



Lesotho

Land Cover Atlas

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

Rome, 2017

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Foreword

Lesotho is a small land-locked mountainous country completely surrounded by the Republic of South Africa. It has a total area of 30 350 km², a north-south extent of about 230 km and a maximum width of about 210 km. Altitude varies from 1 500 m to 3 482 m. Its population is about 2.1 million inhabitants (2015/FAOSTAT Projection) with 70 percent of rural population and annual growth rate of 1 percent.

The climate is temperate with cool to cold winters and hot, wet summers. Mean annual rainfall is 788 mm and varies from less than 300 mm in the western lowlands to 1600 mm in the north-eastern highlands. There is substantial seasonal distribution of precipitation and as much as 85 percent of the total can be received during October to April. January is the hottest month with maximum daytime temperatures exceeding 30°C in the lowlands. Temperatures on the mountains can fall to -20°C in winter.

Distribution of water and reliability of rainfall are serious constraints on agricultural production. Taken as a whole, rainfall in Lesotho is at a level that is adequate to sustain healthy agricultural activity. However, the erratic nature of its distribution is a major constraint for food production. Extreme weather conditions occur periodically, heavy frosts are frequent and heavy unseasonable rains also occur from time to time. Although Lesotho's main natural resource is water, drought chronically affects the country forcing the Government to appeal for assistance from the international community, thus illustrating the vulnerability of the agricultural sector. Lesotho continues to face one of the strongest drought crisis due to the El Nino weather phenomenon of 2015-2016 where its significant effects on the population are set to continue and worsen until at least April 2017, leading to widespread crop failure and causing food insecurity and malnutrition.

One of the characteristics of Lesotho's environment is its great variability of landscapes. Lesotho is the only country in the world situated completely over 1000 m of elevation which varies from 1000 m to about 3400 m.

Lesotho cultivable land is largely confined to the lowlands and foothills on the Western border and the Senqu River valley in the south. The country has extensive areas of shrub lands, in particular rangelands, and a modest area of plantation forests (based on Eucalyptus and Pinus), while only about 1 percent of the total land area is forest and woodland.

Smallholder farmers whose farms are generally less than 1 ha in size dominate the agricultural production. Maize is by far the most popular crop accounting for some 60 percent of the cropped area, sorghum between 10 and 20 percent, wheat for about 10 percent and beans for a further 6 percent.

Lesotho is divided into four geographical regions:

1. The mountain region covers 18.037 km² (59 percent of the total area of the country) and is characterized by the bare rock outcrops of the Maluti range and deep river valleys, with elevations of 2000 m and above.
2. The foothills region covers 4529 km² (15 percent) and lies at elevations from 1800 m to 2000 m between the lowlands and the Maluti mountains.

3. The lowland region covers 5094 km² (17 percent) and is situated along the western border and consists of a narrow belt of land with elevation of 1800 m or less and width between 10 and 65 km.
4. The Senqu Valley covers 2690 km² (9 percent) and forms a narrow strip of land that flanks the banks of the Senqu (Orange) River and penetrates deep into the Maluti Mountains; elevations vary from mountains to lowlands.

Land degradation, in various forms, is a dominant landscape feature in the country. It is mainly caused by overgrazing, deforestation and other poor land use practices, and limited access to agricultural technologies and quality inputs. Management and inherent fertility soils problems influence the productivity of both agricultural land and rangelands. FAO studies predicted a decline of land under cultivation due partly to land going out of production from erosion and partly to settlement expansion around main towns.

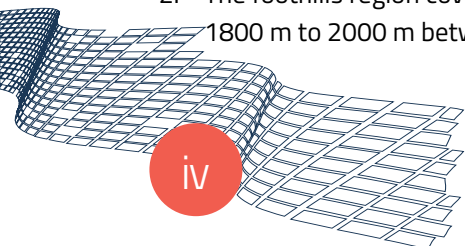
Taking in consideration the unstable climate conditions and the landscape of Lesotho, the development of detailed land cover database is one of the most useful and important sources of information to support the majority of decision makers and technicians involved in environmental and rural development in the country.

The Land cover database generated from the project provides accurate information on both physical and socio-economic resources. For physical resources, it provided timely and precise information on the actual state of the agricultural, forestry/ rangelands, natural vegetation cover, the level of degradation useful for the evaluation of the impact on rural development and agricultural production. For socio-economic resources, the land cover database and statistics can clearly show the population pressure on the land and inform on main agro-information systems and on infrastructure and habitat development. Land cover information represents the human action on land and its continuous change, therefore its assessment has to be monitored regularly.

Building commensurate and a detailed database of the status of the countries land cover forms a critical baseline upon which to monitor and evaluate land degradation and to evaluate the effectiveness of measures being put in place to reverse or slow the rate of natural resources depletion

Lesotho institutions need to assess accurately and rapidly the status and trends of various components of the country renewable resources enabling the government to identify areas where ameliorative actions should be taken and identify existing development opportunities especially in the context of depletion of natural resources. Furthermore, sound management of renewable natural resources requires reliable and updated maps and statistics. In this situation the main demand is improving the mapping and monitoring of agricultural, land and water resources.

Finally, the implementation of on-site training courses represents a significant contribution of the project to improve the local capacity for producing, undertaking, maintaining, archiving and disseminating land cover information to support informed decision-making in the country.



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The contribution of all the above, as well as the support from the partners and donors involved in this activity along with input from many other unnamed people has been fundamental for the success of the project.

