of grave concern is the contradiction in regard to the protection of high potential

agricultural land (Department of Agriculture 1998:71) whilst the repeal of Act 70 of 1970 was on-going.

One of the main activities recommended in the policy and achieved thus far is the establishment of a LandCare programme, facilitated by the national Department of Agriculture (DoA), but implemented by the provincial Departments of Agriculture.

To date, no amendments or changes have been made to the *Conservation of Agricultural Resources Act, 43 of 1983* or *Act 70 of 1970*. For a number of years the Sustainable Utilization of Agricultural Resources Bill (SUAR) or also lately known as the Sustainable Utilization and Protection of Agricultural Resources Bill (SUPAR) has been in the process of development (see chapter 6).

5.2.3 Strategic Plan for South African Agriculture, 2001

In a follow-up to the White Paper on Agriculture, 1995 and the Agricultural Policy, 1998, a Strategic Plan for South African Agriculture was developed in 2001 and is to date the major strategic document governing agriculture in the country. The Strategic Plan was a combined effort between the national Department of Agriculture (DoA) and organized agriculture represented by Agri-SA and the National African Farmers' Union (NAFU). This combined effort had the advantage of the management of agriculture being seen from a commitment perspective, built on a unique partnership.

Objectives identified in the Strategic Plan include (Department of Agriculture 2000:viii):

- A common vision for all involved parties
- The establishment of a framework for future policy development and implementation
- Improvement of confidence in the sector leading to an increase in participation and access and resulting in global competitiveness, growth and profitability
- Sustainable development through lasting partnerships.

The vision set for the agricultural sector is (Department of Agriculture 2001:viii):

“A united and prosperous agricultural sector” with a shared common goal by all role-players, namely “To generate equitable access and

participation in a globally competitive, profitable and sustainable agricultural sector contributing to a better life for all”.

The Strategic Plan was based on the following three strategic goals (Department of Agriculture 2001:7-18):

- **Equitable access and participation**

The opportunity should be created for all interested in the sector to have access thereto and unlock the full potential thereof. Negative perceptions of the agricultural sector should be replaced by a vibrant, successful and represented sector that takes cognisance of environmental and food safety measures. Land reform is important in ensuring rural stability. According to the Strategic Plan, economic empowerment can only be achieved through access to land and the improvement of security of tenure. Continuous post-settlement support is a critical success factor that includes extension support as well as the establishment of infrastructure such as fencing and dip tanks and soil conservation works, as well as access to finance.

- **Improved competitiveness and profitability**

Profitability should not only be seen in primary production, but also in agro-processing and agro-tourism. Important factors influencing profitability are high input prices, cost of labour, infrastructure, high risks, capital cost and the productivity of the natural resource base. Taking into consideration the relatively low potential of the country's soils and the unstable climate in comparison with other countries, the South African agricultural sector has a difficult role in competing globally. Government may have to reconsider additional programmes, such as the reduction in taxes, structural adjustment incentives and innovative financial instruments to name but a few. According to the Strategic Plan, a farmer has to become a business manager in order to be more successful.

- **Sustainable management of natural resources**

The strategy aims at using the resources in a sustainable manner and the impact thereof on land care, distribution of land, the use of land within the urban environment, the preservation of ecological sensitive areas and the zoning of high potential agricultural land. The use of correct farming and production systems is encouraged.

As an outcome of these three strategic goals, a number of complementary strategies have also been identified, including improved co-operative governance, sustainable and integrated rural development, knowledge and research, international co-operation and safety and security (Department of Agriculture 2001:18-23). Furthermore, it should be mentioned that it was recommended that agriculture has to guide local government through the inclusion of a chapter in their Integrated Development Plans (IDP's) on improving knowledge management regarding agriculture (Department of Agriculture 2001:19).

It was envisaged that the provincial departments of agriculture would adopt the strategic plan in designing their own strategic plans and budget planning.

The Strategic Plan acknowledges that there are a number of challenges that will have to be addressed (Department of Agriculture 2001:6), including

- *Limited competitiveness and profitability*
South African Agriculture needs to increase its competitiveness in both the local and international markets. Factors that need to be reviewed are the current high input costs, low productivity and poor marketing strategies.
- *Skewed participation*
Due to the legacies of the past, participation in this sector does not reflect the compilation of the population.
- *Limited investment in the sector*
Due to the high risk associated with agriculture, the sector does not attract high investment confidence and this needs to be addressed.
- *Inadequate supporting structures*
There is a major requirement for the improvement of supporting structures in this sector that involves the improvement of inadequate resources, poor executive decisions and weak governance.

- *Limited availability of natural resources*

The management, protection and utilization of the natural resources and the output per unit of land need to be addressed as well as the improvement of agricultural infrastructure and other supporting structures.

In bringing the Strategic Plan closer to implementation, a number of priority programmes and actions were identified, which in summary were focused mostly on improved access to land, land reform and the empowerment of targeted groups, the transfer of technology, risk management and access to finance and markets (Department of Agriculture 2001:8).

Being very comprehensive, the Strategic Plan manages to create quite a broad scope of strategic issues that need to be addressed. To a certain extent, the Strategic Plan is a more balanced and realistic approach that focuses on the core issues driving agriculture. Objectives that need to be addressed, the challenges that the sector faces as well as some priority programmes were highlighted. Nevertheless, the success of the Strategic Plan is dependant on the further development of topic-specific policies and their implementation. However, the interaction and responsibility shared between national and provincial Departments of Agriculture were not clearly defined.

Limited attention was given to the importance of the protection of the natural resource base, although the limited agricultural potential of the larger part of the country was mentioned. The protection of the resource base was not identified as a priority programme even though it was regarded as one of the strategic goals.

5.2.4 National Department of Agriculture Strategic Plan

In 1997, a Joint Ministry of Agriculture and Land Affairs was created consisting of the national Department of Agriculture (DoA) and the Department of Land Affairs (DLA). The aim of this step was to align parallel functions between the two departments in terms of land administration and land reform for agriculture, while also ensuring security of tenure, sustained production of food, economic growth and effective and sustainable utilization of natural resources.

The national Department of Agriculture (DoA) is regarded as a major role-player in managing and driving agriculture in the country. Together with its partners in the organized agricultural sector, private sector and supported by the nine provincial Departments of Agriculture, its aim is to achieve a united and prosperous agricultural sector, as stated in the Strategic Plan for South African Agriculture (Department of Agriculture 2001:viii).

The DoA has the responsibility to ensure that it lives up to the challenges identified in the Strategic Plan for South African Agriculture, through the development of policies and legislation. Underlying this is the DoA's responsibility to ensure environmentally sustainable development and production in achieving food security and poverty alleviation, through the effective management of risks and the transfer of technology systems (Department of Agriculture 2004a:15).

The DoA's vision is "a united and prosperous agricultural sector". This vision is to be achieved through identified strategic objectives that include ensuring access to safe and nutritious food, equitable access and participation to the sector, maximum growth, sustainable management of the natural resources as well as ecological systems, effective governance and information and knowledge management (Department of Agriculture 2004a:26).

The mission statement of the Department is to "lead agricultural development for sustainable economic growth and food security in South Africa and in the process plays a constructive role in agricultural development in Africa" (Department of Agriculture 2002:18). A number of service delivery programmes or priority areas have been identified, including food security, settling of new farmers and the development of new markets for farmers. It further includes increased accessibility to finance, the transfer of technology and information, the management of natural resources as well as the management of risks and improved service delivery (Department of Agriculture 2004a:45).

The priority area of natural resource management's aim is to "promote the sustainable management of agricultural land and water resources in agriculture" (Department of Agriculture 2004a:55). This also includes the preservation of biodiversity and exploring options for minimized use of fossil fuels. The objective is to develop policies and

legislation that will result in the suitable utilization of natural resources that is to result in increased productivity, food security and poverty alleviation.

The Department's programme: Production and Resources Management and Use is responsible for carrying out the above objective. Of particular importance here is the Directorate: Land Use and Soil Management (LUSM), which is responsible for the administration of both Act 70 of 1970 and Act 43 of 1983 as well as for driving the processes associated with the newly proposed Sustainable Utilization and Protection of Agricultural Resources Bill (SUPAR). The responsibility for the development and expansion of the web-based information management system, the Agricultural Geo-referenced Information System (AGIS), which hosts all existing spatial information on natural resources, is also located within this Directorate (Department of Agriculture 2004c:76). LUSM also drives the national LandCare initiative that promotes sustainable land use management practices and the rehabilitation of degraded natural resources. Since 1998, R140 million has been invested in this project, 300 rural projects have been implemented and 13 000 jobs created (Department of Agriculture 2004c:6).

The Directorate: Water Use and Irrigation facilitates the protection of agricultural land resources against degradation and establishes groundwater developments and runoff control infrastructure in priority areas. It also promotes agricultural water management through the effective use of water and the development of policies aligned to the National Water Act (Department of Agriculture 2004c:85).

According to deliverables earmarked in the Strategic Plan for the Department of Agriculture 2006, the development of a national spatial plan, depicting high and unique agricultural land, and the submission of the SUPAR Bill for promulgation were anticipated (Department of Agriculture 2006a:80). To date, the SUPAR Bill has not been promulgated. In terms of a national spatial plan indicating high potential and unique agricultural land, the only reference available is the development of criteria indicating high potential and unique agricultural land (Schoeman 2004:1). No spatial plan has been developed.

The Minister of Agriculture, Ms. Lulu Xingwana, once again emphasised the importance of the utilization and protection of agricultural land at a Ministerial Lekgotla held in November 2006. She stated spatial planning needs to be enhanced to deal with the loss

of agricultural land for other developments and to identify marginal land that can be used for other uses, such as housing (Department of Agriculture 2006g:2)

5.2.5 Department of Agriculture's Incentive-based Framework to Promote Sustainable Utilization of Natural Resources in Agriculture: A discussion document, April 2006

Although protection of natural resources and the sustainable use thereof forms part of the core function of the national Department of Agriculture, concerns have been raised about the effectiveness in reaching this objective. One of the reasons stated for the inability to achieve this objective is the lack of an incentive programme for land users. Similar incentive programmes have been implemented by the mining and energy sectors (Department of Agriculture 2006f:3). The aim of such a programme is to create awareness and to promote best management practices on-farm. Examples of best management practices include the reduction of inputs, the decrease of soil erosion as well as sediment control measures, among other things. Conservation barriers and buffers, and prevention and mitigation measures against disasters such as avoiding overstocking of livestock, runoff management and the prevention of veld fires are further examples. The incentives would include any activity that would lead to the conservation of biodiversity and the environment and would motivate farmers to adopt and apply these measures. This programme will apply to all farmers.

It is important that an incentive scheme is balanced against the fact that farmers are ultimately responsible for the sustainable utilization of agricultural resources (Department of Agriculture 2006f:16). The type of incentives can include education and training, community grants and technical assistance, cost sharing, credit-linked stewardship, research and trade as well as compliance and disaster management. Each farmer who applies will be requested to develop a conservation plan that will act as a contract after approval. Regular monitoring and evaluation assessments will be conducted to determine compliance with the conditions. This programme has not yet been implemented.

5.2.6 Department of Land Affairs' Strategic Plan, 2006 - 2009

As mentioned earlier, both the Department of Agriculture and the Department of Land Affairs (DLA) resort under the same national Minister.

The vision of the Department of Land Affairs is “to be a global leader in the creation and maintenance of an equitable and sustainable land dispensation that results in social and economic development for all South Africans” (Department of Land Affairs 2006b:9). Efficient land use and land administration services are among the core objectives of the Department.

The restrictions that the sub-division of agricultural land place on land users are challenges identified in their Strategic Plan that the DLA faces. The DLA would like to promote intensive farming practices on smaller farm sizes, thereby limiting speculation in land, as well as the implementation of land tax. The Department is committed to the development of a land-based integrated land use and development plan through its responsible area of Spatial Planning and Information. The Strategic Plan states that DLA is focused on the development of an evaluation framework as well as guidelines for the development of Spatial Development Frameworks, according to the terms stated in the *Development Facilitation Act, 67 of 1995* (Department of Land Affairs 2006b:4-7).

The DLA is committed to produce maps that will identify the most suitable areas for land reform targets and for development that is to commence with four provinces in the 2006/2007 financial year (Department of Land Affairs 2006b:7). This commitment is to ensure higher productivity and land use, thereby leading to sustainable development.

The DLA is also responsible for and administrates a number of Acts focused on land redistribution, restitution and tenure reform. In terms of land planning and information, the DLA administers the *Development Facilitation Act, 67 of 1995* and the *Spatial Data Infrastructure Act, 54 of 2003* (Department of Land Affairs 2006b:11).

- **Land reform**

Land reform was identified as one of the main objectives of the Department of Land Affairs. This objective not only had a direct impact on the Department of Agriculture and its activities, but also on the natural resource base of the country.

The Government's RDP vision for agriculture (South Africa 1994a:1) states "Apart from land reform as a measure to improve the quality of life and rural development as a strategy to create a strong, dynamic and balanced economy, agriculture is also identified as an important sector to build the economy. .

At the Land Summit held in 2005 it was again emphasized that by 2014, 30% of White-owned farms should be re-distributed to previously disadvantaged individuals. This amounts to 26.4 million ha of farmland with a re-distribution rate of 1.75 million ha distributed annually since 2000. To date, about 3.3 million ha have been distributed (Department of Agriculture 2007:8).

In 2007, the Minister of Agriculture (Department of Agriculture 2007:9) again stated that there is a strong possibility that the Sub-division of Agricultural Land Act, 70 of 1970 will be reviewed to release more land for land reform purposes. This land, however, should only be used for agricultural purposes or human settlement.

5.2.7 Combined initiatives between the Departments of Agriculture and Land Affairs

- **Land and Agrarian Reform Programme (LARP)**

The LARP is a newly formed combined initiative between the DoA and the DLA. It provides a framework for increased service delivery on land reform and agricultural support with the aim of increasing the rate of transformation. It is also one of the 24 Presidential priorities. The main objective of the LARP is to redistribute 5 million hectares of land that belonged to white commercial farmers to 10 000 new agricultural producers by 2009. Comprehensive agricultural support will be given to these farmers. It is hoped that through these actions agricultural production will increase by 10 to 15% (Department of Agriculture 2008a:2).

LARP will also focus on identified areas to increase synergy between land redistribution, agricultural production and agri-business development, increased support to projects and cooperative governance through effective planning and implementation of projects. Partnerships with sector partners, the decentralization of decision-making and the monitoring of individual projects are further focal points. This is to ensure limited failure with regard to land reform projects, as was the case, due to the emphasis on the acquisition and redistribution of land and limited post-settlement support (Department of Agriculture 2008c:8).

Focal areas will be defined in each province but could include (Department of Agriculture 2008c:9):

- High potential production corridors along national roads
- Large concentration of farm dwellers or farm dweller evictions
- Municipal areas with a strong demand for land reform or farm employment by people living on farms
- Identified market opportunities
- Women and youth as priority beneficiaries.

Provincial forums are to be established in each province to oversee annual provincial land reform planning, whilst District Committees will be responsible for the planning and decision-making responsibilities. The implementation structures at both provincial and district level have to ensure that the LARP projects are viable and sustainable over a five-year incubation period. Each project will have an individual business plan that will be used for monitoring purposes. Land will only be transferred to beneficiaries who have required sufficient entrepreneurial and other skills to farm successfully and have received appropriate training or passed a skills test. The criteria for the mentioned still need to be determined by the Land Reform Steering Committee (Department of Agriculture 2008c:21).

A review of the Land Redistribution for Agricultural Development (LRAD) programme identified a need to further de-centralize agricultural support to districts and local municipalities and to incorporate these into the municipal Integrated Development Plans. At these levels, responsibilities will revolve around joint planning, funding for projects, identification of beneficiaries, identification of economic opportunities,

identification of the most suitable land and acquisition of the land and the sub-division thereof, if needed. The settling of the beneficiaries, including housing, development of agricultural infrastructure and the provision of support such as extension services, input supply and credit, will also form part of the responsibilities.

It is also acknowledged that about 80% of the current extension staff are not adequately trained and this will now receive attention through a joint Extension Recovery Plan. The National Agricultural Marketing Council (NAMC) will take responsibility in identifying two to three key commodities per province with their associated requirements. Extension staff will then be trained in these areas.

The area-based planning will be used as a vehicle to enhance integrated planning. Suitable and productive land will be identified in close proximity to the current location of beneficiaries.

The land acquisition targets for the country for the 2008/09 year have been set at 1 500 000 ha, with 48 565 ha earmarked for Gauteng. For the 2009/10 year, 2 800 000 ha need to be addressed for the country, with 60 000 ha in Gauteng. It is acknowledged that current budget allocations are not sufficient to address these targets, but will be addressed through additional funding from the National Treasury (Department of Agriculture 2008c:32).

The LARP programme will be managed in accordance with the *Intergovernmental Relations Framework Act, 13 of 2005* (Department of Agriculture 2008c:10).

- **Settlement and implementation support (SIS) strategy for land and agrarian reform in South Africa**

This strategy forms part of the Commission for the Restitution of Land Rights in the Department of Land Affairs. The aim of the Settlement and Implementation Support (SIS) strategy is to ensure that support is provided to beneficiaries of the land reform programmes in order to ensure sustainability and forms part of the LARP programme (Department of Agriculture 2008b:3). It is hoped that this strategy, which has not yet been adopted as a comprehensive joint strategy, be accepted by key government

departments, in this case specifically the national Department of Agriculture and the Department of Land Affairs.

Land reform is regarded as an essential element of sustainable rural development. The strategy is therefore aimed at building capacity within local municipalities for the fast tracking of agricultural development and land and agrarian reform, based on community leadership. These are linked to area-based planning as well as integrated and developmental planning (Department of Agriculture 2008b:7). It is envisaged that land reform should form part of district and local municipalities' IDP's.

5.2.8 White Paper on Spatial Planning and Land Use Management, 2001

“Land is an asset. Land is scarce. Land is fragile” (Department of Land Affairs 2001:1). These are the opening words of the *White Paper on Spatial Planning and Land Use Management* developed in 2001. Land, according to the White Paper, is a basic requirement for food, shelter and people's existence.

The White Paper was developed in response to Chapter 10 of Agenda 21, from the United Nations Conference on Environment and Development held in 1992 in Rio de Janeiro, in order to provide guidance on land use legislation. Agenda 21 states that the “broad objective is to facilitate allocation of land to uses that provide the greatest sustainable benefits and to promote the transition to a sustainable and integrated management of land resources” (Department of Land Affairs 2001:2).

The White Paper acknowledges that conventional land use planning has failed and that the emphasis should shift to appropriate integrated planning for land resource management in support of decisions. This will entail the development of policies to best address sustainable management of land, improved planning and monitoring as well as the strengthening of capacity and coordination between role-players. Development programmes should be holistic, taking into consideration the resource's capabilities as well as the requirements of the land users. These development programmes should thus include spatial planning for both urban and rural areas with principles and norms aimed at sustainable land use management.

It is further proposed in the White Paper that municipalities should take the lead in this requirement and to be the most important sphere in decision-making, pending the type of decision required. In each province a provincial land use tribunal and an appeal tribunal will assist in certain situations, with the national Minister as the last resort (Department of Land Affairs 2001:3).

The White Paper provides minimum details on the specifications that should be included in the Spatial Development Frameworks (SDF's) as part of the Integrated Development Plans (IDP's). An SDF should consist of a policy that focuses on land use and development, supported by guidelines, a capital expenditure framework as well as a strategic environmental assessment. The SDF must guide and inform priorities areas for development, both for housing and infrastructure development, areas for conservation or specific identified land uses as well as the intensity of development. It should further be indicative, but supported by a land use management scheme. The former is regarded as the legal requirement in guiding or informing development of land, whilst the land use management system is seen as the binding requirement. The regional SDF's should form the basis for a national spatial planning framework that will allow for sustainable planning on a national level, focusing on national priorities. Norms guiding the development of the spatial plans and land use management should include the restructuring of inefficient settlements, promoting the sustainable use of land resources, addressing the need versus the development potential, economic growth and the protection of rights. It should promote accountability by the various spheres of government in decision-making, cooperative governance and implementation of proposed plans as well as transparency in the decision-making process (Department of Land Affairs 2001:11). However, it should be noted that the policy states that norms will not be descriptive in "black and white" but will rather allow for decision-making on a uniform and consistent manner based on a set of criteria (Department of Land Affairs 2001:12).

The underlying principles governing the development of spatial plans and land development should be conducted in accordance with the law. Decision-making should be dictated by approved policies within the three spheres of government. Existing natural, cultural and environmental resources should be protected. Compact human settlement should be promoted that limits urban sprawl. Land that is currently used for agricultural purposes should not be re-allocated to any other use except where there is

a real need. Prime agricultural land should remain in production (Department of Land Affairs 2001:13).

The White Paper is the initial phase of a proposed new law, the “Land Use Management Bill” that will ultimately replace that Physical Planning Acts and the Development Facilitation Act, allowing especially local government to formulate its own policies and strategies pertaining to land use management and development (Department of Land Affairs 2001:6). According to the White Paper (Department of Land Affairs 2001:18), land use management includes changes in land use, the development of undeveloped land, the management of the sub-division and consolidation of land parcels as well as the upgrading of informal settlements and the further development of towns.

Not stated in the White Paper is the role of specialists’ input and applicable research outcomes conducted by other spheres of government. These could have an influence on the proposed spatial planning of local government, such as the incorporation and protection of identified prime agricultural land in the policies. However, it acknowledges that integration should occur between the three spheres of government, which, to date, has not yet happened.

Another issue addressed by the White Paper is the conflicting application procedures and legislation. Pending the type of development, it frequently requires more than one application to be lodged at various government departments responsible for the management of an Act or policy related to land use management and development. This results in additional costs for the applicant, long waiting periods and in many instances authorities providing different conflicting decisions. One such an example currently is the use of the Development Facilitation Act parallel to existing planning laws such as the Sub-division of Agricultural Land Act, 70 of 1970 (South Africa 1970:1). A uniform procedure in terms of application processes should therefore be adopted across the country to ensure consistency in decision-making. This would then facilitate addressing the conflicting land use policies and the lack of effective spatial planning within the various spheres of government (Department of Land Affairs 2001:4).

The National Government has the responsibility to manage spatial planning and land use management and development, thus providing an effective framework, with local government acting as the responsible decision authority. On a national level, the White

Paper makes specific reference to the Department of Land Affairs taking the responsibility for the proposed Land Use Act that is to replace all older planning laws, nationally, provincially or locally. The new law will determine policies, norms and standards as well as land use frameworks (Department of Land Affairs 2001:27).

5.2.9 National Strategy for Sustainable Development (NSSD)

Early in 2006, the Department of Environmental Affairs and Tourism (DEAT) released a draft national strategy on sustainable development. This was developed as a follow-up to the 2002 World Summit on Sustainable Development, where it was decided that nations should take steps to ensure that national strategies were in place and implemented by 2005 (Department of Environmental Affairs and Tourism 2006c:7).

The strategy opens with its vision (Department of Environmental Affairs and Tourism 2006c:5):

“South Africa aspires to be a sustainable, economically prosperous and self-reliant nation state that safeguards its democracy by meeting the fundamental human needs of its people, by managing its limited ecological resources responsibly for current and future generations, and by advancing efficient and effective integrated planning and governance through collaboration nationally, regionally and globally”.

It acknowledges that economic growth and the utilization of resources have been running parallel to each other, thereby resulting in an increase of pressure on the resources. Whilst striving to reach the increased demand for food consumption, the status of nutrients in soil has decreased, production has lowered and there has been no increase in the production of alternative energy sources. Despite the increase in the economy in 2005/2006, unemployment and poverty levels still remain high. This emphasizes the fact that in achieving sustainable development, not only should the economic and social development factors be taken into consideration, but it should also manage the increased pressure of the rising levels of the use on natural resources and waste generation (Department of Environmental Affairs and Tourism 2006c:5).

Trade-offs in terms of natural resources should be non-negotiable in order to maintain their existing levels. A precautionary approach, supported by effective governance, should be followed.

The focus of the NSSD is to ensure cross-sectoral policy development, implementation and integration, especially in the long term. It allows for monitoring and evaluation, decision-making for spatial development and improved interaction between government and society. The Strategy provides a framework whereby existing governmental policies and governance systems and planning tools, such as the IDP's and SDP's can be integrated, managed and evaluated (Department of Environmental Affairs and Tourism 2006c:7-8).

Challenges that need to be overcome include the lack of a common and consensual national vision, as well as a lack of capacity for sustainable local development, long-term planning and interactions between government and society. Climate change and its implications is a challenge that needs to be faced. Climate change will have a direct impact on production and the agricultural sector as a whole. Other challenges are the over-utilization of soils resulting in soil degradation with a threat to food security and land reform, as well as the utilization of high potential soils for urban development and other infrastructure. The Strategy converted this challenge to an opportunity by stating that a ban should be placed on the loss of high potential agricultural land to other uses and that this land should form part of the IDP's and the Spatial Development Frameworks (Department of Environmental Affairs and Tourism 2006c:16).

Strategic priorities identified to meet the challenges include the sustainable utilization of natural resources, sustainable infrastructure and communities as well as integrated planning and capacity building.

A starting point in achieving the priorities is through effective spatial planning. In recent years many data sets have been made spatially available that can assist in effective spatial planning, from a natural resource perspective. In developing their IDP's and Spatial Development Frameworks, not many municipalities make use of the information resources and tend to ignore sustainable resource use in their planning. The State of the Environment Reports have also identified that there is also room for improvement in the availability of detailed environmental data or updated data sets. Specific mention is

made to data on land cover, detailed spatial information on soils, aspects of water quality and some aspects of biodiversity. Also important is the inclusion of sustainable resource use criteria that need to be incorporated in spatial data sets used for spatial planning purposes (Department of Environmental Affairs and Tourism 2006c:32).

Another concern identified by the strategy is the non-existence of a sustainable development cluster where policy makers and ministers attending these forums have the opportunity to prioritise this very important issue. It could therefore be concluded that the Constitutional commitment to sustainable development has not yet been put in place (Department of Environmental Affairs and Tourism 2006c:27).

The *National Environmental Management Act, 107 of 1998* makes provision for the compilation of environmental implementation plans (EIP's), environmental frameworks (EMF's) as well as environmental impact assessments (EIA's). The EIA's especially focus on decision-making at a local level. In the case of EIA's, in particular, the lack of capacity and insight has hampered this process. It has also resulted in tension between environmentalists and developers, as these two are seen as complete opposites to one another (Department of Environmental Affairs and Tourism 2006c:60).

The NSSD proposes that an Action plan be put together in order to make it a reality. A positive political momentum should be maintained as well as high-level commitment. Existing capacity should be strengthened and roles and responsibility clearly identified and defined. Furthermore, policies and strategies should be aligned and stakeholder interaction increased through the use of information and communication. Monitoring and evaluation processes should evaluate each initiative (Department of Environmental Affairs and Tourism 2006c:70- 72).

5.2.10 White Paper on Environmental Management Policy

The Department of Environmental Affairs and Tourism developed a *White Paper on Environmental Management Policy* in 1997. The current status of the paper is unknown.

The White Paper defines the environment as “the conditions and influences under which every living creature exists or develops. The conditions and influences include the

natural environment, both renewable and non-renewable natural resources, social, political, cultural and economic factors as well as natural and constructed spatial surroundings.” According to the Paper, the interaction between people and the environment as well as the use of natural resources depend on culture, economic consideration, social aspects, politics and value systems (Department of Environmental Affairs and Tourism 1997:4).

The vision of the environmental management policy aims to create an environment where there is sufficient food, clean air and water as well as decent homes and surrounding green spaces that would allow people to live in harmony with their natural surroundings. This vision would be achieved through integrated and coordinated environmental management that addresses improvements in the quality of life of people. Moreover, access to land and natural resources, the integration of economic development and environmental sustainability, efficient use of energy resources, as well as public participation in environmental management would be addressed in this vision (Department of Environmental Affairs and Tourism 1997:7).

The focus of this White Paper is to ensure that the environment is so managed within its limitations that the carrying capacity is not exceeded. The principles for environmental management encapsulated in the White Paper include accountability, allocation of functions, wise use of resources as well as capacity building and education, among other things. It also includes limited conflict of interest, coordination, demand management, environmental justice, good governance, open information, precaution and prevention, and the principle of “the polluter pays” (Department of Environmental Affairs and Tourism 1997: 10-12).

Goals needed for environmental sustainability and integrated management identified include an effective institutional framework and legislation, sustainable resource use and impact management. The latter includes low input farming systems and the use of chemicals in agricultural practices. Integrated planning participation and partnerships in environmental governance, education, information management and international cooperation also form part of the identified goals. As part of information management, environmental indicators need to be developed for informed decision-making based on applicable information (Department of Environmental Affairs and Tourism 1997:14).

DEAT, as the lead agent in managing the environment, is responsible for the development of policies, strategies and legislation as well as the coordination thereof, the regulation and enforcement of environmental matters. The development of information management systems for all aspects of information management, participation in environmental governance and the monitoring and review of environmental performances of other national departments, forms part of this mandate. The White Paper sets out the powers and responsibilities pertaining to environmental management within the various spheres of government, as well as the mechanisms and instruments that can be used in achieving them. Provision is also made for research and development opportunities in identified areas (Department of Environmental Affairs and Tourism 1997:25-29).

5.3 GAUTENG PROVINCIAL GOVERNMENT POLICIES AND STRATEGIC OBJECTIVES WITH THE FOCUS ON AGRICULTURE

5.3.1 Gauteng Government strategic objectives

In 2004, the Gauteng Provincial Government embarked on a five-year strategic plan, identifying key programmes and priority actions that need to be achieved by 2014, taking into consideration the unique interactions in the context of the province. The main challenge for the province up to 2014 is to reduce unemployment and poverty by 50%, resulting in a better life for all. In achieving this challenge, the province has to progress from economic growth to employment growth, increase job creation possibilities, provide food security, and respond to increasing environmental pressures.

The slogan, “Fighting poverty and building safe, secure and sustainable communities” forms an integral part of the province’s strategic plan (Gauteng Provincial Government 2004b:1).

Strategic priorities identified in reaching the 2014 goals (Gauteng Provincial Government 2004b:3) are to

- Enable faster economic growth and job creation.
- Fight poverty and build safe, secure and sustainable communities.

- Develop democracy and nation building and realize the constitutional rights of people.
- Build an effective and caring government.

Key programmes with regard to the protection of the natural resource base envisaged in achieving the above, include maximization of the use of agricultural land, sustainable development, the protection of the environment, and local food production (Gauteng Department of Agriculture, Conservation and Environment 2006a:18). This commitment will only be achieved through the co-ordination and integration of activities at all levels of government.

In the longer term (ten years), the building of houses on well-located land and the promotion of increased densification, as well as sustainable development will need to be effectively addressed. The Gauteng Provincial Government's (2005:1) strategy is to develop Gauteng into an integrated and globally competitive city region.

5.3.2 Gauteng Growth and Development Strategy (GDS)

As the smallest, but also the most economically active of the nine provinces, Gauteng annually experiences a large influx of people, with the hope of finding better opportunities. Although many people do find opportunities and ultimately contribute to the ever-growing economy of the province, many are not so fortunate. The province therefore, also has a high level of unemployment and poverty. The GDS seeks to address these contradictions. The strategy focuses on actions rather than just a policy and reaches across all sectors of society in the province.

The aim and purpose of the GDS is to ensure that all socio-economic development within the province is integrated, sustainable and participatory across all spheres of government, to ensure growth and job creation with increased involvement of the private sector. This reflects the seriousness of the Gauteng Provincial Government's commitment to socio-economic growth and development that can be monitored and evaluated (Gauteng Provincial Government 2005:5).

The strategy acknowledges the contribution of the province to the economy of the country in various sectors, but also states that land is an important resource and land

use in the province is inefficient and not appropriately structured. Urbanization and its associated activities are a threat to the survival of many plant and animal species, the quality of air and water resources, and the potential and utilization of agricultural land.

The GDS is informed by the Trade and Industry Strategy, the Gauteng Integrated Development Plan, the Local Economic Development Strategy, the State of the Environment Report, the Environmental Implementation Plan, the Global City Region Strategy, and other policies (Gauteng Provincial Government 2005:13).

The vision of the GDS is to create a better life for people living in the province through long-term sustainable growth, addressing the socio-economic needs of the people, creating jobs and alleviating poverty (Gauteng Provincial Government 2005: 16).

The GDS mechanisms are focused mainly on economic opportunities and socio development. One of the identified GDS mechanisms is investment and support to selected economic growth sectors. Agriculture has been identified as one of the growth sectors with special emphasis on agro-processing and biotechnology (Gauteng Provincial Government 2005:19).

The GDS also identified “strategic levers” aimed at expanding or upgrading the province’s “hard economic infrastructure” supported by the “soft infrastructure”. Among these are an accessible and affordable public transport system, provision for housing, public safety and an urban information system. Also included are the 2010 Football World Cup, a public health system, human resource development, and social development. All the identified levers will build on existing or proposed projects and/or programmes in the provincial departments. The roles and responsibilities in achieving the aforementioned have broadly been identified within and outside of government and targets in the priority areas for the next ten years determined. These priority areas include economic growth, increased employment and job creation, skills development, small and medium business support, black economic empowerment (BEE) and NEPAD (Gauteng Provincial Government 2005:24-31).

5.3.3 Gauteng Strategy for Sustainable Development (GSSD)

The Gauteng Strategy for Sustainable Development (GSSD) was developed to address priority areas that have to be met in sustainable development and to ensure that an integrated approach is followed in putting policies into action. The GSSD aims to build on the existing active policies within the province regarding sustainable development. The focus is not on “what” has to be done, but rather on “how” it should be done to achieve a desired state for sustainable development (Gauteng Provincial Government 2006b:iv).

Clear targets have been identified for Gauteng to become “an economically productive, socially just, globally competitive region that manages and utilizes resources sustainably”. The strategic priorities identified include building capacity and human resources, improved intergovernmental and social relations, sustainable economic development as well as human settlements. These priorities address concerns such as economic growth, resource and eco-system protection and income equity that are linked to the Gauteng 2014 planning process. Linking these priorities to action and assigning them to key provincial departments will ensure the implementation of the GSSD (Gauteng Provincial Government 2006b:iv).

Historically, Gauteng has primarily focused on economic growth and development whilst environmental protection was regarded as secondary. In many instances there are huge trade-offs when it comes to the cost of development, especially in terms of the protection of scarce natural resources. However, economic growth is directly linked to the intensive utilization of natural resources that could make economic growth unsustainable. This, again, will have an impact on poverty, as limited funds will be utilized to address the resource constraints (Gauteng Provincial Government 2006b:1).

The GSSD envisages a common understanding of the concept of sustainable development that would clearly identify priority areas, roles and responsibilities of various role-players both within and outside of government that will ultimately have an impact on strategic policy planning with regard to economic development, social planning and environmental management. If done correctly, this approach would result in an improved economy for the province (Gauteng Provincial Government 2006b:2).

The GSSD was developed in three phases, namely the state of play assessment, the identification of the vision, principles and priorities, and the Gauteng Sustainable Development document.

5.3.3.1 *State of play assessment*

The state of play assessment provided an overview of the *status quo* with regard to sustainable development in Gauteng. Its purpose was to create a forum for future discussions by all interested parties. The integration between economic viability, social equity and ecological integrity in good governance is stressed and regarded as a pre-condition for achieving sustainable development (Gauteng Provincial Government 2006c:2).

The report acknowledges that any strategy on sustainable development should primarily be focused on natural resource management with a re-focus on production and consumption patterns.

To date, a number of laws, both nationally and provincially, have been developed that, to a certain extent, address the common principle of sustainable development. The *National Environmental Management Act, 107 of 1998* focuses on the principle that development should be regarded as “socially, environmentally and economically sustainable” (South Africa 1998a:9). According to the report, the *Development Facilitation Act, 67 of 1995* also supports development that is environmentally sustainable, whilst the *National Housing Act, 107 of 1997* and the *National Land Transport Transition Act, 22 of 2000* function under the principle of optimal utilization of resources that is economically sustainable. At provincial level, the *Gauteng Planning and Development Act, 3 of 2003* describes principles for the promotion of sustainable development whilst the *Gauteng Tourism Act, 18 of 2001*, the *Gauteng City Improvements District Act, 12 of 1997*, the *Gauteng Housing Act, 6 of 1996* and the *Gauteng Transport Infrastructure Act, 8 of 2001* all make reference to sustainable development (Gauteng Provincial Government 2006c:7). However, prior to the development of the GSSD, no formal provincial policy or strategy was in place to promote the integrated principle of sustainable development, especially in terms of environmental sustainability.

At local implementation level, the *Municipal Systems Act, 32 of 2000* aims to deliver services in a financially and environmentally sustainable process. The most important “tool” in driving the process of sustainable development at local level, is the IDP process. Municipalities are becoming more aware that sustainability should be incorporated in all stages of planning and development (Gauteng Provincial Government 2006c:10).

Other documents relevant to this topic include the Gauteng Environmental Implementation Plan; the Strategic Plan of the Gauteng Department of Agriculture, Conservation and Environment; the Gauteng Growth and Development Strategy; the Gauteng Spatial Development Framework; the Integrated Sustainable Rural Development Strategy; the Environmental Management Framework; the Urban Edge Policy, and several other local management plans and strategies that have either been completed, are under revision or in the process of being finalized (Gauteng Provincial Government 2006c:13-23).

The level of interaction in the development of the documentation is unknown, including the relevant role-players’ awareness thereof and the extent of implementation, as well as its status in comparison with other existing policies, strategies and legislation.

The state of play report highlighted the following important factors:

- Gauteng has the responsibility to develop a sound policy on sustainable development, taking into consideration the unique dynamic interactions existing in the province.
- All sectors active in the province should form part of the strategy. A holistic approach should thus be followed in developing such a policy.
- Gauteng has to determine which actions will work best for the province. Although there are a number of laws, policies and regulations available to deal with sustainable development, there is no clear guidance on how these principles should be put into action to ensure that it works optimally.
- Roles and responsibilities should be clearly identified and actions integrated that cut across all spheres of government.

In essence, it was concluded that the GSSD should address areas of priority and review the required legislation and the implementation thereof. It should also ensure an integrated approach and policies should be translated into action (Gauteng Provincial Government 2006c:11).

5.3.3.2 Vision, principles and priorities

The vision for sustainable development in Gauteng is, “By 2020 Gauteng will be an economically productive, socially just, globally competitive region that manages and utilizes resources sustainably” (Gauteng Provincial Government 2006b:13). This vision encapsulates the effective and sustainable utilization and distribution of the province’s natural resources.

The mission of sustainable development focuses on limiting the utilization of non-renewable resources, the re-use and recycling thereof and bringing it into balance with its rate of replacement as well as the reduction of waste generation. This mission should be achieved in such a manner that it will still contribute to the economic growth of the province and improve its social equality through effective intergovernmental forums and increased awareness and understanding of the importance of a well-balanced development strategy (Gauteng Provincial Government 2006b:14).

The Strategy admits that current national as well as provincial legislation is weak in terms of sustainable development. Although many policies and strategies have been developed with goals and deliverables, they have never been monitored and evaluated (Gauteng Provincial Government 2006b:15). In view of this, the GSSD has set up a number of key objectives or measurable goals. These goals need to be incorporated in the provincial departments’ strategic plans as well as in their budgets.

Key objectives identified include an efficient transport system; improvement in human resources and capital; sustainable utilization of land and eco-system functioning, but also linking resource use to economic development; improved intergovernmental relations, and environmental health management. The outcome of these is, to a large extent, targeted at addressing mostly social matters, such as the eradication of the current housing backlog, but with increased densification, job creation, improved access to services, improvement of skills, and economic development, in comparison with

primary natural resource protection where fewer targets were set. However, one of the targets set for the short term includes the incorporation of sustainable development criteria in the decision-making processes as well as the adoption of these goals by all provincial departments and supported by annual reviews and assessments. This includes the incorporation of the requirements in the municipal IDP's.

The strategic priorities identified put great emphasis on effective communication and awareness, starting at school level already. Improved inter-governmental relations are also crucial. The GSSD should not be regarded as an isolated activity in a provincial department, but should firstly focus on the incorporation of sustainable development in policies, planning and decision-making. Secondly, it should result in the strengthening of government-related businesses (Gauteng Provincial Government 2006b:31).

Major challenges exist in achieving the first focal point. To date, limited interaction regarding sustainable development has occurred between the various provincial departments, as well as between the provincial governmental levels and local government, with a lack of regular monitoring and assessment on the achievement of targets. GDACE has specifically been targeted to be responsible for ensuring that sustainability is incorporated in the municipal IDP's, and also for the effective monitoring and enforcement of legislation and policies.

Existing structures, such as the Gauteng Intergovernmental Forum, should be utilized to reinforce the priority of sustainable development for both provincial and local government, whilst the Premier's Coordinating Forum should be utilized in coordinating service delivery. All the proposed priorities and actions should, however, also be expanded to the private sector. The private sector should at all times be aware of the importance of sustainable development, but Government should also be transparent in its actions and not cause unnecessary delays in reviewing development applications.

Economic growth for sustainable development also forms an integral part of the GSSD. The creation of jobs and sustainable production is a major focal point. Here the agricultural sector can contribute through land reform, the identification of niche markets, and intensive production systems.

Human settlement and the impact on natural resources and ecosystems is another factor that the province has to address. The GSSD acknowledges that natural resources form the basis for future growth and development (Gauteng Provincial Government 2006b:49).

Due to the competing land uses in Gauteng, attention needs to be given to addressing the impact of human settlement on water, air quality and biodiversity. Urban sprawl, the high migration rate into Gauteng, the increased demand for fossil fuels, higher emission of carbon dioxide and impacts associated with mining activities are some of the challenges that need to be addressed. Attention should also be given to the threat to the conservation of natural resources, viability of land for agricultural purposes, air pollution and the higher demand for water. Activities identified to address these include higher density development, rehabilitation of strategically located land, conservation of land and appropriate zoning for land use. A balanced approach to managing the demand for competing land uses is required (Gauteng Provincial Government 2006b:52).

Implementation of the GSSD should occur through the Environmental Implementation Plans, the annual departmental budgets, and the State of the Environment Reports.

Key criteria in the successful implementation of the GSSD include a long-term vision, comprehensive planning, taking into consideration opportunities, protection of natural resources, and prevention of the degradation of the environment, thus a balanced approach between economic, social and environmental aspects, resulting in the creation of jobs and the alleviation of poverty (Gauteng Provincial Government 2006c:25).

5.3.4 Gauteng Department of Agriculture, Conservation and Environment (GDACE) Strategic Plan, 2004-2009

GDACE's primary focus is on the protection, conservation and management of natural resources, especially taking into consideration the highly urbanized nature of the province. The sustainable utilization of the natural resources is a pre-requisite for continuous economic growth and addressing basic needs, such as safe and adequate water and healthy food for the population of the province. The management of the

provincial natural resources base and the eradication of poverty are regarded as two integrated processes (GDACE 2004b:7).

In its Strategic Plan, GDACE (2004b:8) states that true development “is guided by equity, justice and social and environmental considerations”. The Department (2004b:2) sees its role through mandated responsibilities as making Gauteng the “most powerful economic block on the continent”, through adhering to the principles of sustainable development as set out in Agenda 21 and the Johannesburg Plan of Implementation (JPOI).

The Department’s strategic priorities are aligned to the 2014 strategic objectives of the Gauteng Provincial Government.

The mission of the Department (2004b:9) is “to contribute towards economic and social development through public and private partnerships by enhancing the quality of life and sustainable utilization of agricultural and natural resources”. This mission is achieved through a number of established programmes in the Department, namely Agriculture, Sustainable Natural Resource Management, Conservation, Environment and Veterinary Services.

The aim of the programme Agriculture is “to optimise the contribution of sustainable agriculture towards the equitable development of all communities and the economy in the Gauteng Province in order to enhance food security, income generation, job creation and the quality of life”, whilst the aim of the programme Natural Resource Management is “to provide a support services and professional expertise to land users in support of equitable, efficient and sustainable management and utilization of natural resources on a wide range of land use patterns”. Similarly, the aim of the programme Environmental Planning and Impact Assessment is “to contribute to sustainable development and improved quality of life by facilitating sustainable land use and land use patterns” (GDACE 2004b:9-10).

The Department adheres to a number of national laws that include the *Conservation of Agricultural Resources Act (CARA) Act, 43 of 1983*, the *Sub-division Act, 70 of 1970*, the *National Environmental Management Act, 107 of 1998*, and the *Environment Conservation Act, 73 of 1989*, whilst it also adheres to provincial laws such as the

Environmental Impact Assessment Regulations (Regulations 1182 and 1183). The Department (2004b:12) puts great emphasis on ensuring co-operative governance between the various organs of state at national, provincial and local level.

Competing land uses is one of the main challenges facing the Department. This includes urban sprawl, which is regarded as an undesirable or unsustainable practice. This concern is being addressed through co-operation between various departments in the province, such as the Departments of Housing, Public Transport and Roads, and Development Planning (GDACE 2004b:27).

On average, the Department (2004b:8) receives 12 000 EIA applications per annum that have to be reviewed through its regulatory mandate, including authorizations for new developments.

Policy-related work that the Department (2004b:14) is responsible for, includes the formulation of a strategy and plan for sustainable development, as set out by the JPOI and a plan to manage EIA authorization on competing land uses in the province.

The Branch: Agriculture, in GDACE, identifies strategic priorities that include the zoning of high potential agricultural land for the exclusive use of agriculture, optimal and sustainable use of agricultural land for primary production and improved levels of food security, especially at household level. A comprehensive agricultural plan and policy on the optimal utilization of high potential agricultural land has been identified as a service delivery indicator. Agricultural land will be spatially mapped and protected through the development of policy and legislation for agricultural production purposes. The Gauteng Agricultural Potential Atlas (GAPA) developed in 2002, identified agricultural land that should be protected for agricultural use. GAPA was updated in 2005/6. The principles and rationale behind the development of GAPA and its importance in protecting high potential agricultural land for agricultural purposes form the core section of this study (see chapters 6 and 8).

The Department encourages the optimal use of agricultural land, especially the planting of high value crops to increase the contribution of primary agriculture to the GDP with the aim of preserving the high potential agricultural land from competing land uses. A

balanced approach between the protection of high potential agricultural land and development requirements should be followed (GDACE 2004b:16).

The sub-division of agricultural land is supported, if it would result in the utilization of land not currently utilized, to change race and gender patterns and production in the agricultural sector. However, the Strategic Plan also states that sub-division allows for one residential unit per sub-divided portion, but would ultimately result in a change of land use from agriculture to the establishment of residential rural estates (GDACE 2004b:20). This activity may result in urban sprawl, especially if it is located outside the urban boundary; therefore a precautionary approach is followed in authorizing the sub-division of land.

The Directorate: Natural Resource Management's strategic priorities include focusing on sustainable land use and land use patterns, effective and optimal conservation of the province's natural resource base and the involvement of the public in achieving these priorities (GDACE 2004b:30). The need for strategic environmental assessments, environmental management frameworks and spatial development frameworks in sustainable use of natural resources, has been identified and promoted.

To further emphasise achieving its mandate, the Department's Branch: Sustainable Utilization of the Environment (Directorate: Conservation) developed a Conservation Plan (C-Plan) with the aim of highlighting priority areas in terms of biodiversity, sensitive ecosystems and conservation areas (GDACE 2004b:35). Agricultural production is regarded as a threat to biodiversity and ecologically sensitive areas.

The Directorate: Environmental Planning and Impact Assessment focuses closely on the implementation of the Environmental Implementation Plan and the GSSD thus balancing the protection of the environment without compromising economic, as well as social development. It is the responsibility of this Directorate to process development applications for the province, measured against a set of environmental management tools and support systems such as the Gauteng Open Space Plan (GOSP), the Gauteng Agricultural Potential Atlas (GAPA), C-Plan, as well as sector-specific guidelines and policies (GDACE 2004b:43).

As the environment is an area of joint responsibility between the three spheres of government, this unit works in close collaboration with not only sister Directorates within GDACE, but also with relevant provincial Departments, such as the Departments of Finance and Economics Affairs, Local Government, Housing and Public Transport, Roads and Works, as well as national Departments such as Agriculture, Water Affairs and Forestry and Land Affairs (GDACE 2004b:45).

Lastly, the Directorate: Compliance and Enforcement is tasked with formal and informal enforcement actions within the mandate of the Department (GDACE 2004b:59).

The Department supports densification and infill development within the urban development boundary, due to limited available land and is very cautious should a new development result in the loss of land suitable for crop production or biodiversity.

In a press release in 2004, the MEC K Mosunkutu stated that the concept of sustainable development is a fundamental building block in executing the legal requirements of GDACE. GDACE is bound by the Constitution to protect the environment and to ensure sustainable utilization of natural resources, whilst ensuring justifiable economic and social development (GDACE 2004c:2).

Key indicators developed by GDACE that should be reported on an annual basis include statistics on area of undeveloped land, area of natural areas remaining, open space within and outside the urban edge, extent of agricultural land, percentage of high potential agricultural land used for agricultural purposes, and land condition (GDACE 2004b:89).

5.3.5 Gauteng Agricultural Development Strategy (GADS), 2006

The Gauteng Agricultural Development Strategy (GADS) was developed in 2006 with the aim of re-looking at the implementation of agriculture in Gauteng. Due to the urbanized nature of the province, a shift occurred from primary production to secondary and tertiary sectors. GADS acknowledges the challenges identified in the 2001 National Agricultural Strategy, as well as a number of government policies, technical reports and market research studies, with special reference to the Gauteng Growth and Development Strategy pertaining to the role that agriculture has to play in the province.

The purpose of GADS was to develop the first and second agricultural economy and to increase agriculture's contribution to job creation and poverty alleviation. It further focuses on the development of a framework for improved investment in the province, aligning agricultural development with the Gauteng Growth and Development Strategy, and integrating existing national and provincial policies and strategies applicable to the province (GDACE 2006a:6).

It is stated that key factors determining income for farmers are production (influenced by rainfall and management) and prices. Issues like drought and poor management may result in a loss in production. Risk mitigation is a critical success factor in farming. Supporting these is an improved transport infrastructure and an evaluation of the levels of subsidizing loan finance. The focus should be on the reduction of input costs, improved productivity and access to markets (GDACE 2006a:14).

The motivation behind GADS was two-fold. Firstly, GADS reviewed the contribution of the agricultural economy to the Gauteng Growth and Development Strategy (GDS). The GDS emphasized the importance of the role of agriculture in the agro-processing and biotechnology sectors, stating that by focusing on the mentioned aspects, agriculture in Gauteng could create a competitive advantage. However, primary production should not be ignored, but should rather be focused on specific niche markets. Secondly, GADS looked at mechanisms to strengthen the agricultural economy. Building blocks identified, include the protection of the agricultural resources, with special reference to the protection of the high potential agricultural land, effective spatial agricultural planning, market analysis, farmer support and development, increased competitiveness of the sector, partnership formation, and an increased focus on vulnerable groups in agriculture (GDACE 2006a:20).

The mechanisms were seen as individual building blocks that were supported by initiatives and objectives. In terms of the protection of agricultural resources, the Gauteng Agricultural Potential Atlas (GAPA), a resource inventory and future legislation were identified as initiatives, with the updating of GAPA and the protection of high potential agricultural land regarded as primary objectives. This information will serve as a planning and decision support tool and allow for a better understanding of the importance of protecting this non-renewable resource for decisions that need to be taken on the most effective land use practice. GAPA needs to be expanded to a fully-

fledged agricultural plan with identified agro-ecological zones. Each zone needs to be developed and addressed within its natural resource context and competitive edge (GDACE 2006a:24).

In terms of farmer support, a value chain and development sector formed part of the strategy focused on the primary, secondary and tertiary sector within the first, second and third economies. An underlying factor of the value chain is effective land use planning on land identified for agricultural use and legally protected. This will result in its optimal use. The Branch: Agriculture in GDACE will have to ensure that the mentioned is incorporated in the Intergraded Development Plans (IDP's) of the municipalities and metros.

Critical success factors identified, include the continuous development of technical information systems, such as GAPA and the Agricultural Geo-referenced Information System (AGIS), legislation and regulation development, land use planning and zoning, and co-operation between the spheres of government (GDACE 2006a:35).

Strategic priorities developed from the Strategy (GDACE 2006a:38) include:

- The completion of a detailed agricultural land use inventory
- The establishment of agricultural hubs or zones, but in alignment with the national Department of Agriculture's approach
- The development of niche market and high value crops
- Intensive animal agriculture
- Additional value adding in close proximity of the urban market
- Applying applicable farming technology.

5.3.6 Gauteng Environmental Implementation Plan, 2001-2004

A Gauteng Environmental Implementation Plan (EIP) was developed in 2002 to meet the requirements of the *National Environmental Management Act, 107 of 1998*. GDACE had been mandated by the Gauteng Cabinet to develop the plan on behalf of the Gauteng Provincial Government. The purpose of the plan is to align and coordinate all environmental policies, plans and programmes assigned to the relevant provincial departments and decisions taken by them, in order to ensure sustainable development

and protection of the environment. The plan focuses on ensuring the limited duplication of effort and the promotion of consistency in taking decisions that have an impact on the environment (Gauteng Provincial Government 2002: 2).

In addition, the Environmental Plan is based on co-operative governance and allows for the close monitoring of achievements and the promotion and protection of a sustainable environment. Within the EIP, formal coordination between key departments on environmental matters is indicated, but it is stated that no forum will be established dealing only with environmental matters, but that these should rather be addressed on a project-specific basis within the existing forums. GDACE was delegated the task of evaluating applications pertaining to natural resources and the living environment and providing extensive comments on the Land Development Plans and Integrated Development Plans, compiled by the local authorities (Gauteng Provincial Government 2002:17).

A checklist for assessing key environmental issues in the province, which is to be used for screening purposes, includes determining the basic needs and service provision, the extent of water and air pollution, urban sprawl and the possible loss of sensitive habitats, high potential agricultural land and open space, waste management and the loss of cultural resources (Gauteng Provincial Government 2002:20).

Each provincial department in the province is evaluated in their field of responsibilities to and impact on environmental compliance. The provincial departments will be held responsible for the implementation of the EIP recommendations relevant to them. These Gauteng provincial departments as well as local authorities have to report to GDACE annually on the extent of their compliance with the EIP.

5.4 CONCLUSION

This chapter discussed strategic objectives in the South African sustainable development priorities, with special reference to agriculture. It was found that although legislation and policies had been put in place on most of the vital issues, in many cases little had been done to date to ensure consistent and effective implementation.

Chapter 6 examines national and provincial legislation and policies.

NATIONAL AND PROVINCIAL LEGISLATION AND POLICIES

6.1 INTRODUCTION

To date, various Acts, Bills and policies have been put in place to govern and manage the resources of the country with the aim of sustainable use thereof. The area of responsibility for most of the national Acts is located within various national Departments and enforceable on a national level, although in certain instances these responsibilities can be delegated to provincial level. The provincial government is also responsible for provincial Acts that are only enforceable within the boundaries of the province. The same principle applies to Bills and policies. The development of strategies in the various Government departments discussed in chapter 5, takes its mandate and responsibilities from the Acts, Bills and policies that they have to manage.

This chapter highlights the *most relevant* Acts, policies and Bills currently active in the country that have a direct influence on the topic of this study. A detailed analysis of all the legislation in the country would show that the underlying factor of sustainability that addresses aspects of human behaviour and interaction with the world around them, is to be found in most of the legislation.

6.2 NATIONAL ACTS

- **The Constitution of the Republic of South Africa 1996 Act, 108 of 1996**

The new Constitution of South Africa was published on 18 December 1996 (South Africa 1996a:1). It is regarded as the supreme law of the country and any law that is inconsistent with the Constitution is regarded as invalid.

Chapter 2 of the Constitution consists of the Bill of Rights. Section 24 of the Bill of Rights in the Constitution (South Africa 1996a:10) stipulates that

“Everyone has the right -

- (a) To an environment that is not harmful to their health or well-being and
- (b) To have the environment protected for the benefit of present and future generations, through reasonable legislative and other measures that –
 - (i) Prevent pollution and ecological degradation;
 - (ii) Promote conservation; and
 - (iii) Secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social developments”.

Section 27 of the Bill of Rights (South Africa 1996a:12) focuses on health care, food, water and social security, stipulating that

“(1) Everyone has the right to have access to -

- (a) Health care, including reproductive health care;
- (b) Sufficient food and water; and
- (c) Social security, including, if they are unable to support themselves and their dependants, appropriate social assistance.

(2) The state must take reasonable legislative and other measures, within its available resources, to achieve the progressive realization of each of these rights”.

Chapter 3, section 40 of the Constitution makes provision for a co-operative Government and the interaction between the three spheres of Government, namely national, provincial and local (South Africa 1996a:21). One of the principles stipulated in section 41(1), is the exercise of powers of the three spheres of government that does not encroach on the geographical, functional or institutional integrity of another sphere of government (South Africa 1996a:21). It stipulates further that the three spheres should co-operate with each other through mutual trust and good faith. They should inform one another on matters of common interest, coordinating their actions and legislation, adhere to procedures and avoid legal proceedings against another (South Africa 1996a:21). According to section 154 national and provincial governments should support local government in managing their affairs.

Draft legislation on a national and provincial level that will affect local government must be published for comment before it is presented to Parliament (South Africa 1996a:63). Provinces have the authority to pass legislation on any matter that relates to their

functional area as stated in Schedule 4 of the Constitution (South Africa 1996a:47). In the case of conflict between national and provincial legislation, national legislation that applies to the country as a whole prevails over provincial legislation, on condition that the national legislation deals with a matter that cannot be dealt with effectively on provincial level. In order for national legislation to be fully effective, uniformity is required across the nation in terms of norms and standards, frameworks or national policies. Section 146 (South Africa 1996a:60) stipulates specifically that national legislation is required, *inter alia*, for the protection of the environment.

Schedule 4 of the Constitution focuses on the functional areas of concurrent national and provincial legislative competence. According to this schedule, agriculture, environment, nature conservation, regional planning and development, urban and rural development and soil conservation are described as areas of concurrent national and provincial legislative competence (South Africa 1996a:117). Provincial planning, on the other hand, is the exclusive functional area of the provincial legislative competence (South Africa 1996a:119).

- **Conservation of Agricultural Resources Act (CARA), 43 of 1983**

This Act is regarded as one of the principal Acts governing the protection of agricultural natural resources. The Act was assented to on 21 April 1983 and came into effect on 1 June 1984 (South Africa 1983:1). The main aim of the Act is to control the utilization of natural agricultural resources to ensure the conservation of soil, water and vegetation, as well as the combating of alien and invasive plants. According to Section 1 (South Africa 1983:1-3), conservation of natural agricultural resources includes the protection, recovery as well as the reclamation thereof. Urban areas are mostly excluded from the provisions of the Act with the exception of the regulation of weeds and invasive plants (South Africa 1983:1-3).