Acronyms

BOS	Bureau of Statistics
CEDAMA	Committee for Environment Data Management
EC	European Commission
ECHO	European Commission Humanitarian Aid Department
FAO	Food and Agriculture Organization of the United Nations
GDP	Gross Domestic Product
GIS	Geographic Information System
GLCN	Global Land Cover Network
GLS	Global Land Survey
LCCS	Land Cover Classification System
LCDB	Land Cover Database
LRSP	Lesotho Resilience Strategy Programme
MADCAT	Mapping Device Change Analysis Tools
MAFS	Ministry of Agriculture and Food Security
MFRSC	Ministry of Forestry Range and Soil Conservation
MLGCA	Ministry of Local Government and Chieftainship Affairs
NDVI	Normalized Difference Vegetation Index
RS	Remote sensing
SDC	Swiss Development Cooperation
SPOT	Satellite Pour l’Observation de la Terre
SWCD	Soil and Water Conservation Department;
UN	United Nations
USGS	United States Geological Survey
UTM	Universal Transverse Mercator
GB	Gigabyte

Abstract

The Lesotho Land Cover Database (LCDB) and ATLAS have been prepared in the framework of the FAO Emergency Program (OSRO/LES/401/EC): “Building Lesotho resilience through the upscale of Climate Smart Agriculture and functional DRR Land Resources Information”. The LCDB was developed in close collaboration with Lesotho Governmental Institutions including: Bureau of the Statistics (BOS), Ministry of Agriculture and Food Security (MAFS), Ministry of Forestry, Range and Soil Conservation (MFRSC). The Lesotho Government supported the development of the Land Cover database providing valuable analogic and digital information. The very high resolution true color Ortho-photos of 2014 and 2004 that were provided by the Bureau of the Statistics (BOS) played a decisive role on the development of the database ensuring a very high and detailed quality and accuracy of the product. Furthermore, the Lesotho Government through, the Bureau of the Statistics and the Ministry of Agriculture and Food Security, supported the field survey activities, development of the land cover classification legend and validation of the LCDB with skilled experts that provided important inputs for a reliable and accurate land cover database.

The Land Cover Atlas of the Lesotho provides information on the land cover distribution by Administrative boundaries and River catchment areas. The administrative unit layer as well as the water basin layer and a number of ancillary datasets are provided by the Ministry of Forestry, Range and Soil Conservation (MFRSC), Ministry of Local Government and Chieftainship Affairs (MLGCA), Ministry of Agriculture and Food Security (MAFS), Ministry of Tourism, Environment and Culture (MTEC), Ministry of Water Affairs (MWA) and Lesotho Land Administration Authority (LAA).

The main data sources include: Multispectral high resolution RapidEye imagery of 5 m resolution obtained in 2014; True colour very high resolution Aerial Photographs of 0.5 m resolution acquired in 2014 from BOS and True Colour very high resolution SPOT 5 Imagery of 2.5 m resolution obtained in 2004. In addition, ancillary data obtained from different Ministries and national Institutions are used to generate a very detailed Land Cover database

The final imagery used for the development of the land cover map is a Pan-sharpened multispectral very high resolution dataset generated from the fusion of two image datasets: RapidEye and Aerial Photos. The final pan-sharpened and multispectral image dataset exploit the very high resolution characteristic of the Aerial Photographs and the multispectral characteristic of the RapidEye imagery.

The newly generated image datasets were segmented into homogeneous polygons and interpreted according to the FAO land cover mapping methodology and LCCS Legend for the production of the national harmonized and very detailed land cover database. The national Land Cover Legend was prepared using the FAO (ISO standard) Land Cover Classification System (LCCS): a FAO’s comprehensive, standardized “a priori” classification system, designed to meet specific user requirements and created for mapping exercises, independent of the scale or means used to map. The classification uses a set of independent diagnostic criteria that allows the correlation with existing classifications and legends.

The final land cover database was composed of more than 5 million land cover units (polygons), classified into 29 land cover classes. The LC legend was prepared in consultation with national experts giving full consideration to user community requirements and priorities. The development of the land cover database is undertaken in two main stages:

- Stage 1 comprise mapping of the main land cover classes of the preliminary LC legend using standard polygon labelling techniques available in the FAO developed MadCat software environment.
- Stage 2 which comprise the mapping of the remaining final LC legend classes as well as the expansion of the generalized LCs mapped in Stage 1 into more detailed LCs using a combination of image processing techniques.

The present atlas is organized into three main sections:

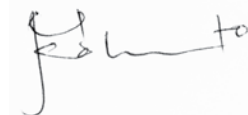
- National LCDB.
- LCDB by Districts.
- LCDB by River Catchments.

Each section provides information on the distribution of aggregated land cover in cartographic form as a map and tabular statistics. These products provide the user with valuable information on the availability and distribution of land resources through a multifaceted approach. The boundaries are in accordance and provided for the Government of Lesotho.

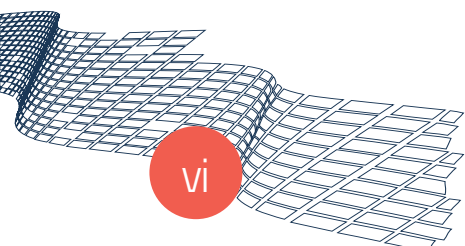


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Background

The 2014 Land Cover Database and Atlas of Lesotho was prepared in the framework of the FAO **Lesotho resilience strategy** that aims to increase the resilience of Lesotho food and nutrition security. Due to the increasing frequency of climate-induced agricultural emergencies, FAO has designed an emergency and resilience programme to promote climate smart agricultural technologies throughout Lesotho.

The Resilience Strategy is focused on three main areas:

- **Emergency and resilience** with focus on vulnerable active farmers in rural areas affected by natural disasters with the provision of training on CSA and agricultural inputs promoting the adoption of new technologies.
- **Climate smart agriculture for all** promoting sustainable agriculture practices and integrated natural resources management among all groups, paying particular attention to mechanized farmers and wider audiences.
- **Social protection through production and nutrition** aiming to optimizing production potential in home gardening, nutrition and food use among poor and ultra-poor families benefiting from Social Protection cash transfers.

In line with the National strategic development plan, the FAO assistance in Lesotho is focusing on the following four strategic priorities:

- **Sustainable food and nutrition security**, with a focus on strengthening national institutions and farmer organizations to effectively respond to the food and nutrition security challenges.
- **Enabling environment for sustainable agri-business development** through strengthened the capacity of key government institutions and other relevant stakeholders to formulate, facilitate and execute agricultural investment plans.
- **Sustainable management of natural resources**, a priority which recognizes land degradation and unsustainable utilization of natural resources as the leading sources of food insecurity and declining agricultural productivity.
- **Strengthen capacity for better agricultural service delivery**, with a view to improve farming communities' access to agricultural advisory services.

The severe impact of El Nino induced drought during the agricultural season 2015-2016 highlighting the prevailing vulnerabilities featuring rural communities in Lesotho. FAO has designed a Drought response plan (2016-2017) built on the Emergency and resilience programme implemented from 2012. The availability of detailed and reliable land cover database is identified as one of the main requirements to support DDR and agriculture monitoring in the country. It has multiple uses and benefits including strengthening the national capacity to undertake consistent land mapping and assessments using standards, cutting edge technology and tools.

FAO implemented the Lesotho land cover database based on integral use of innovative geospatial technology to respond to the needs of the country related to: land cover and its change assessment, land degradation and erosion analysis, agriculture monitoring, area frame and statistics, etc. FAO provided technical assistance as the executing agency in close cooperation with all national parties.

The immediate benefits are the provision of improved, timely and reliable information for decision making in the Ministry of Agriculture and Food Security (MAFS); Land Administration Authority (LAA); Ministry of Forestry and Land Reclamation (MFLR); Bureau of Statistics (BOS) and other national and multilateral organizations engaged in agricultural rehabilitation, poverty alleviation and food security programmes.

The ultimate beneficiaries are the Basotho people in particular the rural people who suffer from significant food insecurity. They will benefit from better targeted programmes and policies to rehabilitate and further develop the agricultural sector, and hence reduce poverty and vulnerability to food insecurity. Through the provision of better information, short-term emergency assistance needs, and also longer-term rehabilitation and development needs, will be fulfilled more efficiently and effectively, ultimately reducing food insecurity, vulnerability and poverty.

Executive summary

Severe land degradation, including excessive soil erosion caused by water run-off, inappropriate agronomic practices and overgrazing is one of the main contributors to declining food security in Lesotho. This situation is exacerbated by the impact of Climate Change and compounded by socioeconomic challenges to sustainable production, nutrition and food security. Up to date information on the status of national natural resources is scarce and fragmented, yet the need for evidence-based decision making is critical in the protection and sustainable exploitation of Lesotho's natural resources.

Since 2012, FAO, the Ministry of Agriculture and Food Security (MAFS) and the Ministry of Forestry, Range and Soil Conservation (MFRSC) are implementing the Resilience strategy, promoting adaptation to climate change, promotion of sustainable farming systems with emphasis on sustainable land management. The FAO Resilience strategy is implemented at national level and involves an increasing range of stakeholders with expansion in schools and inclusion of local leaders.

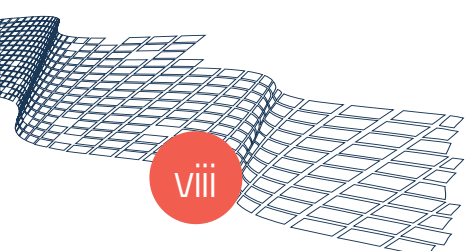
In the framework of the Resilience strategy, FAO has developed the National Land Cover database in partnership with the Government of Lesotho through Committee for Environment Data Management (CEDAMA) chaired by the Bureau of Statistics.

Land cover is an indicator of both physical and socio-economic status of the country. It provides accurate information on the actual state of the agricultural, forestry/ rangelands and natural vegetation cover and on their level of development, level of degradation and on their potentiality for rural development and agricultural production. Besides, land cover information can clearly show the population pressure on the land and inform on main agro-information systems and on infrastructure and habitat development.

This new LC database, created with financial assistance from the European Commission Humanitarian Aid Department (ECHO) and the Swiss Development Cooperation (SDC), is an important element of the resilience strategy for Lesotho. It will serve as baseline for assessment and analysis of natural resources and agriculture status, land and water condition, climate and environmental studies, etc. Furthermore, it will build and support the dialogue and technical information flow among Government institutions, national and local authorities, farmers, stakeholders in Natural Resources management and will provide information for evidence-based decision making.