The management authority of this Act resides with the Directorate: Land Use and Soil Management (LUSM) within the national Department of Agriculture (DoA) and is a replacement of the *Soil Conservation Act, 76 of 1969*. In an effort to conserve the country's natural heritage, especially the agricultural land, Act 43 of 1983 strives to act against any individual that deliberately misuses the natural resources. It provides control measures for the cultivation of virgin soil (soil that has not previously been cultivated or

not cultivated for at least ten years), the utilization and cultivation of land, including irrigated land, and the protection of water sources such as vleis (marshes, small lakes) and wetlands. It also includes control measures on the use of water to prevent water logging and regulate water flow patterns, the protection of vegetation, grazing potential of the veld, prevention of erosion and land degradation, construction and management of soil conservation structures, as well as the combating of weeds and invasive plants (South Africa 1983:5-6).

Non-compliance with the provisions of the Act may result in the issuing of a directive to land users, a fine and/or imprisonment. The Minister may, where deemed necessary for the restoration and reclamation of the natural agricultural resources, expropriate any land (South Africa 1983:13).

Sections 15 to 17 make provision for the establishment of conservation committees and regional conservation committees, as well as a Conservation Advisory Board with the purpose of promoting the conservation of the natural agricultural resources (South Africa 1983:13-18). The Act also provides for the establishment of schemes and financial assistance through subsidies, to restore and improve the status of the natural agricultural resources (South Africa 1983:7).

Section 29 (South Africa 1983:24) incorporates regulations to manage the requirements of the Act. These regulations came into effect on 1 June 1984. The regulations focus on control measures pertaining to the cultivation of virgin land (no virgin land shall be cultivated without approval), cultivation on land with a slope (cultivation should not occur on land with a slope of more than 20% or 12%, pending the locality) and the protection of cultivated land against erosion, through the actions of water and wind. The regulations further focus on the prevention of water logging and salination of irrigated land, the use and protection of water sources, regulating the flow of run-off water, grazing capacity requirements and the utilization of veld, including veld (bush) fires, as well as the restoration of eroded land and the combating of weeds and invader plants (South Africa 1984:1-13).

In March 2001, Amended Regulations 15 and 16 of CARA were promulgated (South Africa 2001). Regulation 15 demarcates alien plants into three categories and describes the management of identified plants within each category. Category 1 plants (declared

weeds) are plants that are no longer tolerated on either land or in water. These plants may not be planted or propagated in any form whatsoever. Category 2 plants (plant invader – commercial value) are plants that have a proven potential to become invaders, but that have a beneficial value in certain circumstances. These plants can be retained within special demarcated areas, but qualify as a water use and are therefore subjected to the requirements of section 21 of the *National Water Act, 36 of 1998*. Category 3 plants (plants invaders – ornamental value) are plants that also have a proven potential to become invasive, but have a popular ornamental value or are shade trees that will take some time to replace. These plants will not be allowed to occur anywhere else unless they were already in existence when the regulations came into effect. The plants can be retained provided that they do not grow within 30 m from a 1:50 year flood line of watercourses or wetlands. However, propagation material of these plants may no longer be planted, bought or sold. Regulation 16 focuses on bush encroachment. Bush encroachment refers to where individual plants are closer to each other than three times the mean crown diameter. Plants within this group are not alien plants, but indigenous ones that tend to become abnormally abundant. This is especially the case when an area is degraded due to mismanagement, such as overgrazing and fires. CARA prescribes management practices to prevent bush encroachment and the combat thereof, should it already have occurred.

The success of the implementation of this Act (CARA) is crucial. It is currently the only Act that directly addresses the issue of the protection of agricultural resources. These conservation measures are required, as sufficient land for agricultural production is needed to feed the growing population. In order to achieve this objective, the status of natural resources in the country needs to be protected and maintained or repaired. The Act also has the responsibility of ensuring that agricultural practices are not conducted in a way that contributes to the degradation of the environment. The enforcement of the Act is done through Resource Auditors deployed within each province. In many instances, however, the Conservation Committees that used to function in certain areas, as per directive from the Act, are no longer in operation.

Some of the control measures in the Act currently overlap with the provisions of the regulations in the *National Environmental Management Act, 107 of 1998*, such as the cultivation of virgin land. This duplication of responsibilities has still to be addressed.

- **Sub-division of Agricultural Land Act, 70 of 1970**

The Sub-division of Agricultural Land Act was assented to on 28 September 1970 and commenced on 2 January 1971. Prior to this Act, certain provinces had some legislation controlling the sub-division of land, but it was deemed unsatisfactory. Farms were divided into small unviable units, especially around urban areas where land was transformed to rural residential areas. The main objective of this Act is to manage the sub-division of agricultural land to prevent injudicious fragmentation of agricultural land and the creation of uneconomical units and thus manage the use of agricultural land. The Act aims at preventing the sub-division of land for residential purposes and illegal change of use (South Africa (Republic) 1970: 1).

Section 1 of the Act (South Africa 1970:1) defines agricultural land as any land, except land that falls within the jurisdiction of a local authority (municipality/town council), village council, health board or committee or land included in Ordinances or excluded by the Minister by a notice in the *Government Gazette*. The Act also excludes land defined as a township under the *Deeds Registries Act, 47 of 1937*, but excludes a private township not situated in a development area or land belonging to the State or held in a trust by the State or the Minister. The Act also excludes land that the Minister, after consultation with the Executive Committee, has excluded from the Act by notice in the *Government Gazette*.

Confusion arose in 1994 through the proclamation of “back-to-back” municipalities pertaining to the area of responsibility that resides under the provisions of the Act. Through Proclamation R 100 of 1995, agricultural land was re-defined as the land that was identified prior to the first election of members of the transitional councils, as stated in Act 209 of 1993 (South Africa 1995b:1). Briefly, this means that all land that resides outside of the municipal boundaries as they were prior to 1994 and that is not regarded as State land or Trust land and that has not been excluded from the Act via proclamation in a *Government Gazette* or a consent number, is regarded as agricultural land. Should State land be transferred to private ownership, the land concerned will again reside under the jurisdiction of the Act. The same principle applies to land currently within a proclaimed protected area or reserve. Also excluded from the provisions of Act 70 of 1970 is land that falls under the jurisdiction of a statutory body such as ESKOM and Transnet.

Actions that the Act (South Africa 1970:4) regulates include

- Sub-division of agricultural land
- Transfer of agricultural land into undivided shares
- Leasing of agricultural land for periods longer than 10 years
- The registration of a servitude over agricultural land if wider than 15 metres
- The registration of a usufruct or right of *habitatio* over agricultural land
- Establishment or extension of a township
- Registration of a share block scheme and a sectional title scheme.

The Minister or his/her delegate has the option to either refuse the application or give permission (with or without conditions) and after consultation with the relevant authority within the Province. Only after receiving approval and written consent, can the applicant submit the relevant plans to the Surveyor-General for approval and the registering of the relevant action by the Registrar of Deeds. Should a person not agree with the decision taken for an application, he/she has the opportunity to appeal to the Minister within 90 days of the decision (South Africa 1970:5).

The national norms applicable to Act 70 of 1970 include that a land unit, after sub-division, should be able to carry 60 large stock units per farm unit, calculated from the 1993 grazing capacity norms and standards regulated under CARA. In the case of dry land production, at least 100 ha of land should be available for production, whilst a minimum of 20 ha of arable land with 10 ha of water rights from a recognized water source will be permitted for irrigated land (Scholtz 2007: Personal communication; Pretoria).

According to the *South African Environment Outlook 2006*, this Act is not regarded as legislation that has an impact on environmental management (Department of Environmental Affairs and Tourism 2006b:57).

Of concern is a recent Supreme Court of Appeal judgement ruling that no land in South Africa can any longer be regarded as agricultural land. All land in the country, according to the judgement, resides under the jurisdiction of local municipalities. Should this scenario be accepted, it would result in the current legislation processes put in place to protect agricultural land and to limit the fragmentation thereof, such as Act 70

of 1970 and Act 43 of 1983, having no legislative footing at all. This paints a very dark picture for the country for future food security and job creation. Limited capacity resides within local authorities to manage agricultural land with their focus rather on development and infrastructure deployment. This case has been presented to the Constitutional Court (De Bruin 2008:6).

One of the concerns regarding the above judgement is the definition of agricultural land used in Act 70 of 1970. It is felt that the definition is too broad. The researcher is currently involved in developing a refined definition of agricultural land together with a number of experts in this field. However, this task can be regarded as easier said than done. Due to the lack of availability of norms, standards and guidelines that demarcate land for agricultural use based on its potential for cultivation, as well as its potential for grazing and other agricultural uses, the use of “potential” in defining agricultural land may result in more problems than answers. This definition may well end up using cadastre boundaries for demarcating agricultural land again until such time as agricultural land has been properly demarcated through a zoning process. It is hoped that the final definition will replace the current one used in the Sustainable Utilization and Protection of Agricultural Land Bill (SUPAR). This Bill is intended to ultimately replace Act 70 of 1970 and the *Conservation of Agricultural Resources Act, 43 of 1983* (Department of Agriculture 2006e:1).

- **Sub-division of Agricultural Land Act Repeal Bill of 1997**

The *Sub-division of Agricultural Land Act, 70 of 1970* was repealed by the Sub-division of Agricultural Land Repeal Act in 1997, assented to on 16 September 1998, but with the provision that the President proclaim a date in the *Government Gazette* for the Act to come into operation (South Africa 1997a:1). This action has not yet occurred, resulting in Act 70 of 1970 still currently being used by the national Department of Agriculture.

Political powers generally regarded Act 70 of 1970 as a limitation in making land available to more farmers for farming practices. The land market felt that there were large portions of land that were under-utilized – but the reason for the under-utilization was not known. It was felt that access to this land might result in a positive impact on production and provide for the resettlement of farmers on various farm sizes. According

to the then Minister of Agriculture, Mr Derek Hanekom, Act 70 of 1970 was expected to conserve agricultural land and to ensure maximum productivity, but it was felt that the Act did not achieve this objective. Unsuitable agricultural practices still continued and it was stated that alternative measures should be put in place to protect high potential agricultural land. One such option was to strengthen Chapter 1 of the Development Facilitation Act to ensure that high potential agricultural land is protected. The Minister stated further that the protection of environmentally sensitive areas, such as wetlands, and the conservation of land were of greater importance than protecting prime agricultural land for farming activities only. At that time, the Minister was of the opinion that eco-tourism would result in better resource management as well as an increased contribution to sustained biodiversity than agricultural land use. Apparently, this would create more jobs and sources of income (Farmers Weekly 1998: 38).

The White Paper on Land Policy recommended that Act 70 of 1970 be replaced by zoning regulations that could assist in the prevention of the loss of agricultural land or the degradation of natural resources. The zoning regulations should be compiled on a national level, but monitored and enforced on a provincial or local level (Department of Land Affairs undated:12).

Such national zoning specifications will not be conducted in the short term, but require lengthy interaction and discussion with relevant role-players. Therefore, the repeal should have been supported by statutory regulations to protect high potential agricultural or environmentally sensitive land.

The Portfolio Committee on Agriculture, Water Affairs and Forestry discussed the above matter in detail. The Chairperson of the Committee asked Professor MC Laker to give a presentation on the sub-division of agricultural land and its impact. In this presentation to the Committee, Laker (1995a:1) stated that the sub-division of agricultural land could not be regarded as either good or bad, but depended on the circumstances. There are areas in South Africa where successful small-scale irrigation farming operations can be observed. However, in terms of dry land grain producing practices, sub-division of land should be handled carefully. The sub-division of this land into small subsistence farming units is not acceptable and will not contribute to food security. Such small areas will only contribute to soil degradation. The outcome of such actions will only result in land being a place to live. According to Laker (1995a:2), a farm should be able to support a

farming family financially without over-exploitation of the land. His concerns were that Government would allocate “too small” farm portions to the previously disadvantaged communities for farming purposes or that the communities would be settled on scarce cropland. The lack of land use planning in these cases was a matter of concern for the sustainability of the farm. The Chairperson of the Committee, Ms Janet Love, summarized that all arable land should be protected for agricultural purposes and that Act 70 of 1970 should be maintained until new legislation had been put in its place (Laker, MC 2008: Personal interview; May 2008, Pretoria).

This matter was again discussed at the Committee in 1998. The Committee was then informed that the repeal of the Act was per instruction of the then Minister of Agriculture and Land Affairs. Concern was then raised that the *Development Facilitation Act, 67 of 1995* would not sufficiently address the vacuum if Act 70 of 1970 were to be repealed. The Chairperson concluded that clarification on this matter would be required from the Minister (Portfolio Committee on Agriculture, Water Affairs and Forestry 1998). No further follow-up on this matter was captured. To date, Act 70 of 1970 is still in use.

In the case of *Stalwo (Pty) Ltd versus Wary Holdings (Pty) Ltd*, the issue of the status of Act 70 of 1970 was again brought into the picture. The Supreme Court of Appeal (SCA) concluded that no land in South Africa is regarded as agricultural land *per se* and that all land falls under the jurisdiction of municipalities and that the Minister of Agriculture’s written permission will no longer be required (Supreme Court of Appeal 2007). This conclusion was reached without any input from the national Department of Agriculture. The matter has been referred to the Constitutional Court. The national Department of Agriculture has registered as an intervening party. Arguments available to the Department included that the SCA undermined the entire purpose of the Act, as it removes the designation of agricultural land from all existing agricultural land. The interpretation thereof threatened food production in South Africa and is therefore contradictory to section 27(1)(b) of the Constitution and that agricultural land was not eradicated by the transition to democracy (Budlender 2008:6).

On 25 July 2008, the Constitutional Court ruled that the demarcation of agricultural land is not tied to the demarcation of the transitional councils. Land demarcated as agricultural land retains this classification, irrespective of the development that occurred

within the local government structures. The national control over agricultural land is therefore still in place (Constitutional Court of South Africa 2008:2).

- **Environment Conservation Act, 73 of 1989**

This Act was the forerunner to the current *National Environmental Management Act (NEMA) (Act 107 of 1998)* and came into effect on 9 June 1989. Since its inception in 1989, this Act has been amended to a large extent with only a small portion still in effect today (South Africa 1989:1-18).

The purpose of the Act was to provide effective means for the protection and control of any activities that may have an impact on the environment. According to the Act (South Africa 1989:3), the environment is regarded as “the aggregate of surrounding objects, conditions and influences that influence the life and habits of man or any other organism or collection of organisms”.

Part IV of the Act focuses on the control of environmental pollution, whilst Part V (section 21(2)(a–k)) used to manage activities that might have a detrimental effect on the environment. These activities relate to land use and transformation, water use and disposal, the removal of resources including natural living resources, agricultural and industrial processes, transportation, energy generation and distribution, waste and sewerage disposal as well as recreation (South Africa 1989:6). However, section 21 of the Act has been repealed by section 50(2) of the *National Environmental Management Act, 107 of 1998* (South Africa 1989:7). As a result of this action, Regulations 1182 and 1183 that identified those activities that may not proceed without an environmental authorization by the relevant decision-making authority or in certain instances requiring the development of an Environmental Impact Assessment or an Environmental Scoping Report, no longer function under the *Environment Conservation Act, 73 of 1989*.

According to section 23 of the Act, an authority may declare any area as a limited development area, which relates to the fact that no development will be allowed within these areas unless authorization has been given by the designated authority. The Act further makes provision in section 29 for penalties resulting in a fine or imprisonment, whilst section 35 refers to the appeal process to the Minister or competent authority (South Africa 1989:7, 12, 16).

Several regulations still function under the Act, including regulations pertaining to waste management, littering, noise and limited development areas (South Africa 1989:8-12).

- **National Environmental Management Act, 107 of 1998**

The aim of this Act is to allow for sustainable, effective and cooperative governance in all matters affecting the environment and forms the basis for people's right to an environment that is not harmful. The Act builds on the international declaration on sustainable development that should integrate social, economic and environmental factors within planning processes, ensuring that development serves both current as well as future generations. It aims to promote conservation, ecologically sustainable development and the use of natural resources, including the prevention of pollution and ecological degradation (South Africa 1998a:1).

Environmental management is a functional area of both national and provincial government and includes the establishment of a legal framework that will provide for effective management of all development activities. According to Chapter 1, section 2 of the Act, national environmental management principles should place people and their needs at the forefront and aim at serving their physical, psychological, developmental, cultural and social interests equitably, whilst development should be socially, environmentally and economically sustainable. This relates to development not leading to the disturbance of ecosystems and the loss of biodiversity, but it should limit pollution and degradation of the environment, ensure responsible use of non-renewable natural resources and apply a risk-averse and cautious approach. It further states that environmental management should be an integrated process and based on inter-governmental co-ordination and alignment of policies, legislation and actions pertaining to the environment (South Africa 1998a:9).

The Act establishes a National Environmental Advisory Forum. The Minister must present an annual report to Parliament on the work of this Forum. It further allows for the establishment of a Committee for Environmental Co-ordination. The objective of this Committee is to promote the integration and co-ordination of environmental functions by the relevant organs of state, including the development of environmental implementation and environmental management plans (South Africa 1998a:11-15). According to section 12, every national department involved in an aspect of the

environment and listed in Schedule 2 of the Act, should compile an environmental management plan. The objective of the plan is to co-ordinate environmental policies, minimize the duplication of procedures and functions, and to secure the protection of the environment across the country as a whole (South Africa 1998a:16). The content of the environmental implementation plan should contain a description of policies, plans and programmes that impact on the environment as well as a description of how the department will ensure compliance under the relevant legislation. The environmental management plan should contain *inter alia* a description of environmental norms and standards and arrangements for co-operation with other national government departments and other spheres of government (South Africa 1998a:16 -17).

Chapter 5 of the Act focuses on integrated environmental management and states the requirements pertaining to environmental authorizations. It includes requirements on environmental authorization, the identification of a competent authority, the listing of activities or areas and the appointment of an external specialist to review an assessment. Of particular relevance here is section 24(2)(b) that states that a Minister or MEC may identify a geographical area based on environmental attributes, wherein certain specified activities may not commence without authorization from the competent authority or where activities can be excluded from authorization. Also included in the Act in sections 28 to 32, is the matter of compliance and enforcement and the roles and responsibilities of the environmental management inspectors (South Africa 1998a:24-46).

Section 50 of the Act emphasizes the repeal of a number of sections of the Environmental Conservation Act 73 of 1989. Of particular reference here are the regulations that focused on the listed activities that require environmental impact assessments or scoping reports. Regulations 385, 386 and 387 replaced those on 21 April 2006. Regulation 385 focuses on the procedures pertaining to environmental authorizations. Under this regulation, provision is made for processes and requirements that are involved in the compilation of a basic assessment, a scoping report and an environmental impact assessment, pending the activity as well as the role of the environmental assessment practitioner. It also includes the issuing of environmental authorizations as well as the amendment and withdrawal thereof should it be relevant. Reference is also made on the requirements for the compilation of an environmental management framework. This is proactive in providing guidelines for development and

focuses on geographic areas as well as the required adoption process (South Africa 2006a).

Regulation 386 consists of the listed activities under section 24 and 24D of NEMA that requires the compilation of a basic assessment (South Africa 2006b). Activities listed that are specifically related to agriculture are mainly focused on the concentration of animals for commercial purposes. Other activities relevant to the purposes of this study include the excavation of soil, removal of indigenous trees and the transformation of undeveloped, vacant or derelict land to other uses (including the cultivation of virgin land). This land may have an agricultural potential. Also included under this regulation is the sub-division of land of 9 ha or larger into portions of 5 ha or less (South Africa 2006b).

Regulation 387 focuses on the activities that require the compilation of a scoping report or an environmental impact assessment (South Africa 2006c). Activities listed include the development of an activity in the extent of 20 ha or more as well as the extraction of peat.

The national Department of Agriculture is currently not involved in reviewing submissions under this Act as indicated under the mentioned regulations, even though these activities may have an impact on agricultural land and its production potential.

Residing under this Act are the *National Environmental Management: Biodiversity Act, 10 of 2004*, the *National Environmental Management: Protected Areas Act, 57 of 2003* and the *National Environmental Management: Air Quality Act, 30 of 2004* (South Africa 1998a: 59).

- **National Water Act, 36 of 1998**

The core aim of this Act is to provide guidance on the protection, use, management and conservation of the country's water resources. The national Department of Water Affairs and Forestry (DWAF) is the custodian of the Act. Under the Act, DWAF is responsible for ensuring the sustainable utilization of water resources and may in certain instances delegate some management functions to a regional or catchment level (South Africa 1998c:2).

The South Africa Government is regarded as the custodian of all water resources and water is thus managed as a public trust. The Act acknowledges Government's responsibility towards the management and protection of the country's scarce water resources, the rehabilitation of water resources and the equal allocation of these resources as well as the protection of the quality thereof. The Act regards basic human needs and environmental sustainability as a right, whilst irrigation requirements are seen as secondary.

Water may be used either under a general authorization, thus no license is required, or per license allocated. Section 4 indicates that a water user has to apply as per stipulated procedures for the water license (South Africa 1998c:15). Water may be used without a license if it is permissible under Schedule 1, section 22, if it is a continuation of an existing lawful use or if a general authorization has been issued. Schedule 1 includes water use for reasonable domestic use and gardening, watering of animals that graze within the grazing capacity of that land (thus excluding feedlots), store and use of run-off water from roofs, for emergency fire fighting purposes and for recreational purposes (South Africa 1998c:132).

According to section 25, water use authorizations may be temporary transferred to be used for a different purpose or to another property in the same vicinity. In making regulations pertaining to water use the Minister may differentiate between various water uses, classes of water resources or geographical areas (South Africa 1998c:34-36).

In Chapters 7 to 9 the Act regards the management of water resources as an integrated process. Institutions that functions under the Water Act include the National Water Advisory Council, the Catchment Management Agency (CMA) and Water Users Associations (WUA) (South Africa 1998c:74-95). The CMA's functions within water management areas. These water management areas are not linked to provincial boundaries, but functions across boundaries.

Provision is made for the development of a national water resource strategy. The strategy should encompass the objectives, plans and guidelines pertaining to the protection, use, development, conservation and management of water resources. It should also make provision for meeting the international rights and obligations and the projected future water needs (South Africa 1998c:17). It also allows for the development

of catchment management strategies within its water management area (South Africa 1998c:19-21).

Also of relevance is section 12 of the Act that focuses on the classification of water resources, whilst sections 13 to 15 regulate the class of water resources and resource quality objectives (South Africa 1998c:22–25). Chapter 12 of the Act is concerned with the safety of dams. It aims to reduce possible risks to the public, property and to the resource quality (South Africa 1998c:102-109).

Of particular importance captured with the Act is the monitoring, recording, assessment and disseminating of information on water resources. National monitoring systems have to be established on water resources and should include amongst others the collection of data and information on water quality and the use of water resources. Proposed national information systems may include a hydrological information system, a water resource information system, a ground water information system and a register of water use authorization. The national information systems should be able to store and provide data and information focused on the protection, sustainable use and management of water resources. This information should be made available for determining the status of water resources, research and development purposes as well as for planning and environmental impact assessments (South Africa 1998c:118-121).

- **Land Administration Act, 2 of 1995**

The aim of this Act is focused on the delegation of powers pertaining to the administration of laws regarding land matters to provinces and to create the platform for uniform land legislations. The Act makes thus provision for the Minister to delegate powers to the Premier or Member of the Executive Council (MEC) of the province where after the mentioned can delegate these powers to the Director-General of the province or to any officer in the service of the provincial government concerned. Large portions of this Act have been amended since its inception (South Africa 1995c:1-3).

- **Provision of Land and Assistance Act, 126 of 1993**

Act 126 of 1993 was compiled to provide for the designation of certain land, to regulate the sub-division of this land and the settlement of people thereon as well as to provide

for financial assistance in acquiring the mentioned and all matters concerning thereto (South Africa 1993:1). Some of the provisions of this Act have subsequently been amended through the *Development Facilitation Act 67 of 1995* and the *Provision of Certain Land for Settlement Amendment Act 26 of 1998*.

The provisions of this Act include state land that has been made available or land that has been acquired by the Minister for these purposes, as well as any private land made available by the owner. Laws that are governing the sub-division of agricultural land and the establishment of townships do not apply to the provisions of this Act (South Africa 1993:2). According to Section 5 a developer can sub-divide a certain piece of land into smaller pieces that is to be used either for small-scale farming, residential, public, community business or other purposes, *irrespective of the potential of the land* (own insertion). Once such a division is completed, ownership can be transferred after the completion of a survey of the land concerned and a deed of transfer has been lodged (South Africa 1993:5).

The Minister may, according to section 10(1)(b), require funding from Parliament to acquire the land for the purposes of the Act, but may also grant an advance or subsidy to any person wanting to acquire the land for residential purposes, agricultural production or small business development. The Act can also be used to require capital assets for the development of the land, securing tenure rights, improvement of the land, acquiring an equity share in an existing agricultural enterprise or to plan and develop the land for settlement purposes (South Africa 1993:8).

The Act makes provision for the development of regulations regarding the size of the pieces of land for sub-division, the supply of services to the land and the number of people to inhabit the land, among other things (South Africa 1993:11).

Following the development of Act 126 of 1993 was the *Provision of Certain Land for Settlement Act, 126 of 1998* with limited amendment to the previous one.

- **Communal Land Rights Act, 11 of 2004**

This Act focuses on matters pertaining to communal land. It aims to provide for legal security of tenure, the democratic administration of communal land by communities and

the co-operative performance of municipal functions on communal land (South Africa 2004b:1). According to section 1 (South Africa 2004b:2), communal land is regarded as “land contemplated in section 2 which is, or is to be, occupied or used by members of a community subject to the rules or custom of that community”. This Act also applies to State land, including the previously self-governing areas under the *Self-governing Territories Constitution Act, 21 of 1971* before its repeal, as well as land acquired by a community, but excludes land vested in the former South African Development Trust (South Africa 2004b: 3).

In transferring land to a community according to section 18(4), the Minister must take into consideration the IDP of the relevant municipality and may reserve a right to the State or stipulate a land use or any other condition necessary for a public purpose or to protect the land and the rights in such land (South Africa 2004b:9).

A land administration committee has to be established as stipulated in sections 21 to 24. The committee has the responsibility to promote the interests of the community and its members and the management of the land in question (South Africa 2004b:10).

- **Local Government: Municipal Structures Act, 117 of 1998**

The aim of this Act is to provide for the establishment of municipalities in accordance with the requirements relating to categories and types of municipalities, as well as for the appropriate division of functions and powers between the categories of municipalities (South Africa 1998b:1). In effect, areas are divided into either category A municipalities (metropolitan municipalities of which there are currently six in South Africa, with three located in Gauteng) or areas that have both a category B and C municipality (South Africa 1998b:8).

The larger portion of the Act focuses on the roles and responsibilities of municipal councils as well as internal structures and functionaries and electoral systems. A function assigned to district municipalities (section 83(3)) includes the integrated, sustainable and equitable social and economic development of its area of jurisdiction, with the main focus on integrated development planning, bulk infrastructural development and the equitable distribution of resources between the local municipalities in its area. Section 84 elaborates further on the division of functions with the exclusive

focus on infrastructure development (South Africa 1998b:33-34). Continued interaction through co-operation and support between district and local municipalities is also emphasised (South Africa 1998b:37).

Important in this Act is the assigned roles and responsibilities of municipalities mainly focused on infrastructure development and services to the communities they serve. There is little or no mention of any responsibility that a municipality has towards protecting the natural environment as well as managing land for agricultural purposes.

- **Local Government: Municipal Systems Act, 32 of 2000**

The *Municipal Systems Act* was assented to on 14 November 2000 and came into effect on 1 March 2001 (South Africa 2000b:1). The main aim of this Act is to provide for mechanisms and processes required by municipalities to progress towards economic and social upliftment of the communities, but in harmony with the environment and to ensure access to essential services. The Act also stipulates the establishment of a framework that includes support and monitoring, as well as the setting of standards by other spheres of government that will allow local government to progressively integrate the activities of all spheres of government. The rationale is the ultimate upliftment of communities in harmony with their natural environment. In accordance with Section 3(2), both national and provincial governments have the responsibility of exercising their executive and legislative mandate in such a way that it does not compromise the municipality's ability to exercise its executive and legislative authority. Briefly, the three spheres of government should work in co-operation with another (South Africa 2000b:14).

As in the case of the *Municipal Structures Act, 117 of 1998*, the focus is on the roles of the municipality in terms of promoting development and the administration of the municipality as such. However, these actions should be conducted in a safe and healthy environment (South Africa 2000b:20).

The Act (South Africa 2000b:9) defines development as “sustainable development, and includes integrated social, economic, environmental, spatial, infrastructural, institutional, organizational and human resources upliftment of a community”. Environmentally

sustainability is seen in relation to the delivery of municipal services that are not harmful to the environment as well as to human health and safety.

One of the main requirements of the Act (South Africa 2000b:29-39) is the compilation of IDP's by each municipality for their area of jurisdiction with a five-year projection, but renewed annually. This allows the municipality to conduct a detailed review of its priorities and planning areas and to earmark land, in consultation with the relevant authorities that can be used for development purposes or other uses. An environmental assessment and review forms part of the IDP compilation requirements. The development of an IDP should be aligned by the development plans and strategies of other organs of state to give effect to the principles of co-operative governance (South Africa 2000b:29).

The core components of an IDP should include the municipality's long-term vision for development, an assessment of the current status quo, the alignment of municipal strategies with any national or provincial plans and planning requirements. It also includes budget projections and key performance targets (South Africa 2000b:31). A Spatial Development Framework (SDF) that allows for a spatial review of its long-term planning areas should also support the IDP. The requirements of the SDF should at least include desired patterns of land use, on a spatial or visual level, guidance on desired or undesired land use, the delineation of the urban area and the identification of priority spending areas. It should provide strategic guidance on the nature of development or land use that should be followed within the boundaries of the municipality (South Africa 2000b:32).

Section 35(1) (South Africa 2000b:37) regards the IDP of a municipality as the principal strategic planning instrument that informs and guides all development within the boundaries of the municipality. It thus binds the municipality with the exception of an inconsistency between the IDP and national or provincial legislation, in which case the legislation will prevail (South Africa 2000b:37). An IDP is approved by the MEC for local government in the province concerned (South Africa 2000b:35).

There is no reference in the Act regarding the role or the protection of agricultural land within the IDP or SDF. However, the objective of an SDF is that it should be done on a strategic level and be influenced by any activity related to land use planning.

It was found that in certain instances the municipalities themselves compile the IDP's, but in the case of smaller municipalities in particular, consultants are used in compiling the IDP's. This is also the case in the development of a SDF. The danger is that this might result in limiting the efficiency of the municipality, as it becomes reliant on the consultancy for the development of maps as well as future planning. It may also impact on the content of the IDP and SDF, as the requirements and priorities of the municipality are not always captured accordingly.

According to an IDP review process for Gauteng in 2006 (Gauteng Department of Local Government 2006: 8-9), some of the matters of concern highlighted and requiring attention included:

- *Integration across the spheres of government.* Interaction between the three spheres of government is limited especially in terms of planning frameworks. Concern was expressed that municipalities are having problems with the compilation of IDP's and that there is a tendency to rather withdraw to what is within the control of the municipality. There is limited interaction between the three spheres of government
- *Linkages with sector plans.* No linkages between the IDP's and other sector plans have been established yet.
- *Plans for local area or local area plans.* Municipalities regard IDP's mostly as an instrument for local planning and not as a plan for the local area. Municipal IDP's are not aligned to plans of other sectors at a local level.

In the review of IDP's 2006 for Gauteng, little or no attention was given to the protection of agricultural land with only a few municipalities referring to management of environmentally sensitive areas or effective land use planning procedures. Although some municipalities made reference to the Gauteng Agricultural Potential Atlas (GAPA), it was not optimally included in the development plans.

- **Development Facilitation Act (DFA), 67 of 1995**

The Act focuses on land development and is aimed at fast tracking the implementation of the Reconstruction and Development Plan and other projects related to land, land development and planning at a national and provincial level (South Africa 1995a:1). It aims at the proper management of the development of land.

According to the Act (South Africa 1995a:3), an environmental evaluation refers to “...an evaluation of the environmental impact of a proposed land development, conducted in accordance with the integrated environmental management guidelines which are from time to time issued or amended by the Department of Environment Affairs and Tourism”. Land development is described as “any procedure aimed at changing the use of land for the purpose of using the land mainly for residential, industrial, business, small-scale farming, community or similar purposes...”(South Africa 1995a:3). It should be noted that an area earmarked for development can include land that is not currently sub-divided or that may be sub-divided, irrespective of whether there are buildings currently on the land concerned, or that is used for any of the purposes defined under the definition of land development.

The Act aims to provide national uniform procedures for the sub-division of land as well as the development of land in urban and rural areas, and allows for fast development of land for residential purposes as well as for small-scale farming or other needs and uses. Specific reference is made in section 2(c) to the Act serving as a guideline by reference when a competent authority makes a recommendation or decision in terms of this Act or with regard to any other Act, dealing with the sub-division and use and planning of land (South Africa 1995a:7).

The principles for land development prescribed in section 3 of the Act focus on the integration of social, economic, physical and institutional aspects of land development. Optimal use should be made of existing resources that also include natural resources, agriculture, land, minerals and bulk infrastructure. Land development should ensure that residential and employment opportunities are located in close proximity to one another. The Act opposes low density and fragmented development, as well as urban sprawl. It further encourages environmentally sustainable land development practices and the sustained protection of the environment (South Africa 1995a:8).

Section 28(2) (South Africa 1995a:32) stipulates that a local government body or the MEC may require an environmental evaluation to assess the impact of a proposed land development objective upon the environment.

Section 3(f)(i), however, requires that national, provincial and local governments should clearly strive towards making known their required functions and responsibilities to the economy and in relation to land development, and provide details of the identity of

applicable legislation managed by them (South Africa 1995a:9). Each land development should be judged on its own merits and no land use should be regarded as more important than another.

Chapter II of the Act makes provision for the establishment of a Development and Planning Commission and, where required, Provincial Commissions. The Terms of Reference for the Development and Planning Commission encompass reviewing matters such as the appropriate scope of planning, including spatial and non-spatial planning, and the appropriate levels of Government where planning should be carried out, as well as the coordination between various departments involved in planning. The Commission should also advise the Minister on policies and laws relating to land development, procedures, environmental sustainability, as well as appropriate land use control systems for land development both in urban and rural areas (South Africa 1995a:13-20).

Chapter III makes provision for the establishment of Development Tribunals operating on a provincial level. A Tribunal should consist of experts from provincial and local government, as well as from the private sector. It has the authority to fast track decision-making and to limit any obstruction to sustainable development. An applicant has the choice of either going through the Development Tribunal process or making use of the existing legal procedures exercised by the various spheres of government. The Tribunals have the power to make decisions and resolve conflicts pertaining to land development projects. Should it be required, the Tribunal can subpoena any person that they feel can give material information concerning a subject of the enquiry. Appeals can also be lodged against Tribunal decisions (South Africa 1995a:20-30).

Section 33(2) stipulates the procedures to be followed by the Tribunal in reviewing an application. However, the Tribunal has the authority to impose any condition of establishment on the proposed application including whether a zoning scheme is applicable, whether the land in question should be sub-divided, or any environmental condition (South Africa 1995a:35). The Tribunal can also impose a condition of establishment in respect of a servitude or a restrictive condition registered on the land (South Africa 1995a:38). The Act (South Africa 1995a:7) defines a zoning scheme as being administered by a local government body and focuses on areas zoned for the

exclusive use of residential, business, industrial, local authority, government or other purposes. It prohibits the use of land that is in conflict with any other related scheme.

Regarding land earmarked for small-scale farming purposes, the Tribunal can also, in accordance with section 51(2), impose any condition of establishment in terms of sub-division and whether provision of any law requiring the approval of an authority for the sub-division of land is needed (such as Act 70 of 1970), as well as whether the use of the land should be regulated by the *Conservation of Agricultural Resources Act, 43 of 1983* (South Africa 1995a:52). Also, in reviewing an application for small-scale farming purposes, the Tribunal should take into consideration the suitability of the area, the status of the natural resources, the location in relation to agricultural facilities and the environmental sustainability (South Africa 1995a:56).

After a development application has been approved, the plans, diagrams and other information can be lodged with the Surveyor-General for approval, as well as with the Registrar of Deeds (South Africa 1995a:55).

Section 46 makes provision for the development of regulations on a number of matters including land use planning in general (South Africa 1995a:48). According to the Regulations, a land development application must be forwarded to any national government department that may be affected by the application. This applies particularly if a national department is responsible for the administration of a law, which the land development applicant will request the Tribunal to suspend, under sections 33(2)(j) or 51(2)(d) of the *Development Facilitation Act, 67 of 1995*. The same applies to any relevant provincial department. Any objections to the proposed development should be submitted within 21 days of notification being given (South Africa 2000a:13).

The Regulations stipulate that an environmental evaluation is required as part of the application documentation (South Africa 2000a:30). The report must indicate the impact of the proposed development on the environment and should include the physical and environmental characteristics of the land, the current and potential land uses, existing infrastructure, the medium- and long-term environmental sustainability, as well as the social and economic impact on the communities.

Within the provisions of the Development Facilitation Act, the Gauteng Provincial Government has developed Regulations that are applicable to the Gauteng Province. The responsibility for coordinating land development objectives resides with the local authorities (Gauteng Provincial Government 1996:2). In the compilation of land development objectives according to section 10(c), a statement should be issued as to the assistance required by the local government body from the Gauteng Provincial Government, in setting these objectives (Gauteng Provincial Government 1996:5). The development priorities of the area, as well as the state of the environment and the improvement and conservation thereof, are among the provisions to be included in the land development objectives. The urban and rural agricultural sectors are among the economic sectors identified to form part of these objectives (Gauteng Provincial Government 1996:8).

Although developed with good intent, Act 67 of 1995 has impacted heavily on the agricultural sector, especially in rural areas. To a large extent, it has contributed to the loss of agricultural land that could have been used for agricultural production. In reviewing the Act, the matter of the inclusion of sub-division of land incorporated within the DFA versus the *Sub-division of Agricultural Land Act, 70 of 1970* raises concern as to the role of the two Acts within the broader spectrum. Both Acts address the same function, but from different perspectives. According to both Acts, the Surveyor-General can approve a diagram and the Registrar of Deeds can register a property upon approval received from either the DFA or Act 70 of 1970. It could be assumed that when the DFA was in the process of being compiled, motions were activated to repeal Act 70 of 1970. However, this process was never finalized.

This duplication thus leaves the option for the developer to follow the shortest possible route with the least possible obstacles that will ensure a positive outcome. In many instances the DFA route is preferred, especially in rural areas, and not Act 70 of 1970. The Act is focused on the protection of agricultural land in the mentioned areas and is not development orientated.

Through personal communication with parties involved in the administration of Act 70 of 1970, the researcher became aware of many cases in which objections were lodged through Act 70 of 1970 for developments on high potential agricultural land, that were put aside by the DFA Tribunal in favour of the development. In some instances, this

could be attributed to a lack of properly approved national or provincial policies on land use management and the protection of especially high potential agricultural land or the non-utilization of the land currently for agricultural purposes, as well as limited insight into or awareness of the importance of the protection of agricultural land for future production. This in spite of specialist reports, submitted to the Tribunal on the negative impact a development would have on the production potential of the land.

- **Intergovernmental Relations Act, 13 of 2005**

The main aim of this Act is to promote and facilitate intergovernmental relations between the three spheres of government and to assist in the settlement of disputes (South Africa 2005:1). All spheres of government have to work together and provision should be made to align actions in the improvement of services.

Sections 6 to 29 of the Act make provision for the establishment of a President's Coordinating Council, national intergovernmental forums, provincial intergovernmental forums and municipal intergovernmental forums. The intergovernmental forums' main purpose is to ensure alignment between the various role-players on related matters and to limit duplication and inconsistencies (South Africa 2005:8-13).

Section 35 focuses on implementation protocols that entail interaction between various spheres of government when implementing a policy or action that may have an impact on other government institutions (South Africa 2005:15). In developing provincial policies and legislation, national priorities need to be taken into consideration as well as the interests of the local sphere of government, as indicated in section 36 to 37 (South Africa 2005:16).

Chapter 4 of the Act deals with the settlement of intergovernmental disputes. It stipulates that every effort should be made to avoid disputes when organs of state exercise their statutory powers or functions. Should a dispute be declared, a meeting should be convened between the relevant parties to resolve the issue. In cases of failure to convene the meeting, the Minister, should it involve a national organ of state, or the Member of the Executive Council (MEC) for local government, must intervene by calling a meeting or appoint a facilitator to act on behalf of the parties (South Africa 2005:16-17). The facilitator has to assist in settling the dispute and must submit a report

to the Minister or MEC concerning the nature of the dispute, as well as the precise issues at the core of the dispute. The report should also include the procedure that will be followed to resolve the dispute (South Africa 2005:17).

6.3 NATIONAL BILLS

- **Land Use Management Bill, 2008**

The development of this Bill was recently finalized and submitted to Parliament in April 2008, after a number of draft versions had previously been made available for comment. The aim of the Bill is to provide for the uniform and integrated regulation of land use management, to set principles, norms and standards in terms of land development and land use management, to provide for land use schemes, and to achieve land reform objectives. The objectives further make provision for co-operative governance in as far as land development and land use management are concerned (South Africa 2008:2)

The Bill functions under a set of directive principles indicated in section 4 that include addressing the imbalances of the past pertaining to land reform, efficiency principles in relation to the best use of available resources, balanced economic development, compact and sustainable human settlements, and limited urban sprawl, as well as the principle of sustainability that includes the protection of the natural, environmental and cultural resources and the sustainable use of agricultural land (South Africa 2008:6). Should this Bill be enacted, it will repeal the *Development Facilitation Act, 67 of 1995*, the *Physical Planning Act, 88 of 1967* and the *Removal of Restrictions Act, 84 of 1967* (South Africa 2008:27).

According to the Bill, “change” (land use change) refers to any alteration to the permitted use or function or form of the land. A restrictive condition on a land use can be registered against the title of the land that can restrict the sub-division or consolidation of the land, the purposes for which the land may be used or land development (South Africa 2008:5).

Scheduled purposes for land use form part of Schedule 1 of the proposed Act. One of the included purposes is agriculture, which is defined as “purposes normally or

otherwise reasonably associated with the use of land for agricultural activities, including the use of land for structures, buildings and dwelling units reasonably necessary for or related to use of the land for agricultural activities”. Other examples of purposes include business, commercial, conservation, industrial, mining, residential and transport (South Africa 2008:25).

“Land development” refers to any action that may have an effect on land, whilst land use management includes implementing measures to restrict or regulate the use of the land, including land development (South Africa 2008:5). Section 5 stipulates the development of compulsory norms and standards for land use management. These standards should reflect national policy and priorities and require a report on existing and desired land use patterns and the identification of strategically located vacant or under-utilized land. Differentiation should be made between geographic areas, types of land use and development requirements (South Africa 2008:7).

Intergovernmental support is clearly stipulated in the Bill and specific reference is made to support between the various spheres of government in the coordination and alignment of land use management schemes (South Africa 2008:7).

As in the case of the *Development Facilitation Act, 67 of 1995*, provision is made in this proposed Act for municipal land use committees and provincial land use tribunals, both acting as land use regulators within their area of jurisdiction, pending the merits of the application. If the application has a national interest, the Minister should act as the land use regulator (South Africa 2008:8-12). The Land Use regulator has the jurisdiction to change a use, form or function of land, remove a restrictive condition, and evaluate applications pertaining to township establishments, sub-division or consolidation of land and the amendment to a land use or town planning scheme (South Africa 2008:12).

The proposed Act makes provision for the establishment of a National Land Use Commission with support being given to this Committee by the Department of Land Affairs (South Africa 2008:20). The Commission is to advise the Minister on all relevant matters pertaining to land use. The Minister has the authority, according to section 73, to exempt a piece of land or an area from the provision of this Act, through publication in the *Government Gazette* (South Africa 2008:22).

Provision for the development of municipal land use schemes within two years of commencement of the Act is incorporated in the Bill. The land use scheme should be developed in accordance with the *Municipal Systems Act, 32 of 2000* and *NEMA (Act 107 of 1998)*. It should form the basis for the integrated development plans as well as the spatial development frameworks. In terms of requirements, it has the option to determine a single or multiple land use for a piece of land or a specified area, as well as to set conditions, such as densities and intensities of use and the requirements pertaining to fixed structures. The scheme should nevertheless take into consideration the land use permitted on the land, prior to the enactment of the Bill. The scheme should also be aligned to the land use of adjacent land use schemes falling within other municipalities. The land use scheme should be developed in accordance with chapter 4 of the *Municipal Systems Act, 32 of 2000*, as well as section 24 of the *National Environmental Management Act, 107 of 1998* (South Africa 2008:1-17). In section 54, a promulgated land use scheme binds the owners of the land, replaces all town-planning schemes and prevails in the case of inconsistencies with the title deed (South Africa 2008:18).

Provision is made for the development of regulations for any matter prescribed within this proposed Act. However, until these regulations are in place, existing regulations will apply, even though the law is repealed under section 77 of this Bill (South Africa 2008:23).

In previous versions of the Bill, specific reference was made to spatial planning and the updating thereof on a five-yearly basis (South Africa 2004a:22). This stipulation is not repeated in the current Bill, although the underlying principles that should be incorporated in such a spatial plan are still present. Moreover, specific reference was made to the protection of prime and unique agricultural land, but this is not present in the current version (South Africa 2004a:15).

- **Draft Sustainable Utilization and Protection of Agricultural Resources Bill, 2006 (SUPAR)**

Concern was expressed over the role of the *Sub-division of Agricultural Land Act, 70 of 1970* in the current South African context and the inefficient protection of agricultural land. Accordingly, it was decided in about 2000 to develop a new Act that would

address these concerns. This led to the development of the Sustainable Utilization of Agricultural Resources Bill in 2006. However, this Bill was subsequently amended and a provisional draft of the Sustainable Utilization and Protection of Agricultural Resources Bill (SUPAR) developed in late 2006. To date, the Bill has not been gazetted for comments. The aim of the Bill is to enhance the sustainable utilization, management and protection of natural agricultural resources for optimum productivity and sustainable development. This also includes support for biodiversity and combating of desertification, as well as the control of weeds and invader plants (Department of Agriculture 2006e:1).

SUPAR (Department of Agriculture 2006e:4) defines agricultural land as “any land which is used or may be used for agricultural purposes, excluding land which the Minister has excluded from the provisions of the Act”, whereas a natural agricultural resource is regarded as “the soil, water resources or vegetation occurring on agricultural land, excluding invasive alien plants”. In terms of sustainability, which forms a core component of the proposed Act, sustainable utilization is defined as “the utilization and protection of natural agricultural resources for agricultural production in an environmentally sound manner, without compromising the ability of future generations to meet their own needs”. The use of the resources should therefore not result in the long-term decline thereof or disrupt the ecological integrity of the ecosystem (Department of Agriculture 2006e:6).

Activities related to the management of the Act include the sustainable utilization of natural agricultural resources, including state-owned land, the management of production practices such as the cultivation and irrigation of agricultural land, the protection of water sources and the protection of natural agricultural resources against pollution and erosion. Also included are the rehabilitation of degraded land, conservation of vegetation and activities related to soil conservation works and veld carry capacity, the change of land use of agricultural land, as well as the control of invasive alien plants and bush encroachers. Finally, the preparation of integrated development plans and the management of existing or planned schemes and programmes are also included. All this should be achieved through the development of standards and control measures that can vary in respect of different classes of users or land characteristics, provinces or areas (Department of Agriculture 2006e:26). A

scheme or programme can make provision for financial or other assistance, such as grants or loans, in order to give effect to the programme or scheme.

Chapter 7 of the proposed Act makes provision for the Minister to declare a specific area as land that is protected for agricultural production. Any change from agricultural land use will then be subject to the provisions of this Act. It is also stipulated that land residing within an urban edge as demarcated by the municipality and that is still regarded as agricultural land shall remain as such, until otherwise determined by the Minister for Agriculture (Department of Agriculture 2006e:32).

In accordance with the Act, the Minister should appoint a Registrar with the responsibility to promote the protection of natural agricultural resources. The Registrar also has the authority to appoint agricultural resource inspectors to monitor the state of the resources and to initiate the development of systems of sustainable utilization and protection of the resources (Department of Agriculture 2006e:9). The establishment of local and provincial agricultural resource use committees, as well as a council and advisory committee to assist with the management of the proposed Act is also included. The council should consist of representatives from national departments, such as Agriculture, Housing, Environmental Affairs and Tourism, Water Affairs and Forestry, Transport, Land Affairs and Provincial and Local Government, as well as members of organized agricultural bodies. It also has the responsibility of initiating the development of criteria, norms and standards for the change of land use and the approval and publication thereof with the Minister's consent (Department of Agriculture 2006e:20-22). The determining of criteria should take into consideration the utilization of agricultural land and its importance relative to a specific province or area, as well as the probable future use of the land for agricultural purposes (Department of Agriculture 2006e:32).

The Surveyor-General may only approve a plan or diagram after the necessary consent has been issued under the proposed Act. The same applies to the Registrar of Deeds (Department of Agriculture 2006e:35).

Non-compliance can result in the issuing of a directive, a fine or imprisonment. Land can also be expropriated if required for the restoration or reclamation of the natural agricultural resources or if the agricultural land is under-utilized or not used at all (Department of Agriculture 2006e:44).

6.4 NATIONAL POLICIES

- **LandCare policy**

The LandCare policy was developed by the national Department of Agriculture in the form of an implementation framework and consists of three parts. The first part focuses on the overall objectives of the programme in relation to the conservation of natural resources. The LandCare principles are built on a community-based perspective located within provincial structures and involve strong participation from the private sector and civil society. The second part focuses on an awareness programme, whilst the third part indicates the organizational structures within which the LandCare programme will be developed (Department of Agriculture 2000:2).

As mentioned, the LandCare approach in South Africa is based on a community programme and aims to work towards the conservation of natural resources (soil, water and vegetation) and sustainable land use, as well as through education and awareness. It further focuses on addressing rural poverty through the creation of jobs. All initiatives in the South African LandCare programme are guided by international conventions and support the general objectives of chapter 10 of the UN Sustainable Development Agenda. Through the LandCare programme, Government will aim to review existing international and national policies, legislation and regulations and to develop new national criteria. It will also aim to optimise productivity and the sustainable use of natural resources that may result in improved productivity, food security, job creation and a better quality of life. Sustainable farming practices will also be promoted (Department of Agriculture 2000:3).

The framework regards land care as the responsibility of all agricultural land users, irrespective if they are commercial, small-scale or communal farmers, but with the support from Government. The programme consists of five elements namely programmes for resource conservation, capacity building of local communities and support to staff, an awareness programme, the formulation of new policies and legislation as well as research and evaluation.

The national Department of Agriculture (DoA) through the Directorate Land Use and Soil Management will take the lead in facilitating the programme together with the

support of the provincial Departments of Agriculture. The latter are mainly responsible for identifying LandCare projects, as well as overseeing the implementation of the approved projects with the assistance of non-governmental associations (Department of Agriculture 2000:5-6).

Awareness initiatives include the development of educational materials to be distributed to schools and communities. In terms of policies and legislation, the Framework states that current initiatives between the DoA and the Department of Land Affairs include a new agricultural policy, an environmental, water and land tenure Bill as well as involvement in the *Development Facilitation Act, 67 of 1995*, whilst future activities include the review of Act 43 of 1983 (CARA) (Department of Agriculture 2000:9).

A number of research activities are conducted through LandCare funding. The development of new data sets and decision support initiatives housed on the web-based Agricultural Geo-referenced Information System (AGIS) has benefited greatly from LandCare research funding. Other research initiatives identified include soil erosion, wetlands, water quality and biodiversity (Department of Agriculture 2000:17).

- **National policy on the protection of high potential and unique agricultural land – draft version**

A national policy on the protection of agricultural and unique agricultural land was released in June 2006 after consultation with relevant role-players at provincial and local level. The Minister of Agriculture has yet to sign the policy, but DoA enforces the principles contained therein. However, until the Minister signs the policy it cannot be regarded as an official document.

The objectives of the policy are to protect agricultural land as stated in Act 70 of 1970 and Act 43 of 1983 and to provide norms and standards for the evaluation of applications pertaining to the sub-division of agricultural land. Agricultural land is defined in the context of the policy as land that can be used for agricultural purposes excluding land that has been excluded by the Minister through a notice in the *Government Gazette*, whilst high potential agricultural land is referred to as land that is best suited for the production of high yields of agricultural produce with limited damage

to the environment. Unique agricultural land is land with unique requirements that can produce specific high value crops (Department of Agriculture 2006d:6).

The policy acknowledges that no policy currently exists for the protection and regulation of high potential and unique agricultural land, whilst a number of other land use Acts and policies, such as the *Development Facilitation Act, 67 of 1995*, the *Municipal Systems Act, 32 of 2000* and the Land Use Management Bill, 2008 favour non-agricultural land use on agricultural land. In many instances, a change of land use, sub-division of agricultural land or re-zoning thereof, occurs without the appropriate permission of the Minister.

Another very important avenue that is also not currently pursued is the incorporation of the protection of agricultural land in the SDF's and IDP's compiled by the local authorities. Standards and norms for consistent decision-making pertaining to agricultural land is a priority.

The strategic objectives of the policy include ensuring the protection of high potential agricultural land for food security, job creation and income generation purposes, and providing guidelines for the management of sub-division and change of land use applications (Department of Agriculture 2006d:10). According to the policy, the Minister is responsible for determining the characteristics (location, size and properties) of high potential and unique agricultural land, and establishing and maintaining a national spatial framework for it (Department of Agriculture 2006d:12).

Provincial Governments are responsible for adhering to and implementing the principles of the policy, assisting in ensuring that the principles are incorporated in the IDP's and SDF's, and developing a database on high potential and unique agricultural land in the province. Where required, the provinces have the option to promulgate additional provincial legislation on the topic. The same requirements are also delegated to the local authorities (Department of Agriculture 2006d:13).

In determining applicable norms and standards, it is important to ensure economic viability, as well as the sustainable utilization of natural resources. Specific norms and standards for the sub-division of agricultural land include 60 large stock units per farm in the case of grazing land that is determined based on the 1993 approved grazing

capacity norms for the area concerned. They further include 100 ha for dry land crop production and 20 ha with 10 ha approved water rights for irrigated land (Department of Agriculture 2006d:14).

In terms of change of land use norms and standards for specific land uses, very broad guidance are given on how this should be managed. However, the loss of high potential agricultural land is not supported as well as the sub-division of agricultural land into uneconomic agricultural units. Provinces can develop their own norms and standards within the national requirements for the Minister's approval. Norms and standards shall be reviewed once every five (5) years or at the Minister's discretion (Department of Agriculture 2006d:15-18).

Continual inventories will be conducted on high potential agricultural land. The policy also encourages close cooperation between the Departments of Agriculture and Land Affairs, especially in view of the proposed Land Use Management Bill, 2008, and the provincial and local governments as well as the Departments of Water Affairs and Forestry and Environmental Affairs and Tourism with regard to sustainable development principles (Department of Agriculture 2006d:19).

- **Policy on Agriculture in Sustainable Development – a discussion document (8th draft)**

As part of its commitment to sustainable development, the national Department of Agriculture has embarked on a process of developing a policy on the role of agriculture in sustainable development. The policy acknowledges the roles and responsibilities of all role-players (Government, farmers and conservationists) in ensuring a sustainable agricultural sector in South Africa. According to the policy, sustainable agriculture is a main user of the country's natural resource base, through the production of high quality and safe agricultural products. Agriculture therefore contributes to the economy and social well being of the land user, but without the degradation of soil and water resources. Tools identified in achieving this goal include policy and agrarian reform, land conservation, improved management and active participation (Department of Agriculture undated:3).

Influencing the content of the policy were the outcome of the 1992 Earth Summit in Rio and the 2002 World Summit on Sustainable Development (WSSD), climate change, biodiversity, desertification, plant genetic resources and the Millennium Development goals.

The purpose of the policy is to ensure a sustainable agricultural sector through government's commitment to food security, poverty alleviation and economic development, whilst protecting the natural resource base. However, it acknowledges that the process is hindered by inadequate infrastructure, globalisation, limited natural resources and appropriate skills, climate change and the absence of a national policy framework (Department of Agriculture undated:6).

Agriculture and its related activities are not always complementary to the environment. Inadequate management and agricultural practices may have resulted in the degradation of natural resources and the loss of biodiversity. The use of chemicals and pesticides has not only had a negative impact on the inherent characteristics of the soil, but is also a source of pollution for the country's water resources. Limited access to suitable land has resulted in inappropriate land use and the utilization of marginal land, which places additional stress on the already stressed natural resource base. Limited research is currently being conducted on improving agricultural production methods and management that can lead to improved sustainability.

The policy lists several strategic initiatives that have been developed to improve or regulate certain aspects of agriculture, such as the *White Paper on Agriculture, 1995* and the *Strategic Plan for South African Agriculture, 2001*. It also refers to legislation that has an impact on sustainable development, including the *Fertilizers, Farm Feeds, Agricultural Remedies and Stock Act, 36 of 1947*, the *Livestock Brands Act, 87 of 1962*, the *Conservation of Agricultural Resources Act, 43 of 1983* and the *Genetically Modified Organisms Act, 15 of 1997*. Not included in the list, however, is the *Sub-division Act, 70 of 1970* (Department of Agriculture undated:11-13). Addressing the principles of sustainable development requires establishing a partnership between the various spheres of Government, as well as with relevant private sector role-players. Appropriate legislation, policies and programmes should be put in place. The policy options that the national Department of Agriculture can focus on include food security, poverty, unemployment, health and equity in terms of the social aspect. In terms of the

environmental aspect, it can include optimal utilization of land, protection of natural resources and biodiversity with global competitiveness, biotechnology and production systems (plant and animal production) addressing the economic principle. It is stipulated that the sustainable utilization of the natural resource base should form the basis of any policy interventions and be regarded as a pre-requisite for development (Department of Agriculture undated:16).

The above should be interlinked within the current DoA programmes and provision for implementing them funded through existing budgets of the individual Directorates. Appropriate policies, regulations and guidelines should be developed internally within the Department. The policy concludes with the recommendation that a ten-year implementation plan needs to be developed in consultation with all sectors, clearly outlining targets and responsibilities (Department of Agriculture undated:27).

6.5 GAUTENG PROVINCE'S ACTS AND POLICIES

- **Gauteng Planning and Development Act, 3 of 2003**

The Premier of Gauteng signed this Act in October 2003. The Act aims to provide a single system for development, planning and land management in the province, and to create the opportunity for developing development plans and frameworks as well as for zoning schemes (Gauteng Provincial Government 2003:2).

This Act promotes spatial restructuring and development through compact urban areas. It also supports limited urban sprawl and the protection of agricultural resources, and focuses on integrated land development. It further promotes sustainable development and optimised use of existing resources, including resources related to agriculture, land, water, minerals, infrastructure and transportation. The Act aims to balance environmental considerations on the preservation of natural resources for future generations with economic developments and requirements (Gauteng Provincial Government 2003:8).

Sections 10 to 18 of the Act allow for the establishment of planning committees, a provincial planning tribunal and municipal planning tribunals (Gauteng Provincial Government 2003:9-13). Section 19 makes provision for the compilation of a planning

and development policy in the province. Sections 20 to 24 stipulate a provincial integrated development plan that is to guide decision-making on development. Municipal spatial planning must be aligned to municipal integrated development plans and national government programmes. Sections 25 to 38 describe a provincial spatial development framework that should be aligned to the municipal SDF's as developed under the *Local Government: Municipal Systems Act, 32 of 2000*. In accordance with sections 39 to 43, every municipality also has to develop a land development policy, which should include the principles of the SDF, as well as the norms, standards and guidelines to be applied in the development of land or a zoning scheme (Gauteng Provincial Government 2003:13-19). There is thus a close link between this Act and the *Municipal System Act, 32 of 2000*.

The Act further requires municipalities to develop zoning schemes that should provide guidance on the regulation of development and the use of land in their municipal areas. Such zoning schemes shall include conditions, obligations, rights and procedures on the development or use of the land. Provision should be made in the schemes for the protection of identified natural features and the conservation of heritage sites (Gauteng Provincial Government 2003:19-21).

Chapter VI, section 61 of the Act focuses on the development procedures and includes the sub-division, as well as the consolidation of land (Gauteng Provincial Government 2003:24). The principles in this provincial Act have a high level of reference to the Land Use Management Bill, tabled in Parliament in April 2008.

- **Draft policy on the protection of high potential agricultural land**

After the completion of the Gauteng Agricultural Potential Atlas (GAPA) Version 3, GDACE developed a policy on the protection of agricultural land in the province. The specifications of this policy were closely linked to the outcome of GAPA, Version 3. The researcher, although responsible for the development of the Policy, could not determine whether to date, either GDACE or the Gauteng Provincial Government has formally adopted it as provincial policy. However, through interaction with consultants involved in EIA and relevant applications, it was established that the principles in the policy were being enforced.

The purpose of the policy is sketched against the background of the limited amount of high potential agricultural land available in the country, of which a large portion is located in the Gauteng province. The policy defines land capability as “the extent to which land can meet the needs of one or more uses, under defined conditions of management, without permanent damage” and high potential agricultural land as “having the soil and terrain quality, growing season and available moisture supply needed to produce sustained high yields of crops economically when treated and managed according to best possible farming practices” (GDACE 2006d:3).

The importance of protecting especially high potential agricultural land for agricultural production, is aimed at feeding the nation and providing upcoming farmers access to productive land in meeting the national targets. Agricultural resources should be optimally utilized. High potential agricultural land is regarded as a scarce, non-renewable resource and it is recommended that a risk averse and cautious approach should be followed when this land is earmarked for uses other than agriculture.

It should be noted that the policy focuses on agricultural practices dependent on the soil itself and that practices making use of artificial growth media, such as hydroponics or activities such as livestock production or animal housing, occurring on high potential agricultural land, are not supported (GDACE 2006d:3-4). It is felt that there is sufficient alternative land available for other uses without compromising potential productive land. As a result, urban sprawl is also not supported due to its impact on agricultural land.

In reviewing applications for development pertaining to the impact thereof on agricultural land, GDACE makes use of GIS information (in this case, GAPA Version 3), detailed soils surveys or field verification, agricultural specialists studies and other departmental information systems, such as land cover. Each application is viewed on merit. Variance from GDACE’s principal position on the mentioned, include where land has been fragmented to such an extent that the remaining land is not longer viable for agricultural production, previous decisions in the same area, and additional soil surveys or specialists studies that contradict GAPA, to such an extent as to over-write GAPA’s specifications. It also includes scenarios where the benefits of the proposed development outweigh the loss of agricultural land (GDACE 2006d:5).

The policy (GDACE 2006d:7-10) identifies criteria against which an application will be reviewed, including

- Agricultural potential (measured against dry land cultivation under correct management practices)
- Soil, its inherent characteristics and thus the potential thereof (a comprehensive list of soil forms and their potential developed as part of GAPA Version 2 is attached to the Policy as an Annexure for reference purposes)
- Water availability and available water rights
- The size of the land and surrounding land use.

The policy divides high potential agricultural land into two main classes with a number of sub-classes under each main class (GDACE 2006d:5-7). The demarcation of the classes was based on the 2002 urban development boundary data set. These classes include:

- High potential agricultural land located *outside* of the urban edge
 - Agricultural hubs

Seven agricultural hubs have been identified in the province, which consist of large portions of high potential agricultural land, located in close proximity to one another. The policy states that all agricultural land (including medium and low potential agricultural land) located within the demarcated hubs should be protected for agricultural use. Proposed activities on the medium to low agricultural potential land should be reviewed and, where possible, have an agriculturally related connection, as these activities will impact on the high potential agricultural land. Applications on any land located within the agricultural hubs should be accompanied by an agricultural specialist study for review within the specified set of criteria.
 - Important agricultural sites

Smaller individual portions of land located outside of the urban development boundaries indicate these areas. A proposed change of land use within these classified areas should be accompanied by an agricultural specialist study. The Branch: Agriculture will review the outcome of the study, after which a decision will be made based on the evaluation criteria.

- High potential agricultural land located *within* the urban edge

- Land incorporated within the urban edge

Agricultural land located within the urban edge is regarded as not being viable for agricultural purposes, due to the pressures exerted on land for residential and other developments. In view of this, agriculture therefore has no objections to development on high potential land located within the urban development boundary.

- Land overlapping the urban edge

Due to the fact that GAPA Version 3 was developed as a spatial decision support system, certain areas (polygons) are located both within and outside of the urban development boundary. Applications located in these identified areas should be accompanied by an agricultural specialist study. The Branch: Agriculture will review the outcome of the study, after which a decision will be made based on the evaluation criteria.

- High potential land located within a protected area

High potential land located within a protected area as was demarcated by C-Plan is noted. However, this land is currently managed under the management plan of the area and is thus not available for agricultural use.

Furthermore, the policy states that GDACE is not in support of the sub-division of agricultural land which may result in uneconomically viable agricultural units (GDACE 2006d:10).

The requirements for an agricultural specialist study to be conducted in terms of the specifications of the agricultural classes are incorporated in the policy together with a detailed explanation of the GAPA Version 3 GIS data set.

6.6 POLICY TRENDS

According to the Department of Environmental Affairs and Tourism (2006a:41), Statistics South Africa is in the process of compiling “natural resource accounts”. The aim of these accounts is to have an accounting system on natural resource assets that will provide decision makers with an information base on natural resources. It will also allow for awareness of environmental issues by all levels of decision makers, as well as the public and create opportunities for the development of related policies. Accounts

that have been completed include mineral, energy, land use and land cover, and water accounts.

Another trend identified, included the use of environmental economic instruments in the management of resources and the environment. New legislation, such as the *National Environmental Management: Air Quality Act, 39 of 2004*, allows for the use of taxes or charges to achieve environmental management targets. The Department of Water Affairs and Forestry follows the same principle in terms of pollution charges (Department of Environmental Affairs and Tourism 2006a:41).

6.7 POLICIES OUTSIDE SOUTH AFRICA FOCUSED ON THE PROTECTION OF AGRICULTURAL LAND

A review of country policies on the protection of agricultural land indicated that few countries besides Australia had such policies.

As early as 1979, the State of New South Wales (NSW) proclaimed the Environmental Planning and Assessment Act with a “Policy for sustainable agriculture in New South Wales 1998” to provide context to the Act. The focus was on the protection of agricultural land through maintaining the availability of the land, minimizing limitations on the use thereof and promoting sustainable agricultural enterprises. The policy stipulates that agricultural policies should be directed at the protection of the natural resources’ base that will retain the production potential of the land. This, in return, will ensure that agriculture is sustainable. Land use and land capability should be dictated by the soil, but other factors such as water, labour, markets and infrastructure are also important (New South Wales Department of Primary Industries 2004:1).

Threats to sustainable agriculture include degradation of natural resources and the alienation of agricultural land through non-agricultural uses and adjacent incompatible developments. However, sustainable agriculture should respond to the needs of the consumer both in quality and quantity, protect the natural resources base and be financially viable (New South Wales Department of Primary Industries 2004:3). Notably, the policy stipulates that land use planning should be an integrated process between all parties involved. This process should cut across the planning phase, production phase and the impact of associated practices on the surrounding community, as well as best-

suited farming methods on the land concerned. The conversion of agricultural land to other uses should be the last resort. This is to ensure that appropriate planning is conducted that will benefit the community and will limit conflict (New South Wales Department of Primary Industries 2004:4).

The State of Queensland states that high potential agricultural land should be protected and managed appropriately for the longer term. This is especially important to ensure sustainability in the rural economy. A fall in economic trends or consumer demands should not form the basis for the conversion of agricultural land into other economic sectors. Agriculture has the potential to respond and adapt to changes in the markets, whilst continuing to provide employment and an income (Sanders 2006:1).

Local government should include the protection of agricultural land when preparing or reviewing their planning schemes. They also have to take into consideration the “negative” impacts associated with agriculture such as chemicals, spraying and dust when identifying land for agricultural and residential purposes, in order to minimize conflict. An important requirement needed for planning and policy implementation is an assessment on land capability and quality. In many instances, the level of detail in data is insufficient for evaluation purposes and applicants are encouraged to undertake land and soil studies with guidance from Government (Sanders 2006:2).

6.8 THE MUNICIPAL ENVIRONMENT (LOCAL GOVERNMENT)

National and provincial acts and policies regularly refer to municipality’s role and responsibilities when it comes to land use management. Therefore, it is necessary to elaborate on this matter.

Municipalities are required by law to ensure sustainable and effective management of the area under their jurisdiction. Documents that need to be compiled by municipalities and updated on a regular basis include State of the Environment Reports (SoER), Integrated Development Plan (IDP’s), Spatial Development Frameworks (SDF’s), as well as Environmental Management Frameworks (EMF’s) (South Africa 2000b:29-32).

In Gauteng, a preliminary Gauteng State of the Environment Report (SoER) was compiled in 1998 for the province by the Gauteng Department of Agriculture, Conservation and Environment. A complete SoER followed this initial attempt in 2004.

The ideal scenario would be for the local SoER's to feed into the provincial SoER. In reference to the Gauteng SoER 2004, this was not the case, mostly due to the unavailability of reports (GDACE 2004a:3).

Most of the municipalities in the province are, to some extent, involved in compiling a SoER for their area. All three Metropolitan municipalities had completed a SoER whilst most of the local municipalities were in the process of doing so and had thus not yet released one. Some municipalities make use of their own expertise in compiling the reports whilst others acquire the assistance of external service providers. In certain cases, these reports are available on the Internet, but usually have to be requested from the municipality concerned (GDACE 2005a:51).

In evaluating the incorporation of the protection of agricultural land, especially high potential land, the Provincial SoER continuously refers to the Gauteng Agricultural Potential Atlas Version 2 as the benchmark. Nevertheless, it concludes that the scale of the data needs to be improved for better decision-making. It notes further that the contribution of agriculture to the provincial GDP has declined. Factors impacting on this include conflicting land use, loss of agricultural land due to urban sprawl and the degradation of the land (GDACE 2004a:49; 2005a:52)

The first SoER developed by the City of Tshwane Metropolitan Municipality (CTMM) in 2004, was regarded as a pilot study due to the lack of sufficient data in using the DPSIR framework. In terms of agriculture, the SoER referred mostly to the state of urban agriculture and its economic impact on the Metro. The report also focuses on the pollution caused by agricultural production. It acknowledges the development pressures experienced on agricultural land and that local government has not previously been involved in agricultural development. A paradigm shift is thus required to include agricultural activities in the economic development plans. Accordingly, the Metro is in the process of considering business plan proposals for urban agricultural projects, while at the same time investigating the possibility of farming on various soil types and the rezoning of land for agricultural activities (GDACE 2005a:54). The presence of the Pretoria Fresh Produce Market, which is the second largest market in South Africa, also provides an ideal opportunity for farmers to sell their produce.

The City of Johannesburg's Metro (CoJ) SoER accuses agriculture of irresponsible and unsustainable water use, as well as of degrading the natural resources due to transformation of natural veld to cultivation, resulting in a loss of biodiversity. The Metro nevertheless acknowledges the role of agriculture in utilizing open space (GDACE 2005a:56).

The Ekurhuleni Metropolitan Municipality (EMM) is one of the few to have compiled a detailed SoER with inputs from the IDP's and SDF's. Large areas of high potential agricultural land (41%) and areas used for commercial agriculture characterise the EMM's area of jurisdiction. The EMM also makes use of GAPA 2 as reference when referring to high potential agricultural land. About 17% of the Metro's area comprises of cultivated lands and grazing areas. However, agriculture only contributes 1% to the GGP. Priority is thus given to residential development in areas where it is felt that agriculture is economically unviable (GDACE 2005a:57).

The EMM recommends that production on arable land be increased and grazing land maintained. The urban development boundary has also been identified to protect against urban sprawl. The EMM does not support the loss of high potential agricultural land outside the urban development boundary (GDACE 2005a:59). At the same time, the impact of agriculture on the environment is not seen in a very positive light. Agriculture is viewed as contributing to the degradation of the natural habitat, loss in biodiversity, fragmentation of habitats and polluting the water sources.

A review of the SoER's of the District municipalities reveals very limited information on agriculture. Some reference is made in terms of land use in their area of jurisdiction and the contribution of agriculture to the GGP. No reference is made to the protection of high potential agricultural land or to available decision support systems such as GAPA Version 2 (GDACE 2005a:61-64).

An Environmental Management Framework (EMF) is regarded as a spatial representation of sustainable development in an area linked to a variety of parameters. It consists of comprehensive information on the environment and should guide decision-making in the area concerned. It should also identify areas of conflict and be aligned with the Environmental Impact Assessments promulgated in the *National Environmental Management Act, 107 of 1998*. Integrated into the EMF should be the desired state of

the environment, environmental control zones, proposed land use in open spaces and highlighted areas of environmental sensitivity. Should agriculture be identified as the preferred land use in a specific area, a strategy in terms of the agricultural activities should be developed, including the mapping of activities that may threaten its existence (GDACE 2005a:65).

A limited number of EMF's have been compiled in Gauteng. The most comprehensive EMF was compiled by the EMM. The main objective of the EMF was to assist GDACE and EMM with decision-making in executing their mandate effectively. Reference is made to the protection of high potential agricultural land in identified areas in the Metro, but should be balanced with other land uses. GAPA 2 was used to determine soil condition and grazing potential. Agriculture, geotechnical, ecological and hydrological factors are seen as development constraints, with the occurrence of medium to high potential agricultural land regarded as a primary constraint to development in the EMM area of jurisdiction (GDACE 2005a:71). The framework identifies zones supporting specific land uses. This also includes zones where agriculture should be the primary objective.

The report recommends that factors such as soil properties, water availability (quality and quantity), climate, economic factors, farm security, support structures, level of skill and land ownership should form part of determining agricultural potential. Agricultural potential areas should be precisely demarcated and based on their real agricultural value. Incentives should be provided to previously disadvantaged individuals (PDI's) for accessing agricultural land (GDACE 2005a:74).

A Spatial Development Framework (SDF) is the spatial component of the IDP and should give guidance in terms of planning and development. The SDF should be in the form of a map/maps with supporting documentation indicating desired land use and development patterns. It becomes a legal document through the approval of the IDP. It has to adhere to the principles for spatial development set out in the *Development Facilitation Act, 67 of 1995* and should be aligned with adjacent municipal SDF's, as well as with the provincial SDF and other provincial and national planning policies and strategies (GDACE 2005a:77).

Land use and land cover play an important role in the development of SDF's, as well as supporting layers, such as high potential agricultural land, when mapping development zones.

In the CoJ SDF agricultural activities are to be located outside the urban development boundary with only structures associated with agriculture permitted. The SDF also stipulates that the sub-division of productive agricultural land is not supported and should only be allowed with the consent of the national Department of Agriculture (GDACE 2005a:81). Urban agriculture is encouraged, provided that mechanisms are in place to prevent pollution. Sustainable land use and agricultural methods are supported. This statement is in contrast with the SoER from the same organization. Aspects that should be taken into consideration when identifying agricultural potential areas include characteristics of the soil (no detailed specifications), slope and water availability (no urban agricultural activities are supported if water is not available). It stipulates further that high potential agricultural land should be preserved for intensive agriculture (GDACE 2005a:83).

The same underlying principles were identified in other SDF's. Agricultural activities should be located outside of the urban development boundary, promoted and protected. Urban agricultural activities should be treated with caution in terms of the pollution impacts but, where appropriate, should be supported. A transitional area should be demarcated between the urban development boundary and the farming areas. Agricultural holdings can thus reside in the transitional area together with other activities such as small industries and businesses (GDACE 2005a:84-92).

Each municipality also has the responsibility of compiling an IDP. The core components of the IDP should include the municipality's vision, review of its existing developments and infrastructure, the development strategies, a spatial development framework and key performance indicators amongst others (GDACE 2005a:93). The IDP is a comprehensive planning process that strives to incorporate all relevant policies, legislation, requirements, capacity, budgeting matters and implementation plans into one comprehensive development plan. The IDP should be amended on a regular basis to incorporate changes and improvements.

In the context of this study it is concluded that that agricultural activities should play an important role in the compilation of an IDP, as it is regarded as a legally binding document that operates above all other plans as far as it involves development on local municipal level. A review was conducted of municipal IDP's developed for the year 2005, with specific focus on agricultural land and the protection thereof.

The CTMM regards agriculture as contributing to job creation, although highly labour expensive. The Metro states that identified high potential agricultural land is regarded as environmentally sensitive areas and should be protected. Urban agriculture can contribute to food security and economic and social development. In achieving this, an agricultural policy is needed (GDACE 2005a:95).

Limited reference is made to agriculture in the CoJ IDP, whilst the EMM identifies a number of agricultural projects that can contribute to food security and economic growth. The EMM adopted an agricultural strategy (GDACE 2005a:97).

Both the Kungwini and Randfontein local municipalities acknowledge the importance of protecting high potential agricultural land. The Randfontein local municipality recommends the establishment of an agricultural hub. Proposed zones for agricultural activities have been identified, pending the outcome of feasibility studies. The municipality stipulates that land currently being utilized for agricultural purposes should only be reallocated to other uses should a real need exist. The Westonaria municipality has also identified agricultural zones that include an urban agricultural zone, an intensive agricultural zone, an extensive agricultural zone and community small-scale agricultural projects, but acknowledges that there are constraints such as climate factors, water availability, support to farmers and economic farming units that hamper success. The Sedibeng District Municipality states that agriculture is the only sector that has increased its activities within the boundaries, but that it is the smallest economic sector. Sedibeng emphasises agriculture because of the large amount of agricultural land within their area of jurisdiction. A number of focus projects have been identified in which agriculture can contribute to food security and economic growth, through improved utilization of existing agricultural resources, including the high potential agricultural land. This sentiment has been adopted by the local municipalities residing under Sedibeng District municipality (Lesedi, Midvaal and Emfuleni) (GDACE 2005a:95-110).

In 2005, GDACE held interviews with representatives from all the local authorities in the province that deal with applications pertaining to the change of land use, sub-division of land and other relevant matters. The purpose of the interviews was to determine how the municipalities handle these applications, the procedures involved and the use of spatial information in assisting with decision-making and the compilation of documents such as SDF's and IDP's. It was concluded that there is a significant variance in the interpretation of SoER, EMF, SDF and IDP studies. Many municipalities experience budget and capacity constraints that limit the completion of essential documentation required by law. Only a few municipalities knew about agricultural studies conducted such as GAPA or other decision support tools for example C-plan or the Gauteng Open Spatial Plan (GOSP). Communication between provincial and local government is limited.

GIS knowledge and experience in municipalities is also limited, thus restricting the use of spatial information in decision-making and future planning. Many municipalities make use of the services of external service providers for data, maps and spatial information. The procedures in handling applications vary from municipality to municipality. There appears to be no correlation between the various municipalities in dealing with applications. In some instances, applications are sent to the GDACE and/or the national Department of Agriculture, whilst in others, the municipality deals with the application on its own (GDACE 2005a: Appendix 1:8). This situation is of grave concern.

6.9 CONCLUSION

This chapter examined national and provincial legislation and policies on agriculture, sustainable development and use of natural resources, and their impact. The findings indicate a need for concerted, on-going co-operation and support between national, provincial and local authorities in this area.

Chapter 7 describes the status of natural resources in South Africa.

THE STATUS OF NATURAL RESOURCES

7.1 INTRODUCTION

In this study, the importance of the natural resource base of the country, with special reference to Gauteng, forms the underlying principle in the management and protection of land for agricultural purposes. This chapter examines and discusses the status of natural resources in the country.

7.2 THE ENVIRONMENT AND ITS NATURAL RESOURCES

According to the *National Environmental Management Act, 107 of 1998*, the environment in which humans exist is made up firstly of land, water and the atmosphere and secondly of micro-organisms, plant and animal life (South Africa 1998a:6). The interaction between the mentioned as well as the physical, chemical and cultural properties and condition thereof has a major influence on people's health and well being.

According to the Constitution, environmental management is a function of both national and provincial government with the option of it being decentralized from national to provincial to local level (South Africa 1996a:117). The Committee for Environmental Co-ordination (CEC) is regarded as the official body for ensuring the integration of environmental issues between various and different resource-based departments and levels of government.

Natural resources are regarded as core components of the more holistic principle of the environment. The FAO (1993: Glossary) defines natural resources as "resources of the land relevant to its potential for land use e.g. climate, water, soils, pastures, forests". According to section 1 of the *Conservation of Agricultural Resources Act (CARA), 43 of 1983*, natural agricultural resources refer to "the soil, the water sources and the vegetation excluding weeds and invader plants" (South Africa 1983:2).

South Africa's natural resources are highly diverse, sensitive and limited. This is illustrated by the fact that more than half of the country receives an annual rainfall of less than 500 mm per annum, the minimum amount regarded as needed for dry land crop production (ARC-ISCW 2004:6). This negative picture looks worse if the country's broad soil classification, in which a limited number of soil forms can be used successfully for agricultural production, as well as the soil's proneness to erosion susceptibility, is taken into consideration.

In the three centuries since the first formal settlement in South Africa, the state of the natural resources has deteriorated to such an extent that the Soil Conservation Act was formulated in 1946. In 1983, this Act was repealed and the *Conservation of Agricultural Resources Act, 43 of 1983* came into effect.

Each land use has an impact, whether positive or negative, on the environment and the natural resources. The crux of the matter is to manage land use to such an extent that the environment can benefit the most. Agricultural activities themselves can be most detrimental to the environment. Impacts, such as soil degradation, erosion, loss in water quality and biodiversity are some of the negative impacts. However, if managed properly and sustainably, agricultural activities can be productive, whilst also ensuring a properly managed environment.

According to Opperman (2000:1), agriculture has an important impact on the environment currently and in the future and should therefore be regarded as an important role-player in conserving the environment. Opperman emphasises that the negative impact of agriculture can be seen through increased pollution due to the use of fertilizers, chemical ingredients and animal waste material. Degradation of the natural resources as a result of over grazing and erosion, the decrease in biodiversity and habitat, negative visual impact and a decrease in food quality, as well as an increase in health risk questions due to the use of herbicides and growth stimulants have a further negative effect. However, agriculture does not only have a negative impact on the environment. If managed well and sustainably through effective use of the natural resources, it can create job opportunities and an increase in the environmental quality. Agriculture is an important and integral part of the economy.

Due to the estimated growth in the world's population, it can safely be assumed that the need for food and housing will increase with a resulting increase in agricultural production and pressure on the world's natural resources. Natural resources should therefore be used sparingly and according to their capability, to adhere to the demand, but not to deplete the resource.

It is well known that a proper balance should be struck between any land use and the protection of non-renewable natural resources such as agricultural land. Once again, the emphasis points in the direction of sustainable development. Opperman (2001:3) points out that corrective measures are mostly re-active, which is not ideal.

Ensuring the availability of up-to-date information about the state of the natural resources, and correctly identified, requires accurate planning on how the resources should be managed and utilized. Environmentally sensitive areas should be avoided and managed according to an environmental management plan. Suitable agricultural land should be identified, protected and managed in order to ensure the protection of the resource. The remainder of the land could be developed pending the need. This should form the basis for integrated, coordinated and sustainable development.

7.3 STATUS QUO OF THE NATURAL RESOURCES (ENVIRONMENT)

Recent awareness of, and emphasis on the conservation of natural resources have led to major initiatives to determine the state of natural resources or the environment, on a national as well as a limited provincial and local level. This information should then form the foundation for future initiatives and the setting of environmental conservation targets. The principle of integrated governance should be followed throughout environmental management. Access to information forms a core element of this process. The *White Paper on Environmental Management Policy* (Department of Environmental Affairs and Tourism 2006b:54) stipulates that institutional responsibilities in terms of regulating environmental impacts and the promoting of resource conservation should be separated.

Every authority at national, provincial and local level, involved in environmental management is required to compile a State of the Environment Report (SoER). The main objective of the SoER is to provide information on the current state of the

environment and to raise awareness of its importance thereof. The SoER is used as a tool to measure changes in the environment. Important information that should form part of the report is an understanding of how the environment operates and the impact of human activity thereon. It should also involve the utilization of data (including the identification of gaps and the obtaining or creation of outstanding data) in the developing and monitoring of the environment to achieve sustainable development (Department of Environmental Affairs and Tourism 2006a:xv).

The “state” refers to the condition of the environment and its reaction to pressures as well as the effectiveness of the response. “Pressures” are the activities and processes exercised on the environment and are grouped into four classes, namely

- social developments
- policies that may have a negative impact on the environment (for example, agricultural policies)
- natural processes
- environmental policies that have a positive effect on the environment.

“Impacts” refers to the consequences of the state of the environment on sustainability with special reference to people, the economy and the environmental sector. “Responses” refer to the actions taken to limit or reduce negative environmental impacts (Department of Environmental Affairs and Tourism 2006a:xvii).

In many cases, the Drivers–Pressures–State–Impacts–Responses (DPSIR) framework was the recommended approach in determining the above. This framework is based on evaluating the driving forces behind human activities and the effect or pressures thereof on the environment with the resulting impact, the evaluation of the current state of the environment, as well as the actions taken to address changes in the environmental state. The evaluation of the environmental state is conducted with the use of indicators. These indicators broadly include land, water resources, atmosphere, biodiversity and ecosystem, health, as well as the social environment reflecting on human related matters. In working with indicators it is possible through the use of existing information to determine the status quo, identify gaps in the unavailability of information, address areas of concern and allow for monitoring over time (Department of Environmental Affairs and Tourism 2006a:xvi).

From a land and resources management perspective, the FAO also puts great emphasis on identifying indicators to measure sustainability within the agricultural field, using a Pressure–State–Response framework. It is recommended that indicators should guide land users in their decision making pertaining to the management of their land and water resources. Pressure or causative factors refer to the driving forces exerted on land by human activities and the related impact on the quality of the land. The state refers to the type, degree and spatial extent of change on the natural resource, whilst the response is the actions of land users and Government to rectify any degradation of the resource. In terms of resource availability, pressure indicators include productivity of the arable land, increased use of marginal land and increased cropping intensity. State indicators include change in erosion, change in productivity (yield/ha) and change in water quality, whilst response indicators can include the movement to more tolerant crops, change in the rate of land abandonment, as well as capital investment. They can also include a change in input efficiency and production systems and a positive response by Government and/or institutions (Benites, Shaxson & Vieira 1996:3-6).

Land changes should regularly be monitored on what is changing, the processes by which these changes occur and the sustainability of the changes. This includes changes in production practices, different land uses, management practices and changes in the condition of the land resources. For effective sustainable planning, identified sustainability indicators should be closely linked to national and lower-level planning. Thresholds and targets should be set and compared for performance, but should be based on basic natural resource information and the identification of gaps for future research. Agriculture uses natural resources in the production of products essential to the survival of the human race. No new resources can be created and the current resources should be used with the utmost care.

The most effective way of assessing the state and availability of natural agricultural resources in a detailed manner is through appropriate and applicable long-term research. This should be supported by baseline natural resource data and verified and updated through field surveys and evaluations. The outcome is best expressed by effective recording of the data and analysed and managed through spatial information in the form of geographical information systems.

Due to the vastness of the country and the accessibility of certain areas many evaluations of natural resources are done through the use of satellite imagery and aerial photography. Obtaining and updating of natural resource information is a very costly exercise and the return on investment can only be seen in the long term. In the day-to-day running of matters, such as ensuring food security and overseeing a growing economy of a country, decision-makers generally do not regard allocating funds to natural resource research as a priority. Funds are consequently allocated to more “visible” and short-term impact areas. Baseline agricultural research sponsored by Government, through the parliamentary grant system, declined from R337 million in 1997/1998 to R262 million in 2001/2002. This equals about 55% of the parliamentary grant received in 1992 (Vink & Kirsten 2003:7). This lack of insight will come at a costly price as the loss in time will not easily be recouped and may have a catastrophic impact on the country and its economy.

- **Agricultural production factors**

In considering factors that influence agricultural production, six possible factors appear to determine the possible yield of crops, namely physical (soil, climate), economic (capital and services) and human (labour and management) factors. According to the Department of Agriculture (1994:10), the human factor (HR) is the most important.

The human sphere of influence plays a major role in the availability and management of natural resources and determining whether a piece of land can viably be utilized for agricultural purposes. On many occasions, agricultural practices have led to a decrease in soil fertility, loss of topsoil due to incorrect contouring, water run-off and erosion. In terms of rangeland management, problems are experienced with overgrazing, loss of cover, alien plant invasion, change of species composition, and bush encroachment. Bearing this in mind, the fact that land degradation and desertification has become a reality in the country cannot be overlooked.

7.4 SOILS

The soils in South Africa are categorized as the third major soil region of the world and differ highly from the other two soil regions, namely the very fertile soils found in the

developed northern countries (North America and Europe) and the infertile soils of the tropical areas (Department of Agriculture 2006a:17).

Factors influencing soil formation are determined by the parent material (passive soil forming factor) and modified by climate (regarded as the main factor behind soil formation), topography, biotic activity, and time. In the case of South Africa, the presence of hard rock parent material combined with low rainfall, limit soil formation, resulting in shallow soils. Soil forming is the foundation of demarcating areas suitable for cultivation for both agronomic and horticultural crops. “Highly productive arable land with optimal physical and chemical characteristics is limited. It is thus of supreme importance that such areas be mapped. The best soils, such as deep, permeable red or yellow loams, are found where weathering has continued unbroken over a long period” (Department of Agriculture 1994:5, 7). The prime factor to realize is that the country’s soil cannot be renewed in a human lifetime, if lost. Factors responsible for soil formation may no longer be present. Even repairs to damaged or degraded soils cannot be done within a number of human life spans (ARC-ISCW 2004: 34).

The annual average soil loss in South Africa is estimated at 2.5 tons per hectare in comparison with the soil formation rate of 0.3 tons per hectare annually. An estimated 25% of soils are lost due to water erosion (Laker 1995b:2). Scotney, Volschenk and Van Heerden (1990:4) estimate that about 81% of South Africa’s soils can be regarded as slightly weathered and calcareous soils. About 30% comprise of sandy soils with a clay percentage of less than 10%, and 60% of the soils have a low organic matter content.

In South Africa, the first soil map, accompanied by the publication, *Soil groups and subgroups of South Africa*, was released in 1941 and revised in 1962. This book was followed by the National Land Type survey, which commenced in 1972 and was completed in 2002. A land type was defined as an “area of land with substantially uniform combination of soil pattern, terrain form and macroclimate” (Paterson & Van der Walt 2003:3). In 1977, the Land Type Survey made use of a newly developed soil classification system, namely *Soil classification: A binomial system for South Africa*. This classification system was revised and expanded in 1991.

Due to increased requirements, the purpose of the land type survey project was to determine the agricultural potential of the country (ARC-ISCW 2004:34). The survey

was conducted on a 1:250 000 scale and is regarded as a baseline data set with a high level of uniformity with regard to terrain form, soil patterns and macroclimate.

Supporting the spatial representation of the land types is a series of land type inventories or memoirs that consist of soil components with an indication of the percentage representation in each land type. Soil profiles with analytical data, as well as detailed soil profile descriptions, further describe the data. The complete land type survey consists of 69 1:250 000 maps, with an area of 121 722 650 ha mapped, about 400 000 field surveys (one every 300 ha) and a total of 7 071 land types classified (ARC-ISCW 2004:35). To date, most of the soil data available in South Africa is derived from the soil and terrain inventories collected as part of the land type survey (see figure 7.1). Figure 7.2 depicts the detailed land type distribution for Gauteng.

Since the land type survey was based on an inventory approach, it was difficult to develop a generalized soil map for the country. To overcome this problem, however, a classification system consisting of twenty-eight (28) broad soil patterns was developed to explain and provide insight into the land type data. These were further refined into nineteen (19) generalized soil patterns organized into nine soil groups by the ARC's Institute for Soil, Climate and Water (ISCW) in 2003 (ARC-ISCW 2004:36). Figure 7.3 refers to the nineteen broad soil patterns in South Africa. Table 7.1 indicates the expanded legend of the broad soil types (ARC-ISCW 2004:36).

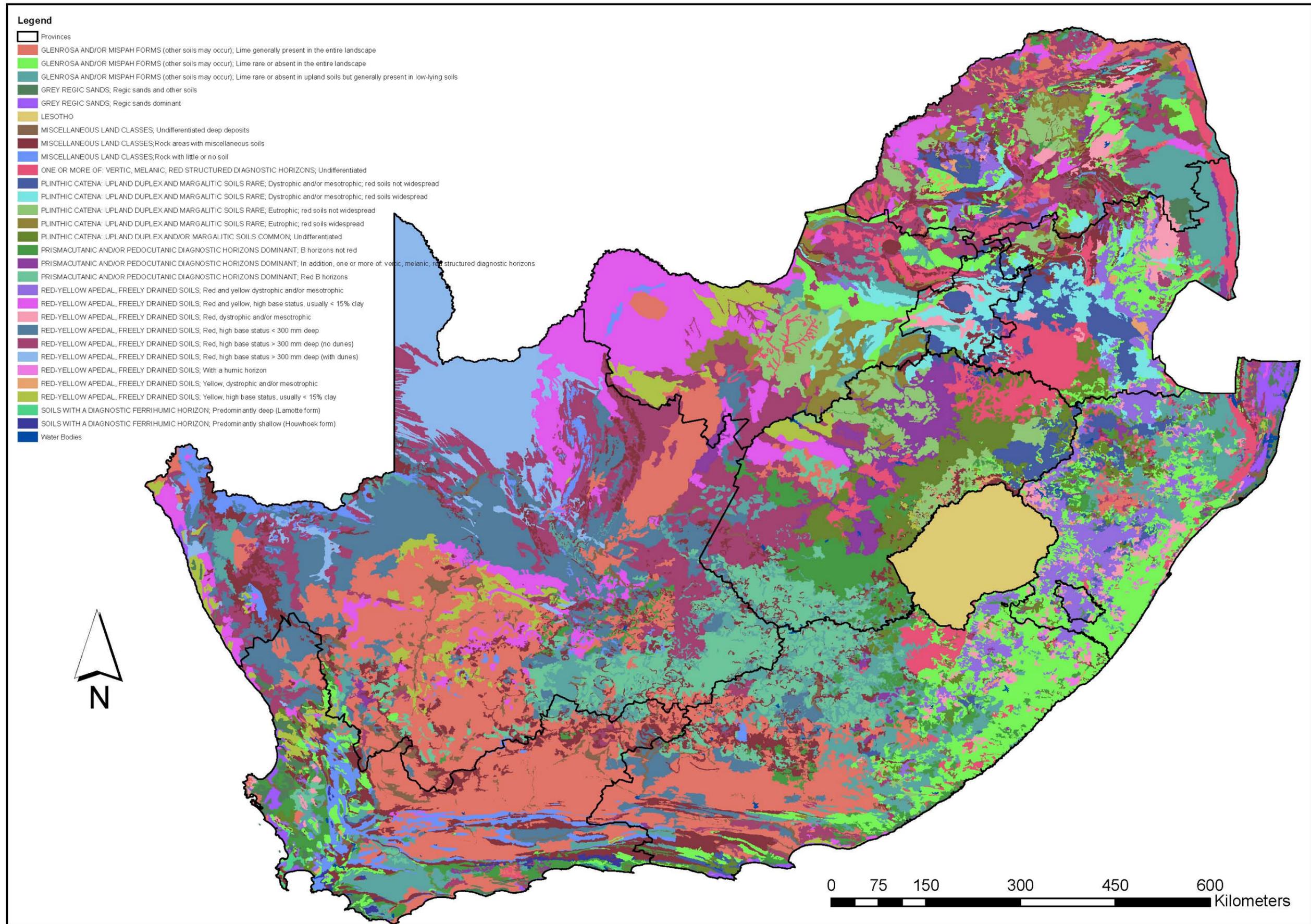


Figure 7.1 Land types distribution in South Africa

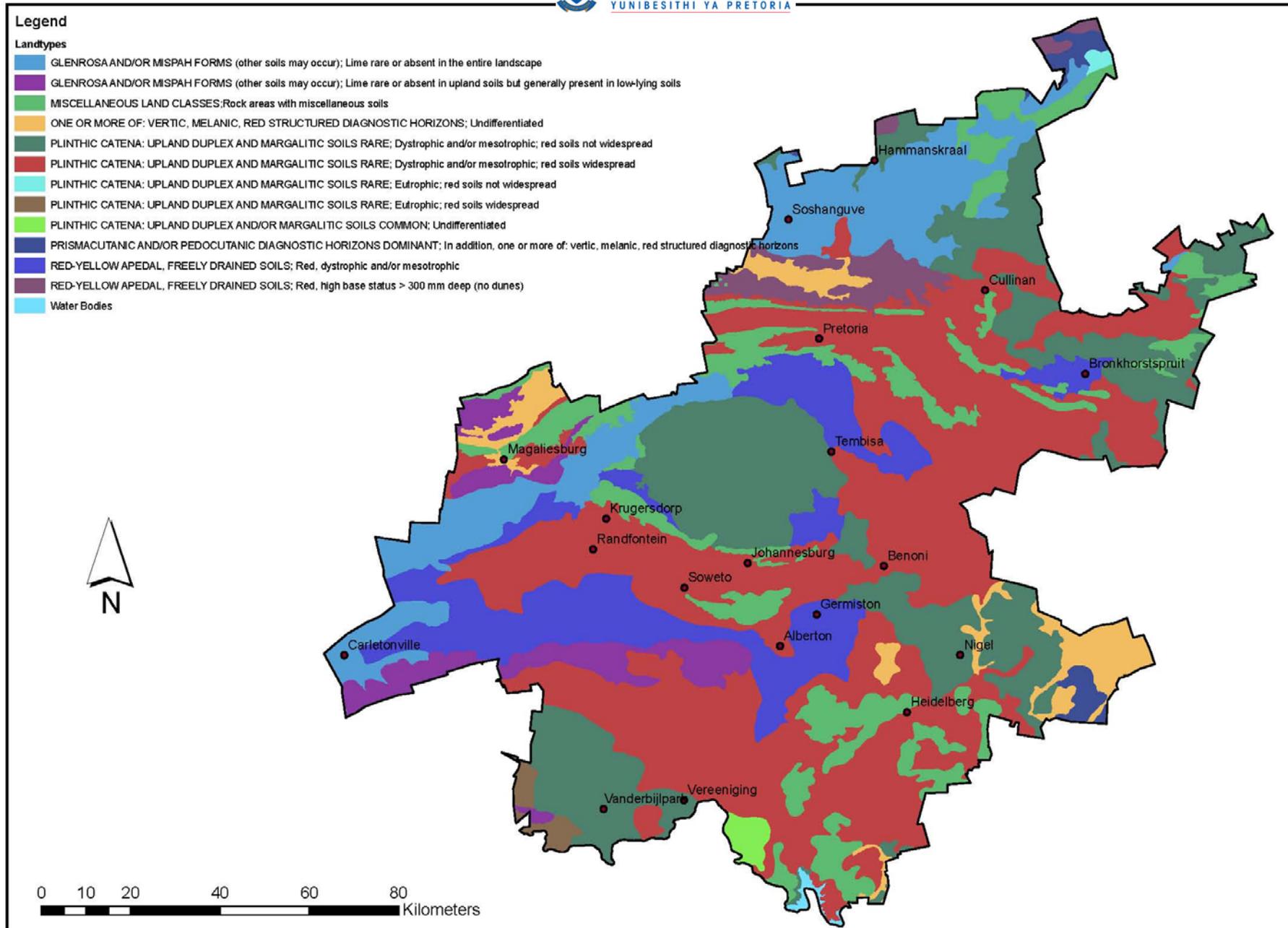


Figure 7.2 Detailed land type distribution in Gauteng

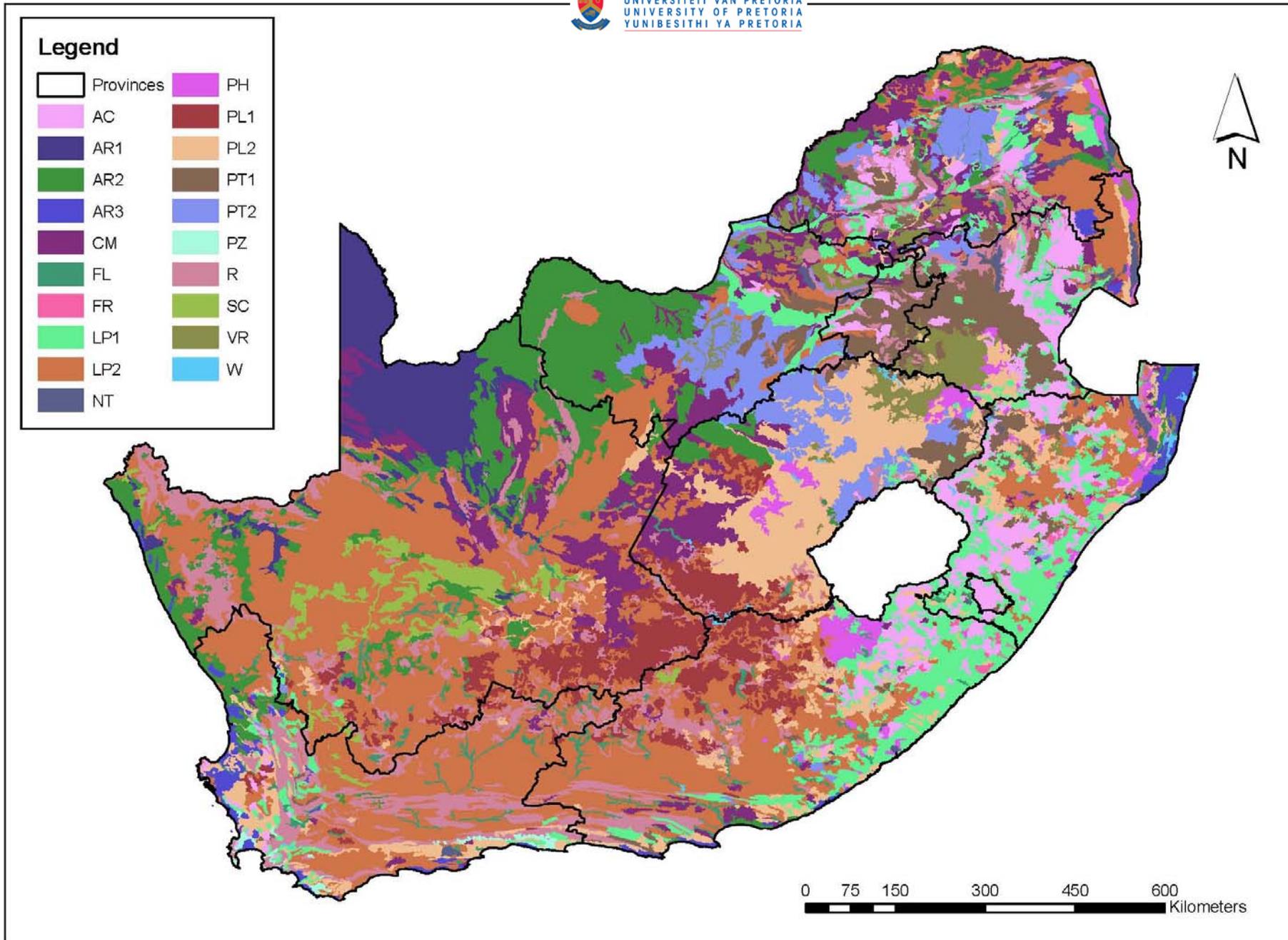


Figure 7.3 Generalized soil patterns of South Africa



Table 7.1 Expanded legend of the generalized soil patterns

Red-yellow well drained soils generally lacking a strong texture contrast	
FR	Red and yellow soils with a humic horizon
AC	Red and yellow, massive or weakly structured soils with low to medium base status
CM	Red, massive or weakly structured soils with high base status
Soils with a plinthic catena	
PT1	Red, yellow and greyish soils with low to medium base status
PT2	Red, yellow and greyish soils with high base status
Soils with a strong texture contrast	
PL1	Soils with a marked clay accumulation, strongly structured and a reddish colour
PL2	Soils with a marked clay accumulation, strongly structured and a non-reddish colour. In addition one or more vertic, melanic and plinthic soils may be present
Well-structured soils generally with a high clay content	
VR	Dark coloured, strongly structured soils dominated by cracking and swelling clays (vertic soils). In addition, one or more of melanic and red structured soils may be present
PH/KS	Soils with dark coloured, well structured topsoil with high base status (melanic soils). In addition, one or more vertic and red structured soils may be present
NT	Deep, well drained, dark reddish soils having a pronounced shiny, strong blocky structure (nutty), usually fine (red structured soils). In addition, one or more vertic and melanic soils may be present
Soils with limited pedological development	
LP1	Soils with minimal development, usually shallow on hard or weathering rock, with or without intermittent diverse soils. Lime rare or absent in the landscape
LP2	Soils with minimal development, usually shallow on hard or weathering rock, with or without intermittent diverse soils. Lime generally present in part or most of the landscape
FL	Soils with negligible to weak profile development, usually occurring on deep deposits
Sandy soils	
AR1	Red, excessively drained sandy soils with high base status - dunes are present
AR2	Red and yellow, sandy well drained soils with high base status
AR3	Greyish, sandy excessively drained soils
Strongly saline soils	
SC	Strongly saline soils generally occurring in deep deposits on flat lands
Podzolic soils	
PZ	Soils with a sandy texture, leached and with sub-surface accumulation of organic matter and aluminium with or without iron oxides, either deep or on hard or weathering rock
Rocky areas	
R	Rock with limited soils

The significance of the above is that it was concluded that more than one third of the country's soils are shallow with limited development possibilities (ARC-ISCW 2004:36).

The Department of Agriculture's (2004a:31) Strategic Plan states that about 81% of South African surface is characterized by shallow soils with about 30% of the surface area regarded as sandy (less than 10% clay) and much less fertile. Almost 60% of the soils have a low productivity and are prone to land degradation due to the low organic content. Only 24% of the country has soils with a favourable top- and subsoil structure that, depending on the climate, is suitable for crop production (ARC-ISCW 2004: 60). Figure 7.4 depicts the distribution of soils with a favourable structure in South Africa and table 7.2 provides a detailed description of the qualifying soil forms in the favourable classes.

The most common soil form found in South Africa is Hutton in all its variations, which covers about 25% of the country's surface, with Mispah (Ms10) the most common single series occurring in 5 682 of the 7 071 land types. The Mispah soil form takes up about 11 million ha. Exposed rock occupies 16 million ha (13.2%), more than any single soil series and soil form except Hutton. Average soil depth is calculated at 577 mm, although about 20% of the country has soils deeper than 900 mm. About 55.5% of the country has limited or no mechanical limitations and can thus be ploughed although in some instances there may be a slope restriction (Paterson & Van der Walt 2003).

The only significant moderate to high potential soils are found in the higher rainfall, humid to sub-humid areas in the east, as these areas have enough water needed for the weathering of rocks and formation of soils (Department of Agriculture 2006a:18). Only about 3% of South Africa's surface can be regarded as high potential agricultural land (Department of Agriculture 2004a:31).

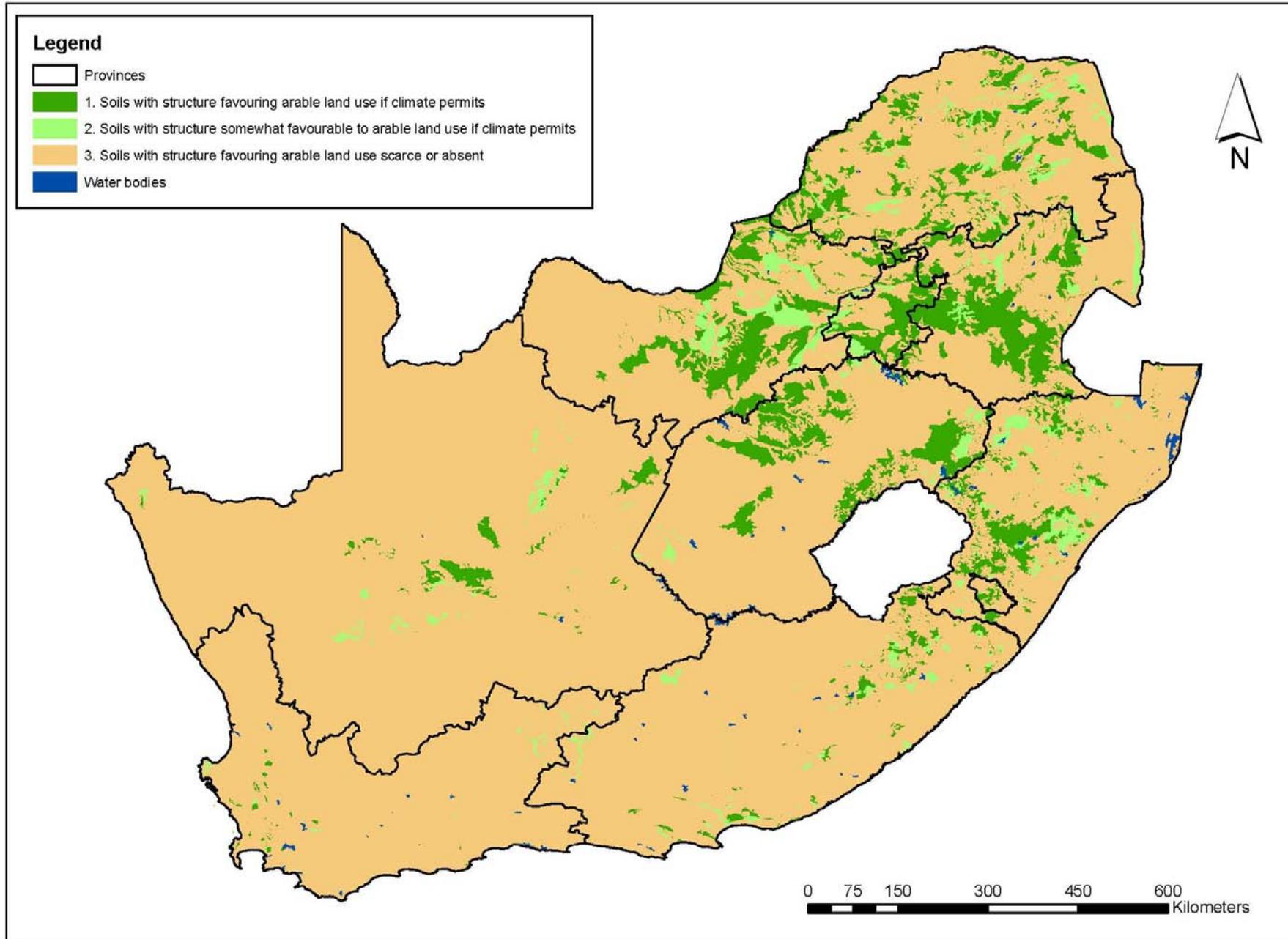


Figure 7.4 Distribution of soils with a favourable structure in South Africa



Table 7.2 Detailed description of the quarrying soil forms in the favourable classes

Class	Description	Qualifying soil forms	Soil depth (mm)	A hor. Clay%	Percentage qualifying soil in land type
1	Soils with structure favouring arable land use if climate permits	Kp, Ma, Ia, Av, Gc, Pn, Gf, Cv, Bv, Hu	600+	10-45	>40
2	Soils with structure somewhat favourable to arable land use if climate permits	Kp, Ma, Ia, Av, Gc, Pn, Gf, Cv, Bv, Hu, Ct, Sp, Cf, Wo, Lo, Fw, Vf, We, Sd, Oa	600+	10-45	>40

Soils suitable for irrigation purposes are also limited. Less than 10% of the soils on the larger irrigation schemes, such as Vaalharts and along the Fish River, are highly suitable for irrigation, whilst on other irrigation schemes this amount seldom exceeds 30 to 40% of the area. It can therefore be concluded that most irrigation practices are conducted on sub-optimal to marginal land, requiring high levels of management (Department of Agriculture 2006a:18).

Dominant soil classes that can be used in algorithms for determining agricultural potential in conjunction with soil depth, texture, and rainfall data were also derived from the land type data. The significance of this data set is that interpretive statements can be linked to this data.

In Gauteng, 41.9% of the area consists of freely drained structureless soils with favourable physical properties (class 2). Limitations to these soils include restricted soil depth, excessive drainage, high erodibility and a low natural fertility. Red or yellow structureless soils with a plinthic horizon (class 3) forms 4.6%, whilst 5.4% consists of lithosols (class 13). Nearly half (45.2 %) of the province's area falls in classes 17 to 26 (ARC-ISCW 2004:38).

A detailed soil assessment was conducted in the area previously known as Pretoria-Vereeniging-Witwatersrand (PWV) region (the central part of Gauteng) in the 1970's and 1980's with the use of 1: 25 000 to 1: 30 000 aerial photographs as a base map. Soil surveys were conducted using a handheld auger. One observation was made for every 25 to 100 hectare area. Soils were classified according to the South Africa Soil

classification system. This data was made spatially available on a 1:50 000 scale, excluding the urban areas (see figure 7.5).

The presence of deep, well drained, apedal soils of the Hutton type resulted in 23.1% of the province consisting of land with arable potential, with an additional 25.3% regarded as marginal. The remainder of the province, however, can be sustainably used for grazing and wildlife (GDACE 2004a:13). Fifty percent (50%) of the province's soil is regarded as unsuitable for irrigation purposes. The high potential areas are located in the southwest, southeast around Heidelberg, and in the northwest, in the vicinity of Bronkhorstspuit.

It should further be noted that South African soils are also susceptible to serious soil compaction due to intensive mechanization, severe crusting, human-induced soil acidification, especially affecting high potential agricultural land and soil fertility degrading due to over-fertilization.

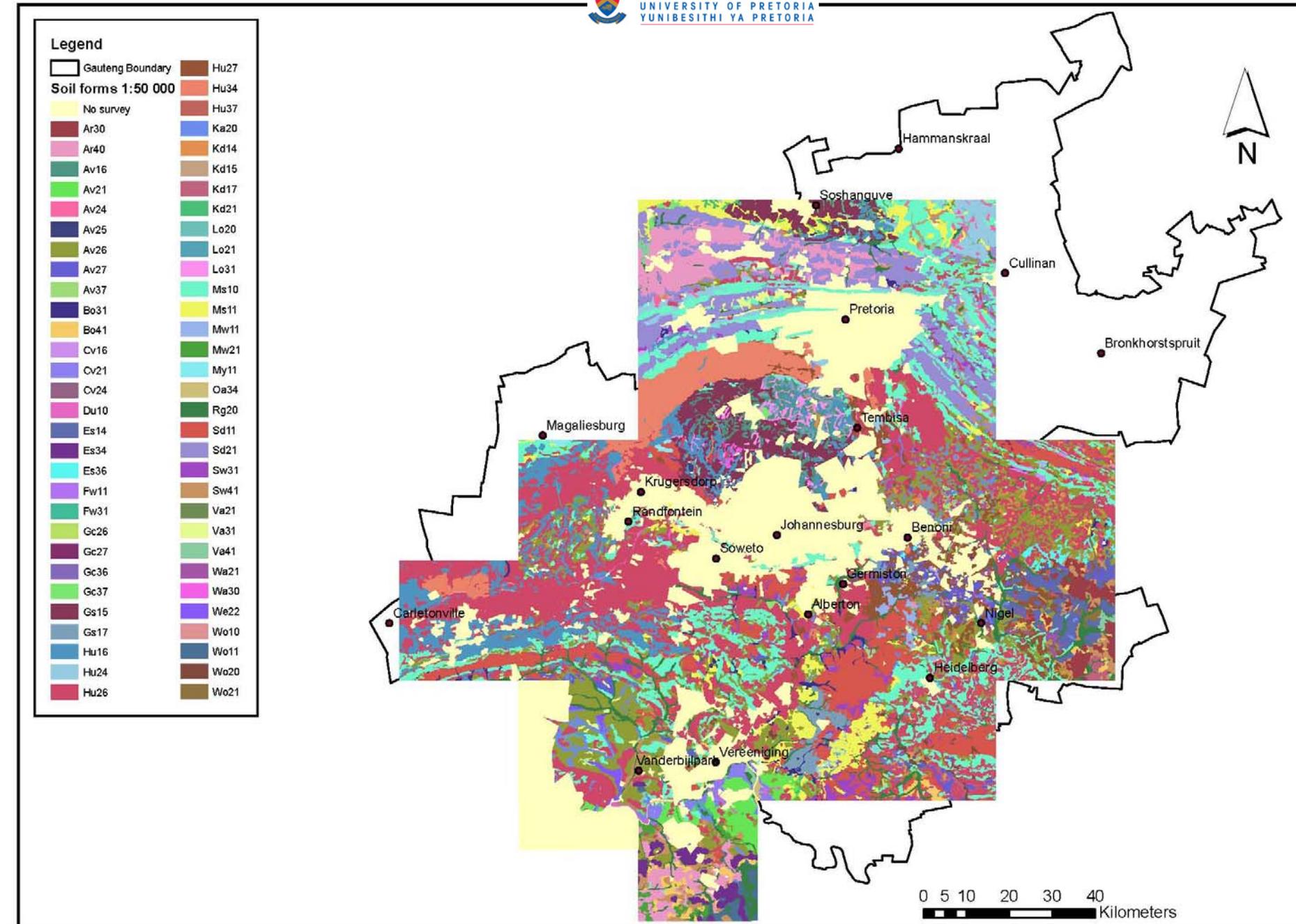


Figure 7.5 Detailed soil classification of the former PWV region (now central part) of Gauteng

- **Water holding capacity of soils**

The water holding capacity of the country's soils that can extend arability, especially in marginal rainfall areas, was determined from the land type data. It was found that the largest areas with both a favourable class rating and a high rainfall are in the Mpumalanga Highveld areas and the eastern Free State. In Gauteng, 52.3% resides in the class 41 to 60 mm, with 30.9% in the class 21 to 40%. Only 0.5% of Gauteng has a water holding capacity in the class of > 100 mm (ARC-ISCW 2004:40).

Significantly, only 8% of the country's soils have favourable water retaining properties due to drainage-retarding layers below relatively deep rooting zones. This enhances the agricultural value of the land and the conservation of these soils is critical. Of these soils, 18.1% resides within Gauteng with only the Free State having a higher percentage of 22.6% (ARC-ISCW 2004:58). Figure 7.6 illustrates the locality of soils with beneficial water retaining layers below the rooting zone. Class 1 is regarded as beneficial water retaining characteristics without the risk of water logging. Class 2 has some risk of water logging, whilst class 3 is characterized by the scarcity or absence of beneficial water retaining characteristics.