The development of the Lesotho Land Cover datasets creates the opportunity for a broad range of applications and contribution in the area of:

- Agriculture and Rural Development planning.
- Livelihoods and food security policy analysis and programming.
- Agriculture, land and water monitoring and assessment.
- Assessment of the land cover change and its environmental impact over time.
- Land erosion and degradation assessment and disaster risk analysis.
- Above-ground Biomass assessment and change over time.
- Crop and livestock monitoring and forecasting.
- Agricultural Economics, Market Information and Statistics Services.
- Demographic and nutrition studies.



Introduction

Land cover information is undoubtedly an important input into predictive models related to environmental protection, such as models for climate change, biodiversity, land degradation, and regional and national food security early warning systems.

Traditionally, land cover mapping was mainly undertaken using a wide range of highly variable and incompatible land cover definitions, classification systems and mapping methodologies. The resulting impact of this state of affairs was that the land cover information emanating from such projects, though containing local information on current state of land cover, could not be reliably compared with other land cover definitions and datasets.

In the early 2000s, with extensive consultations with relevant organizations and experts, FAO developed a land cover classification system, the Land Cover Classification System, LCCS, which was designed to overcome these shortcomings,

primarily to be used with remotely sensed imagery, in particular from satellites. At the same time, and to complement this classification system, FAO developed modern state-of-the-art image processing and analysis techniques that would considerably speed up and facilitate the land cover mapping of large regions.

The continued development and upgrading of the LCCS system from the year 2000 to the present time, affected in tandem with improved tools and techniques designed to facilitate image interpretation and land cover mapping, together with increasing availability of higher resolution satellite imagery, has resulted in the development of a methodology that is presently employed at FAO and other organizations on a regular basis for implementation of regional land cover mapping projects. National land cover maps for a number of countries, including those of South Sudan, Libya, Senegal, Fouta Djallon, Uruguay, Pakistan and most recently Afghanistan, have all employed and benefitted from this methodology.

Land Cover Mapping of Lesotho using FAO methodology and tools

2.1 General

The basic elements of the methodology adopted by FAO for undertaking land cover mapping are as follows:

- The utilization of satellite imagery complemented with aerial photographs whenever possible.
- The utilization of FAO's Land Cover Classification System, LCCS, a comprehensive classification system capable of meeting a wide range of needs and conditions and flexible enough to allow mapping at different scales and levels.
- Undertaking interpretation of the satellite imagery and/or aerial photographs, using state-of-the-art image processing and analysis tools and techniques.
- The implementation of field verification programs or so-called "ground-truthing", for validation of image interpretations.
- Compilation of land cover databases (LCDBs) for use by the full spectrum of potential users in commonly used GIS software suites.
- Provision of capacity development through conducting appropriate training courses and workshops with the aim of providing the necessary capabilities for management of the generated land covers databases and their future maintenance and upgrading.
- Increasing access and utilization of generated land cover datasets through generation of internet based portals.

These above basic elements are discussed in more detail below, with special reference to the generation of the Lesotho 2014 Land Cover Database (LCDB), initiated in May 2014 and completed in September 2016.

2.2 Satellite imagery and aerial photo datasets

2.2.1 General

The choice of the satellite imagery selected to implement a land cover mapping project is naturally dependent on the overall objectives of the project. These would normally include the expected types and detail of the land cover classes being mapped, the scale of anticipated output products and of course the available time and resources.

In most cases, the spatial ground resolution of the satellite imagery and its spectral characteristics define the overall level and scale of the land cover mapping. Generally speaking, with increasing spatial and radiometric resolution, more and more land cover detail becomes available for mapping, usually with an increase in the number of land cover types.

On the other hand, the increased resolution and detail result in increased image processing activity, requiring more time and resources. The selection of the type of satellite imagery to be used in a land cover mapping project is in effect the result of an optimization of the trade-off between the technical characteristics of the imagery, the objectives of the mapping project and scheduling and budgetary constraints.

2.2.2 RapidEye satellite imagery

RapidEye multispectral satellite imagery was selected for generation of the Lesotho 2014 Land Cover Database. RapidEye imagery is acquired by a Multispectral push-broom imager, capable of acquiring 6.5 m resolution imagery in 5 spectral bands (Blue, Green, Red, Red Edge and Near Infra-Red)¹. The imagery is resampled to 5 m resolution by the data provider and is usually delivered in ortho-rectified 25 km x 25 km tiles. The following figure describes a small portion of a 5 m resolution 3-band false color RapidEye image (bands 5,3,2), including a full resolution inset.

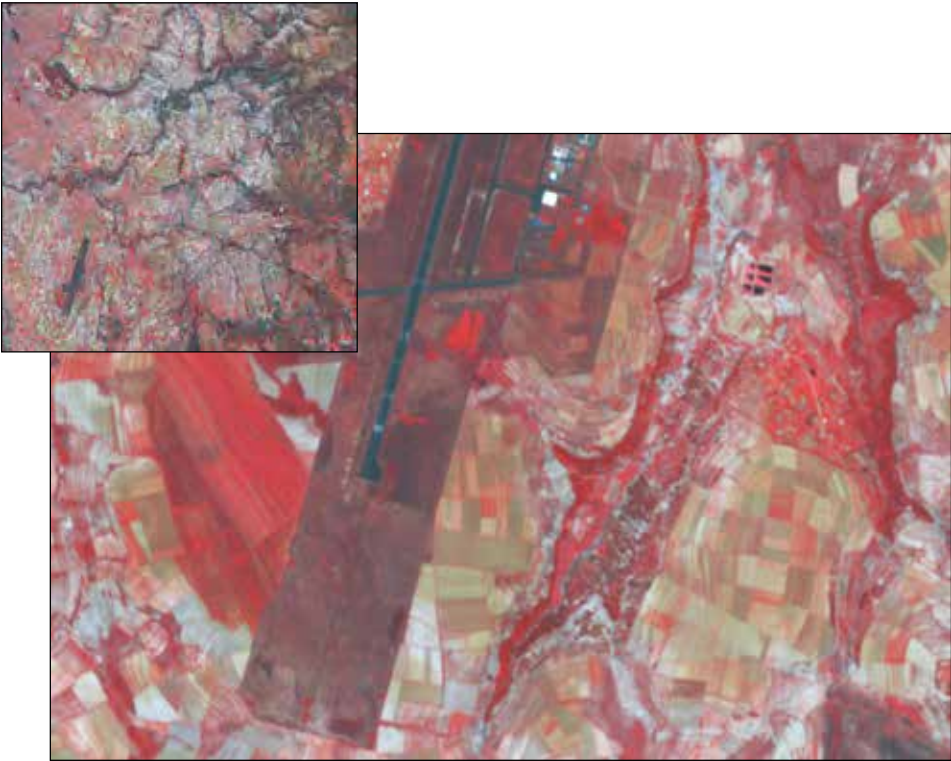


Figure 1 RapidEye image of a region in Maseru District, acquired in 2014

The RapidEye 5m multispectral dataset attained for the generation of the Lesotho LCDB, comprised 91 Level 3A RapidEye scenes acquired in 2014, mainly between the months of January and April, with a few scenes acquired in late 2014 as fill-in scenes (due to cloud cover of earlier scenes) to complete the coverage.

¹ Band and Bandwidth (nm): Blue 440-510; Green 520-590; Red 630-685; Red Edge 690-730; Near Infra-Red (NIR) 760-850.

The RapidEye dataset generated from these scenes was supplied as 74 geometrically corrected 5-band image tiles, each with ground coverage of 25 km x 5 km. Figure 2 shows the dates of acquisition of the RapidEye images.

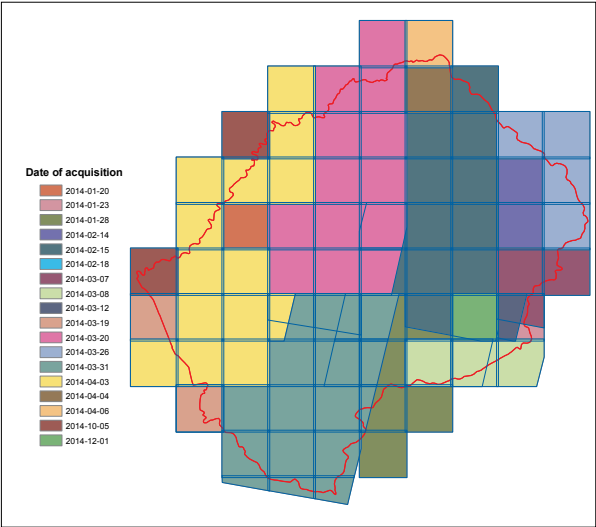


Figure 2 Dates of acquisition of RapidEye imagery

The received RapidEye images were mosaicked and subsequently re-divided into sixty tiles/mosaics (numbered from 1 to 60), each 15 minutes of Latitude x 15 minutes of Longitude, corresponding exactly to Lesotho’s 1:50,000 Topographic Map index. The coverage of the RapidEye 5 m multispectral dataset employed in the generation of the Lesotho 2014 land cover map is shown in Figure 3.

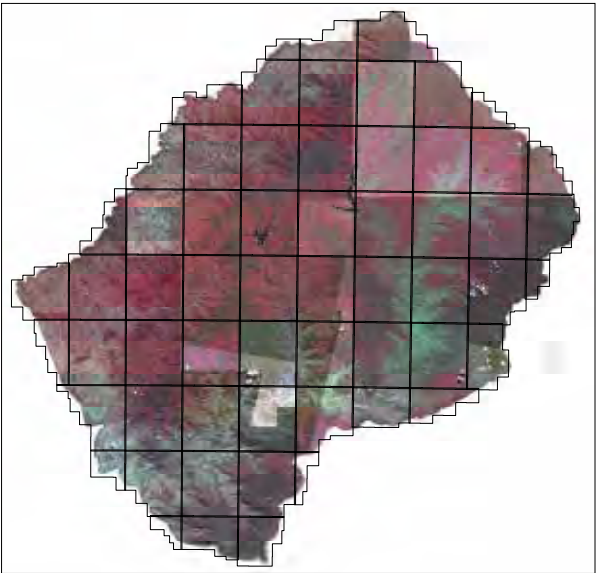


Figure 3 RapidEye 2014 coverage of Lesotho

2.2.3 The 2014 aerial photos of Lesotho

The 2014 Lesotho LCDB was initially planned to be implemented using solely the above mentioned RapidEye satellite imagery. However, after preliminary



Figure 4 Example of a 2014 Aerial photograph with full resolution subsets.