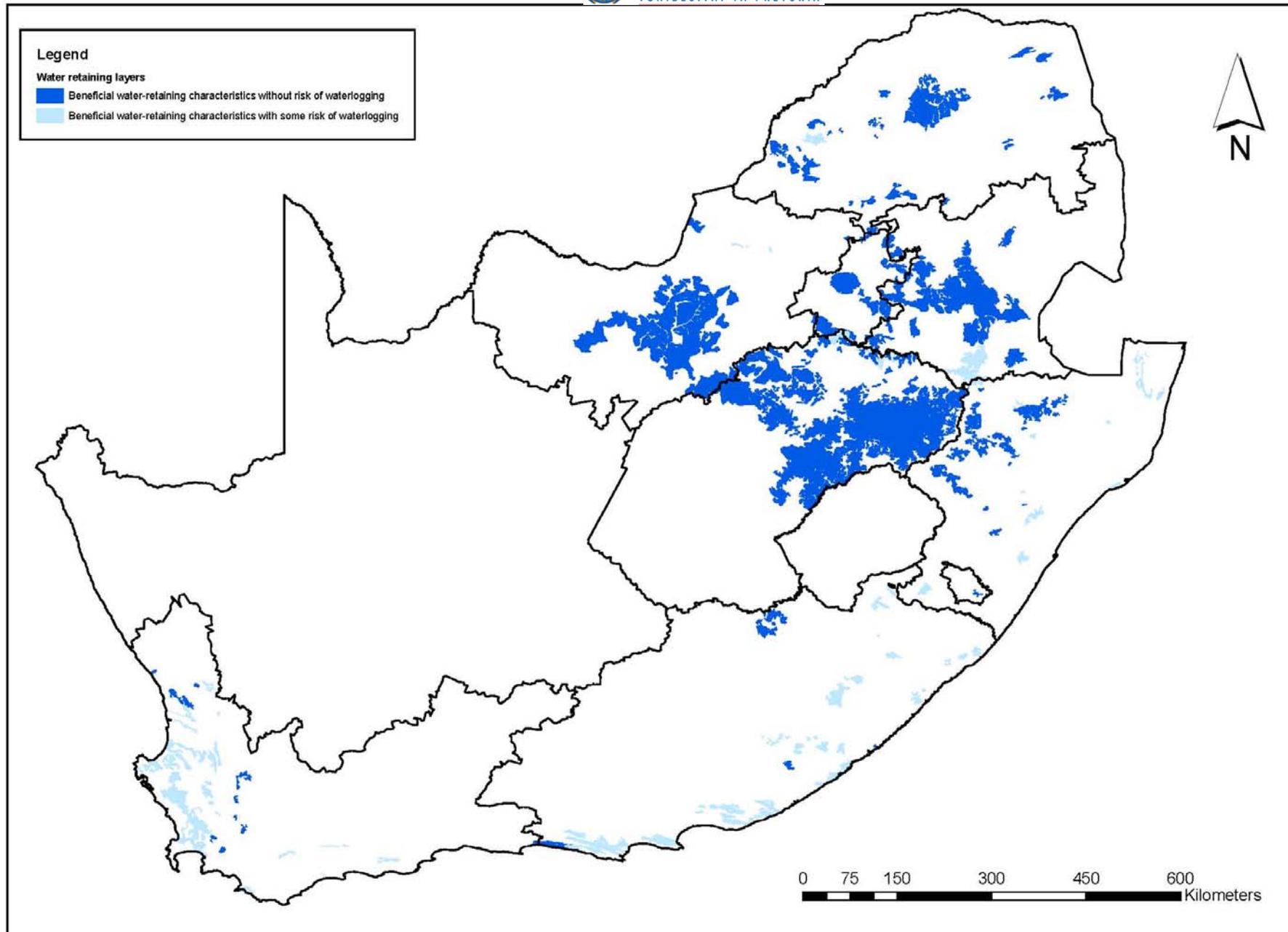


Figure 7.6 Locality of soils with beneficial water retaining layers below the rooting zone

- **Land degradation and erosion**

Human impact and the harsh climatic conditions have resulted in more than half of South Africa's land surface being under threat of desertification. It is estimated that the annual soil loss due to erosion is 2.5 tons, which exceeds the rate of soil formation of 0.31 ton ha/year by far (Department of Agriculture 2004a:31).

Thus far, limited work on degradation has been done in South Africa on a national scale. Hoffman and Ashwell's (2001) study is regarded as a national baseline. Hoffman and Ashwell found a clear correlation between degradation and desertification and the communal rangelands. Wind and soil erosion are the major factors contributing to soil degradation, whilst vegetation degradation can be the result of change in species composition, bush encroachment, and loss of plant cover (Department of Environmental Affairs and Tourism 2006a:97). The *Conservation of Agricultural Resources Act (CARA), 43 of 1983* (South Africa 1983:2) describes erosion as "the loss of soil through the action of water, wind, ice or other agents including the subsidence of the soil".

Water erosion is regarded as one of South Africa's biggest environmental problems. Estimations indicate that up to 25% of topsoil has been lost due to water erosion in the twentieth century. In some areas, the extent of the erosion has declined because there is little or no soil left (Department of Agriculture 2004a:31).

Factors that affect water erosion are regarded as complex and it is difficult to determine the impact of a specific factor if the data is not stratified. Some of the major factors that have an influence on erosion cannot be quantified and therefore do not form part of an equation or model. Laker (2004b:347-350) lists parent material, the degree of weathering and pedogenesis, free iron oxides, clay mineralogy, sodium and magnesium, as well as organic matter, particle size distribution and soil structure, rainfall, slope, vegetation cover and land use, as the main factors impacting on erosion.

Factors used by the ARC-ISCW to determine the influence on susceptibility of land to water erosion include slope gradient and length, soil erodibility and rainfall erosivity, as well as variable factors such as vegetation and management practices. The larger portion of Gauteng is regarded as land with a low to moderate susceptibility to water erosion (ARC-ISCW 2004:42).

In terms of wind erosion susceptibility, factors like particle size distribution of the topsoil; wind speed; topography, soil cover and soil water content can have an impact. Estimations are that up to 25% of South African soils are susceptible to wind erosion. Sands in the Northern Cape and North West Province, as well as the coastal areas are dependent on vegetation cover due to the high susceptibility to wind erosion, whilst some susceptibility may occur in the crop production areas of the Free State, Mpumalanga and the Eastern Cape. None of Gauteng's soils are regarded as highly susceptible to wind erosion (ARC-ISCW 2004:42-44).

Table 7.3 Extent of wind and water erosion in South Africa

Type of erosion and land use	Seriousness of erosion and area affected			Total (ha)
	Serious (ha)	Moderate (ha)	Not significant (ha)	
Wind erosion				
• Cultivated land	415 001	1 325 749	1 427 088	13 370 469
• Pastures	569 524	1 700 436	7 932 671	
Water erosion				
• Cultivated land	930 735	2 258 193	2 886 727	16 978 705
• Pastures	801 288	3 128 613	6 973 149	
Total	30 349 174			

Source: Department of Agriculture (2004a:31)

From Table 7.3 it is evident that pastures are particularly exposed to erosion with water erosion being the main problem area. Figure 7.7 illustrates areas susceptible to water erosion in South Africa. Inappropriate farming practices can contribute to water erosion, but in many instances it results from inappropriate cultivation on non-arable land that contributed to the erosion (Department of Agriculture 2006a:19).

Gauteng has a very low to low predicted soil loss as determined in the Gauteng Natural Resources Atlas study. Steep topography was identified as the most dominant factor impacting on erosion susceptibility, but the erosion hazard can be regarded as a factor of cover and cover management (ARC-ISCW 2001:15).

Only about 5% of the province is regarded as having a high to very high erosion hazard (>60 ton/ha/year) whilst 77% has a very low erosion hazard (<5 ton/ha/year). In 2002, no sheet erosion was visible in Gauteng, but it was found that 598 ha of bare rock and soil were present. In comparing the actual erosion, through the national land cover 2000 dataset with the predicted erosion, most of the erosion areas were classified in the low erosion potential areas (> 61%) and 15% in the high to very high potential areas (GDACE 2004a:45). Gauteng's soils, then, generally have a good conservation status although this does not take cultivated lands and steep slopes into consideration.

In terms of high potential areas subject to soil erosion, it was found that the Eastern Cape, KwaZulu Natal and Limpopo Provinces are the most affected, amounting to about 859 500 ha. In total, only 8.6% of soil erosion is predicted on high to very high potential agricultural land in the country. In Gauteng, a total of 73 000 ha of moderate and high to very high potential agricultural land are predicted as subject to erosion. There is only a 0.24% prediction of erosion on the high to very high potential agricultural land (Department of Agriculture 2006a:20).

The Gauteng SoER, 2004 (GDACE 2004a:46) refers to Hoffmann and Ashwell's (2001) finding that Gauteng is the second least degraded province, after the Free State. The lowest veld degradation is found in Gauteng with the fourth lowest soil degradation index.

- **Potential sources of soil pollution**

Potential sources of soil pollution were mapped as part of the Gauteng Natural Resources Audit. Mining and industry were the main sources investigated. It was estimated that about 31 000 hectares have been degraded due to soil pollution as a result of disposing solid waste and effluent. As a result, this land can no longer be used for any other land use (ARC-ISCW 2001:252).

Acidification of soil is another serious concern. The incorrect use of fertilizers and other applications have resulted in acidification of more than 5 million ha in South Africa. Added the 16 million ha of naturally acid soils and the impact of coal mining, these matters need to receive urgent attention (ARC-ISCW 2004:66).

In general, South African soils have a low recovery potential and it becomes increasingly difficult to get degraded soils back into a productive state. Actions should be put in place to limit any possible contributor to soil degradation. Sustainable land use management and planning is vital in achieving these goals.

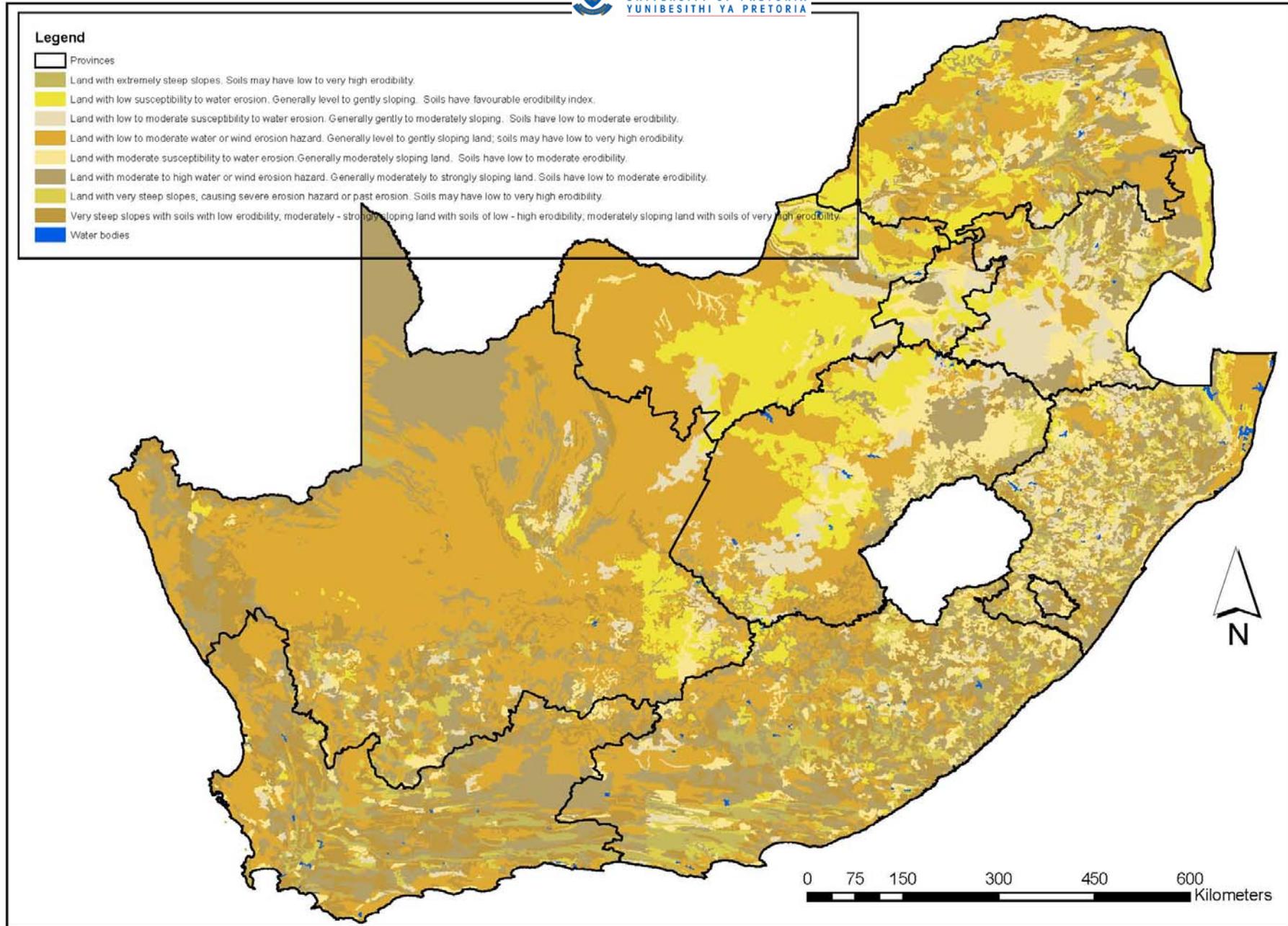


Figure 7.7 Areas susceptible to water erosion in South Africa

7.5 CLIMATE

Southern Africa's climate is highly variable and subject to extremes due to the country's locality. Latitude, altitude and oceanic influences contribute to the variance in climatic conditions. Tyson (1987) (cited in ARC-ISCW 2004:4) found that the inter-annual variability of rainfall from 1910 to 1977 was more than 40% in the southern Kalahari region, but less than 20% in the eastern parts of the country. The importance of rainfall has an influence on the resource situation, crop selection, and agricultural potential and production.

The mean annual rainfall in South Africa is less than 500 mm per annum, which is far below the world average of 860 mm. About a quarter of the country receives less than 200 mm rain per year. Only 35% of the country receives more than 500 mm, which is regarded as the minimum rainfall needed for crop production. About 3% of the country receives rain throughout the year (Department of Agriculture 2006a:16). The average minimum rainfall is about 70 to 80% of the mean throughout South Africa, whilst the absolute maximum values vary from more than 250% to less than 175% of the normal (Tyson 1987 as cited in ARC (ISCW) 2004:4).

In terms of temperature, South Africa is characterized with high temperatures with a very low relative humidity and high vapour saturation deficits. Less than 10% of the country can be regarded as humid. The surrounding seas as well as the Benguela and Agulhas currents have a big effect on the coastal temperatures, resulting in a difference of up to seven degrees (7°C) in average temperature between Durban in the east and Port Nolloth in the west (ARC-ISCW 2004:4).

Cold spells are a regular occurrence during the winter months and may result in a drop of 5 to 10°C in temperature at least twenty times per year over large parts of the country, with resulting frost. During the late spring, hail also occurs, especially in the eastern escarpment areas.

Both rainfall and temperature are important in agricultural production. Taking into consideration the availability of limited water resources, much of large-scale agriculture has to rely on dry land production with the associated increased risk for successful and sustainable crop production.

- **Rainfall**

Rain is regarded as of prime importance. Three rainfall areas can be classified in South Africa: the winter rainfall areas found in the southwestern corner of the country; the all-year-round rainfall area along the southern coasts, and a summer rainfall area over the remainder of the country. Rainfall increases from west to east with limited rainfall on the arid west coast of 125 mm per year to more than 1000 mm east of the escarpment. It is stated that the 500 mm rainfall line divides the country into two areas. Of the total area of the country, only 10% receives more than 750 mm per annum. Rainfall in South Africa is extremely irregular, which may result in either droughts or floods (Department of Agriculture 1994:5). Figure 7.8 indicates the rainfall distribution in the country.

During any growth period, the availability of rainfall in certain growth stages, such as the tasselling phase of maize, is of prime importance. During South Africa's summer rainfall period, midsummer drought normally occurs in January, coinciding with the maize tasselling phase. Farmers therefore have to ensure that their planting dates are specific to the area in which they live (Department of Agriculture 2006a:16).

In Gauteng, 97% receives between 601 and 800 mm rainfall per annum with the remaining 3% receiving 401 to 600 mm per annum. This homogeneous rainfall pattern compares favourably with the national perspective where the highest percentage class of 27.3% receives 201 to 400 mm rainfall per annum (ARC-ISCW 2004:6).

The availability of moisture to a plant at the end of the climatic moisture season has an important influence on the production of crops. The ARC has developed a moisture availability rating for the country. On a scale of 1 to 6, 31 % of the country is classified as Class 6, which is unfavourable for crop production, due to either severe aridity or extreme temperatures. Only 8.2% is classified as Class 1, translating into favourable conditions for growing a wide variety of adapted crops. The major portion of Gauteng (82%) is classified as Class 3, which has a moderate rating and may be subject to water stress, extreme temperatures and a possibility of frost, wind or hail damage that restricts crop selection and influences yield potential (ARC-ISCW 2004:13).

The above coincides with the fact that from a global perspective 90% of South Africa is regarded as dry land, as defined by the UN Convention to Combat Desertification

(UNCCD). Almost half (44.3%) of the country is regarded as semi arid with 36.9% as arid. In Gauteng, 99.8% resides within the semi arid zone (ARC-ISCW 2004:14). Figure 7.9 illustrates the aridity zones in South Africa.

- **Temperature**

Another component of climate that should be taken into consideration is temperature. About 22.2 % of the country has an average maximum temperature of 29.1 to 31.0°C, whilst 4.1% has an average maximum temperature of >35°C. Only 9.8% of the country has an average maximum temperature of less than 25°C. In terms of minimum temperatures, 32.7% of the country resides within the minus 1.9 to 0.0°C temperature range with only 3.5% having an average minimum temperature of >8.0°C.

Of Gauteng, 56% has an average maximum temperature of 25.1 to 27.0°C, whilst 54% has an average minimum temperature of 0.1 to 2.0°C (ARC-ISCW 2004:16-18).

Figure 7.10 depicts South Africa's minimum and maximum temperatures.

- **Frost**

Frost commonly occurs in certain parts of the country in winter. The step-in date for frost varies, depending on the locality. The greater part of Gauteng (western parts) has a frost step-in date of 21 to 31 May, whilst frost may start occurring in the eastern parts of the province from late April to early May. The last day of frost is usually at the beginning of September. The average last day of frost, whether regular or occasional, does not encroach on the summer moisture season (ARC-ISCW 2004:20). Schulze (1997) estimates that an average of 30 days of frost is experienced in Gauteng.

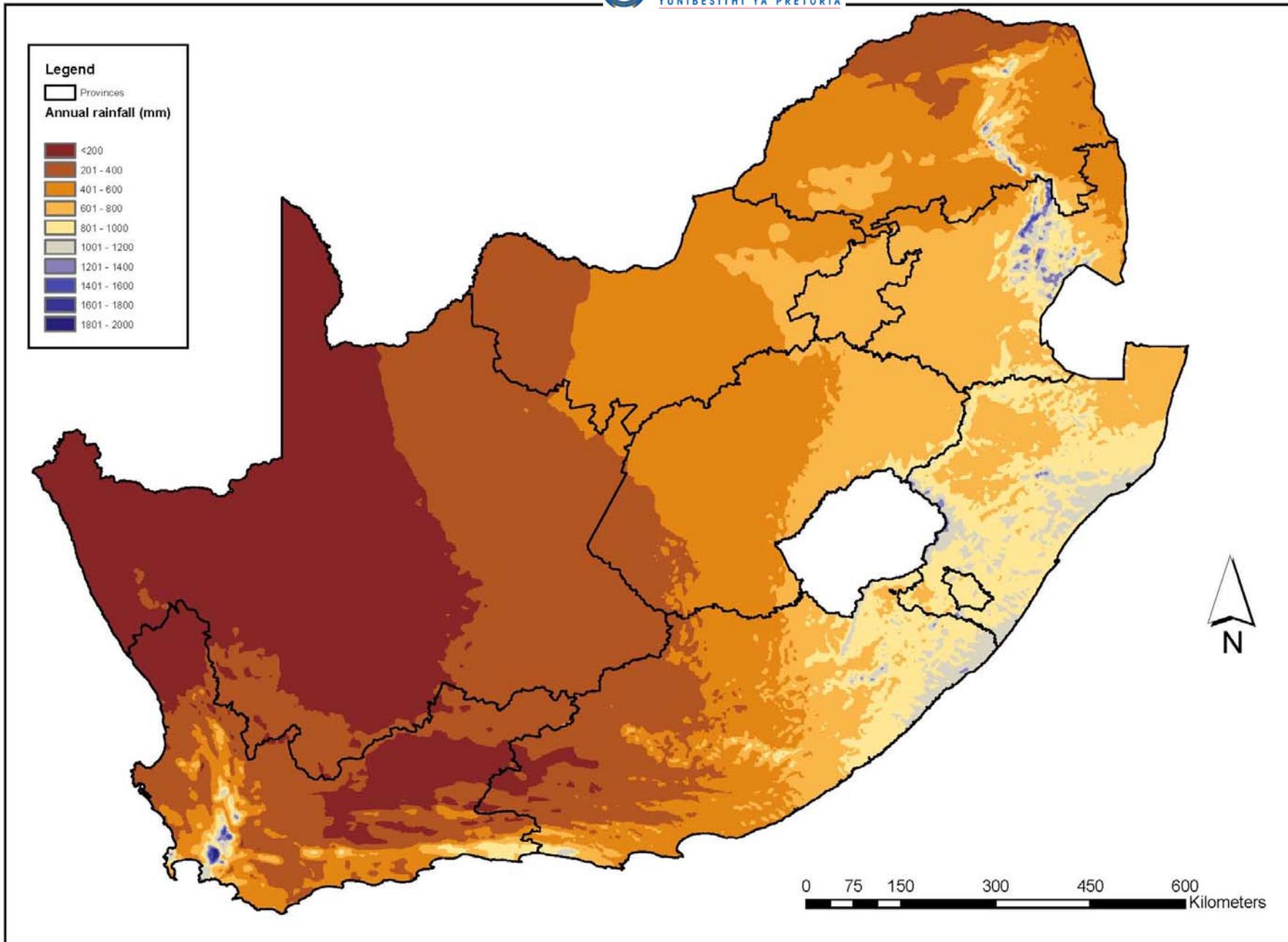


Figure 7.8 Annual rainfall map of South Africa

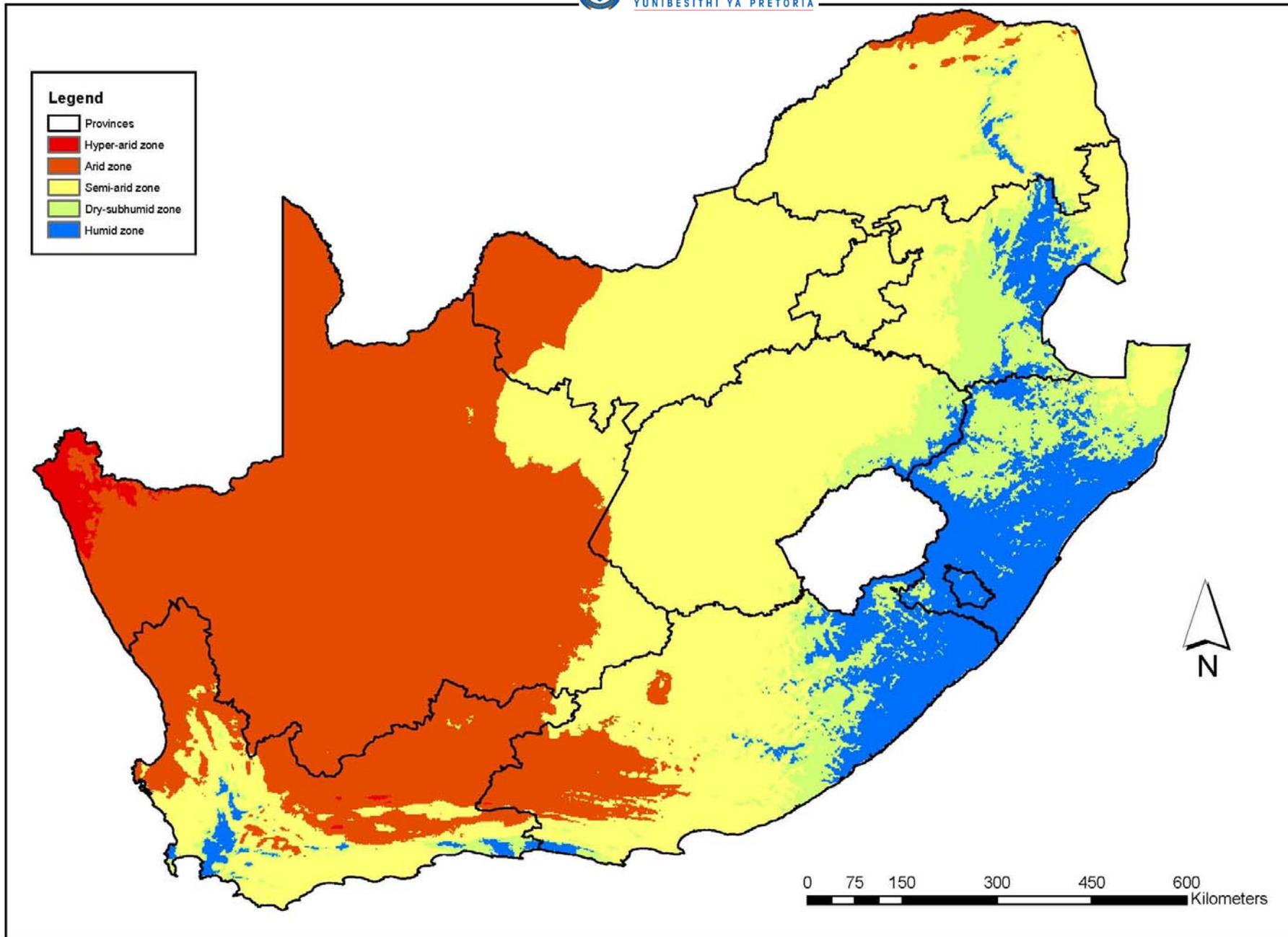


Figure 7.9 South Africa's aridity zones

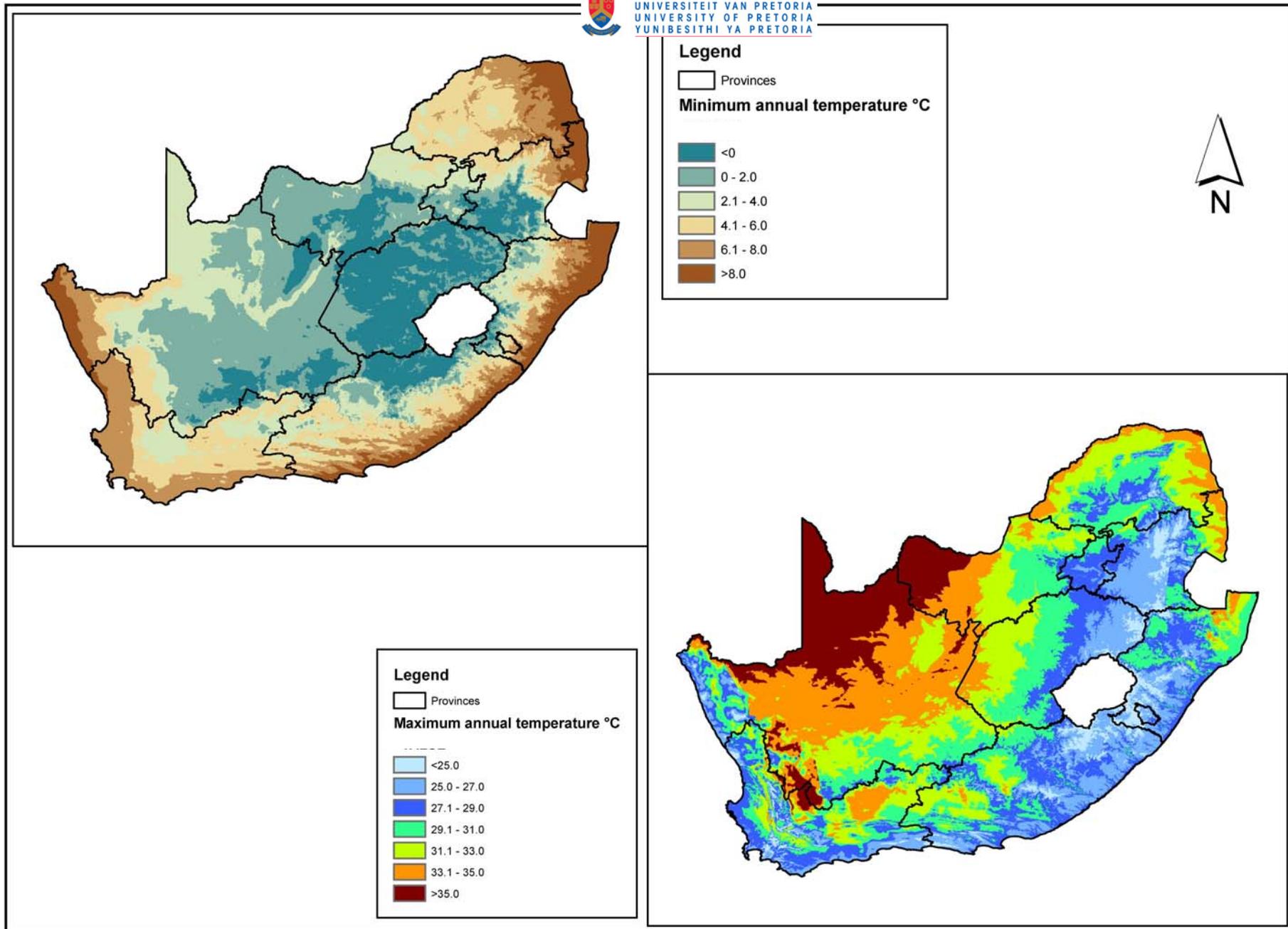


Figure 7.10 Maximum and minimum temperature distribution of South Africa

7.6 GEOLOGY

Both climate and geology play an important role in the formation of soil-terrain landscapes. The geological formations, which are the basis for the soil parent materials, are highly variable, especially with regard to clay forming potential resulting in swelling black clays as well as differences in natural fertility and erodibility. Geology is thus regarded as indirectly responsible for the diversity of plant habitats.

The Johannesburg Granite, formed 3500 to 2500 million years ago is the oldest rock formation found in Gauteng and is situated between Pretoria and Johannesburg (GDACE 2004a:10). The Malmani dolomites of the Transvaal Supergroup are prone to dissolving carbonates, which results in the formation of sinkholes, especially on the East and West Rand, limiting development in these areas. However, dolomite areas are prone to water holding capacity, which if managed properly can be utilized to the advantage of agricultural production. Figure 7.11 demonstrates the geology of South Africa.

- **Terrain**

The importance of terrain, particularly in cultivation of land cannot be underestimated. South Africa consists of relatively level land (70%), making it favourable for crop production pending the soil and climate variables. About 78% of the country consists of slopes of 12% and less. A slope of 12% is regarded as the maximum slope that can be cultivated without unusual protection, provided that the soil and climate qualities are sufficient. Of the 78%, 43% of these areas are level or have a slope of 0 to 2%. Only 6% of the country has steep slopes of more than 20%. These areas are used mainly for nature conservation purposes and water harvesting (ARC-ISCW 2004:32). Figure 7.12 illustrates the percentage slope distribution in South Africa

Gauteng is located within the convergence of the Vaal, Crocodile and Elephant catchment areas. Of the area, 35.4% has a slope of 0 to 2%, whilst 42.1% of the area has a slope of 2 to 5%. Only 0.6% of the province has a slope of more than 20%, making the province suitable for cultivation, pending the climate and soil qualities.

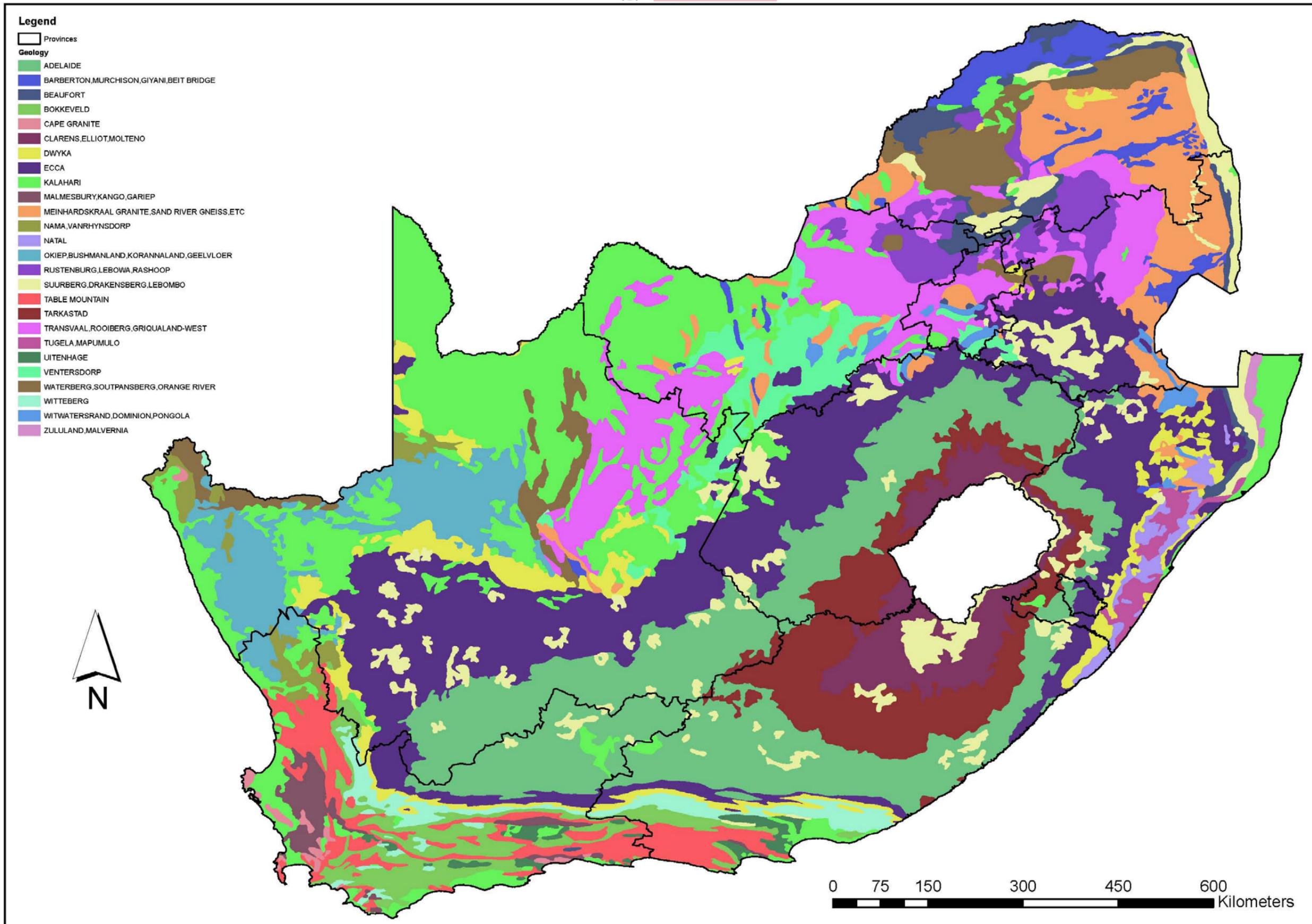


Figure 7.11 Geology of South Africa

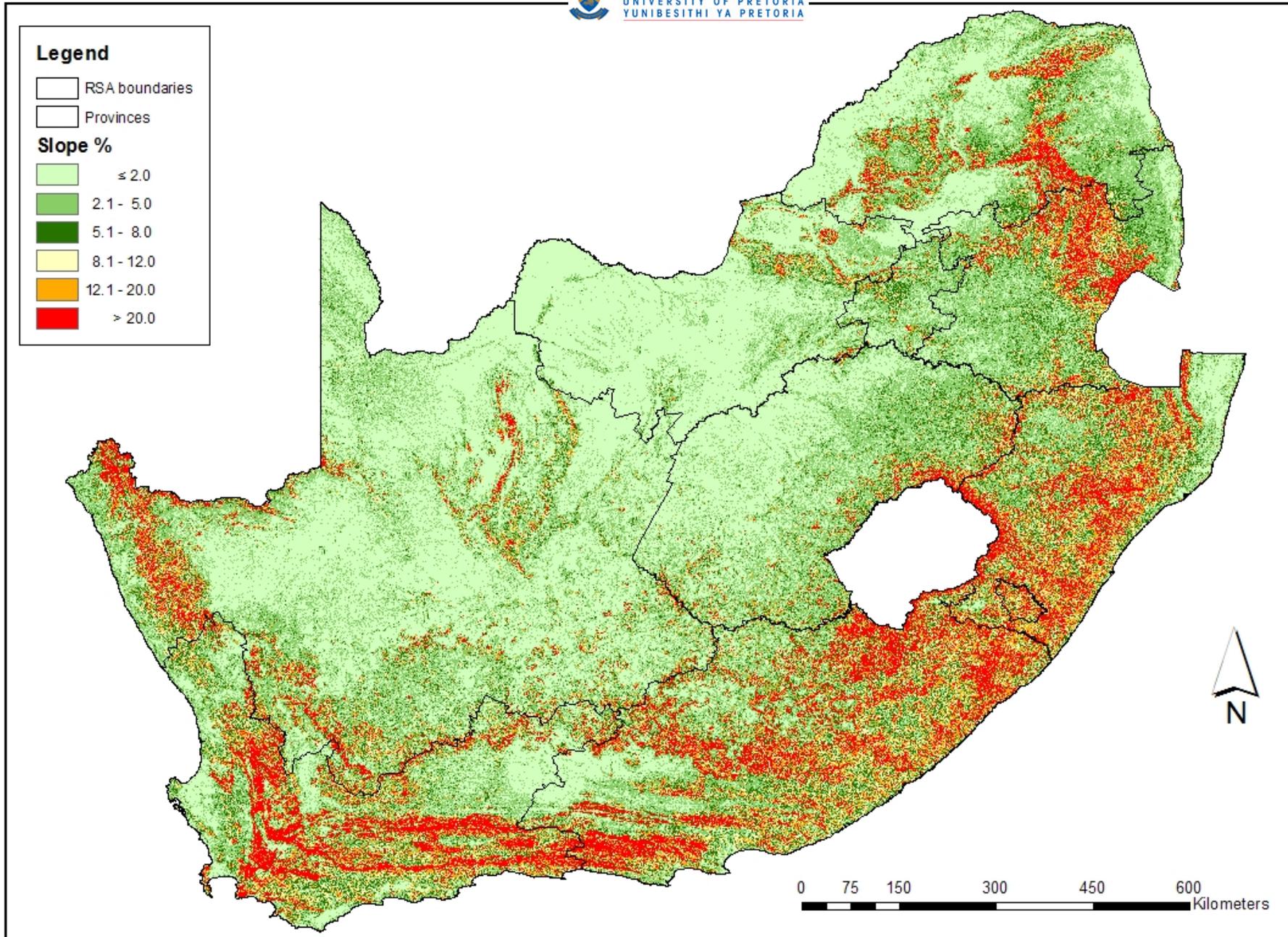


Figure 7.12 Slope percentage distribution found in South Africa

7.7 VEGETATION AND BIODIVERSITY

South Africa is in the unique position of being the country with the fifth highest number of plant species in the world. The country consists of only 2% of the world's land surface, but is home to nearly 10% of the world's plant species, and 7% of the bird, reptile and mammal species (Department of Environmental Affairs and Tourism 2006a:108). It is also fortunate that one of the world's six floral kingdoms (the Cape Floral Kingdom) is totally contained within the country (Low & Rebelo 1996:1). Only 6% of the land in South Africa is formally protected, with 110 of the 447 vegetation types not protected at all (Department of Environmental Affairs and Tourism 2006b:27).

The habitat or environment has a major impact on the occurrence of natural vegetation. Plant species live together, compete for natural resources and, in certain instances, support each other, but ensure that a balance is maintained. However, this depends on how the environment is treated and managed. A number of factors have an influence on species composition in a specific environment, including grazing, fire, crop production and forestry, as well as the human factor, which in many instances has largely resulted in the change or even loss of biodiversity.

On average, terrestrial biodiversity is in a better condition than aquatic ecosystems. However, the areas with the highest biodiversity, such as the southwestern Cape, the central grasslands and the eastern coastal regions, are also the ones under constant pressure for other land uses. Land degradation and desertification have a significant effect on the ecosystem's function subsequently resulting in the loss of productivity of the land, and impacting on especially the livelihoods of poor people and the country's ability to feed the nation. In the Limpopo, Mpumalanga, North West and the Eastern Cape provinces, the conversion of stock farming to game farming has limited the loss of habitat and land degradation. Considerable action to reduce the clearing of land for cultivation purposes, as well as the implementation of stock reduction schemes on private land has also contributed to reducing habitat loss (Department of Environmental Affairs and Tourism 2006b:12-13).

Acocks (1988:1) identifies 70 actual veld types with 75 variations in South Africa (see figure 7.13). A veld type is defined as "a unit of vegetation whose range of variation is small enough to permit the whole of it to have the same farming potentialities".

Moreover, changes in vegetation are based on the way it is treated. Very little of the vegetation in South Africa is still in its original condition. Acocks (1988:1) points out, however, that only broad guidelines were given and variations should be mapped for improved farm management.

Acocks focused on the agricultural potential of the vegetation and a comprehensive vegetation map was required for the country. Consequently, in 1996, a working group under the leadership of Low and Rebelo compiled a description of the vegetation of South Africa, Lesotho and Swaziland. Low and Rebelo (1996:1) describe a total of 68 vegetation types within 7 biomes. Mucina and Rutherford (2006:1) refine this work in the newly published *Vegmap for South Africa, 2006*, which classifies vegetation in 35 bioregions, 9 biomes (including forests and the Indian Ocean Coastal Belt) and 435 vegetation types (Mucina & Rutherford 2006:1) (see figure 7.14).

According to Low and Rebelo (1996:1), Gauteng consists of 2 biomes with 8 Acocks veld types. A total of 3 303 plant species, 125 mammal species, 326 bird species, 25 amphibian and 53 reptile species are found in the province. In addition, more plant species can be found in Gauteng per unit area than in any other province.

Gauteng is largely characterized by the Grassland biome (82.5%), of which 26.7% is Pure Grassveld and 55.8% False Grassveld, whilst the remainder consists of the Savannah biome (17.5%) (ARC-ISCW 2004:86). Low and Rebelo (1996:5) divide the Grassland biome into mainly the Highveld Grassland types, including the dry, sandy highveld grassland, the moist clay highveld grassland, the moist cool highveld grassland and the rocky highveld grassland. The Savannah biome is divided into the clay thorn bushveld and the mixed bushveld. According to Low and Rebelo (1996:5), about 2.70% on average is conserved.

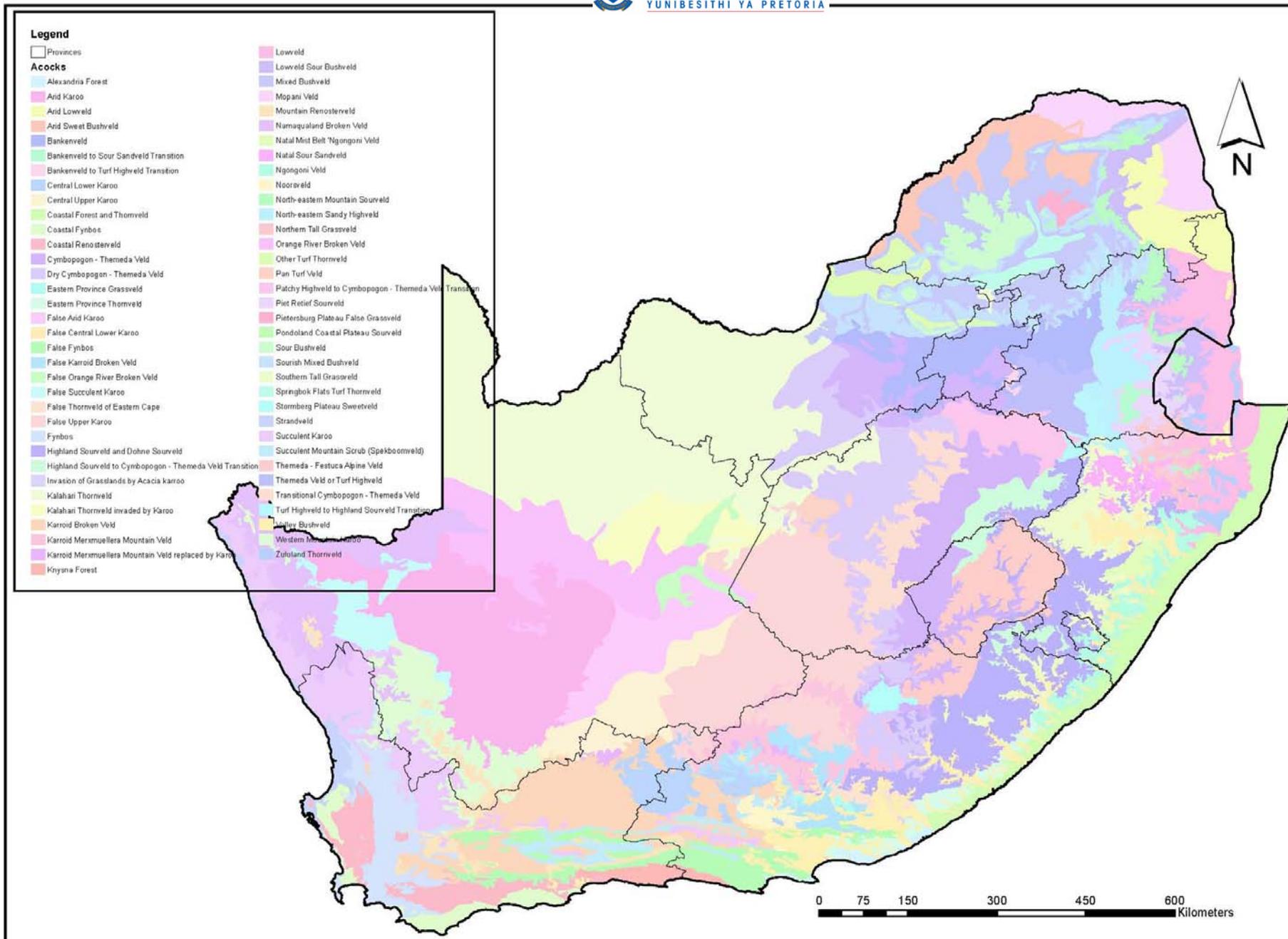


Figure 7.13 Acocks veld types of South Africa

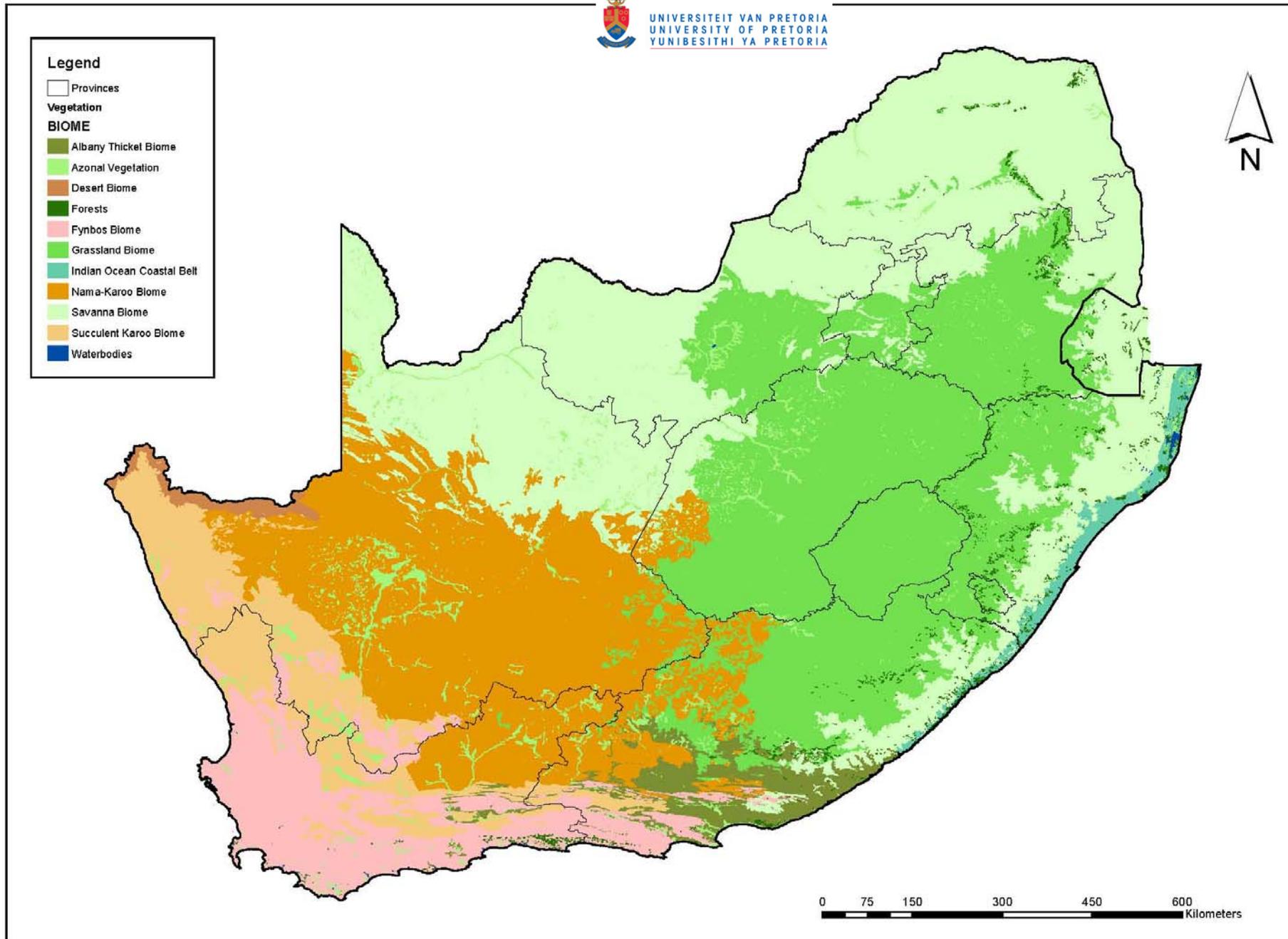


Figure 7.14 Vegetation types for South Africa according to Vegmap, 2006

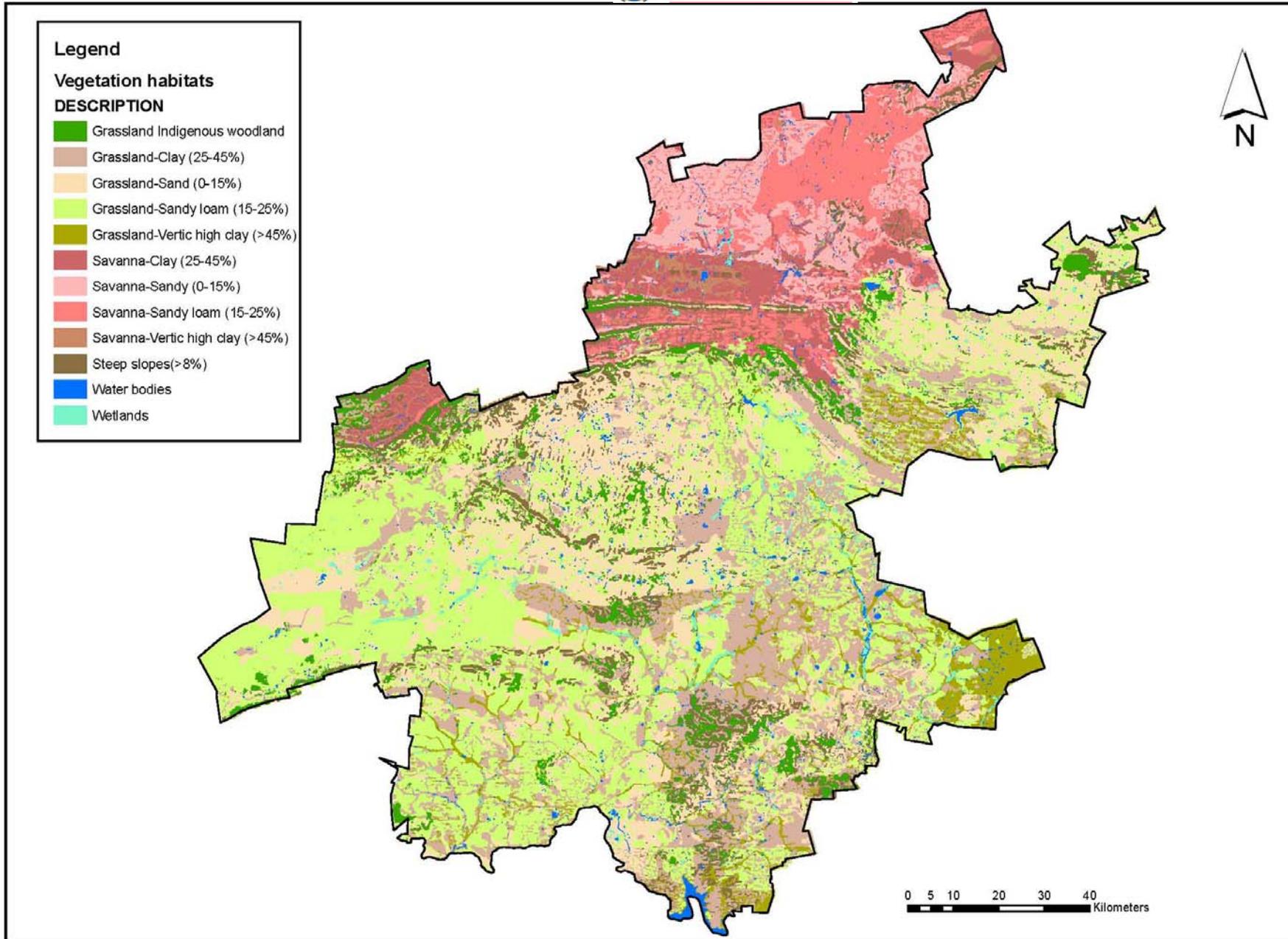


Figure 7.15 Vegetation habitat types of Gauteng

An audit of Gauteng's resources found climate (altitude, rainfall and temperature) to be the dominant factor influencing vegetation type distribution, although supported by the soil clay content (ARC-ISCW 2001:5). Furthermore, 53 to 57% of the grassland was in very good to good condition with 14 to 19% in a poor to very poor condition. About 35 to 42% of the savannah was found to be in a poor to very poor condition. The variance in figures was attributed to different approaches followed in conducting the surveys (field surveys versus an objective multi-variate analysis). Figure 7.15 illustrates the vegetation habitat types in Gauteng.

The loss in vegetation and biodiversity in Gauteng is of major concern. Contributing thereto is urban development, particularly unplanned development that results in the fragmentation of plant habitats and the pollution and degradation of natural habitats. However, a number of protected areas, such as the Suikerbosrand Nature Reserve and Dinokeng, have been established, taking up about 5% of the province's surface, whilst some, like the Cradle of Humankind World Heritage Site and the Blesbokspruit RAMSAR wetland, are also protected by international legislation. Figure 7.16 depicts the Gauteng protected areas and reserves.

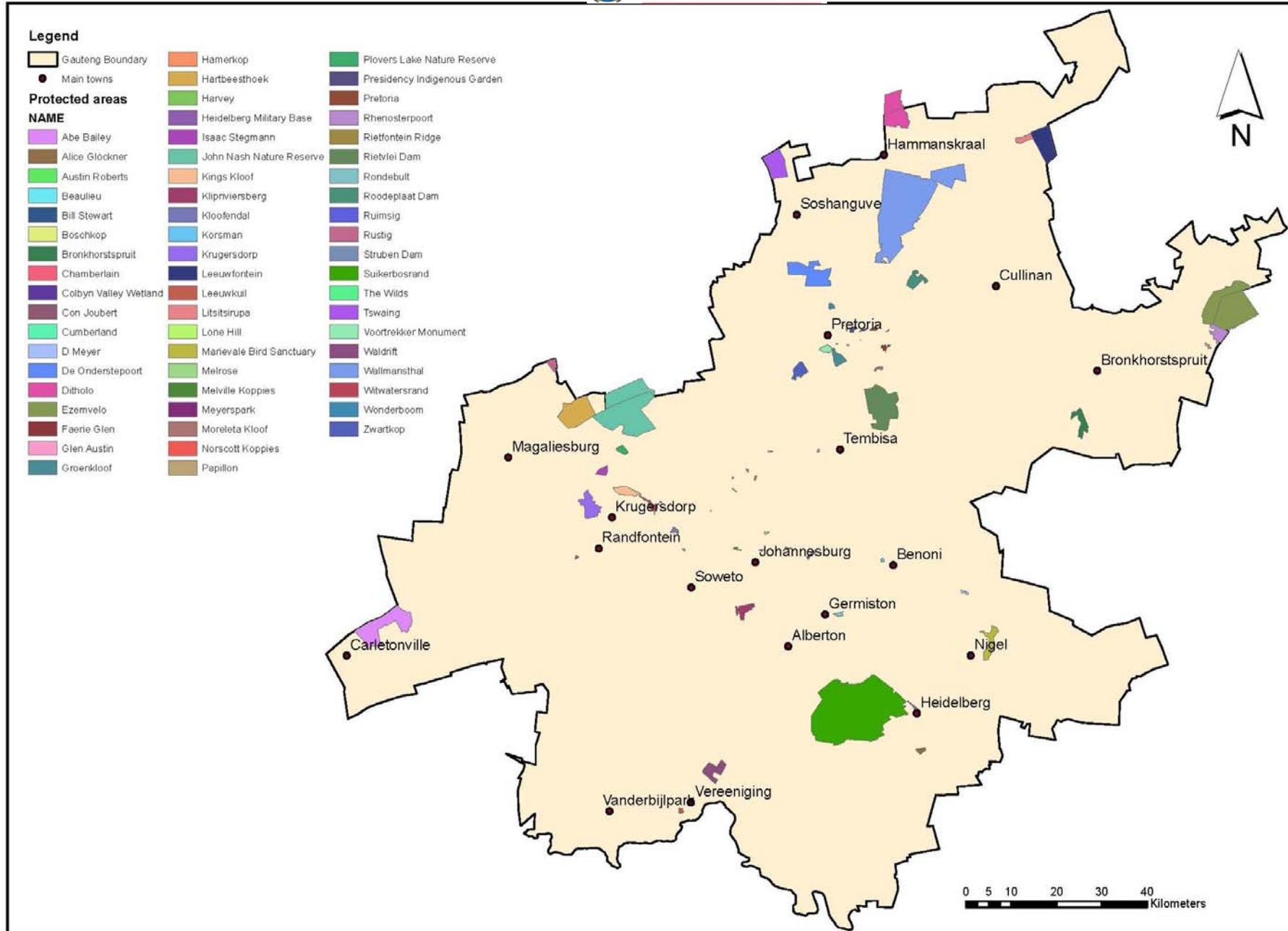


Figure 7.16 Gauteng protected areas and reserves



- **Gauteng Conservation Plan**

The Directorate: Nature Conservation in GDACE developed the Gauteng Conservation Plan to assist with the conservation of biodiversity and to protect the environment against the further loss thereof. About 3 303 plant, 125 mammal, 326 bird, 25 amphibian and 53 reptile species have been recorded in the province (GDACE 2005c:37).