project definition, the availability of an excellent 2014 aerial photo coverage of the country, (access made possible by the kind permission of Lesotho's Bureau of Statistics, BOS) coupled with expressed sentiments for superior land cover detail and accuracy, resulted in a decision to utilize the 2014 high resolution color aerial photographs of Lesotho in conjunction with the 2014 RapidEye satellite imagery. The aerial photo dataset made available to the project consisted of 1,237 orthorectified natural color aerial photographs acquired over Lesotho in November 2014 and December 2014. The ground coverage of each aerial photo was approximately 5 kms x 6 kms. The aerial photographs had a photo overlap of 450 m. The spatial resolution of the aerial photos was 50 cms. Figure 4 is an example of one of these photographs, together with full resolution subsets of the image showing the exceptional detail attainable from these aerial photographs. For the land cover mapping and image interpretation task, the aerial photographs were repackaged into 60 tiles, each tile consisting of a grid of 5 x 5 aerial photographs, as shown in Figure 5. Each aerial photo tile corresponded exactly to a 1:50,000 Topographic map of Lesotho.

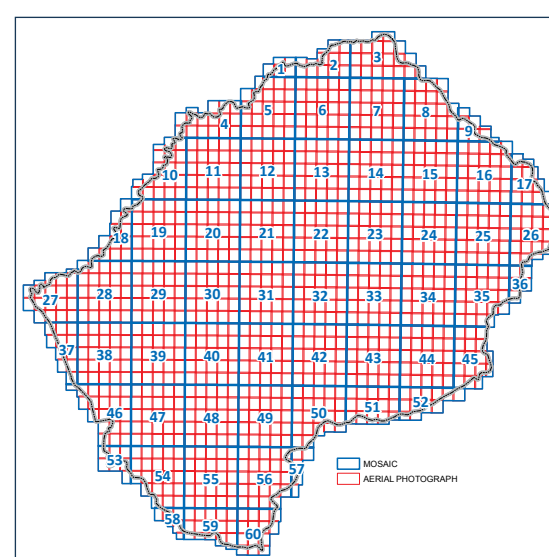


Figure 5 Coverage of aerial photo tiles generated for the 2014 Lesotho LCDB

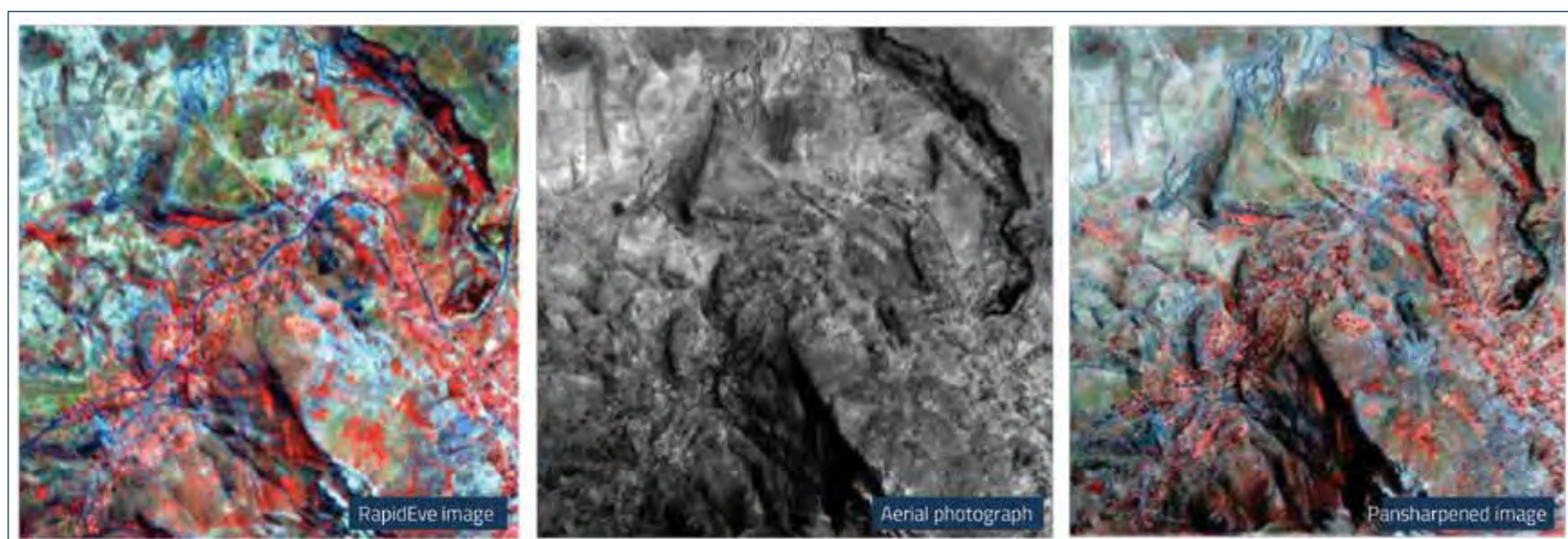


Figure 6 Pansharpening of RapidEye imagery with aerial photographs

2.2.4 Generation of “pansharpened” image datasets

In order to take full advantage of the technical characteristics of these two datasets, it was decided to integrate the RapidEye multispectral imagery with the aerial photographs, using the image processing technique of Panchromatic Sharpening, usually referred to as Pansharpening. In this procedure, a single B&W band (panchromatic) of a spatially high resolution image (in this case the aerial photos) is employed to “sharpen” or increase the lower resolution of a multispectral image (RapidEye imagery).

After several trials in which different spectral bands of the RapidEye imagery were reviewed, integration was affected by merging/fusing a single panchromatic band from the color aerial photos (in this case the 1st Principal Component² containing the bulk of the information of the aerial photos) with bands 2 (G), 4 (Red Edge) and 5 (NIR) of the Rapid Eye multispectral imagery. The so-called “Pan-Sharpended (PS)” images, resulting from this procedure, showed spectacular increase in detail, essential for detection of small extent land covers and their accurate delineation, while at the same time maintaining the radiometric information from the multispectral RapidEye imagery for spectral differentiation of land cover classes. Figure 6 shows an example of a Pansharpened image utilized in the generation of the Lesotho 2014 LCDB.

The Pansharpening procedure was undertaken for each of the 60 tiles/mosaics of the LCDB project. Figure 7 shows the advantage gained in image interpretation by utilizing Pansharpened imagery. It will be noted that the increased resolution of the pansharpened image (from 5m to 0.5m) clearly results in a substantial increase in the detail observed, making possible more accurate land cover mapping. At the same time, the spectral information from the multispectral RapidEye has been essentially maintained, making possible the differentiating and delineation of areas with vegetative cover (appearing red in the false color imagery) from areas with little or no vegetative coverage. It is important to note that the increase in

the resolution of the pansharpened imagery resulted in an equally substantial increase in the size of the image datasets utilized in the image interpretations: from about 5.7 GB for 60 RapidEye tiles to about 192 GB for 60 Pansharp tiles, an eye-catching 33-fold increase. While the detail and accuracy attained in the final 2014 Lesotho LCDB fully justified the decision to incorporate the aerial photographs into the image dataset, nevertheless, it is in place to point out that the significantly higher amounts of data processing and image interpretation work resulting from this process meant that to cater for this increase, the image interpretation effort had to be substantially increased.

2.2.5 SPOT 2004 imagery

In addition to the RapidEye imagery and the Aerial Photographs, both acquired in 2014, the project also received a SPOT 5, 2.5 m resolution 3-band satellite image dataset of Lesotho, acquired in 2004. This dataset was delivered to the project as 19 Tiles as shown in Figure 8. To make possible the utilization of the SPOT 2004 imagery, all 19 tiles were firstly, geometrically corrected to match the 2014 datasets³ and secondly remosaicked and subsequently divided into 60 tiles/mosaics, compatible with the 60 tiles of the RapidEye, Pansharp and Aerial photo imagery datasets. The 2004 SPOT satellite imagery did not play a direct role in the generation of the 2014 LCDB. It will however constitute a major component of the envisaged change detection analysis that is planned to be undertaken following the completion of the 2014 LCDB.

2.3 The Land Cover Classification System (LCCS) and the land cover legend

The FAO-developed Land Cover Classification System (LCCS) generates superior land cover legends for regional land cover maps. This is a comprehensive, standardized a priori classification system that enables comparison and correlation of land cover classes regardless of mapping scale, land cover type, data collection method or geographical location. The initial Lesotho 2014 land cover legend generated using the LCCS was compiled in early 2014 in close consultation with

² Principal Component is a linear transformation of the multidimensional data. The data are transformed in a new coordinate system such that the first principal component (first coordinate) represents the largest variance by any projection, the second coordinate to the second largest variance, and so forth.

³ The SPOT 5 dataset received from Lesotho was found to have a geometric discrepancy of about 30 meters with the geo- corrected RapidEye and Airphoto image datasets. This defect was removed and a new rectified SPOT dataset was generated.