In developing the Gauteng Conservation plan (C-Plan), the aim was to identify areas where habitat transformation and fragmentation had occurred, map areas of importance as far as biodiversity is concerned, and guide decision-making on the protection of areas with a high conservation value. Setting conservation goals for the province, as well as operational targets based on conservation biology principles, identified these areas.

The Biodiversity Information Management database that is continuously being updated as new biodiversity data is collected, updated and verified was used as well as C-Plan software, linked to ArcView. C-plan assisted in determining how the conservation targets are currently met and identifying additional areas that will complement existing protective areas to achieve the conservation targets (Compaan, Pfab, Coetzer, Forsyth, Whittington-Jones & Peinke 2005).

Three main areas were classified, namely irreplaceable, important and reserved sites (see figure 7.17). Irreplaceable sites are required to meet the biodiversity conservation targets for the province, important sites are required for the conservation of biodiversity, and reserved sites include existing Level 1 and 2 protected areas. Level 1 protected areas are legally proclaimed for the protection of biodiversity and nature conservation, whilst Level 2 areas include legally protected areas or areas that have an approved ecological management plan for the conservation of biodiversity as primary objective. Agricultural activities are among the threats to biodiversity identified, because of their impact on the loss of biodiversity through utilizing land for cultivation purposes. To date, C-Plan has been refined several times and Version 2.1 is currently used in Gauteng.

In evaluating the results of C-Plan, as well as the land identified for agricultural use through the Gauteng Agricultural Potential Atlas, there is an overlap between these two views. Although both conservationists and agriculturalists wish purely to protect the

land for their own purposes, these two conflicting land uses should also come to an agreement. The underlying principles of sustainable development are necessary here as well, in order to determine the land use most suited.

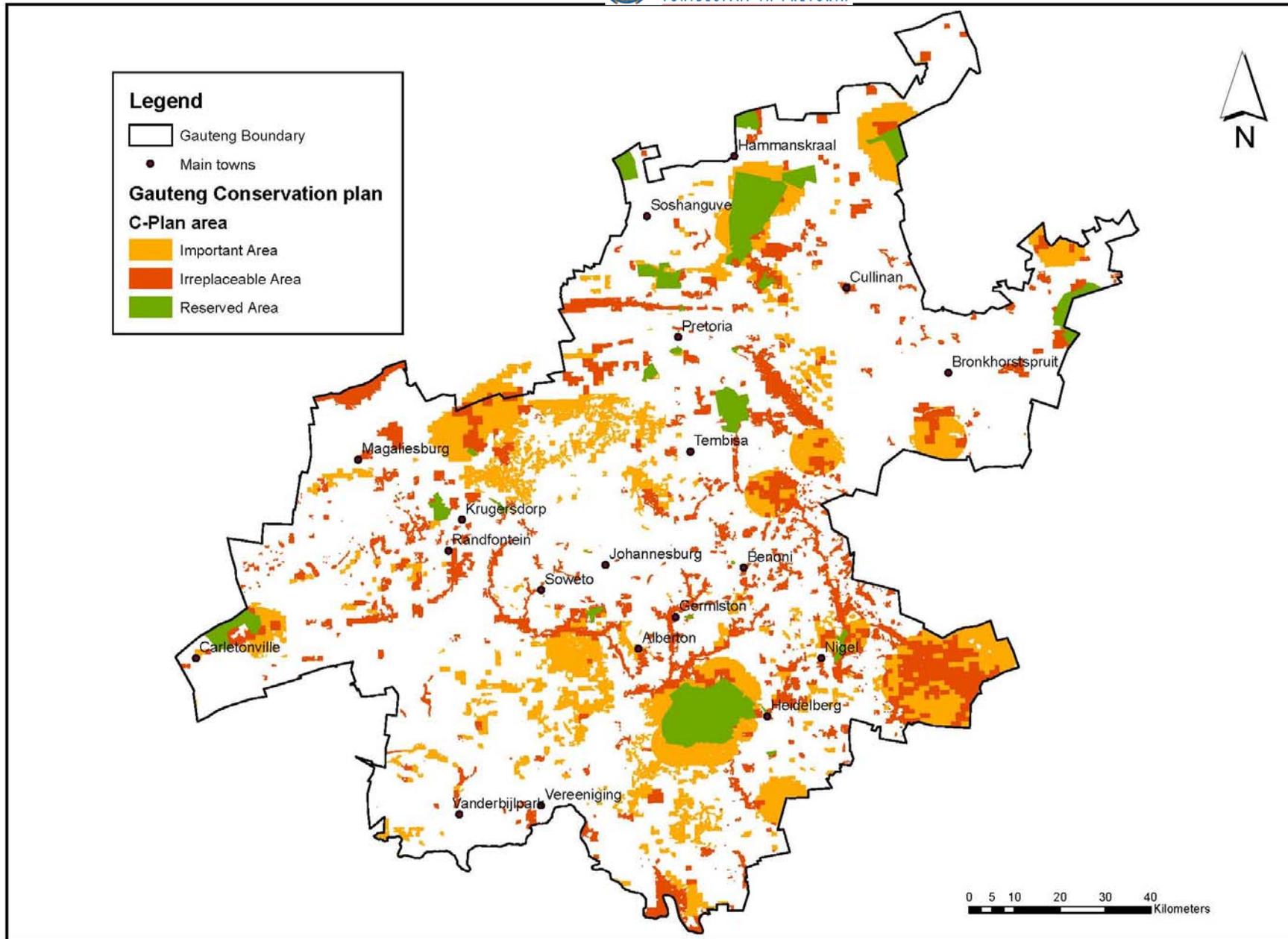


Figure 7.17 Ecological sensitive classified areas in Gauteng

- **Grazing capacity and rangelands**

Due to the variance in the South African climatic conditions and limitation of arable soils, many farmers rely on livestock farming as a source of income. In the 1990's, however, the expansion of developments and other activities led to a decline in grazing areas (Department of Environmental Affairs and Tourism 2006b:24). Livestock production can be dependant on natural grazing or planted pastures. In the case of natural grazing though, large areas of the country are exposed to effective veld management in order to limit degradation of the veld.

The biggest portion of South Africa's rangelands is located mainly in areas with limited rainfall and very low potential soils. This combination therefore results in a low carrying capacity. However, the palatability and nutritional value of vegetation in dry areas are normally very high, provided that the veld condition is good. This land is thus very sensitive to overgrazing and degradation (Department of Agriculture 2006a:18).

South Africa's rangelands are mostly moderate to severely degraded, with the arid areas mostly affected. These areas also have a low recovery potential. Rangeland degradation includes the reduction of the basal cover, bush encroachment and densification, and negative changes in the composition of grass species and vegetation (Department of Agriculture 2006a:18).

Management of veld condition is a high priority according to the *Conservation of Agricultural Resources (CARA) Act, 43 of 1983*. The Act (South Africa 1983:2) describes grazing capacity in relation to veld as "the production capacity over the long term of that veld to meet the feed requirements of animals in such a manner that the natural vegetation thereon does not deteriorate or is not destroyed". In 1993, an official Grazing Capacity Index or potential was formalized, but work is continuing on improving the product with the aid of remote sensing techniques. Since 1993 a number of updated versions have been developed and verified to some extent, but not released as a formal updated version within CARA yet. One of the main concerns in developing an updated grazing capacity map for South Africa, with the aid of remote sensing, is the level of detail required at ground level management. Since the first release of the grazing capacity map, some provincial departments of agriculture have refined their provincial maps, based on ground-truthing and indigenous knowledge of the area, with the result

that the national map differs from the provincial versions. A workshop hosted by the national Department of Agriculture in March 2008, decided that the final map should incorporate the provincial requirements (Pretorius. Personal interview, March 2008, Pretoria).

According to Scotney *et al.* (1990:5), grazing capacity in South Africa varies between 2 ha/LSU to more than 45 ha/LSU with an estimation that up to 60% of the veld is in a poor condition. The CARA (South Africa 1983:2) describes a large stock unit (LSU) as a “unit which consists of the prescribed number of animals of a prescribed kind, type, breed, age or sex, or which is in a prescribed phase of production or is of a prescribed approximate live mass”. According to the Department of Environmental Affairs and Tourism (2006b:25), the long-term grazing capacity has been exceeded in all the provinces. Figure 7.18 illustrates the 1993 grazing capacity potential determined for South Africa.

Gauteng is largely regarded as Transformed Rangeland (43.4%), the highest in the country. Valuable natural rangelands have been transformed by cultivation, including marginal crop production areas, as well as urbanization. About 29.6% of the province has a carrying capacity of 8 to 10 ha/LSU with 19.1% having a carrying capacity of 5 to 7 ha/LSU (ARC-ISCW 2004:92). These grazing capacity norms compare favourably at a national level. However, due to the pressures on the availability of land, especially the availability of large land parcels experienced in the province, very few farmers rely on livestock production through the utilization of natural pastures. Livestock production is intensified through the use of planted pastures, mostly for dairy production and feedlot production systems.

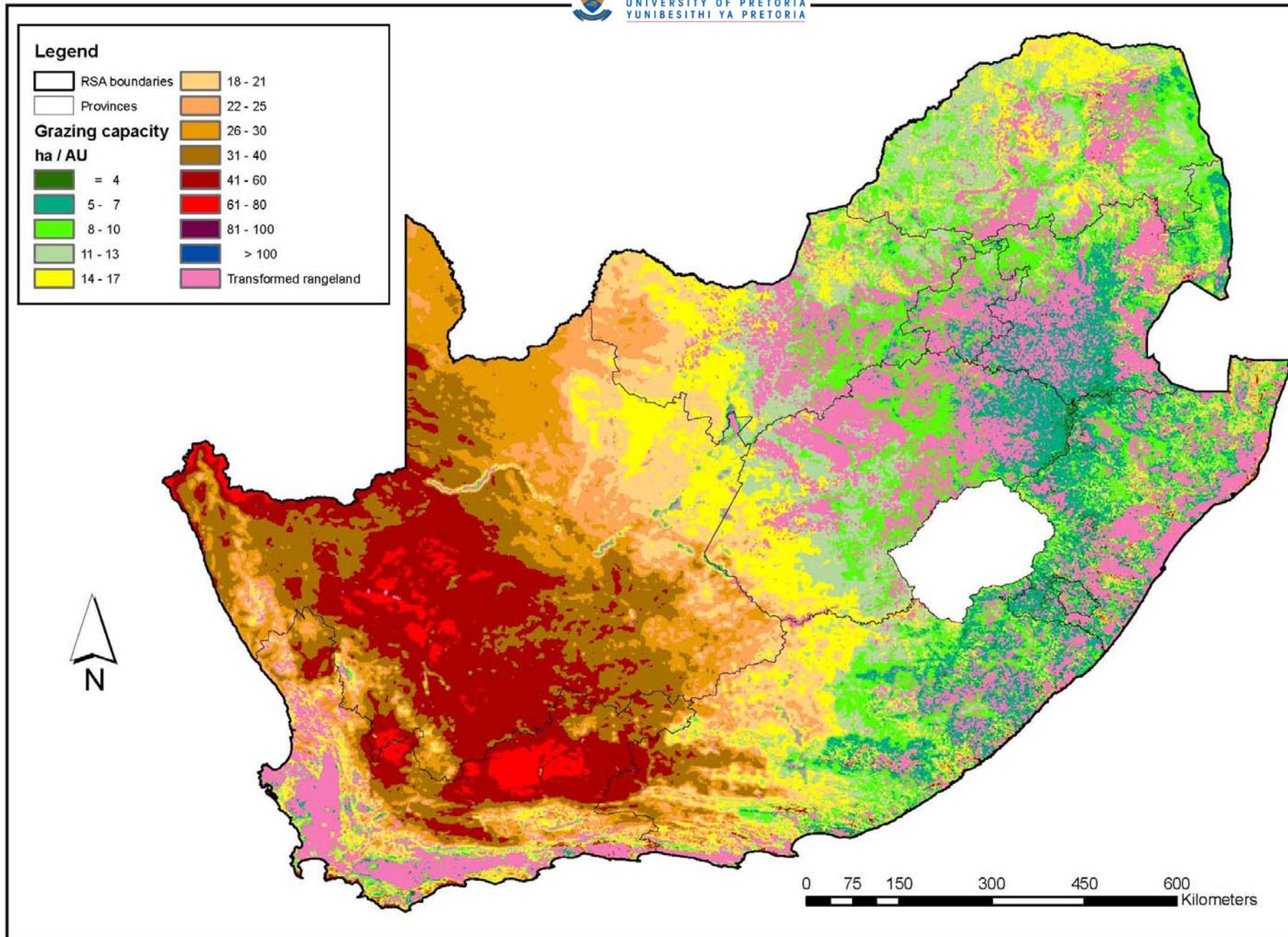


Figure 7.18 Grazing capacity index or potential, 1993

- **Alien plants**

Invasive plants are regulated through the *Conservation of Agricultural Resources (CARA) Act, 43 of 1983*. The Act (South Africa 1983:2) regards an invader plant as any that has been declared as such and includes the seed or any vegetative part of the plant that reproduces itself sexually.

The invasion of alien plants is regarded as a critical factor that can contribute to the loss of productivity of land. The impact of alien plant invasion can result in a 7% decrease of water run-off and the loss of biodiversity (Department of Environmental Affairs and Tourism 2006a:99).

The most common alien plants found in Gauteng include the Black Wattle (*Acacia mearsii*) and the Blue gum (*Eucalyptus camaldulensis*). About 50 600 ha or 3% of the province's surface is taken up by alien plants. These plants are not located on steep slopes, but can be characterized by stands of invader vegetation (ARC-ISCW 2001:3). Figure 7.19 depicts the alien plant distribution in Gauteng.

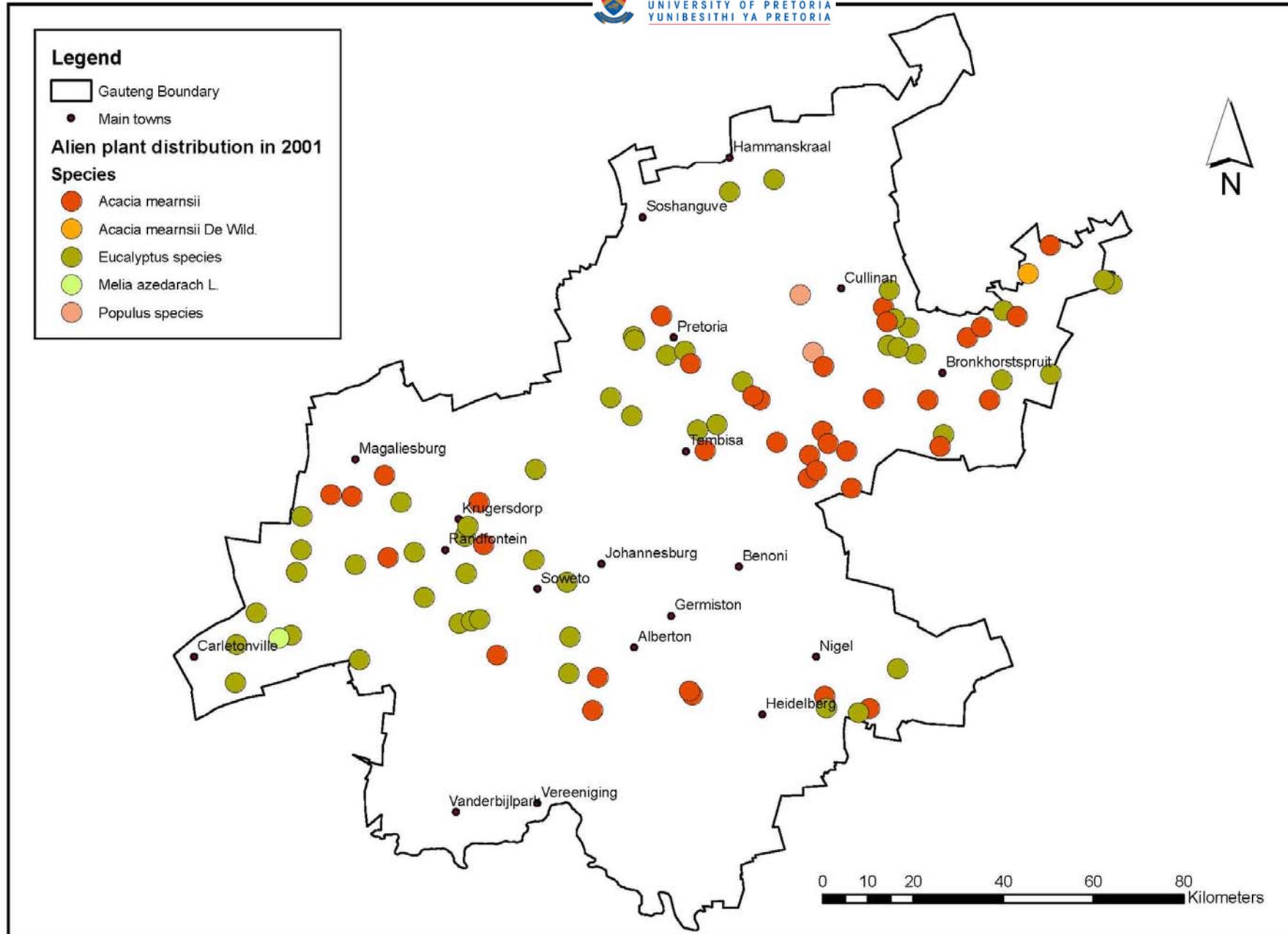


Figure 7.19 Alien plant distribution in Gauteng

7.8 WATER

South Africa is regarded as a country with limited water resources. Increasing demands are placed on water resources from the agricultural sector as well as for industry and human consumption. Due to the uneven distribution of the country's water resources, large amounts of water are distributed throughout the country. It is projected that South Africa may face the possibility of a water deficit in 2025, if not earlier (Department of Environmental Affairs and Tourism 2006b:3).

Significant progress has recently been made in the development of new legislation on the country's water resources, both in managing and protecting the quality of the resource. Despite these changes, there are fewer available water resources and the quality of the water is declining. Insufficient control over sources of pollution and land use practices has contributed to this scenario (Department of Environmental Affairs and Tourism 2006b:3).

The Department of Water Affairs and Forestry has initiated a project to conduct a groundwater resource assessment in order to quantify the ground water resources of the country on a national scale. Table 7.4 depicts the results of the study.

Table 7.4 Groundwater resources in South Africa

Type	Amount
Total volume of groundwater	235.5 billion m ³
Groundwater resource potential	49 billion m ³ /a
Average groundwater exploitation potential	19 billion m ³ /a
Potable groundwater exploitation potential	14.8 billion m ³ /a
Utilizable groundwater exploitation potential	10.3 billion m ³ /a

Source: Holtzhausen (2005:15)

According to the National Water Resources Strategy of 2005, cited in the draft National Strategy on Sustainable Development (NSSD), there should be sufficient water resources to meet the requirements, provided the resource is carefully managed, not taking into consideration the effects of climate change on water availability. It is

predicted that climate change will have a significant influence on the availability of water. Furthermore, by 2025, requirements will exceed water availability with a requirement growth especially in the industrial and urban domestic sectors (Department of Environmental Affairs and Tourism 2006a:14).

The status of water sources, such as rivers is also alarming at present. About 82% of the main river ecosystems are threatened, of which 44% can be regarded as critically endangered, 27% endangered and 11% vulnerable (Department of Environmental Affairs and Tourism 2006a:119). This status can be attributed to several reasons.

Agricultural use of water requires about 62% of the country's total water with 23% needed for urban requirements. The remaining 15% is shared by rural needs, mining and industry, power generation and afforestation (Department of Environmental Affairs and Tourism 2006a:147). Very little of the water is available for re-use, with most of the effluent returning to the oceans.

In 1995, according to the Department of Water Affairs and Forestry (DWAF) (cited in Backeberg 2003:151), 1 290 132 hectares of South Africa was under irrigation with the possible expansion of 178 000 ha. Of the total area under irrigation, however, only about 86.5% is suitable for irrigation, with 82.5% resorting within these areas. The national Department of Agriculture estimates that the total potential irrigable land of 1 573 482 ha consists of about 10% of the arable land in the country. Nell and Van den Berg (2001) (cited in Backeberg 2003:151) state that calculations from satellite imagery, taken in 1994 and 1995, identified 1 589 884 ha of land under irrigation, which indicates that the potential for irrigation has already been exceeded. This means that there should be optimum utilization of water resources, including the selection of applicable irrigation methods.

Run-off of water is estimated at 8.5%. In 1990, 48% of all run-off water (in dams) was used for irrigation, whilst 54% of the economically utilizable run-off water was utilized by other sectors in the country. It was thus concluded that 26% of the available utilizable run-off water was used for irrigational purposes with an estimation that in 2010, 46% of this water will be used for irrigation and all other sectors will only utilize 70% of the economically utilizable run-off water. Large volumes of unused surplus water are thus not used, mainly located in areas where there is little economic development and where

the irrigation requirements are low, due to high levels of rainfall and limited possibilities of irrigation, due to topography (Department of Agriculture 2006a:17).

Statistics released by the Water Research Commission in 1997, comparing water use in South Africa in 1990 to 2010, estimate that municipal or domestic use of water will increase from 12% in 1990 to 17.3% in 2010, whilst mining water use will decrease with 0.2%. As far as water use for irrigation is concerned, a decrease from 50.9% in 1990 to 45.96% in 2010 is estimated (Meyer 1998:20). This decrease will have significant impacts on agriculture.

In a country with limited high potential soils and a below average rainfall, agriculture is dependent on water for irrigation purposes. Currently about 74% of South Africa's potential available rainwater is used by agriculture and forestry. Of the 74%, about 60 % is used for the maintenance of forest growth and natural vegetation used by livestock and game, and 12% is used for rain fed crop production. Only 2% of the 74% available rainwater is used for irrigation purposes. Agriculture is the largest single user of run-off water (Department of Agriculture 2006a:17). The storage of water is therefore of high importance. South Africa has about 320 large dams with a total capacity of 32 400 million m³ that forms 66% of the total water run-off (Department of Environmental Affairs and Tourism 2006a:145).

Gauteng is located within three water management areas, namely the Crocodile West-Marico, Upper Vaal and Elephants Rivers. Yet most of Gauteng's water is imported from outside the province with the main supply being the Vaal River, which receives input from the Lesotho Highlands project (GDACE 2004a:51). About 40% of the population depends on the 4.5 billion m³ of water carried by the Vaal River on the southern border of the province.

Water resources in the province are mostly affected by the high demand for water, due to increased urban development and population growth and the accompanying sanitation requirements. Further pressures are due to mining and industrial activities and, to some extent, agricultural activities. The loss of ground water recharge, due to an increase in water run-off resulting from urban development, is of considerable concern. Pollution, in various forms, has also resulted in the deterioration of the quality of water resources. According to GDACE (2004a:56), no river in Gauteng is still in its

natural state. The water quality is very poor and, in comparison with other provinces, the ecological state of rivers in Gauteng can be regarded as fair to poor. Figure 7.20 indicates the water resources in South Africa.

- **Wetlands**

The Department of Environmental Affairs and Tourism (2006a:163) defines wetlands as "land which is transitional between terrestrial and aquatic systems, where the water table is usually at or near the surface, or the land is periodically covered with shallow water or would support vegetation typically adapted to life in saturated soils". A wetland must have one or more of the following criteria:

- Wetland (hydromorphic) soils that display characteristics resulting from prolonged saturation
- The presence, at least occasionally, of water-loving plants
- A high water table that results in saturation at or near the surface, leading to anaerobic conditions developing in the top 50 cm of the soil.

Various factors can influence a wetland, both from a development perspective (building of infrastructure, houses, mining, open space use) within or in close proximity to a wetland, as well as agricultural activities, such as crop farming, grazing, burning wetlands and the presence of alien plants. It is estimated that about 50% of wetlands in South Africa have either been destroyed or converted to other uses with only about 10% currently protected (Department of Environmental Affairs and Tourism 2006b:11; 27).

An estimated 1.5% of the Gauteng surface consists of wetlands, of which 52% are threatened and a further 44% partially threatened. The Blesbokspruit wetland, which forms part of only six inland fresh wetlands, protected under the RAMSAR Convention, is also found in the province (GDACE 2004a:78).

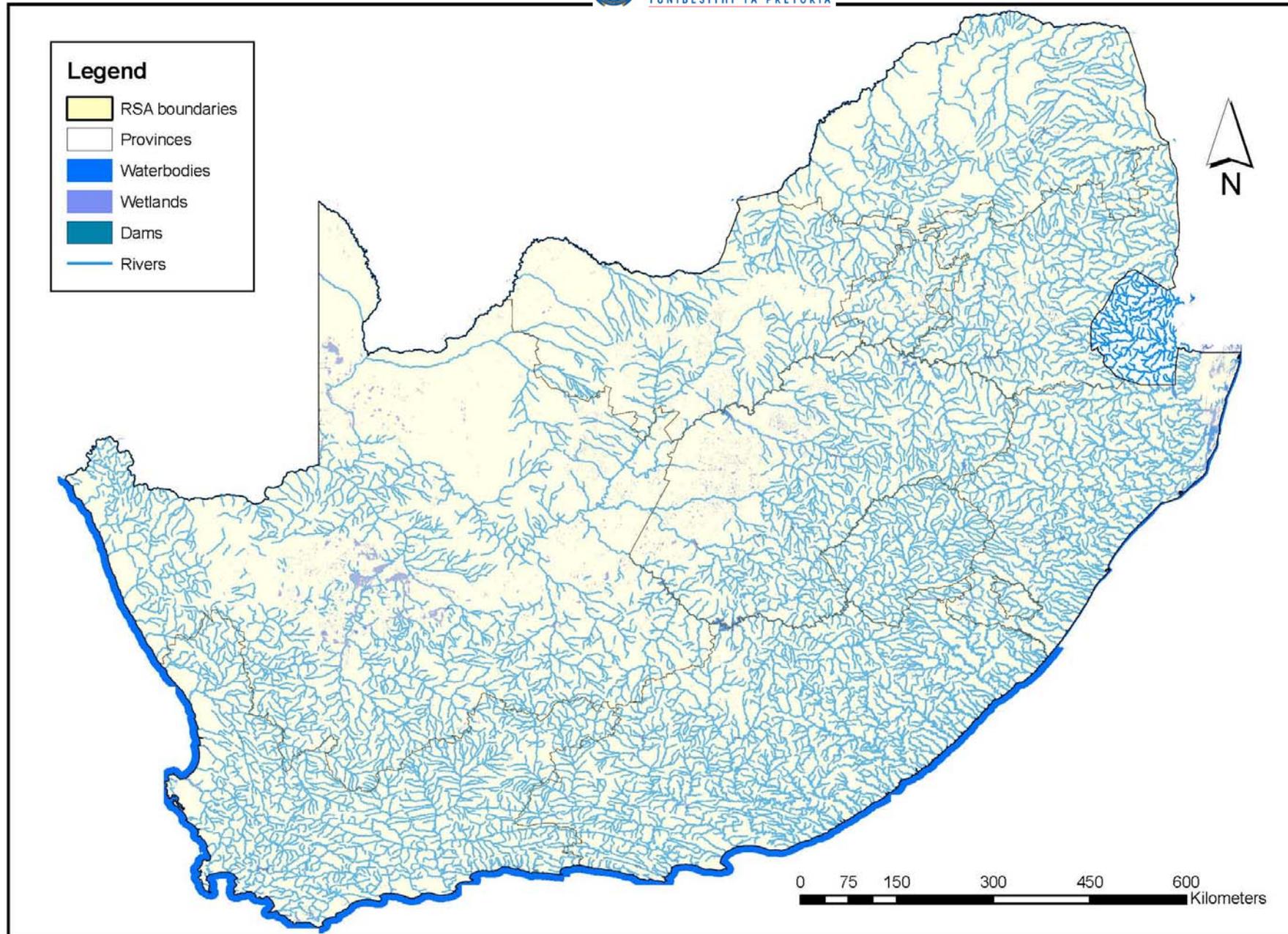


Figure 7.20 Water sources in South Africa

7.9 THE WAY FORWARD

It is the intention of the national Department of Agriculture (DoA) (2004a:45) to focus on optimal utilization of the natural resources. Accordingly, it is important to conduct detailed surveys and determine the potential of the land supported by detailed information. This is to ensure good farming practices and optimal yield without sacrificing the state of the natural resources. Problems in achieving this initiative should be identified and guidelines provided as a solution to the problem.

Taking into consideration the variance in environmental factors, it can be said that it is to the advantage of the country, as it lends itself to a large variety of agricultural practices resulting in a year round availability of products to markets. The risk aspects are thus limited as factors such as drought, pests and possible diseases are restricted to a specific area, resulting in prosperity for another area (Department of Agriculture 1994:10).

Considerable research has been conducted in the field of agriculture and natural resource management, taking into consideration the identification and mapping of natural resources, as well as the effective utilization thereof. It further focused on cultivation and/or farming practices to enhance the quality of farming, as well as factors that can contribute to the increase in possible yield as far as crops are concerned, by identifying limited factors, such as diseases and pests, and making alternative options available to combat the problem.

In considering the country's natural resources, it has to be concluded that red lights are flickering that cannot be ignored. Effective resource management systems need to be implemented and sustainable land use practices promoted.

An effective way of managing natural resources is through the use of spatial information and decision support systems.

7.9.1 Spatial information management

“Good policy decisions need to be based on timely, consistent and accurate information” (Department of Environmental Affairs and Tourism 2006b:15).

This statement is one of the key building blocks in ensuring sustainable management of natural resources. It is nearly impossible to manage a resource without knowing the resource as well as its current status. In a society driven by information and knowledge, managers of natural resources must realize that it is the only way to achieve success. Recently, as the field of geographic information (or the spatial representation of information) became the norm, it was realized that representing natural resources in a spatial format would assist management thereof.

Spatial information allows for the interrogation of data through various layers and to reach overall conclusions on a specific matter. In the context of this study, this principle can best be illustrated when a particular land portion is investigated. The use of available data on natural resources (soil, climate, terrain), as well as land use makes it increasingly easier to reach conclusions on the potential of the land portion and its current state and to assess whether the current use is the most sustainable option.

To date, considerable natural resource information is available in a spatial format. Core natural resource data sets that are available in spatial format, include land type data, broad soil patterns, terrain units, certain climate data, grazing capacity and veld types to name but a few. Two national land cover data sets are also available.

The scale of data is very important. On a national level, the scale of data of at least 1: 250 000 should be used, whilst on a provincial level the recommended scale should be 1: 100 000 or larger, where possible. For a more localized level, a scale of 1: 50 000 is required and for farm level management, a scale of 1: 1000.

In many cases, the scale of the data is insufficient for decision-making on a local level. Most data sets are available at a national level that can be used on good authority as a guiding tool for high-level decision-making. Nevertheless, this is not suitable for detailed level decision-making and on-site investigations by a qualified specialist, for gathering of site-specific data should form an essential part in the decision making process.

The main reason for a lack of detailed information is the cost involved. Information is expensive on the basis of administration costs (for example, the processes involved to obtain the data) as well as the utilization of specialists needed to conduct the

investigation. Related to this is the translation of paper-based field investigations to spatial format. At present, limited funds are available for research that previously used to be the main driving force behind the gathering and capturing of new information. Another reason is the lack of capacity in the various scientific fields. South Africa is in a situation where very few experienced scientists are still available who focus on natural resources. This, again, is mainly due to costing factors, but may also be due to a lack of awareness, interest, support, commitment or understanding of the dynamics involved in natural resource management.

A third reason is the human factor. Many people are of the opinion that data generated by them is not available to other researchers or the public in general. Much critical and valuable data has been lost in this way. In some instances, another individual has gathered the same data without knowing that the work has been done before, resulting in a waste of time and resources. Laker (2004a:ix) maintains that legislation should be put in place to ensure that all resource surveys conducted are submitted to the ARC-ISCW to be placed in a national resource database.

New or updated data sets are not released frequently enough. This is especially relevant to land cover and land use, habitat degradation, water and air quality as well as the secondary processes that build on this information. The principle of effective land use planning thus comes into play. According to the *White Paper on Spatial Planning and Land Use Management* (Department of Land Affairs 2001:32), spatial planning is “planning of the way in which different activities, land uses and buildings are located in relation to each other, in terms of distance between them, proximity to each other and the way in which spatial considerations influence and are influenced by economic, social, political, infrastructural and environmental considerations”.

Using relevant data sets and conducting detailed analysis thereon, also allows relatively easy determination of the gaps existing in the data sets, especially in the field of natural resources. Decision- and policy-makers need to pay attention to this. Important gaps in data sets need to be prioritised and funding made available to obtain the information. The collection and management of data and information, especially overlapping information between institutions, should be an integrated process.

Data generation should also ensure proper capturing and documentation of the origin of the data and associated processes (also known as metadata), including the constraints within which the data set operates, to ensure that it is used accordingly. Misinterpretation of data remains a source of concern.

7.9.2 Agricultural geo-referenced information system (AGIS)

www.agis.agric.za

During the early developmental years of Geographic Information Systems in the late 1990's, the national Department of Agriculture, the ARC (especially ISCW) as well as the nine provincial departments of agriculture expressed the need to work towards a common goal, especially when working with spatial information. At that time, spatial information was very expensive and not easily accessible. This initiative led to the development of the Agricultural Geo-referenced Information System (AGIS). AGIS is a web-based spatial information system, focused mainly on providing spatial natural resource information, free of charge, to the broader public.

One of the main driving forces behind the development of AGIS was the fact that the government institutions mentioned were all paying for the same spatial data with taxpayers' money. Most of the natural resource data sets were then under the custodianship of the ARC and were mostly available on a national level. Limited provincial spatial data sets were available. Also of concern were the lack of spatial standards and the duplication in achieving the same objectives. Data sets were duplicated, with a number of versions being available and no clear indication of the correct version. This duplication was also very costly as data is an expensive item.

AGIS is currently co-managed by the DoA as well as the ARC through guidance received from the AGIS Working Group. Representatives from each provincial department of agriculture, DoA, ARC as well as DEAT and DWAF are on the Working Group. The purpose of the working group is to identify gaps in available spatial data sets, develop standards on spatial information, make members of the group aware of research being conducted, and make natural resource information available to the parties involved and, where possible, the broader public. This includes research results and reports. It is envisaged that all natural resource information be housed on AGIS in order to limit duplication of effort and protect the data from getting lost.

One of the main AGIS achievements thus far, and available on the web, is the development of a comprehensive atlas that includes the data layers of the natural resources atlas, consisting of a large amount of spatial information. Within the Atlas, users have a certain amount of GIS capability in terms of selecting data layers to view and analyse, supported by additional information.

Other achievements include the development of a Virtual Herbarium of more than 300 indigenous plants species, the Weeds and Invasive Plants web, the Farm Animal Genetic Resources web, and a comprehensive Climate web. A Soil web is in the process of being developed. Applications pertaining to Act 70 of 1970 can also be lodged electronically on AGIS with the option to determine the status of the natural resources on an identified farm, with acknowledgement of the scale of the data. The aim of AGIS is to become the single information portal on agriculture in country. To date, it is the only website available in South Africa with such comprehensive spatial information on natural resources.

7.10 CONCLUSION

This chapter described the status of natural resources in South Africa, agriculture's impact on the environment, the need for a proper balance between land use and the protection of non-renewable natural resources, conservation of natural resources, soils, vegetation and biodiversity in South Africa, and spatial information management.

Chapter 8 discusses agricultural potential.

AGRICULTURAL POTENTIAL

8.1 INTRODUCTION

Agricultural production and land with its associated characteristics are two factors that cannot function independently. The potential, condition and status of the one depend on the other. The survival and maintenance of these factors are crucial in ensuring the continuous production of food for a nation. To these, Crosson (1983:340-342) adds the factor of technology. The technology used in the combination of both the resources and the environment for production purposes will have a major impact on the yield, as well as on the sustainability of the environment. The main intervener in determining the outcome of this process is the land user. It is the responsibility of the land user to know the potential of the land and to apply the correct technologies or decide on the correct land use that will allow the land to reach its optimal performance. However, the land user needs to be supported in this decision by various external role-players, such as land use planners, researchers, environmentalists, consumers, financial institutions and politicians.

Applying these factors, and with the support of the various role-players will ensure that the environment will still be there for future generations.

8.2 HIGH POTENTIAL AGRICULTURAL LAND

Thus far the status and sustainability of natural resource management, as well as existing legislation, policies and strategic objectives, have been emphasised. The objective of this study was the protection of high potential agricultural land, in particular, and recommended procedures that should be followed in achieving this objective.

The value of land depends on the scarcity or rarity of its qualities in a specified area or region. This scarcity of quality often results in the land being irreplaceable and requires thus protection against uses that may be highly profitable (FAO 1976:21).

Wood (1976) (cited in Smith 1998:1) maintains that the protection of agricultural land is crucial to the welfare of the state, especially prime agricultural land, in order to ensure food, fibre, open space and employment opportunities for current as well as future generations. Schoeman and Scotney (1987:260) point out that high potential agricultural land is not only limited, but competing non-agricultural land uses as well as the abuse, particularly of soil resources, constantly put this land under pressure. This has a serious impact on possible food production. It is therefore essential that the production potential for each country be determined and evaluated against the demand for food supply and population growth.

It has long been recognized that high potential agricultural land is a scarce resource in South Africa and should be protected (Scotney *et al.* 1990:7). Research on dry land cropping potential found that less than 14% of the country's land is suitable for dry land cropping, with only about 3% regarded as land with a high agricultural potential.

Smith (1998:119) maintains that in using land type data and rain fed maize in an overall performance model, about 2.76% or 2.62 million hectares of the total farmland of approximately 95 million hectares in South Africa, can be regarded as high potential agricultural land. This land is mainly found in four provinces, namely KwaZulu Natal (11.7%), Mpumalanga (8.6%), Free State (4.9%) and Gauteng (9%). However, it was stated clearly that the percentages indicated, include large areas that are no longer available for agricultural production, as large portions of them may already be lost due to mining activities and urban and industrial sprawl. According to Smith (1998:118), almost all the open cast mining activities in Mpumalanga, as well as industrially related activities that are mainly expanding into the rural areas of Gauteng, occur in areas with a high concentration of high potential agricultural land for rain fed crop production. Much high potential land is also used for forestry purposes. Smith (1998:188) emphasises that each hectare "taken from cropland by urban development usually means one more hectare is isolated and lost to farm production".

Evaluating the importance of the protection of high potential agricultural land for crop production versus development pressures, raises the question of whether there will be sufficient natural resources available in future if the growing population and increased demand are taken into consideration. In addition to the utilization of open spaces for housing and infrastructure development, as well as recreational purposes, more

pressure will be exerted on the intensive use of suitable natural resources for the production of food, to meet the demands of the growing population.

Current estimations predict that the demand will far exceed the supply. It is predicted that a production growth of 4% per annum for the next twenty years (not including imports) is required in Africa to ensure food security. However, this target will not be sustainable, economically viable or environmentally supported (Meyer 1998:112).

There is still the question of what is regarded as high potential agricultural land, how to identify this land, what the preferred land use thereon should be and the best management practices required.

8.3 IDENTIFICATION AND EVALUATION OF HIGH POTENTIAL AGRICULTURAL LAND

A number of research projects have been initiated to determine criteria for identifying high potential agricultural land and to further indicate its locality in South Africa. Criteria such as soil, climate and terrain are important factors used to describe the agricultural potential of a land portion. The first research on this matter was conducted through the land type survey, wherein each land type unit was described by its applicable soils, slope and climate classes found in the unit, on a scale of 1: 250 000 (ARC-ISCW 2004:34). Schoeman and MacVicar (1978:25) maintain that agricultural potential should be measured against the factors determining yield, namely management, climate, soil type and slope. The yield for a given climate, soil and slope depends on the production techniques a farmer applies that show very good results in practice. Moreover, should the management factor remain constant, the potential thus depends on soil, climate and terrain.

Determining the potential of the land, using these criteria, especially under dry land conditions, would assume following a worst-case scenario in identifying the capability of the land. However, this should further be influenced and guided by other underlying principles of sustainable development, such as prevailing marketing factors, available infrastructure, possible additional water sources, socio-economic factors, suitable crop selection and excellent management practices.

This still raises the primary question of what is defined as “land”?

The FAO (1976:15) regards land as “the physical environment, including climate, relief, soils, hydrology and vegetation, to the extent that these influence potential for land use”. A land characteristic should be measurable. Economic and social characteristics are not included in the concept of land. A land-mapping unit is regarded as an area of land with similar characteristics, defined and mapped by natural resource surveys. Variations in soil and landforms are the main reason for the difference in land-mapping units, but should not be the only environmental factor for determining land suitability (FAO 1976:15-16).

Sombrook (1996:3) refines the FAO’s definition further by adding that land is “a delineable area of the earth’s terrestrial surface, encompassing all attributes of the biosphere immediately above or below this surface, including those of the near-surface climate, the soil and terrain forms, the surface hydrology (including shallow lakes, rivers, marshes and swamps), the near-surface sedimentary layers and associated groundwater reserve, the plant and animal populations, the human settlement pattern and physical results of past and present human activity”. Functions of the land include production, biotic environmental, climate regulative, hydrological, storage, waste and pollution control, living space, archive or heritage and connector of space.

According to Schoeman (2004:4), land refers to “the total natural environment of the exposed part of the earth’s surface, including atmosphere, climate, soils vegetation and the cultural environment.

For the purposes of this study, land was regarded as an area characterized by its soil, climate, terrain and vegetation whose interaction is interdependent.

8.3.1 Land evaluation and capability

Land evaluation and land capability determination play a pivotal role in land use management and the identification of land that should be protected for agricultural use. Van Niekerk (1981) (cited in Schoeman, van der Walt, Monnik, Thackrah, Malherbe & le Roux 2002:1) views land capability as the mapping tool that can assist the user in the long-term planning of land utilization and can be used in any agricultural field.

According to the FAO (1976: Glossary), land evaluation is the “process of assessment of land performance when used for specific purposes involving the execution and interpretation of surveys and studies of landforms, soils, vegetation, climate and other aspects of land in order to identify and make a comparison of promising kinds of land use in terms applicable to the objectives of the evaluation”.

Within the concept of land capability Scotney, Ellis, Nott, Taylor, Van Niekerk, Verster and Wood (1991:2) define land capability as “the extent to which land can meet the needs of one or more uses under defined conditions of management, without permanent damage. Land capability is an expression of the effect of physical factors (e.g. terrain form and soil), including climate, on the total suitability and potential for use for crops that require regular tillage, for grazing, for forestry and for wildlife without damage. Land capability involves the consideration of (i) the risks of damage from erosion and other causes, (ii) the difficulties in land use caused by physical factors, including climate and (iii) the production potential.”

The FAO (1993: Glossary) defines land capability classification as “a classification of land in terms of its potential for use in specified ways and with specified management practices, generally as a sequence of capability classes 1, 2, 3...”.

Prior to 1978 very little land evaluation was conducted in South Africa and soils were used to interpret land use capabilities (Scotney [1980] cited in Laker 2004b:358). After 1978 work done followed the FAO principles. Van Niekerk (1983) (cited in Laker 2004b:358) points out that early land capability classifications were conducted in an uncoordinated way by the then agricultural regions, with very little of the work actually being published. The advantage of each region conducting its own land capability was that it incorporated the local requirements that may have suited the land use planners.

The first comprehensive land capability study in South Africa was conducted by Schoeman *et al.* (2002:v) in which land capability was regarded as the total suitability of land for use of crop production, grazing, woodland or wildlife, but in an ecologically sustainable manner. Schoeman *et al.* (2002:1) define land capability as “the extent to which land can meet the needs of one or more uses under defined conditions of management” whereas a land capability class is regarded as a group of land units with similar potentials and limitations or hazards. Van der Watt and van Rooyen (1995) (cited

in Schoeman *et al.* 2002:1) describe land capability as “the total suitability for use without damage to crops that require regular tillage, for grazing, for woodland and for wildlife”, whilst Vink (1975) (cited in Schoeman *et al.* 2002:1) emphasises that the degree of capability is influenced by the state of associated attributes found in the area in question. Grove and McCart (1976) (in Schoeman *et al.* 2002:1) regard land capability as the limits to which a resource can be used for both present and future societies.

Most of the initial research was based on soil surveys and their interpretation, but due to the development of technology and information systems many of the data sets were captured in spatial information systems (GIS), which allowed researchers to do more detailed modelling and manipulation of the data.

The processes in determining land capability are sometimes at the core of controversy, as scientists each have their own methodology. Issues that should form part in determining land capability differ. This confusion centres mainly on the inclusion of economic and social factors versus the physical land factors, such as soil, climate and terrain. Another factor that might influence the outcome of the methodology used is the possible incorporation of water (including availability, quantity and quality).

Aandahl (1958) (cited in Smith 1998:7) describes a soil survey interpretation as the “organization and presentation of knowledge about characteristics, qualities and behaviour of soils as they are classified and outlined on maps” and that people make the choices for alternatives.

Smith (1998:122) maintains that land evaluation techniques are critical in determining the area of a high potential for crop production, as well as its locality and especially the reasons why it is regarded as important. Examining the biophysical properties of the land is the first step in evaluating the land as they represent the physical factors, but Smith (1998:122) emphasizes further that this should be supported by an economic analysis as a logistical progression from the land evaluation. The identification of soils as a starting point for land evaluation is the easy part, but when a multidisciplinary approach is considered, whereby other matters, such as economics of scale and production inputs are incorporated in the equation, it becomes more complicated.

The determination of land capability through evaluation, is a considerably expensive process that cannot always be repeated regularly as new natural resource data is not routinely made available, whilst economic indicators change on a daily basis. Using a multidisciplinary approach by incorporating issues such as economics of scale, opens the possibility of further controversy.

The definition of land evaluation is thus based largely on physical factors, but should not be read in isolation and the final decision should be supported or influenced by additional dynamic factors, such as economic factors.

Klingebiel and Montgomery (1961) (cited in Smith 1998:8) describe the USA's Department of Agriculture (USDA) Land Capability Classification as a long-term use of soils for production of crops, but with no degradation. Capability is classified on three levels, with the highest level referring to alternative uses of the land, but with a priority for crop production. The second level refers to conservation problems, namely water run-off and erosion, wetness and drainage, rooting and tillage limitation and climatic limitations. The third level refers to units formed by soil groups with a similar potential for plant growth, appropriate management and conservation requirements. The grouping of the soils is based on the land use potential pertaining to soil and economic aspects, but no formal weighting procedure is attached for each soil factor.

Storie (1976) (cited in Smith 1998:9) developed the Storie Index Rating, whose core objective was to develop an agricultural rating for soils to be used for land tax assessment and zoning of land use. The Storie Index Rating focuses on the influence of soil factors and its suitability in the production of crops. No management factors are included. The Index was defined as follows:

$$\text{Storie Index} = A \times B \times C \times X$$

where

A = soil factor determined by depth, permeability and gravel content

B = Texture

C = Slope

X = Miscellaneous

and is expressed as a percentage rating. Again, its reliability depends on the factor selection, the weighting and the interaction between the factors. Smith (1998:9) points out that the assigned values can be subjective, however.

In 1962, Loxton (Schoeman *et al.* 2002:3-4) developed the first documented South African land capability determination. This was done through determining a land capability code called the ECM. The ECM referred to the erosion hazard (mostly soil erosion arising from cultivated land), soil climate (referring to the interaction between natural precipitation, relief, runoff, infiltration capacity, internal soil drainage, texture, horizontal development and other physical soil characteristics), and mechanical limitations (including physical obstructions or preventable arable land use, such as steep slopes, rockiness or strong compaction). The code was supported by local knowledge, experience, and research results. It is not known whether this system was applied in practice, although some of the principles used were found in later land capability developments.

Smith (1998) makes use of soil types (using expert knowledge to classify soil forms based mainly on the leaching status and internal drainage), slope classes, top soil clay percentage, soil depth, soil texture, permeability of the upper sub-soil, soil wetness, rockiness and soil surface crusting to determine a framework for land capability classes in KwaZulu Natal (Schoeman *et al.* 2002:5). The land type data set was used as the basis input data set. The soil and land characteristics were weighted in such a way that the potential of the land was expressed on a scale from 0 -100.

On a national scale, the Multilateral Technical Committee for Agriculture and Environmental Affairs appointed a task team to develop a system for soil and land capability classification, with the emphasis on the self-governing areas and the former homelands in South Africa. The first results were tabled in 1987 and again reviewed in 1991. The purpose of this exercise was to limit confusion between soil surveyors and to rather focus on a uniform system for interpreting soil data and conducting a land evaluation. The task team had to review existing land capability systems, devise an improved system that would promote decision-making on the use of agricultural resources and also address the issue of mapping scales. The outcome was a systematic arrangement of land, indicating the long-term use possibilities for agriculture, as well as a focus on permanent hazards that should be taken cognisance of in each

class. The task team acknowledged that a single system would not be able to meet all the requirements and that the situation analysis in first- and third-world countries would differ. It was therefore decided to rather focus on guidelines to allow for flexibility in meeting specific requirements (Scotney *et al.* 1991:2).

One of the main issues that could not be resolved in developing the requirements was the inclusion of climate as a parameter. The situation was exacerbated by the fact that at the time no suitable climatic regions had been described that could be used as basis. The situation was resolved through the development of soil capability classes using permanent terrain (erosion and flood hazards) and soil factors (effective depth, texture, internal drainage and mechanical limitations), whilst adding climatic factors in the development of land capability classes. This might result in a soil capability class being downgraded due to climatic factors. Nevertheless, this becomes relevant in assessing land capability for dry land crop production. In the case of possible irrigation, a separate irrigation assessment should be conducted although the soil capability class should give a good indication of the suitability for irrigation (Scotney *et al.* 1991:6). In both processes, accurate surveying of the soil and classification, according to current limitations or constraints, is crucial.

The task team's proposed system comprises of three levels:

- The first level or land capability unit (ecotope/management unit) consists of mapping soil units with a similar use potential, that is the capability of producing similar crops with similar management practices and conservation treatment. The capability units are most suited at a 1: 25 000 or larger scale.
- The next level is land capability sub-classes, which includes grouping units with the same type of limitations or conservation concerns, such as erosion, excess wetness or flooding, mechanical limitations, climatic limitations or root zone limitations. This is followed by the development of land capability classes having the same degree of potential or limitation. There are eight classes of land capability biased towards agriculture, but also reflecting suitability for rural land use as well as resource conservation. Classes I to IV are generally suited for cultivation, classes V and VI are non-arable, but allow for some intensification. Class VII should be left under natural vegetation, whilst class VIII has limited or no agricultural potential and should

be protected for conservation purposes. Both the land capability classes and subclasses are appropriate on a 1: 50 000 scale.

- The last level comprises a land capability order, suitable at a scale of 1: 100 000 or smaller, where the capability classes are grouped based on an assessment of arability and agricultural potential. Order A (arable land) consists of classes I and II (high potential with few limitations) and Order B (arable land) consists of classes III and IV and has moderate to severe limitations. Order C consists of classes V to VII and is regarded as grazing and forestry land, and Order D (class VIII) is non-agricultural land.

Concern was raised that due to the complexity of the various factors, a diversity of interpretations could still occur. This system does not provide for indications on crop suitability for specific crops, the economic value of the land or the crop. Economic considerations should be considered after a soil or land capability assessment has been conducted. The use of appropriate farming practices and good management skills is assumed. Soil and land capability are also classified according to the current status and based on rain fed agriculture.

The guidelines recommended for soil survey scaling are divided into broad soil surveys that include one observation per 100 ha on a 1: 100 000 scale, and one observation per 35 ha on a 1: 50 000 scale. For detailed soil surveys on a scale of 1: 5 000, one observation per 2.5 ha is recommended (Scotney *et al.* 1991:21).

In 2002, the ARC, commissioned by the national Department of Agriculture, did a follow-up on the task team's work to establish a formal land capability classification system for South Africa. The study followed Klingebiel and Montgomery's (1961) land capability concepts, as well as the task team's work, to allow for international and national technology transfer. The system made use of the eight-class land capability classification system, but aimed to incorporate the parameters in a Geographic Information System (GIS). The new system incorporates erosion hazard, excess wetness, physical root zone limitations, subsoil acidity and climatic limitations in determining the land capability subclasses. The eight land-capability classes, developed by the task team, are further grouped into three land-capability groups, namely arable, grazing and wildlife land (Schoeman *et al.* 2002:12).

The outcome of the work is currently used as the national norm for determining land capability. Results indicate that there are little or no soils in South Africa that are not subject to limitations. Most of the country's soils have moderate to severe limitations largely due to limited soil depth or moderate erodibility, caused by sandy texture or slopes. Areas with a very good climate, such as in KwaZulu Natal and the former Transkei, had to be degraded due to high slopes and limited soil depth. It was determined that nowhere in South Africa do best soil and good climate classes coincide (Schoeman *et al.* 2002:35).

Most of the arable land in the country is classified as Class III or IV. If Class IV is included, the total arable land in the country is 23.4%, which is higher than the 12% traditionally accepted (Schoeman *et al.* 2002: 35). Classes I to III represent 12.4%. Ninety eight percent (98%) of South Africa (Class III – VIII) has severe limitations in terms of rainfall, terrain or soils. Unique farmland, especially in the Western Cape, is classified as Class IV and V mainly due to limited soil depth. Table 8.1 indicates the percentages of land capability classes in South Africa per province.

Table 8.1 Land capability classes for South Africa

Province	Percentage of province occupied by various classes								
	I	II	III	IV	TOTAL I - IV	V	VI	VII	VIII
Eastern Cape	0.1	0.9	6.7	9.9	17.6	10.4	25.3	27.7	19.1
Free State	0.0	0.3	17.3	28.7	46.2	25.3	15.7	4.9	7.8
Gauteng	0.0	20.4	35.3	5.6	61.3	3.4	21.9	1.6	11.8
KwaZulu-Natal	0.1	5.7	24.9	11.1	41.8	3.0	29.5	16.2	9.5
Limpopo	0.0	0.7	16.8	20.2	37.8	25.7	17.5	6.9	12.2
Mpumalanga	0.0	12.1	26.9	12.2	51.3	5.1	26.2	5.0	12.5
Northwest	0.0	0.2	14.0	21.7	35.8	19.8	16.8	19.7	7.9
Northern Cape	0.0	0.0	0.0	0.0	0.0	2.7	4.0	78.6	14.7
Western Cape	0.0	0.2	6.9	6.8	13.9	4.7	14.6	39.7	27.1
RSA	0.2	1.8	10.6	11.0	23.4	10.5	15.5	36.1	14.4

Source: Schoeman *et al.* (2002:36)

Concern was raised that the outcome of the system might be subjective, due to knowledge of a certain area and limited availability of data and that a single set of class limits per criterion was used for the whole of the country. These limits should rather be

adapted to cater for unique situations in certain parts of the country (Schoeman *et al.* 2002:34).

Several international land evaluation systems have also been developed. Most of these systems focus on ecological and economic aspects and are thus condensed in a suitability class rating.

The FAO Framework for Land Evaluation (1976: Glossary) sets out the principles for land evaluation as “universally valid, applicable in any part of the world and at any level, from global to single farm”. The FAO (1976: Glossary) defines it as “the process of assessment of land performance when used for specified purposes, involving the execution and interpretation of surveys and studies of land forms, soils, vegetation, climate and other aspects of land in order to identify and make a comparison of promising kinds of land use in terms applicable to the objective of the evaluation”. The Framework’s underlying concepts of land evaluation and land use planning include land management, current land use or land utilization type, the characteristics of the land, land use requirements and improvement. The concept of land is referred to as soil being the basic unit although vegetation, hydrology, landform and climate are also included. The fundamental principles refer to the comparison of economically viable and ecologically sustainable options in determining a specific land use. The Framework refers to a comparison of present and/or future land use under preferred conditions, through a judgment process called “matching” (FAO 1976:46).

The Framework was only an approach to land evaluation and was never meant to be a system. Based on the Framework’s principles, the FAO developed *Guidelines: Land evaluation for rain fed agriculture* in 1983, *Guidelines: Land evaluation for irrigated agriculture* in 1985, and *Guidelines: Land evaluation for extensive grazing* in 1991. These documents reiterate the importance of using local criteria for evaluation (Smith 1998:11).

Kilic, Evrendilek, Senol and Celik (2005:323-335) qualify land suitability requirements through the following steps:

- Using land use and land cover data together with biophysical factors and identifying homogeneous land mapping units. Land cover and land use should be determined, based on local information on economic, management and ecological systems.
- Identifying land management units, using land characteristics with the aid of soil surveys and topographical and geological maps at a scale of at least 1:25 000. Aerial photos and satellite imagery may also be used to support this.
- Compiling a suitability rating index (SRI), using the land use and land cover data, as well as the land characteristics.
- Compiling a biophysical suitability index (BSI) from the suitability rating index (SRI) by determining how the biophysical requirements of the land cover and land use compare with those of the land management units.
- Calculating an agricultural profitability index (API) for each land cover by adding economic values.
- In using the FAO Framework for land evaluation, taking land suitability (suitable or unsuitable) classes to calculate an agricultural land suitability index (ALSI) by using multiplicative combinations of the biophysical and economic assessments.

Due to recent technological developments, the conventional way of land evaluation has made way for a modelling approach and thus a computer-based analysis of land capability. Care should nevertheless be taken in developing models, as these may be prone to errors in themselves or in the use of parameters.

According to Smith (1998:6), modern land evaluation is an integration of knowledge on land use and land resources. Moreover, although a land resource audit should form the basis of a land evaluation process, the definition does not include the study of technological, economic, social and other aspects for land evaluation activities. Smith (1998:22) emphasises that land evaluation models should be regarded as valid if they reflect the best judgement of the land evaluator and include an explanation as to why the judgement was made.

8.3.2 Prime or high potential agricultural land

The terms “prime agricultural land” and “high potential agricultural land” are used interchangeably, but their basic definitions are based on the same criteria.

Miller (1979:299) cites the USA Council on Environmental Quality's definition of prime agricultural land as lands "whose value derives from their general advantage as crop land due to soil and water conditions". At the same time, Miller (1979:301) states that farmland is a combination of the qualities required for high productivity, as well as relative environmental stability using modern agricultural production practices.

According to Schoeman and Scotney (1987:260), agricultural potential is what is agriculturally possible on a piece of land and is "a measure of possible productivity per unit area, per unit time, achieved with specified inputs of management". Schoeman and Scotney (1987:260) regard productivity as an indication of the agricultural potential for a given crop under a management level and for an identified portion of land as being dependent on precipitation, temperature, soil conditions, terrain and crop characteristics.

Meyer (1998:20) defines agricultural potential as "productivity per unit area achieved with specific management inputs". Furthermore, the interaction between natural resources, such as the soil, climate and terrain, determines the agricultural potential of a specific crop, but with a level of management.

Laker (undated:1) regards prime agricultural land as land that has a high quality for crop production with high quality soils and a favourable climate and topology.

The Soil Conservation Society of America (1975) describes prime agricultural land as "land best suited for producing food, feed, fibre and oilseed crops (and available for these uses)" (Smith 1998:1). This identified land should not be used for urban purposes or be under water. Moreover, it has "the soil quality, growing season, and moisture supply needed to produce sustained high yields of crops economically when treated and managed according to modern farming methods". Smith (1998:81) identifies the characteristics in determining high potential land as mean annual rainfall; soil depth; soil texture; soil type, and slope percentage. It should also have a long enough growing season, not subject to flooding, and rockiness should be limited.

Raup (1976) (cited in Smith 1998:2) acknowledges that the final analysis of prime agricultural land depends on a detailed economic analysis, but maintains that the

physical factors of the soil and climate, supported by detailed survey data, form the basis of the identification of prime agricultural land.

At the same time, Raup (1976) (cited in the Gauteng Agricultural Potential Atlas [GAPA] Version 2 2002:5) emphasizes that prime agricultural land is also prime land for other developments and is therefore in direct competition with other land uses. This is especially relevant in an urban and industrial development area.

This, again, reinforces that there will always be a conflict over land, especially in a province like Gauteng, where it is usually assumed that the province is urbanized and that there are limited possibilities for agricultural production. The available land cover data for Gauteng indicates the opposite (see chapter 4).

In its study on the zonation of high potential agricultural land, GDACE (2006b:8) modified Smith's (1998:1) definition as follows: "It has the soil and terrain quality, growing season and available moisture supply needed to produce sustained high yield of crops economically when treated and managed according to best possible farming practices." GDACE regards prime agricultural land as having soil that has an adequate moisture supply under rain fed crop production. The soil should not be too wet or subject to possible flooding, the average temperature should be sufficient to support a growing season and the terrain should not be too steep, susceptible to erosion and/or too rocky for cultivation purposes.

The nationally accepted definition of prime agricultural land describes it as "the best land available, primarily from the national perspective, but with allowance of provincial perspectives; land best suited to, and capable of, consistently producing acceptable yields of a wide range of crops (food, feed, forage, fibre and oilseed), with acceptable expenditure of energy and economic resources and minimal damage to the environment (and is available for these uses)" (Schoeman 2004: 4).

Raup (1976) (cited in Miller 1979:294) maintains that prime agricultural land is both time and space bound and cannot solely be based on physical and biological terms. Raup adds that prime agricultural land is an economic concept and should rather be defined in terms of economic variables.

Miller (1979:296) points out that location has a strong influence on prime agricultural land as well as its use and, in certain cases, outweighs the physical criteria of the land although this should not be the case. Soil and climate properties should determine prime agricultural land as these characteristics stay the same and form the building blocks for potential crop production.

According to Miller (1979:299) properties or criteria required to define prime agricultural land include:

- soil properties (texture, organic matter, structure, consistency, pore space, permeability, depth, drainage, chemical properties, clay percentage, topography and erodibility),
- geographic-cultural properties (precipitation, temperature, growing season, air quality, location, water availability, size, use),
- economic factors (production costs, payback capacity),
- environmental factors (aesthetics, open space, aquifer recharge, flood plain, watershed)
- productivity index (productivity potential, crops adapted to an area).

Once consensus has been reached on the measurable criteria to be used, an ordinal ranking of land units can be devised. A piece of land can thus be expressed as a numerical value or index indicating its land quality. Thereafter it can be decided what the cut-off point will be for prime and non-prime agricultural land. Miller (1979:299) regards the selecting of criteria the domain of the scientist, whilst the boundary between prime and non-prime land is the domain of the land use policy-maker, as well as society at large. Management practices may influence the production outcome of a piece of land, but do not alter the intrinsic value of the land for agricultural production purposes.

Other data that could influence the delineation of prime agricultural land include zoning maps, land use maps and population data (Miller 1979:305). Miller (1979:309) further regards the monitoring and invoicing of prime agricultural land for production purposes as “obvious”.



8.3.3 Unique agricultural land

Another term frequently used, but often in the wrong context, is “unique agricultural land”. Miller (1979:294) defines unique agricultural land as land that has a high productivity capability for a very narrow range of crops, but a restricted use capability for other uses.

Smith (1987:119) describes unique land as land that has the possibility of producing specific high value crops such as vines, fruits and industrial crops. This land is not prime or high potential agricultural land, but is regarded as very important for agriculture due to its location, soil quality and moisture supply, as well as growing season, which makes it highly suitable for a specific crop, when managed appropriately.

Schoeman (2004:4) defines unique agricultural land as land “that is or can be used for producing specific high value crops. It is usually not prime, but important to agriculture due to a specific combination of location, climate or soil properties that make it highly suited for a specific crop when managed with specific farming or conservation methods. Included is agricultural land of high local importance where it is useful and environmentally sound to encourage continued agricultural production, even if some or most of the land is of mediocre quality for agriculture and is not used for particularly high-value crops”. Laker (undated:1) regards unique agricultural land as land that may not have a high potential for general cropping, but has a high potential for a specific agricultural enterprise. An example of this is the Hex River valley, which is regarded as unsuitable from a land suitability perspective, but has a unique high potential for the production of high quality export table grapes.

In 2004, the ARC developed national criteria for high potential and unique agricultural land in South Africa for the national Department of Agriculture, depicting what land should be regarded as high potential agricultural land per province (Schoeman 2004:4). These criteria are divided per 1: 50 000 map sheets of South Africa (located per province) and focus on qualifying soil forms, minimum soil depth and topsoil clay content, as well as moisture availability classes dependent on the median seasonal rainfall. October to March is used for the summer rainfall areas, April to September for the winter rainfall areas and the highest-class value of the rainfall for areas receiving

rain throughout the year. This is divided by an appropriate fraction of the potential evaporation.

All land currently under irrigation qualifies as prime agricultural land. A scarcity factor was also taken into consideration, particularly in the Western Cape where shallow soils were included as they meet the criteria of “best available” (Schoeman 2004:4).

In Gauteng, high potential agricultural land is regarded as land that can be cultivated under the regulations of the *Conservation of Agricultural Resources Act, 43 of 1983*. It also include land under permanent irrigation or classified into listed soil forms, with an effective soil depth equal to or more than the minimum stated, as well as a topsoil clay content that falls within the required norms stated (Schoeman 2004:5).

According to the AGIS (2007) web site, prime and unique agricultural land’s criteria include land that does not have any restrictions for cultivation, land that is currently under irrigation, both permanent or seasonal, has suitable moisture availability, as well as suitable soil types, such as deep loamy soil of the Hutton, Clovelly, Avalon or Oakleaf soil forms with an effective soil depth. The scarcity factor where shallow or clay soils with a limited depth are regarded as unique is also taken into account, as it is the best available soil in the region. Under appropriate management conditions and applicable crop selection, this land may produce sustained yields of high-income crops.

It can be concluded that land with a high land capability potential for cultivation purposes (mostly land capability classes I to III) and high potential agricultural land aim at the same end result, with limited difference between the two terms. Land capability, however, focuses chiefly on the capability of the natural resources and in the context of this study, refers to soil, climate and terrain capabilities. Agricultural potential includes additional factors, such as level of management, economic factors and crop selection or suitability. Economic factors are nonetheless subject to a specific time and place and are dictated by demand and supply. The same subjectivity applies to management requirements and crop suitability. These factors are open to interpretation pending the envisaged outcome expected from a land evaluation. Land may have a low potential for a specific crop, but be highly suitable for another crop, pending the capability of the land. This fact is often overlooked when land is earmarked for non-agricultural purposes. The mismanagement of a resource can also contribute to its degradation,

lowering the current potential of the land, but not its capability, unless the land is degraded to such an extent that it is beyond repair. Incorrect crop selection or farm management may also result in a limited agricultural potential. However, should the situation be rectified through correct land use planning, management of the resources and correct production practices, a completely different outcome may be achieved. However, the capability of the land remains the same. The same reasoning should be applied to the potential of the land for either production or grazing purposes.

This study focused on the principles of determining the potential of the land for agricultural purposes in general. The potential of the natural resource base, in its current state, was used in deciding on the identification of land that should be regarded as having a potential for agricultural production, irrespective of the economic factors, level of management or crop selection. The potential in this context was thus not focused on a specific crop or management factor, but rather on the potential of the resource itself.

Identifying the potential of the natural resource base for land allows for the possibility of demarcating the land into units or zones. Zoning creates the opportunity for linking specific analysis of crop selection, level of management and economies of scale to the requirements of the zone. It also creates the opportunity for linking norms, standards and guidelines to the zone that can be incorporated in policy or legislation. This will allow for more informed and detailed decision-making on the best use of the land.

8.4 AVAILABILITY OF INFORMATION OR DECISION SUPPORT SYSTEMS ON LAND CAPABILITY OR AGRICULTURAL POTENTIAL

Scant detailed information is available on agricultural potential land (see chapter 7). Little research has so far been undertaken to determine the locality of this land. Most studies focus on defining high potential agricultural land and determining criteria for evaluating the land. Opinion is divided on the definition of agricultural potential land. However, this problem become minute if sufficient detailed data is not available that could be used with a certain level of confidence.

A review of the available spatial data sets on natural resources shows that much research is still needed to address this matter. Although there are some on a national

level, so far very few data sets are available on a provincial or local level. The view that data should not be shared, but remain the property of the owner has persisted among researchers and people involved in information management and data gathering. Over the years this notion has led to either the loss or the duplication of valuable data sets at considerable cost and time.

Currently no detailed spatial soil data set exists on a national level in South Africa. The only data set available and used as a baseline for soil studies and evaluation, is the national land type data set and the broad soil patterns of South Africa derived from it. However, the scale of the land type data set is 1: 250 000. The information captured in the land type survey did not include the exact demarcation of soil boundaries, but rather focused on a degree of uniformity in terms of soil patterns, terrain and climate described in the Land type Memoirs (ARC-ISCW 2004:34). The only other widely available semi-detailed data set for soil is the soil data set for the old PWV region (now situated in Gauteng) on a scale of 1:50 000.

Soil surveys are conducted on a regular basis by provincial Departments of Agriculture in support of improved farming practices and effective land use planning, and by individual farmers themselves. Farming Cooperatives also conduct soil surveys as a service to their members, as well as in environmental surveys and state of the natural resources' projects. Most of these surveys are location specific. In some instances, these surveys are not conducted by qualified pedologists, which could raise the question of the integrity of the survey. Many soil surveys do not adhere to the national norms, standards and specifications. In most cases, the result of the survey is displayed on a hand-drawn map and not made available in electronic format to be used in a GIS. Furthermore, there is no commitment or regulation that requires a soil surveyor to make the outcome of the survey available for storing in the national soil databank. The national soil databank is registered as a national asset and is managed by the ARC's Institute for Soil, Climate and Water (ISCW).

A similar situation exists with climate data. Like the soil data bank, a national agricultural climate databank is under the custodianship of the ARC's ISCW. The ISCW is responsible for over 400 rainfall and climate stations in South Africa that record and have recorded climate data, dating back to the early 1900's (see figure 8.1). However, the current distribution of these stations needs to be improved to depict climate

variability on a more detailed level. The cost of doing so, however, is quite high and not regarded as a priority.

The soil and climate data sets are only used as examples, but the same applies to other data sets on natural resources, such as vegetation and water, as well as land cover and land use. These data sets form an integral part in determining land capability and agricultural potential and the level of detail governs the ease of making correct decisions in land use planning and management.

Statistically speaking, only about 3 to 4% of the country's surface is regarded as high potential agricultural land with 12% of land that can be cultivated (GDACE 2004a:44). If the international norm of 0.4 ha of arable land required to feed a person is used, it can be concluded that the 14 million hectares in South Africa can only feed 35 million people, resulting in the overexploitation of the country's soils (Department of Environmental Affairs and Tourism 2006a:16).

In terms of available spatial layers depicting high potential agricultural land, using various scales and different methodologies, a few have been developed by provincial Departments of Agriculture. To date, however, no spatial data layer demarcating high potential agricultural land is available on a national level that is supported by the national Department of Agriculture.

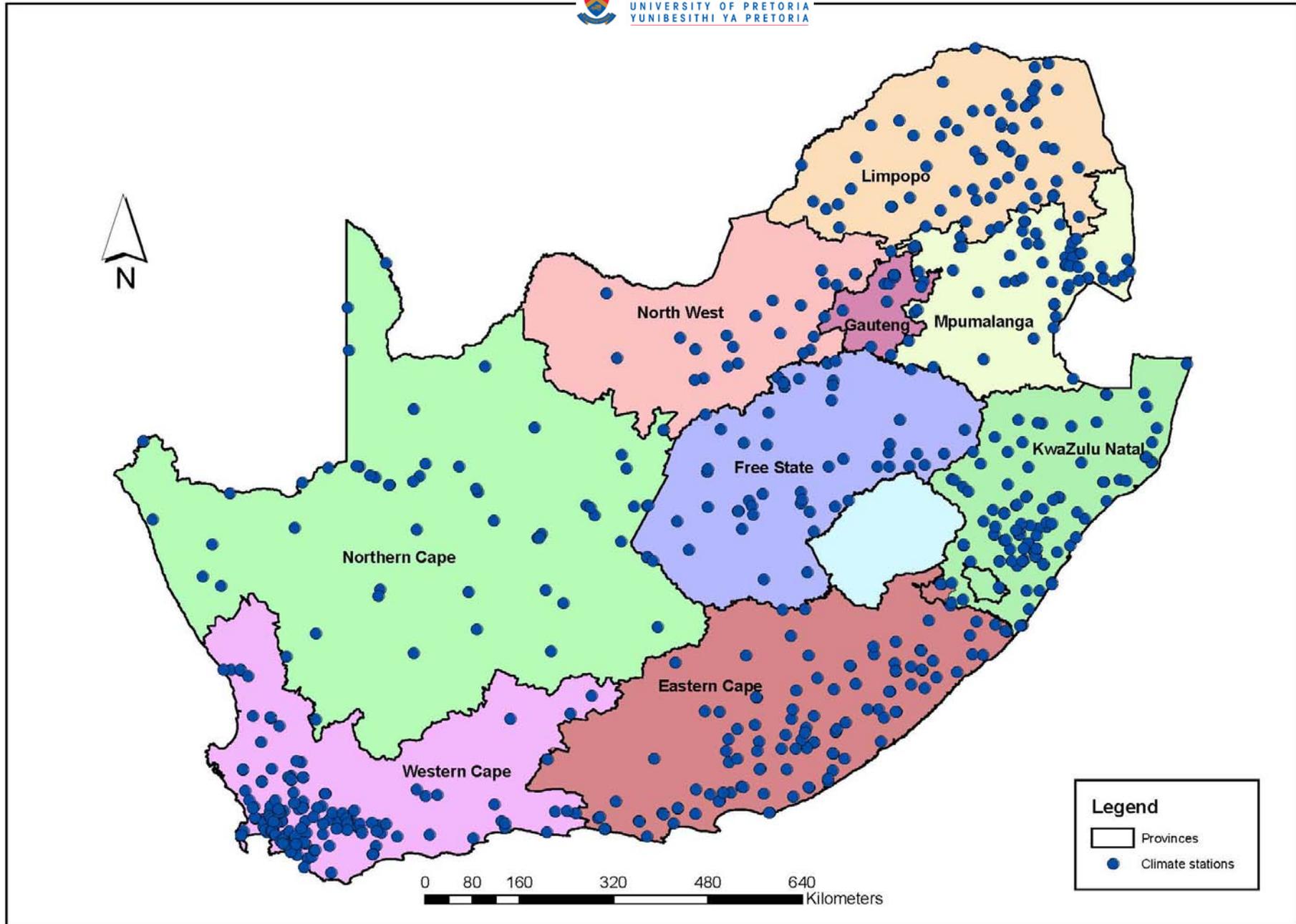


Figure 8.1 Agricultural rainfall stations distribution in South Africa

The national Department of Agriculture in conjunction with the ARC has developed a national spatial land capability data set. The land capability classification includes the following characteristics (Schoeman *et al.* 2002:12-27):

- terrain (including a flood hazard based on terrain units and soil types),
- an erosion (water and wind) hazard that is based on a slope gradient and soil erodibility,
- a soil factor including soil depth, texture, erodibility, internal drainage, mechanical limitations, acidity, susceptibility to crusting or compaction, salinity (irrigated soils), and
- a climate factor that includes moisture availability, length of moisture season, length of temperature season, frost and wind hazard and hail.

The development of the land capability data set was dependent on the availability of spatial data on a 1: 250 000 scale. The soil and terrain data were mostly derived from the land type data set with a certain degree of modelling, whilst the climate data was based on the 10-day rainfall and temperature surfaces and climate hazard maps.

The final product can be used on a scale of 1: 2.5 million and, with certain restrictions, on a 1: 250 000 scale (see figure 8.2). Improved data, especially on a more detailed scale, would result in an improved outcome for better use at provincial level.

The KwaZulu Natal Department of Agriculture and Environmental Affairs has developed the Bio-resources system for the province that consists of Bio-resource units (BRU's). These units are defined as areas where the soil, vegetation, climate and to lesser degree terrain form are similar. This, then, provides the platform for uniform recommendations on land use and farming practices, and assists land users in making informed decisions (Schoeman, Strydom & Collett 2008:7).

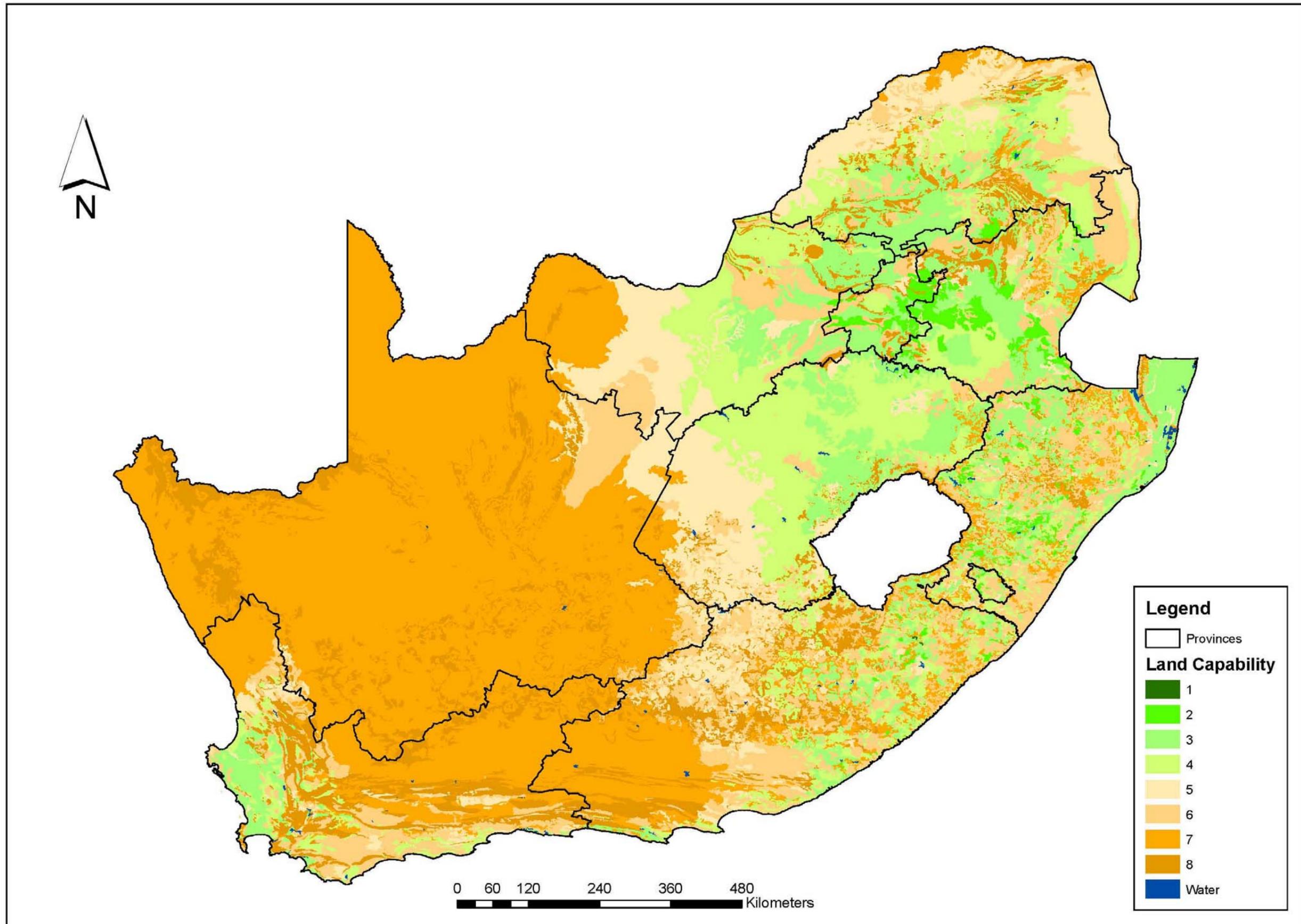


Figure 8.2 Land capability classification for South Africa

Climatic factors, mainly rainfall and temperature, are used as the main criteria for the delineation of the BRU's as it was felt that geo-morphological factors would be climatically too complex (Camp 1997:2). Climate and soil types are regarded as uniform within each BRU, which then allows for defining the productivity and management techniques required in each unit.

A total of 590 BRU's have been defined for KwaZulu Natal. Each BRU is described in terms of its climate, vegetation, soil patterns, crops or pastures that can be grown in the BRU and the level of production. The concept of BRU's is a computer-based spatial system that allows for queries and mapping per selected farm. It should be noted, however, that the BRU's are derived from the land type data and should be interpreted cautiously on farm level due to the scale of the data.

The BRU's are grouped into ecological units based mainly on climate and vegetation, as soil form can vary, to form Bio-resource groups (BRG's). A number of sub-groups have been identified in the BRG's (Camp 1997:3).

In 2001, the ARC conducted an initial review on the spatial mapping of the agricultural potential of soils for Gauteng, as part of the Gauteng Resource Audit (see figure 8.3). Similar work had been done before for the Mpumalanga Department of Agriculture. Various classes of soil potential for rain fed crops were mapped at a scale of 1: 250 000 using land type information and at a scale of 1: 50 000 for the Pretoria-Witwatersrand-Vereeniging (PWV) area. Depth, texture, structure, base status and drainage, as well as non-soil factors, such as slope angle and shape and local relief, were taken into consideration in developing an algorithm (ARC-ISCW 2001:2). The result was the first data set used in the province to determine potential areas that should be protected for agricultural use. However, it was felt that the soil potential determined in 2001 was not sufficiently detailed for use in the identification of areas for agricultural use and that additional factors should be taken into consideration. Consequently, the first Gauteng Agricultural Potential Atlas (GAPA) was developed in 2002. GAPA Version 2 followed with minor changes.

The purpose of developing GAPA was to allow for a holistic decision support tool in the assessment of proposed development applications, making use of existing data. It will result in guiding development and land use decision-making on agricultural land, with

the emphasis on available high potential and prime agricultural land. The two focal points were the identification of crop production areas and grazing potential (GDACE 2002:2). The intention of the product was not to develop new data sets, but rather integrate existing ones.

In identifying the agricultural potential for possible crop production area, the 1: 50 000 PWV soil survey data were reclassified into soil-slope units. This was done by making use of covariant properties of soil forms, such as soil depth, mechanical limitations, soil drainage, erosion susceptibility, soil texture, soil structure and the mapping of contours. In the provincial areas outside the boundaries of the PWV soil survey, the land type data were used. The soil descriptions were aligned to the PWV soil survey and the soil-slope units derived by making use of soil depth, mechanical limitations, soil drainage (water logging), erosion susceptibility and soil texture. Contour mapping was not used as it already formed part of the land type survey. Resource units with the most important agricultural limitations (slope, soil and climate) were developed and superimposed on the soil-slope units. Each resource unit was then aligned with the requirements of a land utilization type (using rain fed maize, general irrigated crops, as well as irrigated tomato, spinach and cabbage). This resulted in an agricultural suitability index, ranked in five classes from highly suitable to very low to none.

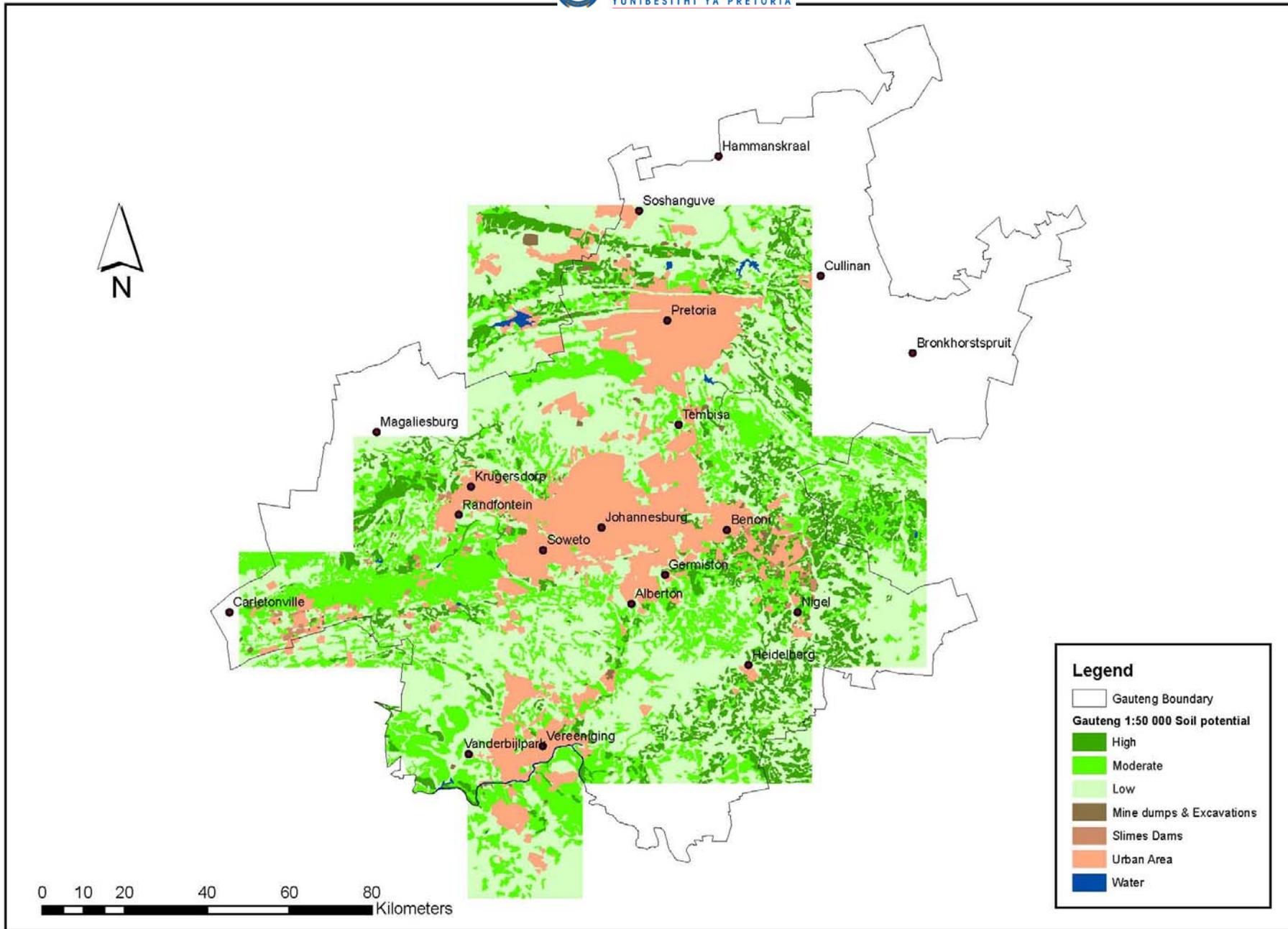


Figure 8.3 Agricultural soil potential for Gauteng from the Gauteng Resource Audit

The availability of groundwater (the available data set was on a 1: 500 000 scale) was divided into four potential yield classes, namely high (> 5 l/s), moderate to high (2-5 l/s), moderate (0.5-2 l/s) and low (0.1-0.5 l/s). With the exception of rain fed maize, whose agricultural suitability classes remained unchanged, the irrigated crops' agricultural suitability classes were placed in a matrix context with the identified groundwater potential yield classes to determine the overall agricultural potential for Gauteng.

A land capability classification was attached to each resource unit. The eight class Land Capability index (based on the work of Klingebiel & Montgomery [1961], Scotney *et al.* [1987] and Schoeman *et al.* [2000]) was used, where class 1 was regarded as having very few limitations to a land use and is highly recommended for cultivated crops, whilst class 8, at the other end of the scale, is highly unsuited for agricultural production purposes (GDACE 2002:7-31). Figure 8.4 illustrates the agricultural potential for rain fed maize and figure 8.5 depicts the suitability potential for irrigated crops. The areas that should be protected for agricultural use were determined by merging the land capability classes I and II and the agricultural potential classes 1 (high) and 2 (moderate to high) (see figure 8.6).

External factors identified that may have an impact on the agricultural potential formed part of an additional data layer and included sensitive areas, high ecological index, animal pest distribution and orientation features, such as roads and urban areas (GDACE 2002:36-37).

The vegetation habitats identified as part of the Gauteng Resource Audit were used as a baseline data set to determine the agricultural potential for grazing. The focus was on the potential for grazing under ideal, medium and poor veld conditions. The vegetation habitats were ranked in two rainfall zones with zone A receiving 549.7 to 663.4 mm per annum and zone B receiving 663.4 to 709.0 mm per annum. The grazing potential classes used were zero potential, low potential (> 7 ha/l/su), low to moderate potential (6-7 ha/l/su), moderate to high potential (4-6 ha/l/su) and high potential (<4 ha/l/su) (GDACE 2002:33-35). Figure 8.7 indicates the potential grazing areas in Gauteng determined in GAPA 2.

GAPA 2 was released as a spatial data set consisting of separate data files used in a GIS environment for further analysis and decision-making.

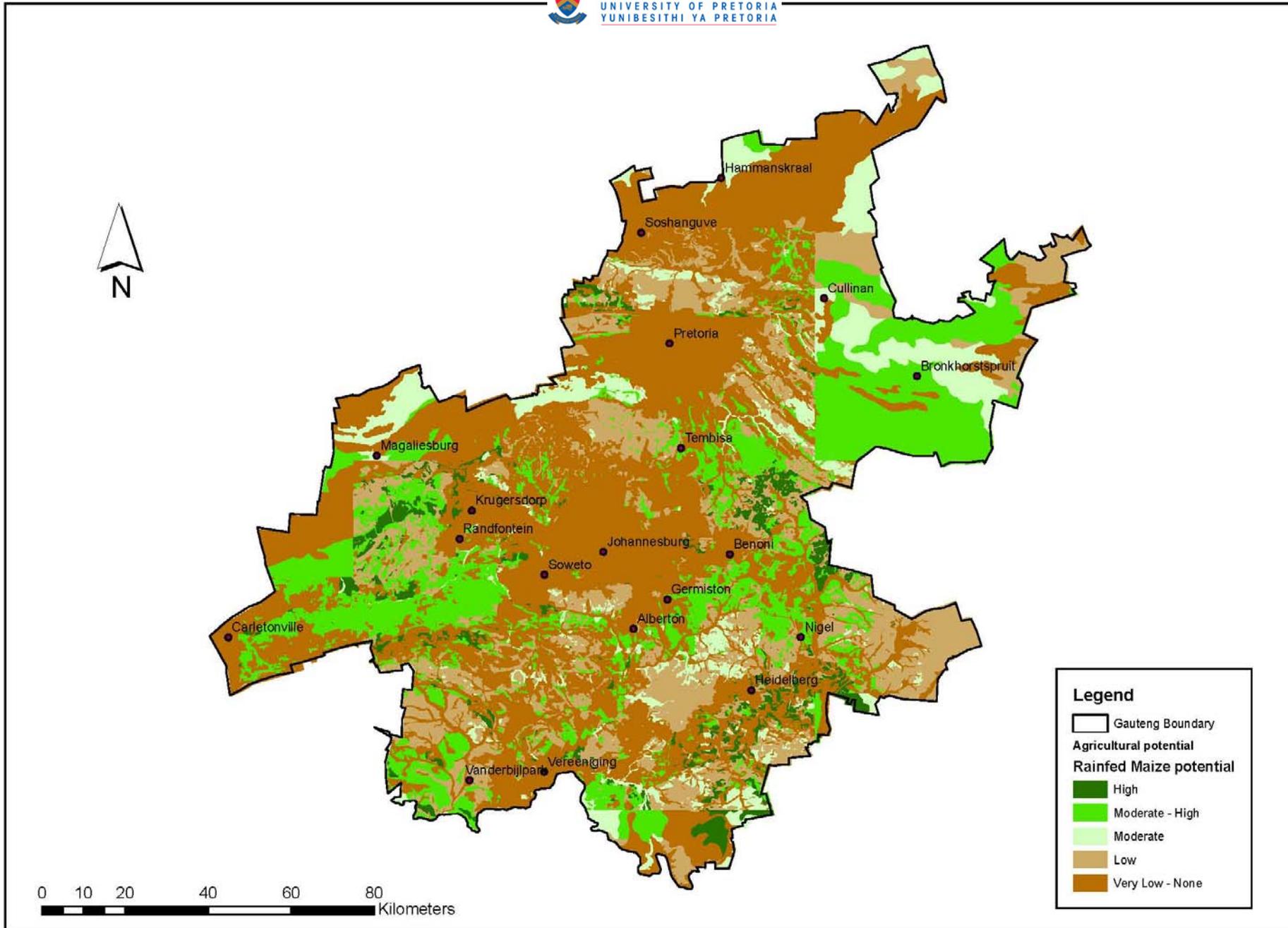


Figure 8.4 Rain fed maize potential areas in Gauteng identified in GAPA 2

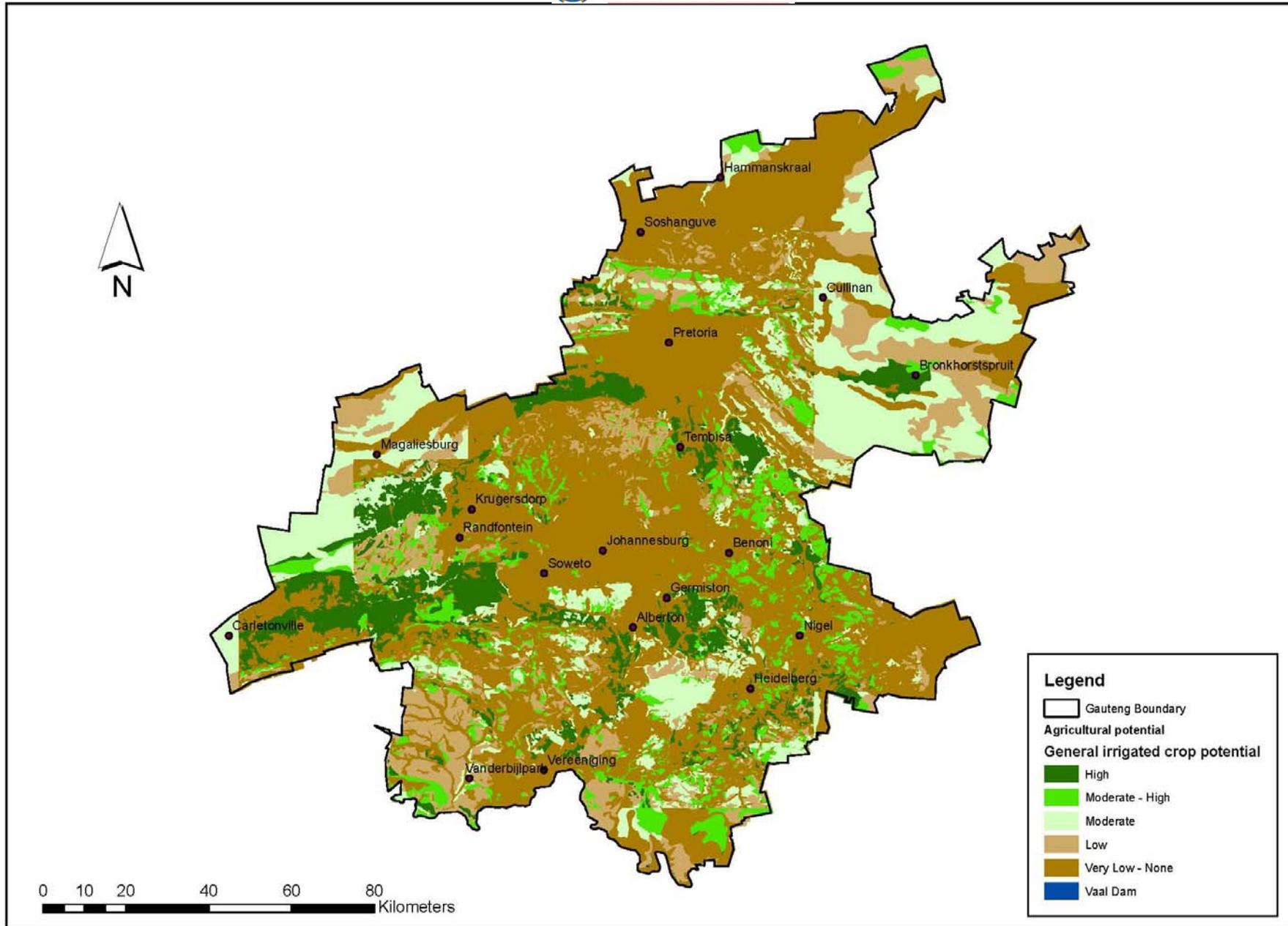


Figure 8.5 General irrigated crop potential areas in Gauteng identified in GAPA 2

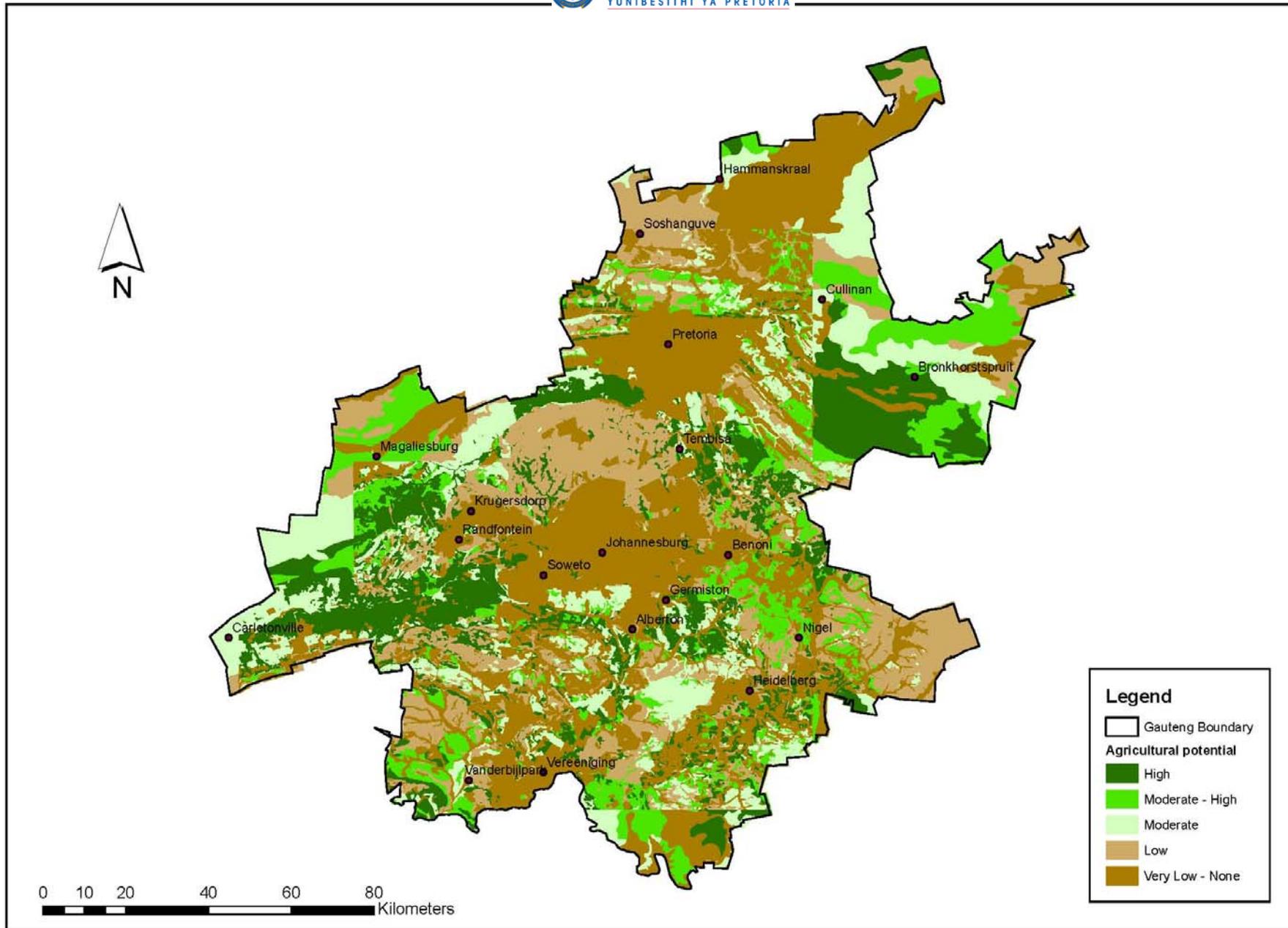


Figure 8.6 Agricultural potential areas in Gauteng identified in GAPA 2

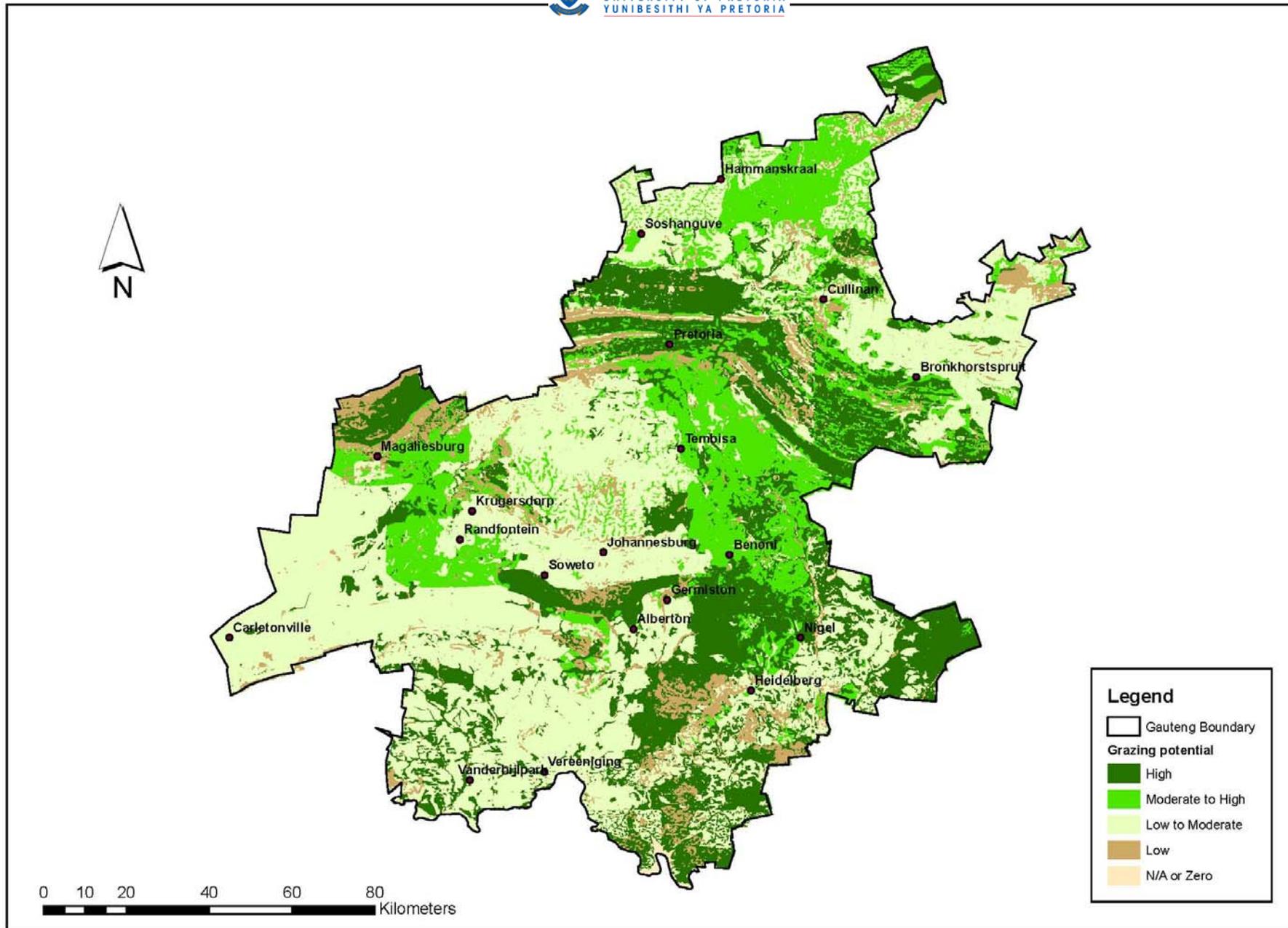


Figure 8.7 Grazing potential areas in Gauteng identified in GAPA 2

Based on the outcome of the results of GAPA 2, land with a high and moderate to high agricultural potential was earmarked as protected for agricultural use and consisted of 28.7% of the province's total area. This is divided into 15.1% high potential agricultural land and 13.6% moderate-high potential agricultural land. However, large portions of the high potential agricultural land are also regarded as having a high conservation status (GDACE 2004a:44).

The outcome of the data in GAPA 2 should only be used as a decision support tool due to the scale of the data. The importance of fieldwork or on-site investigations should not be overlooked. Data used in the project were also classified on the basis that no intervention or manipulation is required. However, physical characteristics can be manipulated with modern farming practices and management, which may result in improving the agricultural land's potential (GDACE 2002:72).

Some concerns were raised when using the products derived from the GAPA 2 study. As mentioned, GAPA 2 was derived from existing data sets making the final product subject to the fact that the data was not suitable for use on provincial level. Another concern was the scale of the data used. The land type data on a scale of 1: 250 000 and the PWV soil data on a scale of 1: 50 000 are unsuitable for making an informed decision on a provincial level, especially considering that most applications pertaining to land use are based on a farm or smaller level.

GDACE did a follow-up study in 2005/2006 to update GAPA 2. This was done through a spatial modelling approach to first map land capability after which a matrix was applied to determine agricultural zones, depicting agricultural potential. The modelling approach can be described as "a combination of deductive-knowledge and inductive-empirical methods" supported by various natural resource data sets (GDACE 2006b:9). The Gauteng model made use of data variables, as well as derivatives and calculations from the variables. The data variables used focused on the soil, climate and terrain and were independent of crop requirements.

- **Soil data**

The model made use of four soil data sets:

- soil surveys conducted as part of a land cover classification survey conducted for the Gauteng province
- soil surveys conducted by officials from GDACE in evaluating scoping reports,
- the 1: 50 000 PWV soil classification data set
- the Gauteng clay percentage data set derived from the Gauteng Resource Audit product in 2002.

A total of 25 812 observation points formed part of the study (see figure 8.8).

Data sets developed that formed part of the soil variables included:

- *Wetness classes.* Wetness classes on a scale of 0 to 3 were recorded as part of the land cover classification study, as well as derived from soil forms that formed part of the provincial soil surveys and the 1: 50 000 PWV soil data set. Soil forms, such as Hutton, Shortlands and Mispah were regarded as well drained; Avalon and Tukulu as moderately drained with wetness in the profile for certain periods of the year; Bainsvlei and Oakleaf as moderate to poorly drained soil with wetness for longer periods of the year, and the Rensburg soil form as poorly drained with the presence of wetness in the profile throughout the year
- *Soil form.* By evaluating the four soil datasets, the frequencies of soil forms found in Gauteng could be determined. Hutton soil forms were mostly found (2457) followed by Mispah (854), Avalon (831) Shortlands (786) Katspruit (304), Swartland (247), Glenrosa (243) and Kroonstad (237).
- *Porosity.* Porosity was calculated using soil structure, soil consistency, soil colour, soil clay percentage and soil mottling. Gericke and Smit's (undated) classification (cited in GDACE 2006b:12), based on a matrix of values, was applied.
- *A-horizon clay percentage.* The A and B horizons were divided into texture classes on a scale of 1 to 6, using the available clay percentages
- *Effective soil depth.* This was defined as the depth that a plant root could penetrate before being impeded by some form of physical restriction. Maximum depth recorded was 120 cm. About 40% of the soil depths in Gauteng varied between 30 and 60 cm with 30% varying between 60 and 90 cm and about 12% between 90 and 120 cm

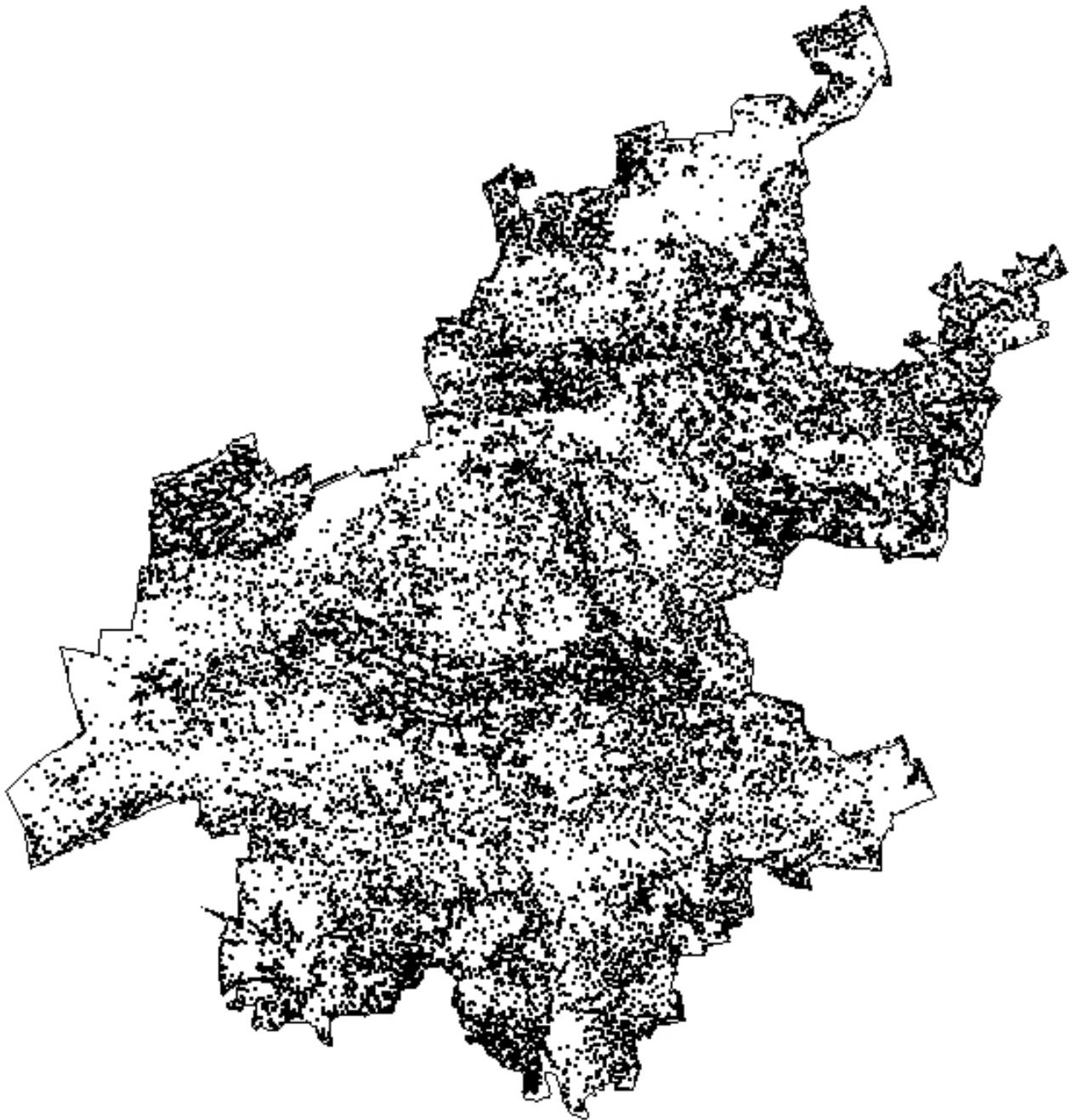


Figure 8.8 Distribution of sample points from the four soils datasets used

Source: GDACE (2006b:10)

- *Depth limiting material* was used to determine effective and total soil depth, as well as to indicate inherent mechanical limitations to the soil
- *Depth of soil moisture penetration*. Plant roots need to develop in the presence of adequate moisture. The depth of moisture will thus have an influence on effective soil depth. Organic material, soil compaction, soil structure and slope gradient will also have an influence on soil moisture. The depth of soil moisture penetration was calculated using Smit's (undated) equation where:

$$\text{Mean Annual Rainfall (mm)/4} * \text{A-factor}$$

Where the A-factor =

Sand:	300
Sandy Loam – Loam:	150
Sandy clay:	100
Clay loam – Clay:	75

- *Wind erosion*. The susceptibility of soil to wind erosion was classified according to Schoeman *et al.*'s (2002:18) proposed clay percentage and sand grade.
- *Water erosion*. Schoeman *et al.*'s (2002:18) approach was followed to calculate a water erosion index. Criteria used included percentage clay content, leaching status, structure and transition and depth, each with class limits (GDACE 2006b:10-16).

Smith (1998: 64) emphasises that not only is soil depth and texture of the utmost importance, but aspects of risk, such as the effect of an impermeable subsoil horizon (e.g., soft plinthite) on water storage, a midsummer drought and the availability of water throughout the growing season should also be taken into consideration. A soft plinthite layer usually found in soil forms, such as Avalon, Bainsvlei and Pinedine, is normally regarded as having a high agricultural potential, especially for dry land production. In drier areas, these soils have an increased probability for a sustained high yield, whilst in wetter areas they may be prone to water logging that might negatively influence the potential. In terms of a midsummer drought, it is important to ensure adherence to correct planting dates. Linked to this is the availability of soil water to the plant during the growing season. This is dependent on the available rainfall and the storage capacity of the soil translated to the texture, depth and presence of an impermeable subsoil horizon.

- **Climate data**

In reviewing climate variables, Schulze's (1997) *South African Atlas of Agro-hydrology and Climatology* was used in the Gauteng model. The following factors were included:

- *Effective precipitation.* This factor was calculated, using mean monthly rainfall and potential monthly evapo-transpiration data in determining the available moisture supply balance. A growing season from October to March was used. Scotney *et al.*'s (1991:40) proposed moisture availability classes were used. A dataset was prepared where the influence of the amount of rainfall together with potential evapo-transpiration on available moisture balance were determined and evaluated
- *Mean monthly heat units.* Heat units were derived from the mean monthly maximum and minimum temperatures. A reference value of 600 HU °C accumulated over a three month period was used (GDACE 2006b:16-22).

- **Terrain data.**

A digital terrain model (DTM) was used to build an aspect, % slope gradient and hill shade dataset that was used in the model. Also used were:

- *Flood hazard.* Schoeman *et al.*'s (2002:16) five flood hazard classes were used. Soil forms were then associated with the flood hazard classes
- *Ground condition.* This factor evaluated ground strength for trafficability under moist conditions. The ground strength rating was determined, using the type of top soil and % clay content
- *Slope gradient.* The gradient was modelled from the DTM (GDACE 2006b:22-26).

The data sets developed were converted into a raster GIS format, which is more suitable for modelling, making use of a 20 m cell size. However, the data sets could not be directly combined and had to be converted to common units depicting the suitability of the data in determining land capability. These units were placed on a scale of 1 to 9 (low-high). Various transformation functions were thus applied to the data. Figures 8.9, 8.10 and 8.11 illustrate examples of data transformations used (GDACE 2006b:29-33).

The transformation of the data sets was followed by applying weights to indicate the importance of the objective measured and then placed on the same measurement scale. Identifying concerns with underlying issues that should address the problem of identifying areas of agricultural potential preceded these processes. Figures 8.12, 8.13 and 8.14 illustrate examples of the processes followed in building the model. Each figure depicts the processes to address the identified concern through the underlying issues (GDACE 2006b:33-40).

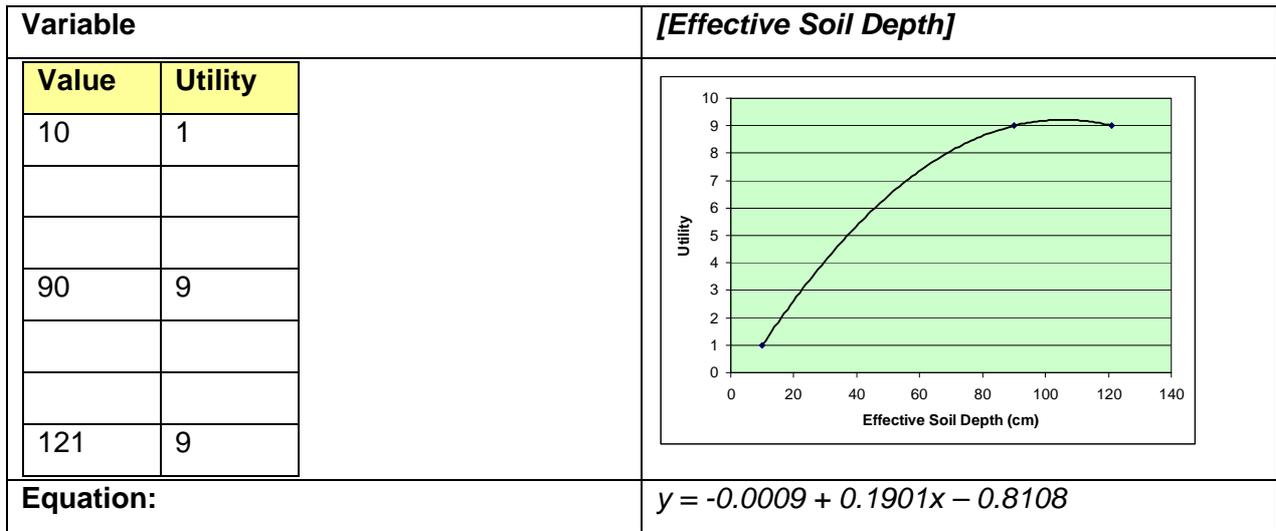


Figure 8.9 Data transformation depicting soil depth

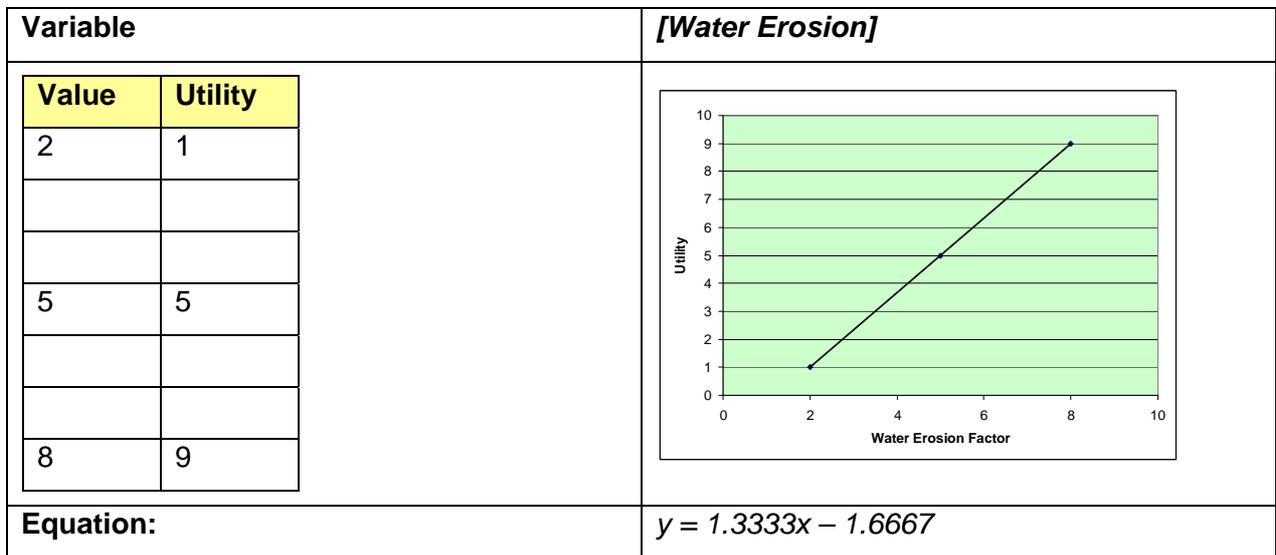


Figure 8.10 Data transformation depicting water erosion



Variable		[Crusting Hazard]																
<table border="1"><thead><tr><th>Value</th><th>Utility</th></tr></thead><tbody><tr><td>1</td><td>1</td></tr><tr><td>2</td><td></td></tr><tr><td>3</td><td></td></tr><tr><td>3.5</td><td>7</td></tr><tr><td>4</td><td></td></tr><tr><td>5</td><td></td></tr><tr><td>6</td><td>9</td></tr></tbody></table>	Value	Utility	1	1	2		3		3.5	7	4		5		6	9		<p>The graph shows a concave curve representing the relationship between Crusting (x-axis) and Utility (y-axis). The x-axis ranges from 0 to 7, and the y-axis ranges from 0 to 10. Three data points are plotted: (1, 1), (3.5, 7), and (6, 9). The curve starts at (1, 1) and ends at (6, 9), with a peak around x=5.5.</p>
Value	Utility																	
1	1																	
2																		
3																		
3.5	7																	
4																		
5																		
6	9																	
Equation:		$y = -0.32x^2 + 3.84x - 2.52$																

Figure 8.11 Data transformation depicting crusting hazard

Issue: Internal drainage

ISSUES		CALCULATIONS		DERIVATIVES		ATTRIBUTES	
<i>Internal Drainage 0.3</i>	←	<i>Wetness Class 0.2</i>	←			Soil form	
		<i>Porosity 0.8</i>	←	Structure	←	Soil Form	
			←	Texture	←	Clay %	
			←		Sand %		
			←		Silt %		
	←		<i>Porosity 0.8</i>	←	Consistency	←	Soil Form
			←	Colour	←	Soil Form	
			←	Permeability	←	Clay %	
	←	Mottling	←	Soil Form			

Concern: Soil moisture availability

CONCERNS		ISSUES
<i>Soil Moisture Availability 0.75</i>	←	<i>Internal Drainage 0.3</i>
	←	<i>Utilizable Soil Volume 0.7</i>

Figure 8.12 Issues and concerns for soil moisture availability



Issue: Available moisture balance

ISSUES		CALCULATIONS		DERIVATIVES		ATTRIBUTES
<i>Available Moisture Balance</i>	←	Number of Positive Rainfall / PET Mths	←			Monthly PET
						Mean Monthly Rainfall
	←	MMR > 0.5 MPET Balance	←			Monthly PET
						Mean Monthly Rainfall

Concern: Moisture supply capacity

CONCERNS		ISSUES
<i>Moisture Supply Capacity 0.8</i>		Length of the Moisture
	←	<i>Available Moisture Balance</i>

Figure 8.13 Issues and concerns for moisture supply capacity

Issue: Vehicle carrying capacity

ISSUES		CALCULATIONS		DERIVATIVES		ATTRIBUTES
<i>Vehicle Carrying Capacity 0.35</i>	←	Ground Condition	←	Organic Carbon Content	←	Soil Form
						Total Soil Depth
			←	Texture	←	Clay %

Concern: Mechanical limitations

CONCERNS		ISSUES
<i>Mechanical Limitations 0.6</i>	←	<i>Trafficability 0.65</i>
		<i>Vehicle Carrying Capacity 0.35</i>

Figure 8.14 Issues and concerns of mechanical limitations

The land capability model was finalized by using the various relevant concerns in determining soil capability and climate capability, each with a weighting of 45% and terrain capability with a weighting of 10% (GDACE 2006b:39-40). The derived land capability classes were grouped according to percentages. Table 8.2 indicates the percentages allocated to each class.

Table 8.2 Land capability classes

Class	% Land capability
1	< 55 %
2	55 – 60 %
3	60 – 65%
4	65 – 70%
5	> 70%

These classes were then placed in a matrix with the land cover classes. The land cover data used was derived from the Gauteng 1: 10 000 Quick Bird land cover dataset. Land cover classes available for agricultural purposes were grouped to form 5 broad classes. Classes that contained built-up areas, forestry, mines or industry as well as waterbodies or wetlands were excluded due to their unavailability for agricultural purposes. The land cover classes are indicated in table 8.3.

Table 8.3 Demarcated land cover classes

Class	Land cover
1	Smallholdings
2	Vacant for grazing
3	Irrigated cultivation
4	Vacant for cultivation
5	Dry-land cultivation

A zonation classification was developed based on a combination of the land capability and land cover classes where an agricultural potential value on a scale of 1 (highest) to 5 (lowest) was assigned to each matrix block (see table 8.4) (GDACE 2006b:42).

Table 8.4 Land cover and land capability matrix

Land cover	Land capability				
	<55	55-60	60-65	65-70	70+
Dry land cultivated	3	2	1	1	1
Vacant for cultivation	4	3	2	1	1
Irrigated cultivated	4	4	3	2	1
Vacant for grazing	5	4	4	3	2
Smallholdings	5	5	4	4	3
Built-up	6	6	6	6	6

Calculations derived from the above matrix determined the area utilized per each class with its associated percentage of the total area of Gauteng (see table 8.5). Figure 8.15 is a graphical presentation of the classes in percentage. Class 1 depicts the highest agricultural potential, whilst class 5 depicts the lowest. Class 6 is regarded as built-up, irrespective of its agricultural potential.

Table 8.5 Land capability classes for Gauteng as a percentage of the province

Class	Hectares	Percentage
1	7 684.59	0.45
2	48 192.92	2.85
3	237 713.89	14.07
4	790 590.84	46.81
5	292 806.51	17.34
6	312 090.59	18.48
Total	1 689 079.35	100

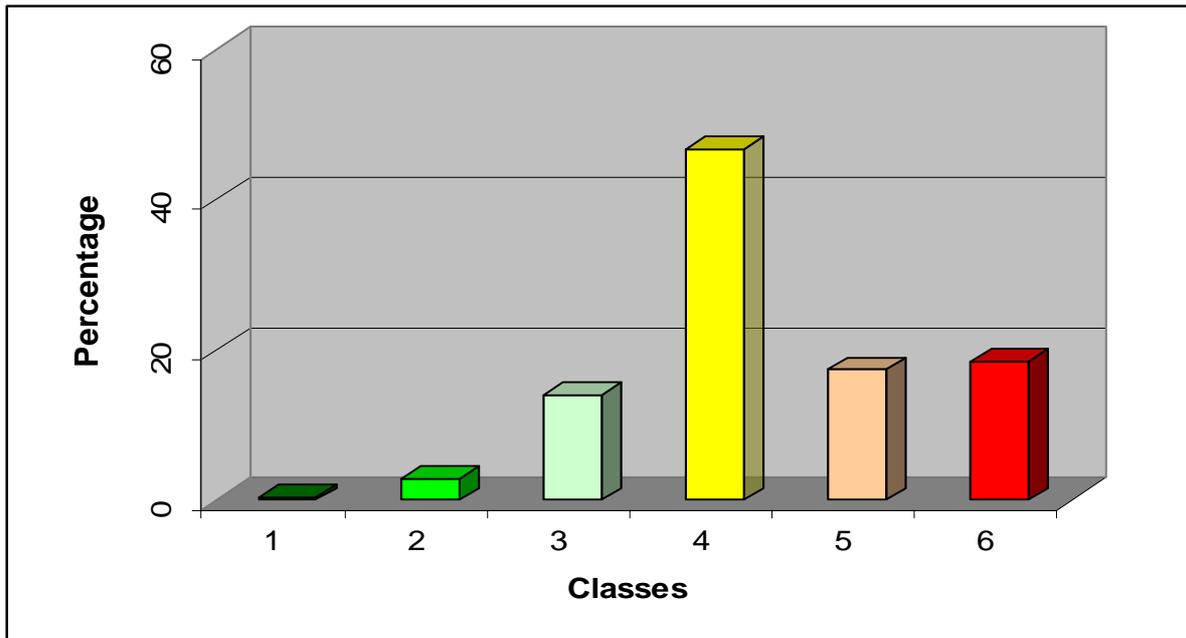


Figure 8.15 Land capability classes for Gauteng

Three agricultural zones were derived from these findings by combining the classes as depicted in table 8.6 (GDACE 2006b:43-45).

Table 8.6 Derived agricultural potential zones for Gauteng

Land cover	Land capability				
	<55	55-60	60-65	65-70	70+
Dry land cultivated	High				
Vacant for cultivation	Moderate	High			
Irrigated cultivated	Moderate		High		
Vacant for grazing	Low	Moderate		High	
Smallholdings	Low		Moderate		High
Built-up	Low				

Table 8.7 presents the final calculations based on the derived agricultural zones, with class 1 a combination of the previous classes 1 to 3 and regarded as the high potential agricultural zone that should be protected for agricultural use. Class 4 is regarded as the moderate agricultural potential zone and class 5 the low agricultural potential zone. Class 6 indicates the built-up areas. Figure 8.16 is a graphic representation of the derived agricultural potential zones.

Table 8.7 Final agricultural potential zones for Gauteng

Class	Zones	Hectares	Percentage
1 - 3	High	293 591.40	17.37
4	Moderate	790 590.84	46.81
5	Low	292 806.51	17.34
6	Built-up	312 090.59	18.48
Total		1 689 079.35	100

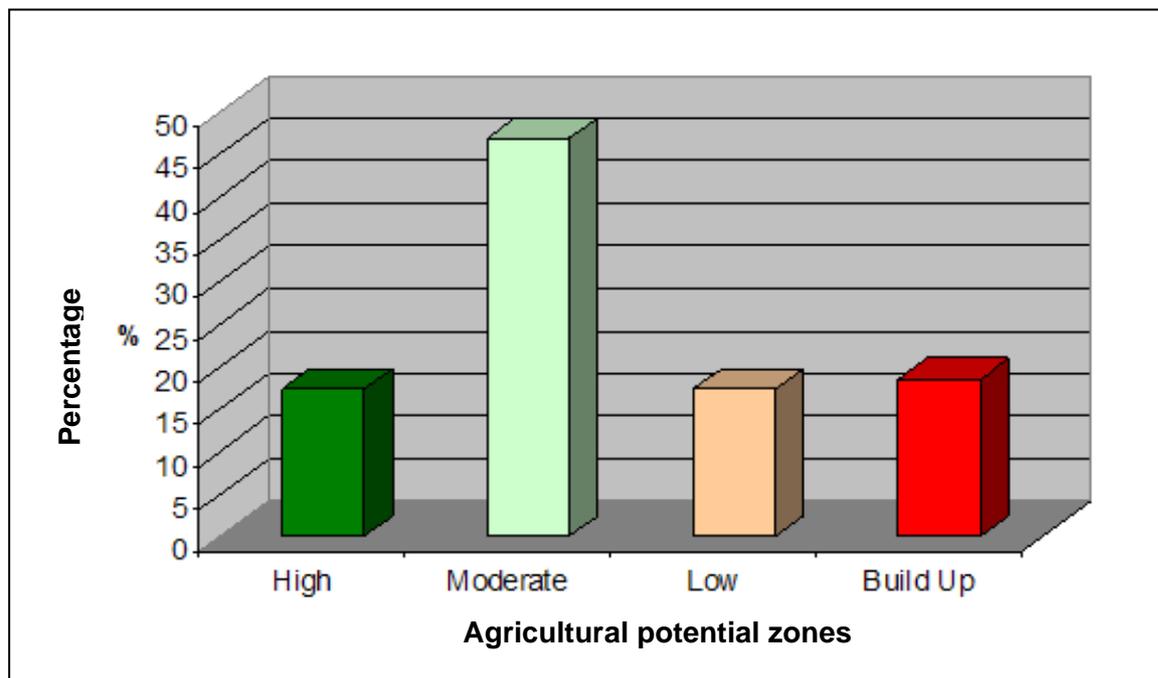


Figure 8.16 Final agricultural potential zones for Gauteng

Figure 8.17 presents a spatial representation of the agricultural potential zones in Gauteng.

In using land cover data it should be taken into account that it does not depict actual land use. A protected area or nature reserve can be classified as grassland according to the land cover classification but, from an agricultural, as well as land use perspective, this area cannot be used when determining areas suitable for agricultural production, even though it may have a high agricultural potential.

It should also be noted that the above modelling process was based on dry land cultivation practices, the worst-case scenario in any farming enterprise. The availability of water was regarded as a “bonus”, which might result in an improved yield, subject to a number of other factors. The use of irrigation should also be carefully monitored, however, as it could cause degradation of the land through salinization and water logging.

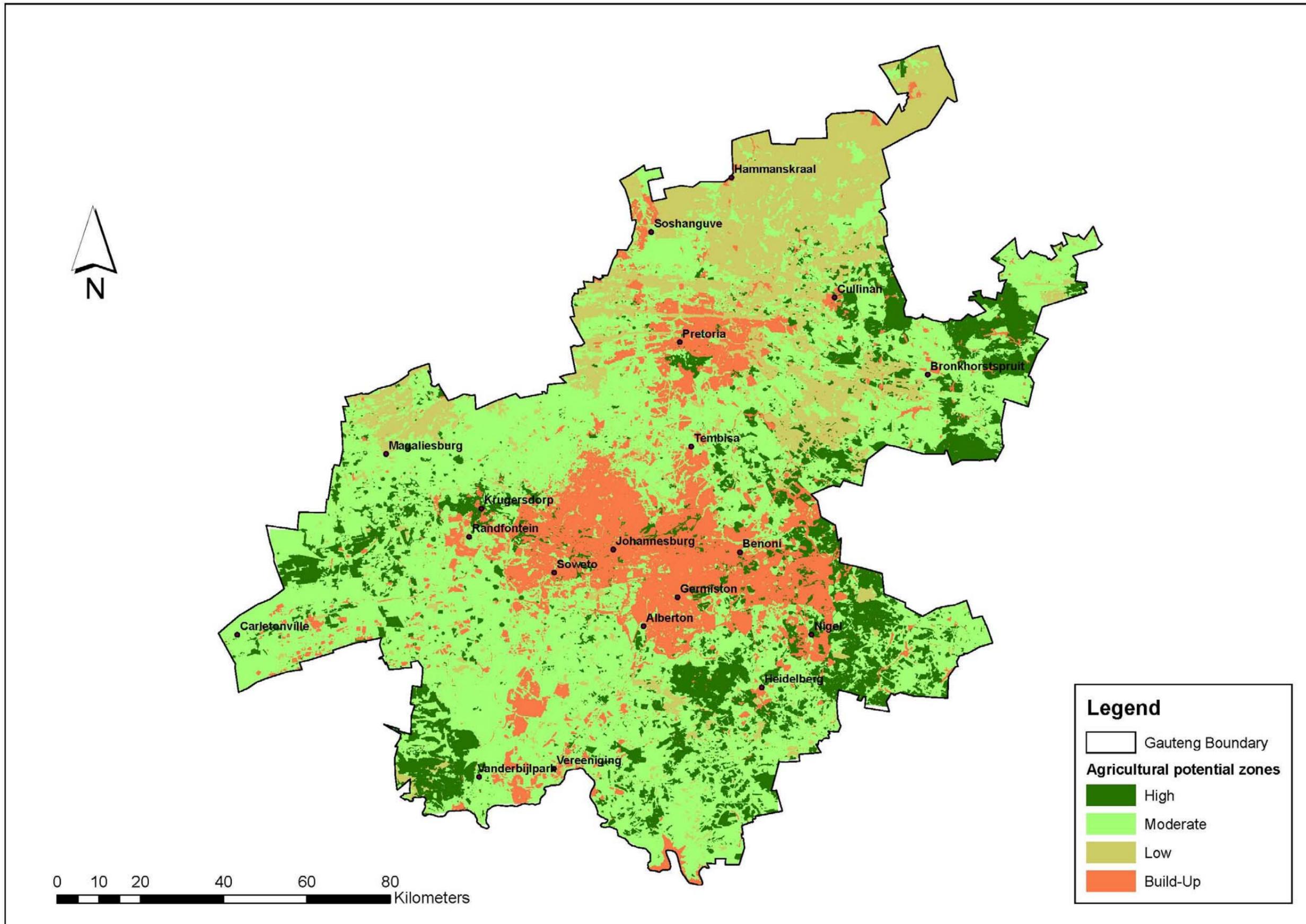


Figure 8.17 Zoning of agricultural land in Gauteng

In comparison with those in GAPA 2, the above findings reveal that the amount of high and moderate to high potential agricultural land has declined from 28.1% to 17.3%. These areas refer specifically to suitable areas for cultivation purposes, whilst the moderate potential areas can be utilized for grazing. The decline in high potential land between the two studies could be due to increased urban development. The difference could also be due to a different methodology followed in determining the locality of the high potential agricultural land.

The high potential agricultural land is also very scattered throughout the province, with some areas consisting of only small areas of high potential land. It is severely influenced by the fragmented urban developments. Some of the high potential areas are also located within the urban development boundaries. This uneven distribution pattern becomes a greater problem if the existing farm boundaries and the impact of farm size on the potential are taken into consideration.

Based on the uneven distribution patterns, GDACE decided to classify the high potential agricultural land into five classes that took into consideration the distribution patterns of the identified land, as well as the urban boundaries and land uses. The agricultural hubs were the first class identified. The high potential agricultural land located outside the urban development boundary was divided into seven agricultural hubs, each consisting of a large amount of high potential agricultural land in close proximity to one another. The other classes included high potential agricultural land located within the urban development boundary (inside urban edge class), high potential land located partly within and directly adjacent to the urban development boundary (overlapping urban edge class) and the high potential land located within protected areas such as Suikerbosrand Nature Reserve (protected areas class). The last class was high potential agricultural land outside the urban development boundary, consisting of small fragmented portions of land still regarded as important for agricultural purposes. This class was classified as important agricultural sites (GDACE 2006d:5-7).

From an agricultural point of view, GDACE decided to focus, on the seven agricultural hubs where agricultural activities will be supported. Calculations made from the spatial agricultural potential zones indicate that the agricultural hubs consist of 60% of the total high potential agricultural land and are 10% of the total land surface of Gauteng. The medium and low potential agricultural lands that are located within the identified

agricultural hubs will also be reviewed, as activities that may occur on these lands can have a significant impact on the high potential agricultural land, either negative or positive. Activities that will be supported on these lands include those that support agriculture, for example agricultural processing plants and agricultural infrastructure. The important agricultural sites will be evaluated on merit, but it will be protected as far as possible. These areas consist of 20% of the identified high potential areas and 3.5% of the total Gauteng land surface. The same principle will also be applied to the areas overlapping the urban development boundary that consist of 1.2% of the total Gauteng land surface (GDACE 2006d:5-7). However, these lands will be the first to come under pressure due to the close locality to the urban areas and the continued amendment of the urban development boundaries by local authorities.

High potential areas located within protected areas will not receive attention as they are already protected by another process. These areas consist of 0.9% of the total Gauteng land surface. High potential agricultural land located within the urban development boundary, consisting of about 7% of the identified high potential land in Gauteng and 1.3% of the total land surface will not be protected further. The breakdown of the mentioned figures is depicted in Table 8.8. All these high potential agricultural land classes have been captured in the policy on the protection of high potential agricultural land for Gauteng (see chapter 6).

A serious concern is the exclusion of the high potential agricultural land located within the urban development boundaries from further protection. From a food security perspective, these areas can very successfully be utilized for community-type agricultural purposes, especially the land located in close proximity to informal townships and very poor areas. Access to this land could be negotiated and people have the opportunity to practise agriculture on a small scale. This could assist them in producing food for home consumption and thereby contributing to food security. This arrangement would be an interim arrangement, however, as it seems inevitable that this land will eventually be lost to development. Until then it could have an impact to the advantage of people desperately trying to improve their living conditions. GDACE could play an important role in the facilitation of this process.

Table 8.8 Classification of high potential agricultural land in Gauteng

Classification		Ha	% of high potential	% of Gauteng	To be protected
Important agricultural sites		59 637	20	3.5	3.5
Agricultural hubs (AH)	AH1	23 281	8	1.4	1.4
	AH2	26 057	9	1.5	1.5
	AH3	27 461	9	1.6	1.6
	AH4	37 363	13	2.2	2.2
	AH5	15 472	5	0.9	0.9
	AH6	32 604	11	1.9	1.9
	AH7	14 365	5	0.9	0.9
AH (Total)		176 602	60	10	10
Inside urban edge		21 680	7	1.3	0
Outside urban edge		21 074	7	1.2	1.2
Protected areas		14 544	5	0.9	0
					Total 14.7%

Based on the above, land in Gauteng was thus divided into “zones” derived from its natural resources potential, but supported by current land use. Figure 8.18 indicates the zonation of high potential agricultural land in Gauteng. Other external factors that might have an impact on the selected zones, but not taken into consideration are environmental sensitive areas, specifically those identified in the C-Plan decision support tool used in Gauteng. The conflict between the agricultural zoning product and the C-Plan will have to be managed according to the most suited land use.

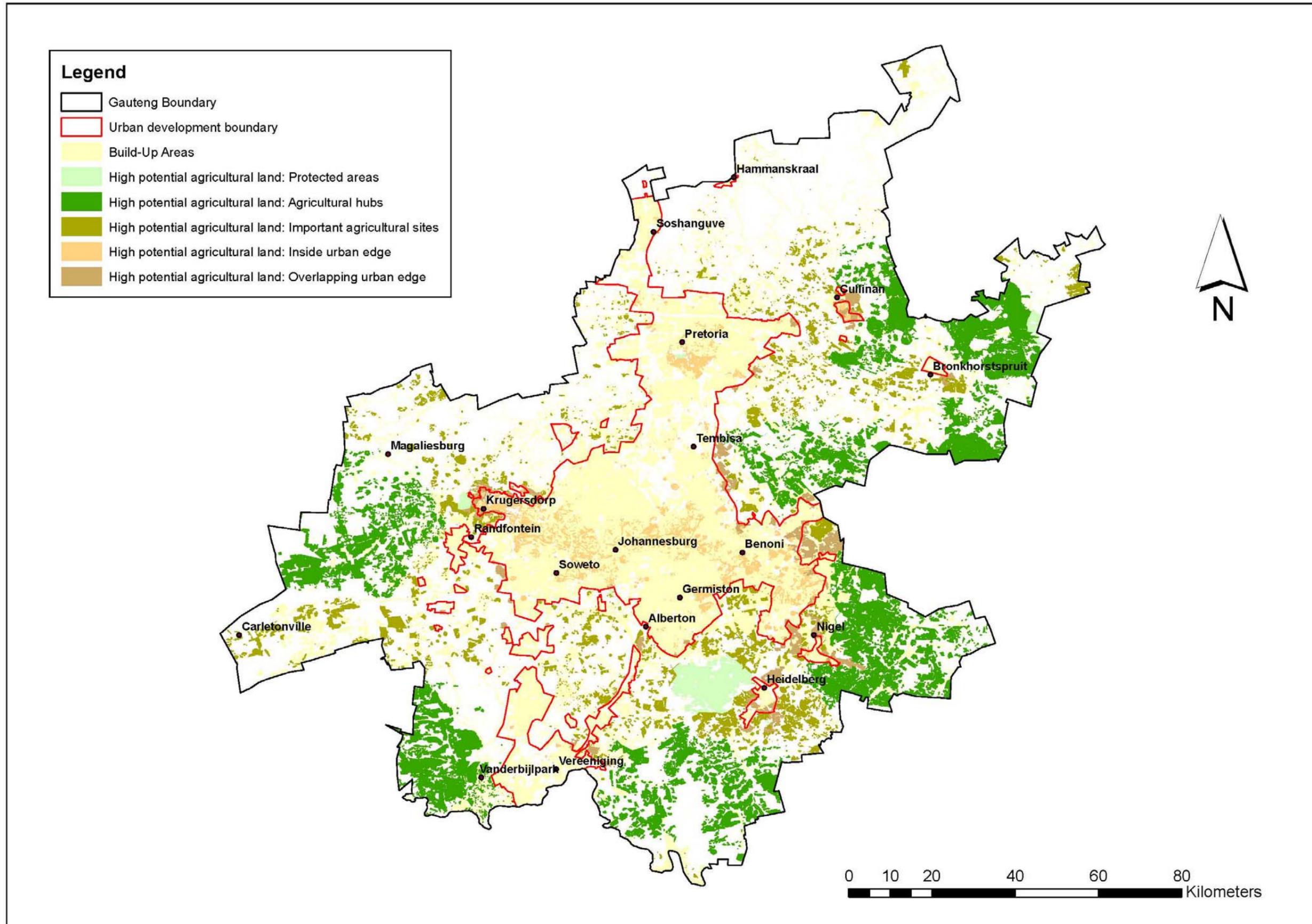


Figure 8.18 Zoning of high potential agricultural land in Gauteng

8.5 ZONING OF AGRICULTURAL LAND

The principle of zoning has long been used in the urban environment and formed part of the Town Planning Ordinances. This concept only recently became associated with ecological or natural resources characteristics. The reference here is to the Agro Ecological Zones (AEZ's) principle developed by the FAO. The FAO (1996:1) defines an AEZ as "a land resource mapping unit, defined in terms of climate, landform and soils and/or land cover, having a specific range of potential and constraints for land use". AEZ's are thus areas that have similar characteristics in relation to land suitability, potential production as well as an impact on the environment. The building blocks for AEZ's are called agro-ecological cells (AEC).

AEZ's focused on the zoning of land based on similar characteristics of the land's physical and biological characteristics (climate, soil, terrain, land cover and, to some extent, water resources) and formed the basis for agricultural land use planning. These were then used to give an indication of potential productivity for various crops based on the crops' environmental and management needs.

The AEZ concept was especially developed as a computer-based system requiring the interaction of relevant spatial data layers in a GIS environment. This principle allows for the initial use of data layers related to natural resources, such as soil, climate and vegetation. It can be expanded to incorporate additional layers such as land use, infrastructure, land availability or population figures to allow for advanced analysis and land use planning.

The three main activities involved in the zoning process are an inventory of land utilization types, as well as their ecological requirements, the mapping of zones based on their land resources, and the evaluation of the land suitability of each zone (FAO 1996:34).

The land utilization types include the mapping of current land use or land use under improved situations. Cognisance should be taken of existing agricultural production systems and factors that can affect the production potential. This also includes the compilation of a climate and soil inventory. The mapping of the zones, based on the resources, is done through combining the different resource layers to define agro-

ecological cells (AEC's) through a typical GIS exercise. The AEC's are combined to form AEZ's. The last step includes using various crop requirements and aligning these with the AEC's potential to determine the possible yields, as well as constraints in terms of soil and climate. The potential yield of crops is determined by taking temperature, day length, other climatic factors as well as site and soil limitations into consideration (FAO 1995:16).

Expert knowledge should be taken into consideration, however, when applying the results to planning and policy-making. Among the advanced applications that can be developed on the AEZ's are potential land productivity, estimation of the potential rain fed arable land and optimising land use.

Depending on the requirements, the AEZ's can further be influenced by external factors such as socio-economics factors. This, in turn, can then form the basis for an ecological-economic zoning. This integrates the ecological or physical land characteristics with the socio-economic factors, as well as a wider range of land uses. The FAO (1996:1) defines ecological-economic zoning as a "kind of zoning which integrates physical land resources elements with socio-economic factors and a wider range of land uses in zone definitions".

This process is seen as an advance on the AEZ principle and allows for negotiations with stakeholders on the most suited land use selection for an area, based on available information. This can then form the basis for future legislation, policies and area-based plans (FAO 1996:51).

Based on the underlying principles of the model used in Gauteng and the guiding principles indicated by the FAO on defining agricultural zones, it can be concluded that the Gauteng model has the potential to be utilized on a national scale. With the exception of the PWV 1: 50 000 soil data, the data sets used are available on a national scale. This model has thus far also been successfully applied in the Limpopo province and tested in the Umzimkulu district of KwaZulu Natal (Schoeman, Strydom & Collett 2008: 3).

The results of the Umzimkulu district were compared with the outcome of the BRU's used in KwaZulu Natal. The initial purpose of the exercise was to determine the best

methodology available on zoning of land that could be rolled out on a national level in the shortest possible time. The strengths identified for the BRU's include the use of high level local knowledge in the demarcation of areas, the availability of continuous units (no salt-and-pepper effects in terms of GIS modelling), the rationalization of the different land attributes namely soil, climate, terrain and vegetation into a single boundary and the use of vegetation as a benchmark. Weaknesses of the model were the dependence on local knowledge, the low repeatability, the limitations to change as the data was not derived from grid cells, and the unavailability of detailed vegetation data in other parts of the country (Schoeman *et al.* 2008: 8). Officials from the KwaZulu Natal Department of Agriculture and Environmental Affairs positively received the outcome of the applied Gauteng model in KwaZulu Natal.

The national Department of Agriculture has thus decided to utilize and apply the principles of the Gauteng model and to roll out a national zoning system for the whole of the country. The purpose of the exercise is to

- Establish legal agricultural zones based on the physical and biological characteristics of the land and through negotiations with local authorities.
- Allow for the use and interpretation of the zones on a district level that will aid in the decision-making process pertaining to change of land use and land use management, based on the same principles as the FAO land allocation principle. Each zone will further be governed by norms, standards and criteria of activities and land use that will be allowed within the zone. It is hoped that these zones and the associated norms and standards will be incorporated in the SDF's and IDP's of municipalities.

It should be noted that a capability model is based on interpretation and what a national level capability should incorporate is still under discussion. The success of such a model is based on the quality of the scale of the data, as well as the availability of the data. Additional external factors such as biodiversity or ecological sensitivity can be included in the model, should the data be available. As mentioned earlier, in the field of natural resources there are still major gaps in available data. Care should also be taken to ensure that the data is still relevant or is derived from a reliable source.

Recommendations on data made after the conclusion of the Gauteng zoning project included the improvement of data, especially soil and climate data, as well as other data

variables such as curvature, ground water availability, soil fertility and land cover. The cadastre data should also be improved to allow for the development of a capability index for each land parcel in Gauteng. This is not possible at this stage due to the quality of the cadastre data set. The results of the Gauteng zoning study should also be incorporated in the municipal SDF's and IDP's (GDACE 2006b:46).

8.6 LAND USE PLANNING

Land use planning should be informed by the land capability of the area concerned in order to adhere to the principles of sustainable development.

The FAO (1993:5) regards land use planning as the “systematic assessment of land and water potential, alternatives for land use and economic and social conditions in order to select and adopt the best land use options”. Land use options should meet the needs of people without compromising the resource. However, there should be a need for the change of land use or actions to prevent unwanted change, as well as the political will and ability to put the plan into action.

The *White Paper on Spatial Planning and Land Use Management* (Department of Land Affairs 2001: 32) defines land use planning as “planning of human activity to ensure that land is put to the optimal use, taking into account the different effects that land uses can have in relation to social, political, economic and environmental concerns”, whilst land development is “the process of building and landscaping land in order to enhance its commercial or social value”.

Land use planning and land suitability evaluation depend on high quality resource information that is collected through resources surveys (Laker 2004a:ix). Crosson (1983:344-353) divides the interaction between the resource availability potential and the productivity into four categories, namely (1) low productivity potential/high land potential; (2) high productivity potential/high land potential; (3) high productivity potential/low land potential, and (4) low productivity potential/low land potential where productivity potential is dependent on the use of modern or applicable technologies. The use of production methods/technologies in cultivation processes should aim at increased production, but should also be conscious of the impact on the environment.

The focus should be on the extension of the agricultural resource base that will thus impact on the availability of land.

The issue of land use planning should therefore have a wider focus than just the planning of the land itself. Production practices and their economic influences should also be taken into consideration. Initial land planning should be done on a larger scale because, in most cases, the protection of resources is beyond the ability of individual land users. This important issue should be taken down to provincial and local level, which should incorporate more detailed localized data and be governed by regular interaction between the various levels. On national level, land use planning should encompass broad planning, policies and legislation to provide guidance on more detailed provincial and local level land use plans required for effective land use planning.

The FAO (1993:44) stipulates that national level land use plans should be developed on a 1: 250 000 scale and provincial planning on a 1: 50 000 scale. The FAO (1993:15) identifies three groups of role-players involved in land use planning, namely land users, decision-makers and the land use planning team. The land use planning team should consist of various disciplines (natural resources, economists and agricultural and social scientists).

Guiding land use planning is the potential or capability of the land as well as economic and social factors, but supported by good information. Not only will this allow for optimum and suitable use of the land, but it will also ensure that the resources are protected. Suitable land use thus forms the basis of effective land use planning.

The FAO (1976:23-24) defines land suitability as “the fitness of a given type of land for a defined use”. The land may be in its present condition or after some improvement. Land is classified as either suitable or unsuitable. Three suitability classes are defined, namely high, moderate or marginal, whilst unsuitable is classified as currently not suitable or permanently not suitable.

Land suitability depends on the proposed land use. A selected piece of land may be highly suitable for maize production, but not suitable for the production of herbs due to limited water availability. The pressures experienced on the land should also be

managed when determining land suitability. In many instances, the most suitable land for an agricultural purpose is also suited for development purposes. In such cases, an indicator like a weighting system measured against defined criteria will have to be applied. This should be supported by the development of policies on land use to effectively manage these demands. Figure 8.19 illustrates the interaction between the concepts involved.

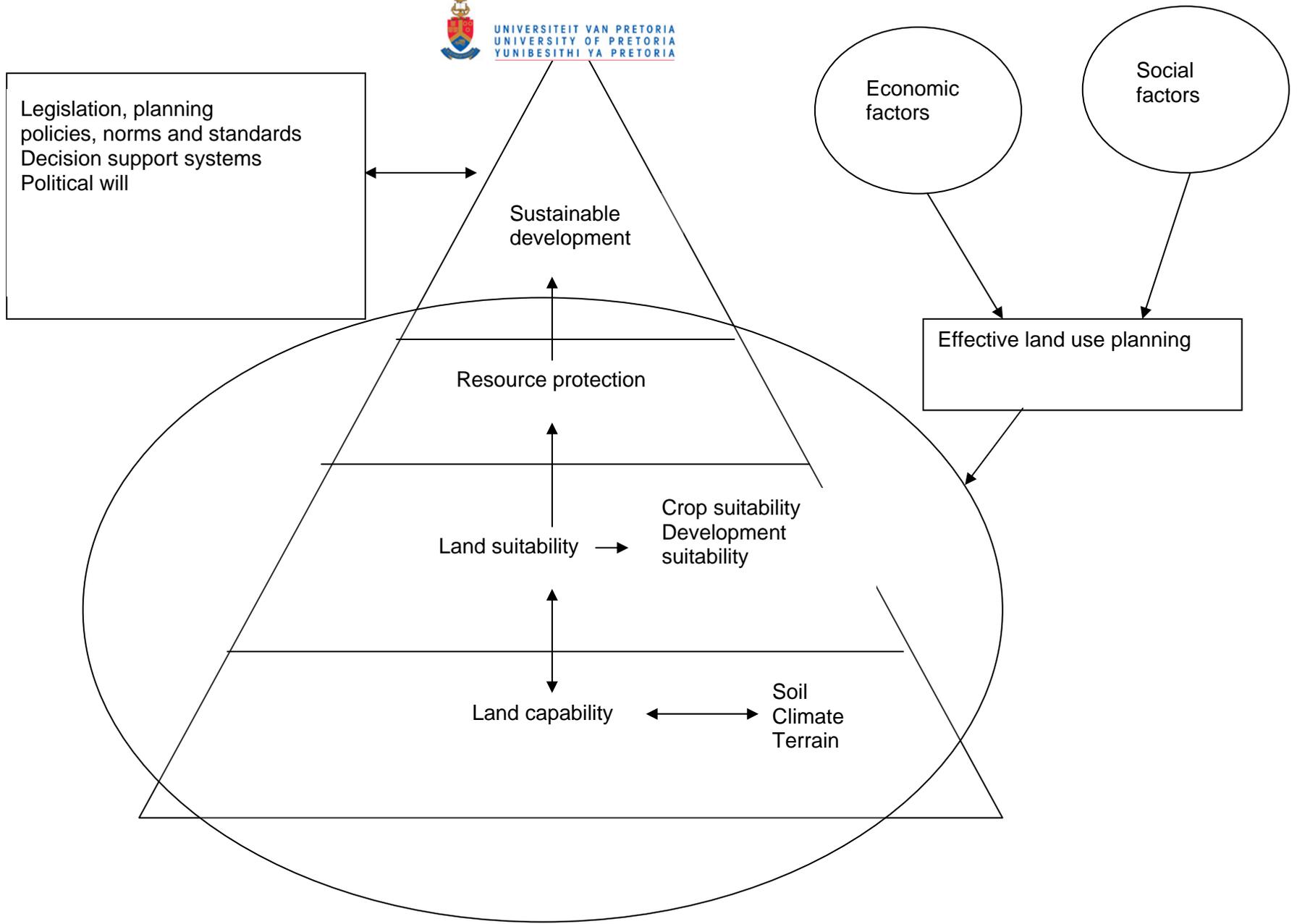


Figure 8.19 Interactions of effective land use planning

In conducting land use planning, the matter of economics should not be put aside. The value of the land and the sustainability of the agricultural practices are just as important for the future of the industry. In this regard, Miller (1979:293) points out that the land value is not only dependent on the physical characteristics of the land, but is also influenced by social and economic considerations. Land use should also not be determined in a local context, but cognisance should be taken of the current land use on surrounding land parcels.

8.6.1 Crop suitability

Based on the work conducted in identifying high potential agricultural land in Gauteng, further research was done to determine crop suitability. In using land capability to map crop suitability, the assumption is that there is a direct relationship between crop requirements and soil, climate and terrain parameters (GDACE 2006c:5). It is important to acknowledge the accuracy and scale of the data that will influence crop suitability and predicted yield calculations. Due to the scale of data available, the results of such crop suitability should rather act as a guide and accurate predictions should be based on actual ground surveys.

In determining crop suitability, the focus was on the requirements of the crop and based on land capability indicators. External factors, such as the accuracy of published research results, economic viability, access to financial support, distance to markets, availability of water in the case of irrigation requirements, legally granted water-use permits, infrastructure, cultivar selection, management experience and knowledge, and surrounding land uses were assumed as correct and in place. The final result was based solely on agricultural production requirements and the requirements of the external factors will need to be taken into consideration before a final decision is made on a suitable crop for a specific area (GDACE 2006c:6).

GDACE focused on two main classes, namely irrigated and rain fed crops. The irrigated crops consisted of pastures, flowers, vegetables, fruit (peaches, apricots, etc) and herbs. The rain fed crops consisted of grains (maize, sorghum, wheat, oats, rye, barley), oil seeds (sunflower, canola, groundnuts), bean crops (dry beans, soya beans, cowpeas, bambara) and pastures (lupines, lucerne, grasses). The process followed for determining crop suitability included a comparison with the land capability classification

in Gauteng, a prediction of yields, using matrix values or a mathematical equation or a combination of both, as well as a suitability rating. The selected methodology was dependent on the availability of published research results for the identified crops. The results were then transformed to suitability ratings on a five-scale rating from very high to very low. It was stated that a comparison should not be conducted between the crops, as an area where a yield of 4t/ha is predicted for both maize and sunflower, a moderate suitability rating may be assigned for maize, but a very high suitability rating assigned for sunflower. The evaluation of an area should thus be based on the possible performance of the crop in comparison with the maximum value that a crop can yield under optimal conditions (GDACE 2006c:7-8).

Ratings for the irrigated crops were based on the land capability classes due to a lack of information on water availability and divided as indicated in table 8.9.

Table 8.9 Crop suitability ratings for Gauteng

IRRIGATED CROPS	LAND CAPABILITY PERCENTAGE RATING				
	<=55	55-60	60-65	65-70	70+
Pastures	Moderate	High	Very high	Very high	Very high
Flowers	Low	Moderate	High	Very high	Very high
Vegetables	Low	Moderate	High	Very high	Very high
Fruit	Very low	Low	High	Very high	Very high
Herbs	Low	Moderate	High	Very high	Very high

In terms of rain fed crops, maize was used as the reference crop for grains; sunflower and groundnuts for oil seeds; dry beans for beans, and *Vetch*, *Cenchrus*, *Kikuyu*, *Panicum* and *Lucerne* were used for pastures. Table 8.10 depicts the hectares and percentage suitability for the crops.



Table 8.10 Suitability percentages for each identified crop

Crop	Hectares			% of very high suitability of Gauteng land surface
	Moderate	High	Very high	
Irrigated crops				
Pastures	22 857	1 122 356	253 397	14. 96
Flowers	117 023	34 458	2 244	0.13
Fruits	-----	34 260	2 243	0.13
Herbs	117 023	34 458	2 244	0.13
Vegetables	117 023	34 458	2 244	0.13
Rain fed crops				
Grains: Maize	298 781	11 618	-----	0
Oil seeds: Sunflower	787 734	220 335	24 298	1.43
Oil seeds: Ground nuts	428 578	397 734	336 083	19. 84
Beans: Dry beans	587 176	547 993	107 488	6.35
Pastures: Grasses	1 122 356	246 198	7 198	0.42

Source: GDACE (2006c:8-19)

Figure 8.20 indicates the maize suitability areas in Gauteng.

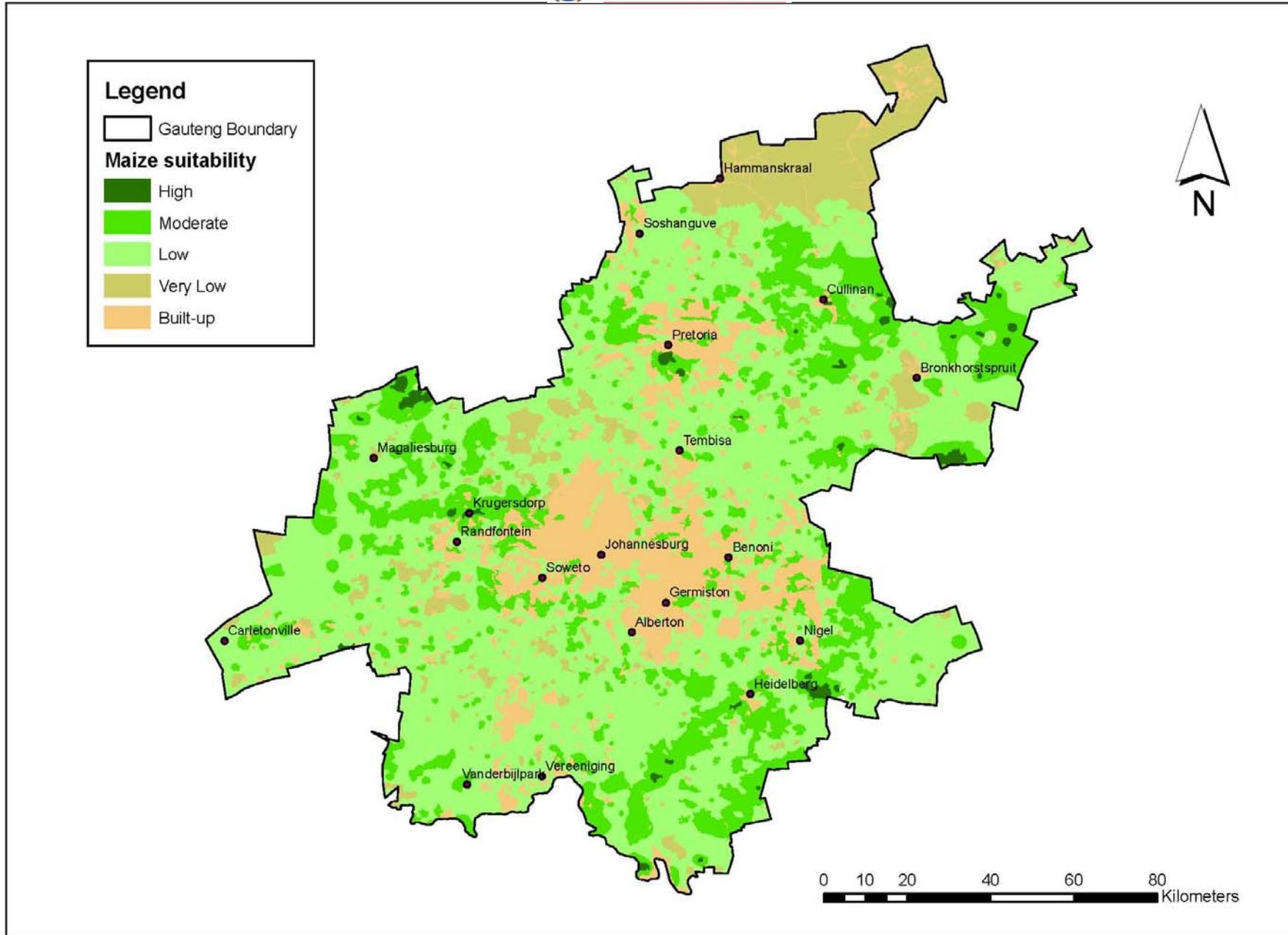


Figure 8.20 Maize suitability in Gauteng

8.6.2 Minimum farm size

This study focused chiefly on determining land capability as a guide to the protection and zoning of agricultural land, using the biophysical characteristics of the land. The follow-up of these actions leads to the next issue, which has been avoided thus far, namely the underlying economic principles.

It is stated that economics should not form part of the zoning or demarcation of agricultural land that needs to be protected for future use. This is mainly due to the constant changes that is experienced in the economy (including input costs and market prices), whilst the potential of the natural resource base is mainly a constant factor. However, due to the pressures on land and in view of the South African situation regarding the sub-division of agricultural land as a stumbling block to land reform, the question is what should be regarded as the minimum viable farm size. In discussing sustainability, reference was made to this factor (see chapter 3).

During personal communication with soil scientists, the researcher found them hesitant and reluctant to commit to an answer. Briefly, it was felt that minimum farm size would depend on a number of factors, such as the capability of the land, the envisaged crop to be planted and the farmers' management experience. Economists add another factor to this list, namely the required income for the family living off the farm. In this regard, Laker (1995a:1-2) maintains that a viable farm size depends on the economic potential of the land. The basis for such an evaluation is to determine the minimum income that a family requires to survive. The follow-up of this action is an estimation of the size of land required to generate the required income. The level of management experience also plays an integral role in this calculation.

According to Aihoon *et al.* (2007a:2), the minimum size for a family farm is “a farm that is large enough to generate minimum required net farm income thereby to retain a full-time farmer and his household in a way that is ultimately sustainable”.

Aihoon *et al.* (2007b:4) regard two relevant criteria as applicable in determining a viable farm size. Firstly, a farm is regarded as viable when it is a self-supporting business unit, irrespective of ownership, and judged by its return on investments. Criteria in this instance are based solely on economic success. Secondly, a farm is able to support its

owner and is judged by the farm's capacity to provide this support. Here the concept of farming livelihood is relevant.

As a basis for determining economic farm units, it was found that the number of farm units in South Africa declined by 48% between 1950 and 1996, whilst the average farm size increased by about 80% from just less than 800 ha to about 1450 ha. Aihoon *et al.* (2007b:7-8) regard the advances in technology that allow a farmer to expand operations the reason for the increase, whilst economic pressures require a farmer to increase the farm size in order to generate similar incomes. The question not asked is whether the increase in farm size should not rather be attributed to a decline in the natural resources production potential.

Irrespective of the reason for the increase in farm size, the requirements to do so were based on experience and expert intervention. It is thus of concern that there is a return to smaller farming units. This will require a farmer to farm on a more intensive scale that will require a higher level of farm management and an in-depth knowledge of agriculture. Newly settled farmers still lack this experience and the consequences of these actions may have a detrimental effect on food security in the country.

Aihoon *et al.* (2007b:17) point out that in view of South Africa's previous political situation, the land reform programme cannot be too restrictive or discriminatory, as it aims at changing the problems of the past as far as access to land is concerned. It is for this reason that many farmers are now settled on land that previously had only one owner. At the same time, the current land reform processes have failed, which has a tremendous impact on the agricultural sector, not only as a future employment sector, but also on food security, environmental degradation and the waste of financial resources.

The general poverty line used by the Department of Social Development is around R380 per month per adult and R700 per month as the average household expenditure. For an average family of 4.5, the household basic survival income is estimated at R2275 per month (Aihoon *et al.* 2007b:20). Taking into consideration the requirements for farming, it is estimated that a basic household income of R4000 per month would be sufficient to align farming income with it (Aihoon *et al.* 2007b:22). The minimum farm

size is thus linked to the basic household income required, specific to an area of land that is able to generate such an income. A risk factor is built into this amount.

Aihoon *et al.* (2007b:29) recommend that a typical farm income per hectare should be determined per area, locality and category. This should then be used to determine the minimum viable farm size. External factors may have an impact on farm size and these should be included in the farm size algorithm.

It was beyond the scope of this study to find an answer to this issue. This matter may become more important in the future. Much research still needs to be done on this topic, both from an economic and natural resource perspective. Minimum farm size will depend on the status of the natural resources, as well as aspects of management and current economic trends. Also of importance here is access to detailed information that may assist in the outcome of such an exercise. Again, effective land use planning is a core component.

8.7 CONCLUSION

This chapter discussed agricultural potential; the identification and evaluation of high potential agricultural land; the definition of “land”; land capability classes; land evaluation systems; the availability of information or decision support systems on land capability or agricultural potential; zoning of agricultural land, and land use planning.

Chapter 9 concludes the study and makes recommendations.

CONCLUSIONS AND RECOMMENDATIONS

9.1 INTRODUCTION

This chapter concludes the study and makes recommendations.

9.2 AGRICULTURAL LAND AND ITS ROLE IN SUSTAINABLE DEVELOPMENT

The role of agriculture in a society cannot be underestimated. Its contribution to food security, the creation of jobs and the improvement of a community's living conditions are well known.

It is important that agriculture does not become only a social upliftment programme. Laker (2004a:48) states that "agricultural development can potentially be a powerful development tool, but it is crucial to see it as merely a tool which can be used to achieve the primary objectives of development and not as an ultimate objective in itself". The primary role of agriculture in society should be to produce food to feed the nation. The role of the commercial agricultural sector should therefore be acknowledged, protected and supported. This sector should form the backbone of a growing economy. It can be concluded that if a country has a stable agricultural sector that is supported by Government and the public sector, it will also result in positive impacts on a secondary level.

In the South African context, land reform has a role to play, but it should be managed carefully and done in a sustainable manner. It is important that this process be conducted in such a way that the previously disadvantaged people do not become more disadvantaged in the process. It should also take cognisance of the fact that current productive areas, irrespective of the current owners, must stay in production. This should specially be applied to high potential agricultural land.

Laker (2004a:xix) recommends that the objectives of the land reform programme be stipulated clearly and that aspects, such as alleviation of poverty and food security, become part of the solution. The size of land allocated to farmers/families should be

economically viable. Government should also support newly settled farmers. It is Government's responsibility to ensure that support structures are in place to assist farmers. Steenkamp (2008:10) reports that the Minister of Agriculture and Land Affairs blames the failure of the land reform programme and the non-productivity of new farmers on apartheid and the commercial agricultural sector. According to the Minister, with the exception of a few white farmers, the commercial agricultural sector is not prepared to assist in training new farmers.

Land must be made available through the correct processes to people who are actually interested in farming as a living. The hope should be expressed that these emerging farmers would ultimately take the place of today's commercial farming sector. Continuing the present way of handling land reform in the country, namely simply giving people access to land, irrespective of a genuine interest in farming productively, will grievously impact on food security and the survival of the agricultural sector. In dealing with land claims registered on productive agricultural farmland, care should be taken to ensure that the land claim process does not take priority over the future of the land. Should the land claim be in favour of the claimant, all possible precautionary options should be put in place to ensure that the land remains in production. Failing this, alternative measures should be applied. Many farmers are willing to negotiate with Government to come to a best-suited arrangement between the current owner and the claimant.

It should be acknowledged that many of the newly settled farmers have little or no exposure to farming practices and that a huge task is at hand to train them. This cannot and will not happen overnight. A prerequisite for any new farmer should be to attend a number of formal training sessions conducted by experts in their respective fields. Training should be given on natural resource management, effective land use planning, crop production, management of grazing and other aspects. These farmers should also have direct access to support structures and information.

Alternative options in aiming for a successful land reform programme could include possible co-ownership of the land, sharing of benefits or settling the claimant on currently unused state land. Government should seek a win-win solution and not only a case of taking back, irrespective of the situation or merits of the case, in order to

redress or rectify past wrongs. Uncoordinated actions will also have a negative impact on the status of the natural resource base of the country.

As stated in this study, South Africa has limited agricultural potential due to its relatively low rainfall and lack of high potential agricultural land. The land with agricultural potential should be optimally utilized and managed accordingly to ensure that it remains in production and that its natural resource potential is not degraded or destroyed. Not using this land accordingly would result in a loss of productive land and negatively impact on food security. The impact thereof on the status of the natural resources would increasingly lead to degraded land with more funds eventually being allocated to rectify the resource instead of supporting a viable agricultural sector.

Supporting the above is the identification of agricultural land in general or defining agricultural land. At present, the only available definition or description of what is regarded as agricultural land is encompassed in the *Sub-division of Agricultural Land Act, 70 of 1970* (South Africa 1970:1). According to this Act, agricultural land is demarcated as per cadastre boundaries. As this is an “old” Act, new demarcation of municipal boundaries has since occurred without the formal updating of the demarcation of agricultural land. This has resulted in an area of conflict between national and local government as to the roles and responsibilities pertaining to land, to such an extent that the matter was referred to the Constitutional Court. In judgement delivered on 25 July 2008, the Constitutional Court (2008:1-86) ruled in favour of Act 70 of 1970 and declared that agricultural land remains under the jurisdiction of the Minister of Agriculture.

The area demarcated as agricultural land needs to be clarified and formalized. The national Department of Agriculture (DoA) recently finalized a process on the demarcation of agricultural land. In identifying agricultural land, reference is made to the provisions of Act 70 of 1970 where matters, such as areas located within municipal boundaries as they were before 1994, are excluded as agricultural land, as well as areas that were exempted by the Minister through a consent number or through publication in the *Government Gazette*. Built-up areas, irrespective of whether approval was given or not, are also excluded as agricultural land because that land is now lost to agriculture. Former homelands, state land, and protected areas are also excluded as agricultural land with the provision that once this land becomes private land, it will again

be regarded as agricultural land (Collett 2008:2-4). In the course of this process, maps were supplied to all local municipalities in the country to verify the contents thereof, as to the classification of agricultural land. Of concern was the number of municipalities that were not aware of the existence of Act 70 of 1970. Many municipalities also regarded their SDF's as their reference point in terms of land management, irrespective of whether the land had been excluded from agricultural land. In many instances, development actions are proposed on land that has a high agricultural potential. Following on the SDF's, municipalities commented that they were in the process of compiling their proposed land use management schemes as required under the proposed Land Use Management Bill (South Africa 2008: 18).

However, limited response has been received from the local municipalities in the updating of the agricultural land areas. It is foreseen that the newly demarcated areas will be gazetted so that all spheres of government have an accurate indication of the land concerned. It is still uncertain what legislation will be used to gazette the newly proposed or updated agricultural land due to the problems experienced with Act 70 of 1970 and the absence of any other relevant agricultural legislation. The only other proposed legislation that deals with similar matters is the Land Use Management Bill (South Africa 2008), which is to repeal the *Development Facilitation Act, 67 of 1995*. However, the jurisdiction of this Bill resides with the Department of Land Affairs and not the Department of Agriculture. It is imperative, then, that the Department of Agriculture should address the matter of the absence of relevant legislation dealing with the initial management of agricultural land. Finalization and amendment of the Sustainable Utilization and Protection of Agricultural Resources Bill (SUPAR) (Department of Agriculture 2006e), that has been in the process of development for the last eight years, needs priority attention. It is of concern that in the process of demarcating agricultural land, the production potential of the land has not been taken into consideration. This matter still needs to be addressed in order to ensure effective land use management. Figure 9.1 illustrates the demarcation of agricultural land in South Africa according to Act 70 of 1970, and figure 9.2 focuses on the demarcated agricultural land in Gauteng.

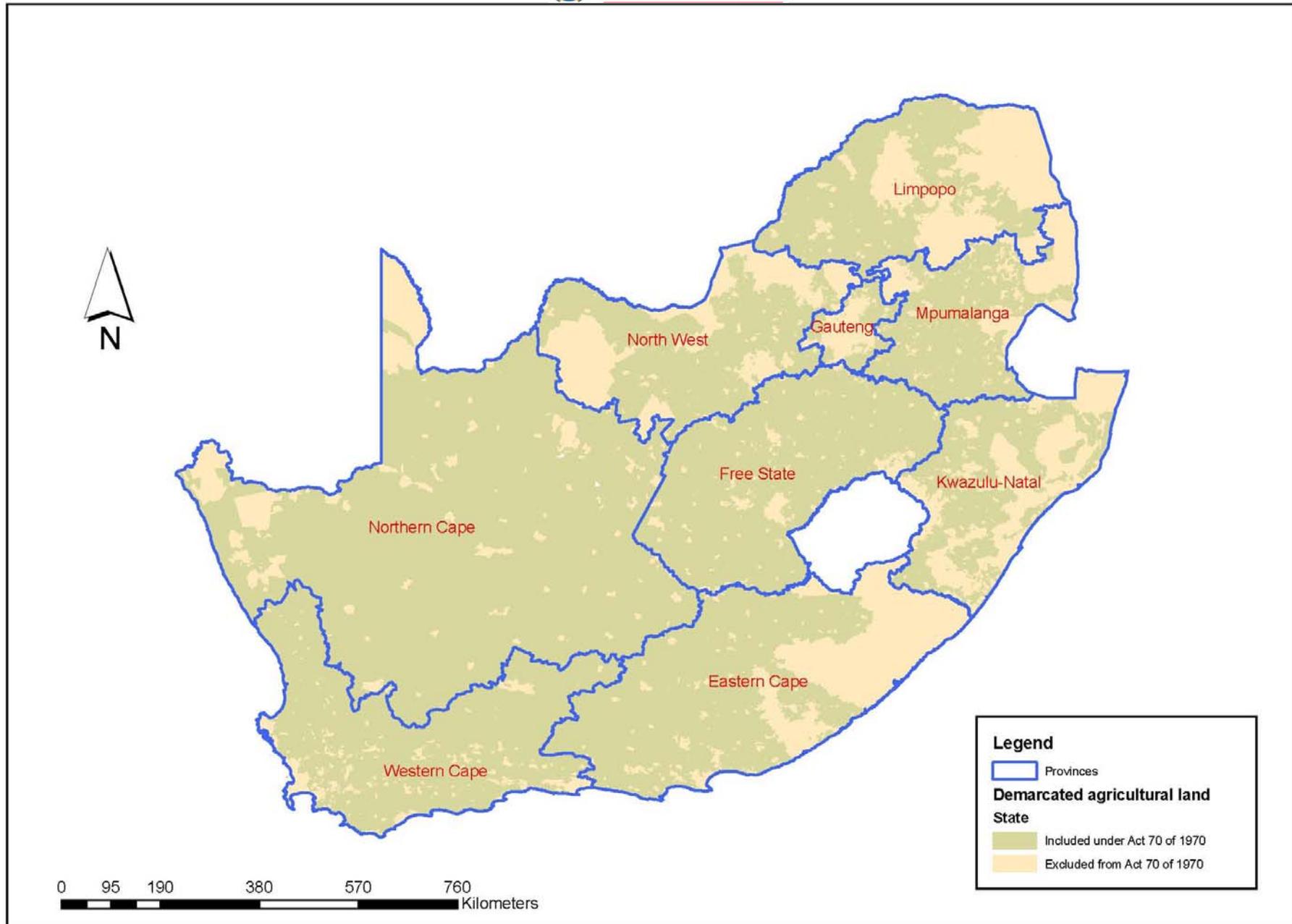


Figure 9.1 Demarcated agricultural land in South Africa, according to Act 70 of 1970

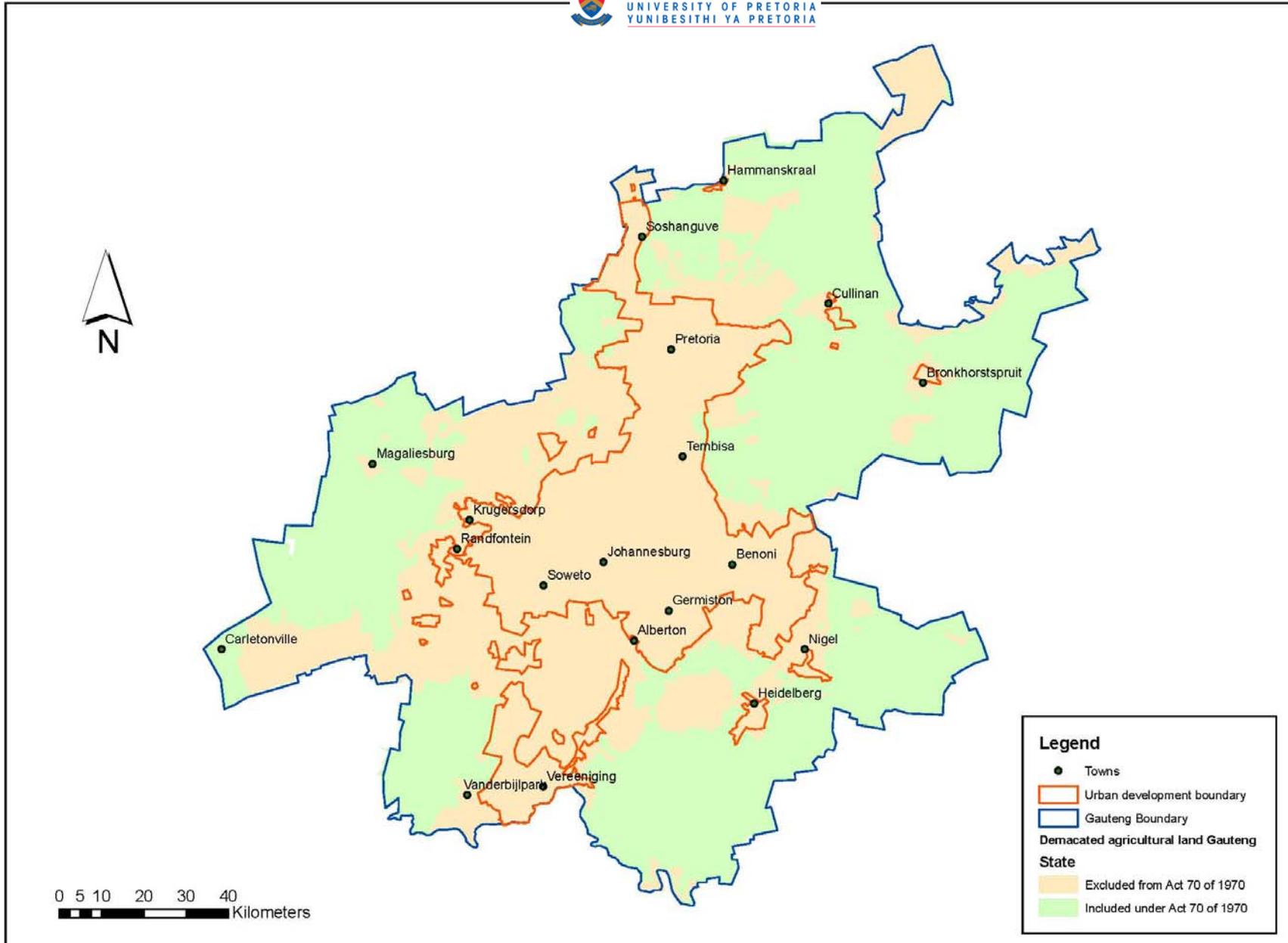


Figure 9.2 Demarcated agricultural land in Gauteng, according to Act 70 of 1970

In discussions with relevant role-players on the definition of agricultural land, it was recommended that matters such as land with production potential or high potential areas should be incorporated in the definition. This could lead to controversy though, as many people would welcome an opportunity to prove the opposite, making it impossible to manage. Until improved information has been presented and tabled pertaining to land that Agriculture wants to retain and until these areas formally gazetted, this will not be possible. Miller (1979:298) maintains that if the definition of prime agricultural land can accommodate itself to existing information as well as resources, the possibility of an all-inclusive and complex definition is not impossible.

9.3 IMPROVED COMMUNICATION

The limited communication between relevant role-players in the agricultural sector needs to be addressed, including the clear demarcation of roles and responsibilities. Although agriculture is seen as a function that involves all spheres of government according to the Constitution (South Africa 1996a:117), a clearer demarcation should be conducted as to the relevant sectors' areas of responsibility.

It is generally accepted that the national Government's responsibility is to develop policies and strategic objectives and to give guidance to provincial and local level. The provincial departments of agriculture have the responsibility of implementing the national strategic objectives and, where necessary, refining the policies to suit the provincial requirements. These departments have access to an extension service whose core function is support to the farming community on implementation level. The extension services in many provinces have failed to reach this objective, however, for various reasons, such as the available capacity in the provinces. The improvement of extension services plays a cardinal role in the successful management of the agricultural sector and post-settlement support to newly established farmers. At the same time, the extension officer should also be supported by updated information.

Local government's role in agriculture is very unclear. Recently it was decided through the Land and Agrarian Reform programme (LARP) that land reform and settlement of farmers be delegated to municipal level (Department of Agriculture 2008c:11). This raises concern about local and district municipalities taking responsibility for finding beneficiaries for the land reform programme. Bosman (2007:15) points out only a few

people are interested in farming and these actions may result in people with no interest in farming in the long term being earmarked as future farmers. For many people, farming is only a short-term solution and the moment new job opportunities arise, the farming enterprise is left unattended. To date, very few municipalities have been involved in the agricultural sector, their core business being infrastructural development. Delegating these responsibilities to local government should be managed cautiously. Municipalities will have to develop the required capacity within their organization and the interaction with the provincial government needs to be strengthened. Clear roles and responsibilities should be identified between them in order to see progress in this sector.

The same concern applies to the areas of responsibility between the Department of Agriculture (DoA) and Department of Land Affairs (DLA). As indicated in the DLA's (2006b:4-7) strategic plan, the Department will focus on the development of spatial area base plans for land reform targets and future development. However, there is very little interaction between the two Departments regarding this matter. The DLA should not develop spatial plans for future development areas without consulting the DoA. The lack of interaction will once again place high potential agricultural land under pressure and raises the question of what the role of land use planning is, without appropriate supporting data.

Formalized forums (although in existence between national and provincial Agriculture) need to be strengthened and expanded to include other relevant national departments, as well as local government. The three partners should work in alignment with each other, with the various levels complementing each other, ultimately with the same objectives in mind.

9.4 IDENTIFICATION AND ZONING OF AGRICULTURAL POTENTIAL LAND

In order for the agricultural sector to be effectively managed, land that needs to be protected for agricultural production should be identified. It is understandable that problems are experienced with the so called "blanket approach" followed to date, on demarcating all land that does not reside under municipal management prior to 1994, be regarded as agricultural land. This causes conflict between land use managers, especially in the South African context, where access to land has become a political ball

game. Land with an agricultural potential needs to be identified and demarcated under appropriate legislation and policies.

Smith (1998:122) emphasises that “prime agricultural land, its definition and its preservation, are critically important in South Africa in order to assure and maximize the food, fibre, open space and employment opportunities which are necessary for present and future generations of the state and the nation”.

To date, there is limited available information on identifying land with an agricultural potential. The only nationally available source of information that can be used is the land type data, which is on a 1: 250 000 scale. The national land capability data set, currently used by the national Department of Agriculture, as well as the provincial Departments of Agriculture was developed from the land type data and supported by additional research (Schoeman *et al.* 2002:1). It needs to be refined, however, as it cannot be used effectively on a provincial or regional level, due to the scale of the data.

The principles in the Gauteng model for determining land capability and the subsequent zoning of agricultural land, create the opportunity to produce a more comprehensive and detailed data set encompassing all aspects of determining the agriculture potential of the natural resource base (GDACE 2006b:43-45). The outcome of this process can be regarded as a scientific approach, with limited subjectivity on deriving the final agricultural zones.

Miller (1979:312) points out that zoning for agricultural use provides the opportunity to create districts where farming would be the only land use allowed. The zoning of land, however, “disappears” as pressures increase on this land. Zoning is highly vulnerable to political influence (Miller 1979:312).

The Gauteng model is presently in the process of being rolled out on a national level, through the incorporation of detailed available soil, climate and terrain data. It is envisaged that the final product will be able to indicate, with confidence the land capability on at least a district municipal level. Within the final derived zones, norms, standards and criteria will be developed that will guide effective land use planning within each of the zones, giving a clear indication of the agricultural potential of the zone. The specific natural resource characteristics associated with the zone will be taken into

consideration in the development of these criteria, norms and standards for each zone. This will include aspects, such as the use of specific production practices in the zone for example, irrigation, grazing potential, sub-division of land, cultivation practices and the importance of the zone within the broader agricultural sector. This may result in the identification of areas with a limited contribution potential towards agriculture. These areas can then be incorporated in the municipal land use schemes for future development. Following this process it will also address the matter of continued movement of urban development boundaries, urban sprawl and leapfrog development and the impact thereof on agricultural production.

Zoning of agricultural land will also allow the agricultural sector to determine the amount of land available for production purposes and to measure it against the food security requirements of the country. Aspects, such as current cultivation areas will also be taken into consideration and the impact on production. Additional planning can be conducted wherein the proposed land reform targets can be weighted against continued food security. Potential agricultural land not currently in production can be earmarked for land reform targets, where farmers can be given the opportunity to develop this land and to acquire the necessary skills, without it impacting on the current food production.

The envisaged zones need to be implemented by the provincial Departments of Agriculture and the local authorities. The provinces have the option to further refine the specifications of the zones, to incorporate more detailed requirements, but not to enhance the zones. The same applies to local authorities. Again the issue of continued interactions between the three spheres of government is recommended.

It must be recognized that the demarcation of the agricultural zones will not be implemented fully, unless it is legalized and incorporated in policies and strategic documents. It should also be noted that in the demarcated zones, areas of lesser agricultural potential would occur, due to the scale of the data.

9.5 EVALUATION REQUIRED FOR MANAGING AGRICULTURAL LAND

It is recommended that each change of land use application be supported by a detailed agricultural specialist study. The reason for this is the lack of available detailed natural resource information and the support of improved decision-making and land use

planning. The principles of an agricultural study should also be included in the norms of the proposed agricultural zones. Such a study needs to be conducted by a registered agricultural specialist, as required by the *Natural Scientific Professions Act, 27 of 2003* (South Africa 2003:1) through the South African Council for Natural Scientific Professions, in order to ensure the integrity of the report.

It is recommended that the following requirements should form part of an agricultural specialist study:

- Detailed soil assessment of the site in question, incorporating a radius of 50 m surrounding the site, on a scale of 1:10 000 or finer. The soil assessment should include the following:
 - Identification of the soil forms present on site
 - The size of the area where a particular soil form is found
 - GPS readings of soil survey points
 - The depth of the soil at each survey point
 - Soil colour
 - Limiting factors
 - Clay content
 - Slope of the site
 - A detailed map indicating the locality of the soil forms within the specified area, on a scale of 1: 10 000 or finer
- Size of the site
- Exact locality of the site
- Current activities on the site, developments, buildings
- Surrounding developments / land uses and activities in a radius of 500 m of the site
- Access routes and the condition thereof
- Current status of the land (including erosion, vegetation and a degradation assessment)
- Possible land use options for the site
- Water availability, source and quality (if available)
- Detailed descriptions of why agriculture should or should not be the land use of choice
- Impact of the change of land use on the surrounding area

- A shape file containing the soil forms and relevant attribute data as depicted on the map

The application concerned and accompanying agricultural specialist report need to be analysed by a person trained in natural resource management or agriculture. The application, after review, has to be presented to a provincial evaluation committee. Such a committee should consist of a dedicated representative from the national Department of Agriculture to ensure compliance with the national strategic objectives, representatives from the provincial Department of Agriculture and other relevant departments such as Housing, Transport and Local Government, as well as representatives from the relevant local authority. Each decision taken by the committee should be weighted against the norms, standards and criteria applicable to the zone relevant to the application. Deviations from the criteria of the zone should be well substantiated and supported by the committee members. Meetings of this committee should occur on a regular basis and all decisions taken at the meeting should be captured in a national database, including the information captured as part of the agricultural specialist study.

Record-keeping of all decisions will allow decision and policy makers to determine at any given point in time, the status of available agricultural land and to evaluate the natural resource base of the country. All newly derived natural resource information captured in an existing database, will ensure the improvement of the current information base on natural resources and resulting in better decision support systems. The Agricultural Geo-referenced Information System (AGIS) is ideally suited to address this recommendation.

9.6 STRATEGIC OBJECTIVES

Since 1994, a number of new policies and strategic objectives pertaining to agriculture have been developed. In earlier policies emphasis was on the importance of agriculture in ensuring food security and its contribution to the economy. Moreover the above should not be conducted to the detriment of the natural resource base. The White Paper on Agriculture (1995) states that land owners should be held accountable for the status of natural resources on-farm, as they are the ultimate users of the land (Department of

Agriculture 1995:13-15). Effective land use planning was thus seen as the basic requirement in ensuring sustainable agriculture.

In 1998, the *Agricultural policy in South Africa* once again emphasized the protection of the natural resource base, although much of the focus shifted to the accessing of land for the small-scale farmers and matters of market access (Department of Agriculture 1998:12). Furthermore agricultural land should be zoned, especially high potential agricultural land, in order to ensure that it is protected for future use. Notably the policy recommended that the *Conservation of Agricultural Resources Act, 43 of 1983* (CARA) should either be amended or replaced.

The *Strategic Plan for South African Agriculture, 2001*, once again aimed at having a balanced agricultural sector, in which provision is made for the commercial sector to address food security and to create opportunities for small-scale or emerging farmers to enter the market, thus the role of land reform in the country (Department of Agriculture 2001:7-18). The urgent need for support to the emerging farmer and for the transfer of technology was acknowledged. All of these activities should occur against the background of food security and the sustainable use of natural resources.

The requirements for protecting the environment as a whole are to be found in various strategic documents across a number of national departments. For example the National Strategy on Sustainable Development (NSSD) makes specific reference to the protection of high potential agricultural land and the impact that the loss thereof will have on food security (Department of Environmental Affairs and Tourism 2006c:16). This makes implementation of strategic objectives very difficult and is in many instances the reason for limited progress in achieving the proposed objectives. The departments only focus on reaching their own individual objectives, without the much needed interaction with sister departments, aimed at achieving the same goals, but from a different starting point. Another concern factor lacking is the monitoring and evaluation of these objectives. There is little feedback is given on the achievement of these targets or follow-up actions conducted.

In most of the agricultural strategic documents, provision is made for the development of refined policies to deal with priority aspects. These policies mostly need to be

developed by the national Department of Agriculture as well as the provincial Departments of Agriculture.

In terms of Gauteng, the old perception that the province has an urbanized nature still persists, making it very difficult to manage land uses other than the proposed developments. At the same time the location of the province and the supporting infrastructure makes it ideally suited for optimally utilizing the natural resources to the advantage of the community. All the province's strategic objectives of the province can be achieved, provided that effective land use planning is conducted. Research, especially work done by the Land Use Task team, provides ample evidence that the province has enough land to address all the needs of its inhabitants, without compromising its natural resource base. Gauteng is also fortunate in the sense that it has already identified its agricultural land that should be protected for future use. This has nevertheless yet to be formally finalized in an approved policy.

It is a matter of adhering to these facts, but also obtaining the support from high-level policy and decision makers to implement these requirements successfully.

9.7 LEGISLATION AND POLICIES

To date, legislation has been developed on the protection of the environment and thus the natural resource base of the country. The *National Environmental Management Act, 107 of 1998* (NEMA) (South Africa 1998a) is one such an example. It can be concluded that NEMA has been successfully implemented. In Gauteng, the principles of NEMA are actively applied and developers are aware of the implications in the case on non-adherence.

In terms of the protection of agricultural resources, reference can be made to the *Conservation of Agricultural Resources Act, 43 of 1983* (CARA) (South Africa 1983). Some of the requirements of CARA have disintegrated, such as the functional conservation committees, as the focus of agricultural production has shifted towards land reform actions. DoA is still applying the principles of CARA. Some interactions occur between DoA Resource Auditors and GDACE officials, but the process is not formalized.

The national Department of Agriculture makes ample provision to address the issue of protection of natural resources, the rehabilitation of degraded areas, as well as the effective planning of land uses within the established directorates. To a certain extent, some of the issues have been addressed that was identified in the policies, such as the development of a national LandCare programme. However, still lacking that should form the baseline of any land use planning, is a clearly identified policy or implementation plan on the protection of natural resources and the adherence thereto. More than ten years after the development of the Strategic Plan for South African Agriculture, under the new South African Government, no new policy on the protection of natural resources has formally been developed. Some drafts documents have been developed,, but none have been formally signed off and implemented. To date the Policy on the protection of high potential and unique agricultural land is available in draft format, but has not been signed by the Minister of Agriculture to be used as an official document. The same applies to the criteria on the identification of high potential and unique agricultural land. In addition, no spatial plan indicating areas of future attention has been finalized.

It is of grave concern that with regard to the protection of agricultural land, no legal document is available. This includes legislation and policy documentation. Some strategic documents by the national Department of Agriculture makes reference to the protection of natural resources and to some extent the protection of high potential agricultural land, with the provision that policies and implementation plans need to be put in place. To date this has not yet realized. DoA and the provincial Departments of Agriculture are practicing the principle of protecting high potential agricultural land, but until a formal policy is in place, the effect thereof is limited. Any attempt to achieve the mentioned gets overwritten by another development legislation or policy, such as the *Development Facilitation Act, 67 of 1995*.

The same concern applies to the Gauteng Department of Agriculture, Conservation and Environment (GDACE) in terms of its policy on the protection of agricultural land which has, to date, not yet been formalized. In his 2005 Budget Vote Speech, the MEC for Agriculture, Conservation and Environment Mr. K Mosunkutu, stated that draft provincial legislation would be presented to the Legislature, aimed at zoning high potential agricultural land that is to be preserved for agricultural use only (GDACE 2005c:3).

The principle of this policy also needs to be incorporated in the Gauteng Planning and Development Act and should be seen as part of the Gauteng Strategy on Sustainable Development. It has to be taken to the local authorities, for inclusion in their Integrated Development Plans (IDP's) and Spatial Development Frameworks (SDF's). GDACE should take a stance that the mentioned documents will not be supported, unless these requirements form part of the local planning processes.

Municipalities should be made aware of the importance of protecting the natural resources within their area of jurisdiction and then specifically the protection of high potential agricultural land. These aspects should therefore be included in the municipal IDP's and SDF's in order to ensure implementation at local level. Again the issue of continued communication should be followed. Agriculture should play an active role in the development of IDP's and SDF's. *The Municipal Systems Act, 32 of 2000* (South Africa 2000b:29) specifically stipulates that the development of an IDP should be aligned to the development plans and strategies of other organs of state to give effect to the principles of co-operative governance. It further states that the municipal IDP is regarded as the principal strategic planning instrument that informs and guides all development within the boundaries of the municipality. It thus binds the municipality, with the exception if there is an inconsistency between the IDP and national or provincial legislation, in which case such legislation will prevail.

Another matter of concern is the overlapping of functions indicated in the available legislation. Specific reference should be made to the aspect of land use planning and management. The Department of Land Affairs develops most of these legislation and policies. The concern in this process is that there is limited interaction between DLA, DoA, Department of Water Affairs and Forestry (DWAF) and the Department of Environmental Affairs and Tourism (DEAT).

No effective land use planning can be conducted in the absence of appropriate information on environmentally sensitive areas or agricultural production priority requirements. Legislation is therefore impossible to implement as the core functions in achieving the objectives are absent. Until such time, the objective of land use planning will stay a paper-based exercise. As in the case of strategic documentation, legislation makes also provision for the development of applicable norms and standards (regulations) in the context of the legislation, but very few of these have been developed

as well. Specific reference is made here to the absence of norms and standards, pertaining to the management of agricultural land and the identification of areas that should be protected on a national level.

Priority should be given to finalizing these requirements. If this is not done, South Africa will run out of agricultural land and the impact thereof on food security will be disastrous.

9.8 LAND USE PLANNING AND MANAGEMENT

The process of effective land use planning, supporting sustainable development cannot be done in silos. It should be conducted in an integrated process, taking into consideration all aspects of sustainable resource management. In conducting a land use evaluation, the most suited use for the land should be determined. The ultimate result in this process is the implementation of these principles. If these requirements are not enforced by law, it seldom happens. As in the case of developing land use plans on a national and on a more localized level, the level of detail to be incorporated, differs. It is crucial that the correct land use be exercised on an identified portion of land. In terms of agriculture, it is frequently found that the current management practices, as well as the cultivated crop on a portion of land are not the most suited or that the land should not have been cultivated at all. This might result in a degradation of the potential of the land and could ultimately have a similar impact as if development is allowed on the land.

The FAO (1999:iv) emphasises that integrated land use planning consists of sustainable management of land resources, appropriate decision support to guide stakeholders in selecting the best suitable land use option and uses the principle of negotiation as the basis for resolving conflicts. Such an integrated process include the clear formulation of the problem to be solved, an enabling policy environment, institutional capacity, knowledge on the status of the land, involvement of relevant stakeholders, a negotiation platform and a set of planning procedures.

Informed decision-making on land uses should be governed by guidelines, policies and decision support systems. Effective law enforcement is essential in combating unwanted or unsustainable land uses. A land use planning policy should be developed on a national level to ensure sustainable development. The objectives of the policy

should be to protect the environment, allow for ecologically sustainable farming systems, ensure self-efficiency in food production, and contribute to economic growth (FAO 1999:57). The law should be regarded as a land resource management tool.

According to the FAO (1999:iv), a national land use policy is “the first and most important instrument; it controls land tenure and land use to provide an environment which is conducive to the implementation of sustainable and productive land use practices and the realization of free and effective negotiation among stakeholders”.

The FAO (1999:15) cites chapter 109 of Agenda 21, which states that an integrated approach to land use planning and management of resources, should focus on the development of policies that will result in the best use and sustainable management of land. Also required are an improved planning, management, monitoring and evaluation system, strengthening of institutional capacity, and coordinating mechanisms allowing for the active involvement of relevant stakeholders, especially at a local level. It is important that a holistic approach be followed in the planning process that will incorporate all factors that have an influence on the resource. Actions taken on a piece of land should be based on consensus between all stakeholders, supported by institutional structures on various levels that will assist in reaching this conclusion. The roles and responsibilities of each role-player on the various levels should be clearly defined.

Conflict arising from land use options is inevitable. A land conflict can be regarded as “a natural phenomenon and refers to the legitimate but opposing interests, activities and impacts on the environment resulting from the different goals and objectives of the many groups and individuals involved or affected by the use and exploitation of land” (FAO 1999:53). Conflict can be attributed to tradition, competition for land resources and uses, contradicting policies, human nature or simply the demand versus the environment factor. Resolving the conflict can be done through negotiation either in person or through facilitation or in more extreme cases through the judicial system.

Table 9.1 depicts the FAO’s (1999:18) recommended interactive process.

Table 9.1 Recommended interactive processes in land use management

Linkage	Policies	Institutions	Information
Level			
International	Conventions	International task forces (e.g. FAO)	Perspective studies
National	Land use policy	National task force (board, committee)	Responds to national demands (economics, politics, environment) Decision making
District	District land use plan/policy	District committees	Demands, technical knowledge and assistance, decision-making
Local (community)	Local land use plan	Land resource management group	Indigenous knowledge, decision-making, demands, needs

It is important to note that objectives at various levels will differ, but the decision making at the various levels should support and not contradict each other. Avoiding conflict is the ideal scenario. This can only be achieved through relevant and updated information, appropriate decision support systems, applicable policies and the implementation thereof. Lastly, but most importantly, the willingness to follow the “give-and take principle” should be followed.

A land use policy “is essentially an expression of government’s perception of the direction to be taken on major issues related to land use and the proposed allocation of the national land resources over a fixed period of time. It has a productive and a conservation component” (FAO 1999:20).

Land use planning should be the norm and not the exception. The development of a land use policy should be reliant on sufficient related information and data. This includes information on the natural resources, economic and social factors, as well as the legal requirements involved. A land use plan should be supported by on-site field surveys, conducted by experts in their respective fields, especially in the absence of detailed and accurate information. It is accepted that all social aspects, such as the right

to housing, infrastructure, water and food, should be regarded as equally important and that any development on any piece of land, should be planned in an integrated manner.

A combined effort should be put in place by all government departments (national, provincial and local) to ensure effective spatial planning of any given piece of land, taking into consideration the potential of the natural resources, as well as other social pressures. Smith (1998:132) recommends that a detailed computer program be developed for land evaluation and land use planning at a comprehensive farm level, supported by detailed climate, soil, fertilizer and yield data.

Although land use planning, at farm level, still has a long way to go, recent progress at least gives guidance at a district municipal level regarding the agricultural requirements, with the proposed zoning of agricultural land. The outcome of this process, nevertheless, still needs to be accepted by the broader community and implemented in development plans.

9.9 KNOWLEDGE AND INFORMATION MANAGEMENT

The management and protection of agricultural land cannot be done without appropriate and accurate information. The role and use of information in natural resource management has recently gained momentum, especially since the advancement of GIS. Spatial natural resource information allows for more in-depth analysis and modelling, determining the best management option of the resource. This does not mean that research conducted in older paper-based versions should be forgotten.

To date, the ARC has been the research arm for the agricultural sector. In the field of natural resource management, ISCW has been at the forefront of newly derived information. One of the main achievements of the Institute is the completion of the land type survey. A comprehensive national climate and soil database is also maintained in the ISCW. This is regarded as a national asset. Although the climate database has been transformed to an electronic version, much work is still needed on making the Institute's soils surveys available in electronic format.

Information is supported by continued research. Research is very expensive and the results cannot be seen immediately. The Government is regarded as the main funder of

research. During the last few years the emphasis has shifted away from in-depth research, due to the Government's focus on land reform. The agricultural sector is a dynamic sector and continued funding is required for research and the gathering of more detailed natural resource information. Priority areas for research include more detailed soil mapping that will allow for improved land use planning on farm level, additional climate stations and the manipulation of climate data, as well as advanced research on grazing, land degradation, erosion and factors impacting on land capability.

The various role-players in the agricultural sector continuously conduct land evaluation surveys. To date, no regulation is in place to ensure that the data gathered by each land evaluation is stored in one central database, which would limit duplication and save costs. Yet many people involved in this field still feel that data gathered during a survey should not be made public. This has led to data repeatedly being captured or, ultimately, lost.

The objective of the AGIS web is to ensure that information on natural resources is made available to the farming community and the general public for improved management of resources. Currently the DoA, with the support of ISCW, sponsors the development of the AGIS web. The AGIS management feels that data or information is of no value if it is not used. AGIS has also created the opportunity for the improvement of the soil and climate databases and the continued gathering of more detailed natural resource management (Lindemann in a personal interview, March 2008, Pretoria).

Accurate and detailed information also allows for improved statistical analysis in determining the status and impact of the agricultural sector in South Africa. This applies to natural resources, too. Improved decision-making and policy development can benefit from the advantages of information and knowledge management and result in an effective, sustainable, economic, and prosperous agricultural sector.

Botha and Ikerd (1995:17-18) describe sustainable agriculture as a direction and not a destination. The agricultural sector is very aware of the direction; all that is needed is the support of all role-players in the industry, especially Government.

9.10 CONCLUSION

This study examined and reviewed the decision support systems for protection and management of agricultural land in South Africa, with particular reference to Gauteng.

Agriculture is an economic asset, as it assists in the creation of jobs and alleviation of poverty, and is also crucial in feeding a nation, which is essential for the well being and growth of its citizens. South Africa's climate and topography enables the country to produce almost any kind of crop under applicable conditions, management and cultivation practices. At the same time, the variance in the climate and types of soil places heavy demands on the producers, bearing in mind that the country has a limited amount of high potential agricultural land for sustained crop production. Moreover, being a developing country with a large urbanized population means there is tremendous pressure for current and future developments and the expansion of industries to facilitate the current growth. This results in high demand for available land.

In managing the pressures on land, it is important to conduct land use in a way that optimally adheres to the potential of the land. Consequently, it is imperative that all available land with the potential for producing sustained high crop yields, thus land with a high agricultural production potential, as well as land with a potential carrying capacity for livestock, be effectively utilized and protected for agricultural use. This will result in the continuous production of food, thereby addressing food security, and will further contribute to job creation, generation of income, and the upliftment of the community in general. Agricultural production or the use of land for any other purpose should nevertheless not be conducted in a way that could result in the degradation or loss of the available natural resources.

Gauteng, the smallest but most densely populated province of the Republic of South Africa, plays a major role in addressing the demands on land. As a result of its locality, the presence of mines and industries, as well as its well-developed infrastructure, the province has a large urbanized component. This places tremendous pressure on the remaining available land, for possible agricultural production, to be used for housing or other developmental uses.

The findings highlight the importance of the protection of agricultural land, especially high potential agricultural land for agricultural production, and the processes involved in the application thereof. This, in turn, could further result in a more cost-effective and time-effective procedure, as well as improved communication and relations between all parties involved. Although various data sets and decision support tools are available, as guidelines for recommendations on the protection of agricultural land, their scale is sometimes very coarse and differs from the situation on the ground. Interested and involved role-players are frequently unaware of the products or decision support tools, currently available to guide and assist in the process, as well as the criteria used. It was found that greater cohesion, co-operation, and support are needed between the various role-players and stakeholders at all levels, for sustained economic and agricultural land use and management. The study also pointed out and emphasised areas for further research.

REFERENCES

Acocks, JPH. 1988. *Veld types of South Africa*. Memoirs of the Botanical Survey of South Africa No 57. Pretoria: Department of Agriculture and Water Supply.

Agricultural Geo-referenced Information System (AGIS). 2007. *High potential agricultural land*. www.agis.agric.za

Agriculture and Land Affairs. 2005. www.gov.za

Aihoon, K, Cherry, M & Kassier, E. 2007a. *Definition of farm and farmer terminology - a study report*. Pretoria: Agri-Africa Consultants.

Aihoon, K, Cherry, M & Kassier, E. 2007b. *Determinants of the viable farm unit, January 2007*. Pretoria: Agri-Africa Consultants.

ARC - ISCW. 2001. *Gauteng Natural Resources Audit: Final Report, 2001*. Pretoria: Department of Agriculture and Gauteng Department of Agriculture, Conservation and Environment.

ARC - ISCW. 2004. *Overview of the status of the agricultural natural resources of South Africa*. ARC-ISCW Report No GW/A/2004/13. Pretoria: ARC-ISCW.

Aventis CropScience. 2000. *Rio Declaration on Environment and Development*. Berlin: Technology Strategy and Resources. PowerPoint presentation.

Backeberg, G. 2003. *Water usage and irrigation policy. The challenge of change: Agriculture, land and the South African economy*. Durban: University of Natal Press.

Benites, JR, Shaxson, F and Vieira, M. 1996. Land condition change indicators for sustainable land resource management. In: *Land quality indicators and their use in sustainable agriculture and rural development*. Rome: Food and Agricultural Organization (FAO).

Bie, SW, Baldascini, A and Tscirley, JB. 1996. *The context of indicators in FAO land quality indicators and their use in sustainable agriculture and rural development*. Rome: Food and Agricultural Organization (FAO).

Bosman, F. 2007. *Land reform: a contextual analysis*. Cape Town: The FW de Klerk Foundation.

Botha, N & Ikerd, J. 1995. What is sustainable agriculture? *Farmers Weekly*, March 24:17-18.

Budlender, S. 2008. *The advisability of seeking to intervene in the Constitutional Court matter of Wary Holdings (Pty) Ltd v Stalwo*, 19 February 2008. Pretoria: Unpublished document .

Camp, KGT. 1997. *The Bio-resources Groups of KwaZulu Natal*. Pietermaritzburg: KwaZulu Natal Department of Agriculture.

Collett, A. 2008. *Draft project report on the decision support system for application of Act 70 of 1970*. Pretoria: Department of Agriculture.

Compaan, PC, Pfab, MF, Coetzer, W, Forsyth, M, Whittington-Jones, C and Peinke, D. 2005. *GIS procedures employed in designing the Gauteng Conservation Plan Version 2*. Proceedings of the AfricaGIS 2005 Conference, 2005. Tshwane. Pretoria: AfricaGIS 2005

Constitutional Court of South Africa. 2008. *Wary Holdings (Pty) Ltd v Stalwo (Pty) Ltd and Another*. 25 July 2008. Pretoria: Constitutional Court.

Crosson, P. 1983. A schematic view of resources, technology and environment in agricultural development. *Agriculture, Ecosystems and Environment*, 9:339-357.

De Bruin, P. 2008. SA het g'n landbougrond oor nie. *Beeld*, 6 Februarie 2008:7.

Del Mar Lopez, T, Mitchell, T and Thomlinson, JR. 2001. Urban expansion and the loss of prime agricultural land in Puerto Rico. *Ambio*, 30(1):49-54.

Department of Agriculture (DoA). 1994. *Agriculture in South Africa, 1994*. Johannesburg: Chris van Rensburg.

Department of Agriculture. 1995. *White Paper on Agriculture*. Pretoria: Department of Agriculture.

Department of Agriculture. 1998. *Agricultural policy in South Africa: A discussion document*. Pretoria: Department of Agriculture.

Department of Agriculture. 2000. *Implementation Framework for the Land Care Programme*. Revised version December 2000. Pretoria: Department of Agriculture.

Department of Agriculture. 2001. *Strategic Plan for South African Agriculture*. Pretoria: Department of Agriculture.

Department of Agriculture. 2002. *Strategic Plan for the Department of Agriculture, 2002 – 2005*. Pretoria: Department of Agriculture.

Department of Agriculture. 2004a. *Strategic Plan for the Department of Agriculture, 2004*. Pretoria: Department of Agriculture.

Department of Agriculture. 2004b. *National livestock statistics, May 2004*. Pretoria. www.nda.agric.za.

Department of Agriculture. 2004c. *Department of Agriculture Annual Report, 2003/4*. Pretoria: Department of Agriculture.

Department of Agriculture. 2005a. *Strategic Plan of the Department of Agriculture, 2005*. Pretoria: Department of Agriculture.

Department of Agriculture. 2005b. *Crop Estimates, May 2005*. Pretoria. www.nda.agric.za.

Department of Agriculture. 2006a. *Strategic Plan for the Department of Agriculture, 2006*. Pretoria: Department of Agriculture.

Department of Agriculture. 2006b. *Abstract of agricultural statistics, 2006*. Pretoria: Department of Agriculture.

Department of Agriculture. 2006c. *Department of Agriculture Annual Report, 2005/6*. Pretoria: Department of Agriculture.

Department of Agriculture. 2006d. *National policy on the protection of high potential and unique agricultural land*. Pretoria: Department of Agriculture.

Department of Agriculture. 2006e. *Draft Sustainable Utilization and Protection of Agricultural Resources Bill, 2006*. Pretoria: Department of Agriculture.

Department of Agriculture. 2006f. *Incentive-based Framework to Promote Sustainable Utilization of Natural Resources in Agriculture: a discussion document*. Pretoria: Department of Agriculture.

Department of Agriculture. 2006g. Media statement by the Minister for Agriculture and Land Affairs, Ms. Lulu Xingwana at the Kopanong Conference Centre, Benoni. Pretoria: Department of Agriculture.

Department of Agriculture. 2007. *Vuna 2007, Agriculture in South Africa*. Pretoria: Succeed/Essential Publication.

Department of Agriculture. 2008a. Speech by the Minister for Agriculture and Land Affairs, Hon. Lulu Xingwana at the launch of the land and agrarian reform project (LARP) in the province of the Free State, 23 February 2008. Pretoria: Department of Agriculture.

Department of Agriculture. 2008b. Speech by the Minister for Agriculture and Land Affairs, Hon. Lulu Xingwana at the launch of the settlement and implementation support (SIS) strategy for land and agrarian reform in South Africa, 18 February 2008. Pretoria: Department of Agriculture.

Department of Agriculture. 2008c. *The Land and Agrarian Reform Project*. The concept document. Pretoria: Department of Agriculture.

Department of Agriculture. Undated. *Policy on agriculture in sustainable development: a discussion document*. 8th draft. Pretoria: Department of Agriculture.

Department of Environmental Affairs and Tourism. 1997. *White Paper on Environmental Management Policy*. Pretoria.

www.environment.gov.za/polleg/whitepapers.

Department of Environmental Affairs and Tourism. 2006a. *South Africa Environment Outlook. A report on the state of the environment*. Pretoria: Department of Environmental Affairs and Tourism.

Department of Environmental Affairs and Tourism. 2006b. *South Africa Environment Outlook. Executive summary and key findings*. Pretoria: Department of Environmental Affairs and Tourism.

Department of Environmental Affairs and Tourism. 2006c. *South Africa's national strategy for sustainable development: an integrated strategy for review*. Pretoria: Department of Environmental Affairs and Tourism.

Department of Foreign Affairs. 2004. *NEPAD in brief*. Pretoria.
www.dfa.gov.za/au.nepad/nepadbrief.

Department of Land Affairs. 2001. *White Paper on Spatial Planning and Land Use Management: Wise Land Use*. Pretoria.
www.info.gov.za/whitepapers/2001/spatialplanning.htm

Department of Land Affairs. 2006a. *Progress report of the panel of experts on the development of policy on the regulation of ownership of land in South Africa by foreigners (non-citizens)*. Pretoria.
www.pwv.gov.za/publications/news/press_releases/docz/2006

Department of Land Affairs. 2006b. *Strategic Plan, 2006 – 2009*. Pretoria: Department of Land Affairs.

Department of Land Affairs. Undated. *White Paper on Land Policy*. Pretoria: Department of Land Affairs.
http://land.pwv.gov.za/legislation_policies/white_papers.htm.

Di Gregorio, A. 2005. *Land Cover Classification System: Classification concepts and user manual*. Software Version 2. Rome: Food and Agricultural Organization (FAO).

Farmers Weekly. 1998. Portfolio Committee agrees to repeal Act: News Update. June 19, 1998:38.

Financial Mail. 1995. Furrowed brows. April 7, 1998:98.

Food and Agricultural Organization of the United Nations. 1976. *A framework for land evaluation*. FAO Soils Bulletin 32. Rome: Food and Agricultural Organization (FAO). www.fao.org/docrep.

Food and Agricultural Organization of the United Nations. 1993. *Guidelines for land-use planning*. FAO Development Series I. Rome: Food and Agricultural Organization (FAO). www.fao.org/docrep.

Food and Agricultural Organization of the United Nations. 1995. *Planning for sustainable use of land resources: towards a new approach*. FAO Land and Water Bulletin 2. Rome: Food and Agricultural Organization (FAO). www.fao.org/docrep.

Food and Agricultural Organization of the United Nations. 1996. *Agro-ecological Zoning Guidelines*. FAO Soil Bulletin 73. Rome: Food and Agricultural Organization (FAO). www.fao.org/docrep.

Food and Agricultural Organization of the United Nations. 1997. *Guidelines for the integration of sustainable agriculture and rural development into agricultural policies*. FAO Agricultural policy and economic development series. Rome: Food and Agricultural Organization (FAO). www.fao.org/docrep.

Food and Agricultural Organization of the United Nations. 1999. *The future of our land: facing the challenge*. United Nations Environment Programme. Rome: Food and Agricultural Organization (FAO). www.fao.org/docrep.

Food and Agricultural Organization of the United Nations. Undated. *World Agriculture: towards 2015/2030. Summary Report*. Economic and Social Department. Rome: Food and Agricultural Organization (FAO). www.fao.org/docrep.

Fraser, G, Nomakhaya, M and van Averbeke, W. 2003. *Food security in South Africa: the challenge of change: Agriculture, land and the South African economy*. Pietermaritzburg: University of Natal Press.

Gauteng Department of Agriculture, Conservation and Environment (GDACE). 2002. *Gauteng Agricultural Potential Atlas, 2002. Report by Strategic Environmental Focus*. Johannesburg: Gauteng Provincial Government.

Gauteng Department of Agriculture, Conservation and Environment (GDACE). 2004a. *Gauteng State of the Environment Report, 2004*. Johannesburg: Gauteng Provincial Government.

Gauteng Department of Agriculture, Conservation and Environment (GDACE). 2004b. *Department of Agriculture, Conservation and Environment Strategic Plan, 2004 – 2009*. Johannesburg. www.gdace.gpg.gov.za.

Gauteng Department of Agriculture, Conservation and Environment (GDACE). 2004c. *Address by MEC Khabisi Mosunkutu on the tabling of Agriculture, Conservation and Environment Department's budget vote in the Gauteng Legislature*. Johannesburg. www.gpg.gov.za/docs/sp/2004/sp0629.

Gauteng Department of Agriculture, Conservation and Environment (GDACE). 2005a. Zonation of high potential agricultural land Phase 1A Version 1.0: Data and Information Working document. Pretoria: EnviroGIS.

Gauteng Department of Agriculture, Conservation and Environment (GDACE). 2005b. *Zonation of High Potential Agricultural Land, Phase 1B, Version 1.0: Land Cover Classification*. Pretoria: EnviroGIS.

Gauteng Department of Agriculture, Conservation and Environment. 2005c. 2005 *Budget vote speech of the Department of Agriculture, Conservation and Environment*. Johannesburg. www.gdace.gpg.gov.za.

Gauteng Department of Agriculture, Conservation and Environment (GDACE). 2006a. *Gauteng Agricultural Development Strategy (GADS)*. Johannesburg. www.gdace.gpg.gov.za

Gauteng Department of Agriculture, Conservation and Environment (GDACE). 2006b. *Agricultural Zonation Project Phase 2B: Land Capability Report*. Pretoria: EnviroGIS.

Gauteng Department of Agriculture, Conservation and Environment (GDACE). 2006c. *Agricultural Zonation Project Phase 2A: Preferred land use*. Pretoria: EnviroGIS.

Gauteng Department of Agriculture, Conservation and Environment (GDACE). 2006d. *Protection of agricultural land: revised policy*. Johannesburg: GDACE.

Gauteng Department of Agriculture, Conservation, Environment and Land Affairs (GDACE). 2002. *Audit of smallholdings in the Gauteng Area*. Johannesburg: Interactive Integrated Planning.

Gauteng Department of Local Government. 2006. *Report on the Integrated Development Planning Engagements, 2–5 May 2006*. Johannesburg: Gauteng Department of Local Government.

Gauteng Provincial Government. 1996. *Regulations relating to land development objectives in terms of the Development Facilitation Act, 67 of 1995*. Johannesburg: Gauteng Provincial Legislature.

Gauteng Provincial Government. 2002. *Gauteng Environmental Implementation Plan, 2001 – 2004*. Notice 488 of 2002. Johannesburg: Gauteng Provincial Legislature.

Gauteng Provincial Government. 2003. *Gauteng Planning and Development Act, 3 of 2003*. Johannesburg: Gauteng Provincial Legislature.

Gauteng Provincial Government. 2004a. *Land use task team: cost-benefit analysis study – low-income housing, 2004*. PowerPoint presentation. Johannesburg: Gauteng Provincial Legislature.

Gauteng Provincial Government. 2004b. *Five-year strategic programme, 2004 – 2009*. Johannesburg. www.gdace.gpg.gov.za

Gauteng Provincial Government. 2005. *A growth and development strategy for the Gauteng Province*. Johannesburg: Gauteng Provincial Legislature.

Gauteng Provincial Government. 2006a. *Gauteng Strategy for Sustainable Development: Discussion Themes Document*. Johannesburg: Mazizi Msutu & Associates.

Gauteng Provincial Government. 2006b. *Gauteng Strategy for Sustainable Development*. Draft for review. Johannesburg. www.gdace.gpg.gov.za

Gauteng Provincial Government. 2006c. *Gauteng Strategy for Sustainable Development: State of Play Report*. Johannesburg. www.gdace.gpg.gov.za

Heimlich, R and Anderson, W. 2001. Development at and beyond the urban fringe: impacts on agriculture. *Agricultural Outlook*, August, 2001:15-18.

Hoffman, MT and Ashwell, A. 2001. *Nature divided: land degradation in South Africa*. Cape Town: University of Cape Town Press.

Holtzhausen, L. 2005. Project shows what a lot we got – but cautions care on how we use it. *The Water Wheel*, November/December 2005:14-17.

Johannesburg Plan of Implementation. 2003. *Response Strategy 2003*. World Summit on Sustainable Development. Johannesburg: WSSD.

Kilic, S, Evrendilek, F, Senol, S and Celik, I. 2005. Developing a suitability index for land uses and agricultural land covers: a case study in Turkey. *Environmental Monitoring and Assessment*, no 102, 2005:323- 335.

Laker, MC. 1995a. *Comments on a law on the sub-division of agricultural land, September 1995*. Invited written and oral submission to Workshop of the Protocol Committee on Land at Parliament, Cape Town.

Laker, MC. 1995b. *South Africa's soil resources and sustainable development*. Pretoria. www.environment.gov.za/nssd_2005.

Laker, MC. 2004a. *Development of a general strategy for optimising the efficient use of primary water resources for effective alleviation of rural poverty*. WRC Report No KV 149/04. Pretoria: Water Research Commission.

Laker, MC. 2004b. Advances in soil erosion, soil conservation, land suitability evaluation and land use planning research in South Africa, 1978 – 2003. *South African Journal of Plant Soil*, 21(5):345-368.

Laker, MC. 2008. Personal communication, April 2008, Pretoria, on the protection of agricultural land.

Laker, MC. Undated. *Proposed Lakes Eco and Golf Reserve: Land Suitability Evaluation for Agriculture*. Pretoria. www.gardenroute.com/waleaf/documents.

Lindemann, HL. 2008. Personal communication, April 2008, Pretoria, on the Agricultural Geo-referenced Information System (AGIS).

Low, AB and Rebelo, AG. 1996. *Vegetation of South Africa, Lesotho and Swaziland*. Pretoria: Department of Environmental Affairs and Tourism.

Marketing Surveys and Statistical Analysis. 2003. *AgrilInsight: Emerging farmer survey, 2003*. Pretoria: MSSA & SDC.

Meyer, NG. 1998. The agricultural potential of South Africa: a provincial perspective on food security and land reform. Unpublished PhD thesis. Pretoria: University of Pretoria.

Miller, FP. 1979. Defining, delineating and designating uses for prime and unique agricultural land. *Planning the uses and management of land*. 1997:291-318.

Mucina, L & Rutherford, MC (eds). 2006. *The vegetation of South Africa, Lesotho and Swaziland*. *Strelitzia* 19. Pretoria: South African National Biodiversity Institute.

New South Wales Department of Primary Industries. 2004. *Policy on the protection of agricultural land*. Australia.

www.ricecrc.org/reader/landuseplanning/policy-ag-land.htm

Nickerson, C. 2001. Smart growth: implications for agriculture in urban fringe areas. *Agricultural Outlook*, April, 2001:24-27.

Omosa, M. 1998. *Population growth, land use and food self-sufficiency in Kenya: a comparative analysis of small and medium to large land holdings in Kisii and Nyamira districts*. Summary Report Number 31.

www.uaps.org/recherche/population.htm.

Opperman, D. 2001. Landbou en sy biofisiese omgewing: 'n GIS-gebaseerde analise van die volhoubaarheid van landboupraktyke in die Piketbergse landdrostdistrik. Ongepubliseerde MBA-tesis. Stellenbosch: Universiteit van Stellenbosch.

Paterson, DG & van der Walt, M. 2003. *Soil patterns of South Africa from the Land Type Survey*. Soil Science Society of South Africa, Golden Jubilee Congress, 20 – 23 January 2003. PowerPoint presentation. Stellenbosch: Soil Science Society.

Portfolio Committee on Agriculture, Water Affairs and Forestry. 1998. Sub-division of Agricultural Land Repeal Act [B101-97]: Introduction by Department of Agriculture, 11 February 1998. Cape Town: Parliamentary Monitoring Group.

www.pmg.org.za.

Pretorius, D. March 2008. Personal communication, March 2008, Pretoria, on the development of a new grazing capacity map for South Africa.

Sanders, R. 2006. *Protection of agricultural land from urban development*. Queensland, Australia: Integrated Resource Management.

Schoeman, JL. 2004. *Criteria for high potential agricultural land in South Africa: for use within a revised spatial framework*. Pretoria: ARC-ISCW.

Schoeman, JL and MacVicar, CN. 1978. A method for evaluating and presenting the agricultural potential of land at regional scales. *Agrochemophysica*, 10:25-37.

Schoeman, JL and Scotney, DM. 1987. Agricultural potential as determined by soil, terrain and climate. *South African Journal of Science*, 83:260-268.

Schoeman, JL, Strydom, HL and Collett, A. 2008. *Zoning of agricultural resources*. ARC - ISCW Report Number GW/A/2008/28. Pretoria: ARC – ISCW.

Schoeman, JL, van der Walt, M, Monnik, KA, Thackrah, A, Malherbe, J and le Roux, RE. 2002. *Development and application of a Land Capability Classification for South Africa*. Pretoria: ARC-ISCW.

Scholtz, A. February 2007. Personal communication, February 2007, Pretoria, on the requirements of Act 70 of 1970.

Schulze, RE. 1997. *South African Atlas of Agrohydrology and Climatology*. Report TT82/96. Pretoria: Water Research Commission.

Scotney, DM, Ellis, F, Nott, RW, Taylor, KP, van Niekerk, BJ, Verster, E and Wood, PC. 1991. *A system of soil and land capability classification for agriculture in the SATBVC states*. Pretoria: Department of Agriculture Development.

Scotney, DM, Volschenk, JE and van Heerden, PS. 1990. *The potential and utilization of the natural agricultural resources of South Africa*. Pretoria: Department of Agricultural Development.

Smith, HJ. 1998. Definition and demarcation of high potential land for rain fed annual crop production. Unpublished MInst Agrar dissertation. Pretoria: University of Pretoria.

Sombroek, WG. 1996. Land resources evaluation and the role of land-related indicators. In: *Land quality indicators and their use in sustainable agriculture and rural development*. Rome: Food and Agricultural Organization (FAO).

South Africa Bureau of Standards. Undated. SANS 1877, *Land cover classification for South Africa*. Pretoria: SABS.

South Africa (Union). 1913. *Native Land Act, 27 of 1913*. Pretoria: Government Printer.

South Africa (Union). 1936. *Native Trust and Land Act, 18 of 1936*. Pretoria: Government Printer.

South Africa (Union). 1950. *Group Areas Act, 41 of 1950*. Pretoria: Government Printer.

South Africa (Republic). 1970. *Sub-division of Agricultural Land Act, 70 of 1970*. Pretoria: Government Printer.

South Africa (Republic). 1983. *Conservation of Agricultural Resources Act, 43 of 1983*. Pretoria: Government Printer.

South Africa (Republic). 1984. *Conservation of Agricultural Resources Act, 43 of 1983*. Regulation GN R1048. (*Government Gazette* 9238). Pretoria: Government Printer.

South Africa (Republic). 1989. *Environment Conservation Act, 73 of 1989*. Pretoria: Government Printer.

South Africa (Republic). 1993. *Provision of Land and Assistance Act, 126 of 1993*. Pretoria: Government Printer.

South Africa (Republic). 1994a. *White Paper on the Reconstruction and Development Programme for South Africa*. Pretoria: Government Printer.
<http://www.africa.upenn.edu/GovernPolitical/RDPWh.html>.

South Africa (Republic). 1994b. *Restitution of Land Rights Act, 22 of 1994*. Pretoria: Government Printer.

South Africa (Republic). 1995a. *Development Facilitation Act, 67 of 1995*. Pretoria: Government Printer.

South Africa (Republic). 1995b. *Proclamation R100, 1995*. (*Government Gazette* No 5597). Pretoria: Government Printer

South Africa (Republic). 1995c. *Land Administration Act, 2 of 1995*. Pretoria: Government Printer.

South Africa (Republic). 1996a. *Constitution of the Republic of South Africa Act, 108 of 1996*. Pretoria: Government Printer.

South Africa (Republic). 1996b. *Growth, employment and redistribution: a macroeconomic strategy*. 14 June 1996. Pretoria: Government Printer.

www.polity.org.za/html/govdocs/policy/growth.html.

South Africa (Republic). 1996c. *Labour Tenants Act, 3 of 1996*. Pretoria: Government Printer.

South Africa (Republic). 1996d. *Prevention of Illegal Eviction from Unlawful Occupation of Land Act, 3 of 1996*. Pretoria: Government Printer.

South Africa (Republic). 1997a. *Subdivision of Agricultural Land Act Repeal Bill, 1997*. Pretoria: Government Printer.

South Africa (Republic). 1997b. *Extension of Tenure Act, 62 of 1997*. Pretoria: Government Printer.

South Africa (Republic). 1997c. *National Housing Act, 107 of 1997*. Pretoria: Government Printer.

South Africa (Republic). 1998a. *National Environmental Management Act, 107 of 1998*. Pretoria: Government Printer.

South Africa (Republic). 1998b. *Local Government: Municipal Structures Act, 117 of 1998*. Pretoria: Government Printer.

South Africa (Republic). 1998c. *National Water Act, 36 of 1998*. Pretoria: Government Printer.

South Africa (Republic). 1998d. *Provision of certain land for settlement Act, 126 of 1998*. Pretoria: Government Printer.

South Africa (Republic). 2000a. *Regulations and Rules in terms of the Development Facilitation Act, 67 of 1995*. Pretoria: Government Printer.

South Africa (Republic). 2000b. *Local Government Municipal Systems Act, 32 of 2000*. Pretoria: Government Printer.

South Africa (Republic). 2000c. *National Land Transport Transition Act, 22 of 2000*. Pretoria: Government Printer.

South Africa (Republic). 2001. *Conservation of Agricultural Resources Act, 43 of 1983*. Amended Regulations 15 and 16. (*Government Gazette* No 22166, Vol. 429). Pretoria: Government Printer.

South Africa (Republic). 2003a. *Natural Scientific Professions Act, 27 of 2003*. Pretoria: Government Printer.

South Africa (Republic). 2003b. *Spatial data infrastructure Act, 54 of 2003*. Pretoria: Government Printer.

South Africa (Republic). 2004a. *Land Use Management Bill*. Pretoria: Government Printer.

South Africa (Republic). 2004b. *Communal Land Rights Act, 11 of 2004*. Pretoria: Government Printer.

South Africa (Republic). 2005. *Intergovernmental Relations Framework Act, 13 of 2005*. Pretoria: Government Printer.

South Africa (Republic). 2006a. *Regulation No R385. Environmental Impact Assessment Regulations in terms of section 24 and 24D of the National Environmental Management Act, 1998*. Pretoria: Government Printer.

South Africa (Republic). 2006b. *Regulation No R386. List of activities and competent authorities identified in terms of section 24 and 24D of the National Environmental Management Act, 1998*. Pretoria: Government Printer.

South Africa (Republic). 2006c. *Regulation No R387. List of activities and competent authorities identified in terms of section 24 and 24D of the National Environmental Management Act, 1998*. Pretoria: Government Printer.

South Africa (Republic). 2008. *Land Use Management Bill*. Pretoria: Government Printer.

Statistics South Africa and Department of Agriculture. 2005. *Census of commercial agriculture, 2002*. Report No 11-02-01. Pretoria: Government Printer.

Statistics South Africa. 2000. *Stats in brief, 2000*. Pretoria: Government Printer.

Statistics South Africa. 2003. *Census 2001: Census in brief*. Pretoria: Government Printer.

Statistics South Africa. 2005. *Stats in brief, 2005*. Pretoria: Government Printer.

Steenkamp, L. 2008. Lulu laat grofgeskut los op wit boere. *Rapport*, 25 Mei 2008:10.

Supreme Court of Appeal. 2007. *Judgement in the matter of Stalwo v Wary Holdings, [2007] SCA 133 (RSA)*. Pretoria: Supreme Court of Appeal.

Theunissen, P. 2005. How much land could pay a civil servant? *Farmers Weekly*, 22 April 2005:28-29.

Van der Merwe, AJ. 1995. *The basis for sustainable growth and development in South Africa*. Proceedings of the ARC-ISCW Wise Land Use Symposium. Pretoria: ARC-ISCW.

Van Eeden, J. 2005. Vat grondhervorming stede toe! *Rapport*, 5 Junie 2005:17.

Van Rooyen, CJ, de Waal, D, Gouws, A, van Zeyl, P, Rust, L, Kriek, N and McCrystal, I. 1995. *Towards an urban and rural development strategy for the Gauteng province, with emphasis on agriculture and conservation: an inventory*. Pretoria: Gauteng Department of Agriculture, Conservation and Environment.

Vink, N. 2003. *The influence of policy on the roles of agriculture in South Africa*. Forum 2003 Papers. Cape Town: Development Policy Research Unit, School of Economics, University of Cape Town.

Vink, N and Kirsten, J. 2003. *Agriculture in the national economy. The challenge of change: Agriculture, land and the South African economy*. Pietermaritzburg: University of Natal Press.

Wildlife and Environmental Society of South Africa (WESSA). 2001. *WESSA Conservation Policy*. July 2001. www.wildlifesociety.org.za