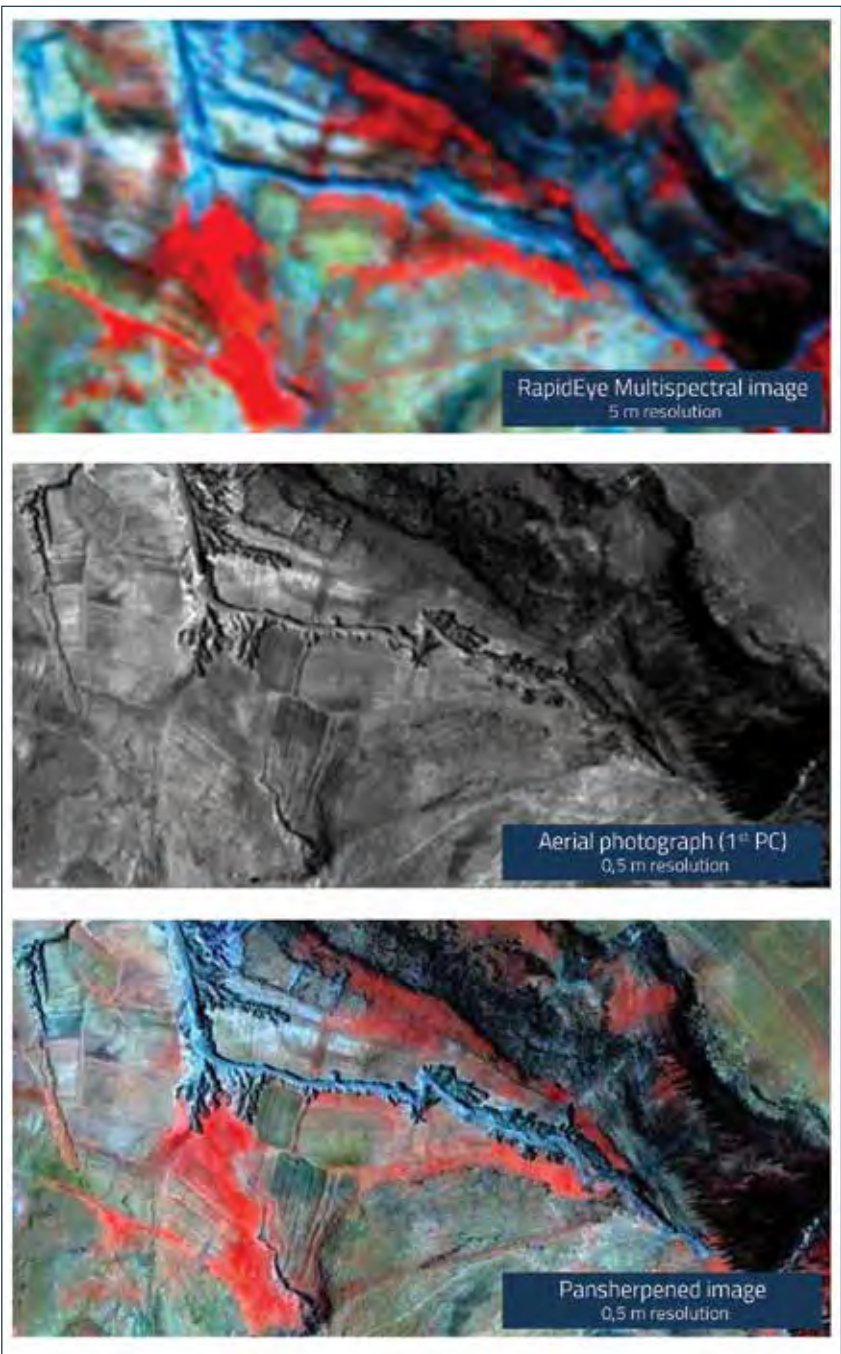


Figure 7 Pansharpening of RapidEye and aerial photo datasets

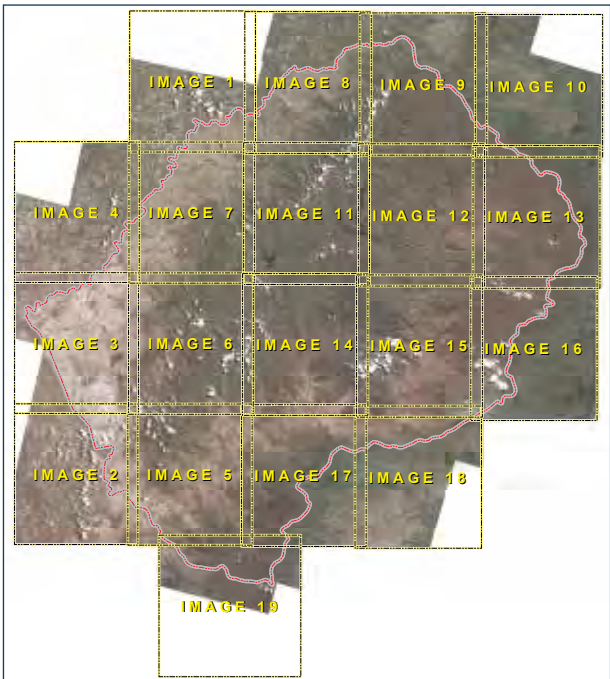


Figure 8 SPOT 2004 imagery of Lesotho

Lesotho experts from different organizations. Full consideration was given to user community requirements and preferences, especially the need for detailed information regarding agricultural land covers, in particular those associated with land degradation.

This initial legend contained 32 land cover classes, covering the full spectrum of land cover types in Lesotho. However, as is the norm in FAO's international land cover mapping projects, with progress of the image interpretation task and increasing familiarity of image interpreters with the area being mapped, the need for modifications to the initial land cover legend became apparent during image interpretation.

Several adjustments and iterations were affected in 2014 and 2015, before arriving at the final 2014 Land Cover Legend. For example, once it was realized that the mapping of Broadleaved and Needleleaved trees would not be satisfactorily affected (as a consequence of the lack of discernibility, even on aerial photos, as well as the fact that in many locations the trees were clearly of a mixed nature), it was decided to add two more classes of Trees to the legend: Undifferentiated/Mixed Trees, Open and Closed. The same solution was affected for the separate Urban Commercial and Industrial land covers. Furthermore, due to its absence and rarity, the originally envisaged land cover class Vineyards was removed from the Legend. In addition to the above, with view to the fact that multi-date satellite imagery was not available, it was decided to forego the differentiation of Permanent and Seasonal Wetlands classes in the original legend, and replace these two classes with one class called Permanent & Seasonal Wetlands. Similar changes were affected in respect of Waterbodies.

Lastly, and in an effort to widen the scope of the legend, a Degraded Grassland land cover was added to the legend, though not envisaged in the original land cover legend. The final LCCS Legend employed for the generation of the 2014 Land Cover Database of Lesotho comprised 29 land cover classes. For a more detailed description see Appendix A.

Builtup	Barren Areas
Urban	Bare rocks & bare areas
Commercial/Industrial	Gullies
Rural housing/Flat areas	Boulders & loose rocks
Rural housing/Sloping areas	Mines and quarries
Trees	Agricultural lands
Needleleaved, closed & open	Rainfed - Flat areas
Broadleaved, closed & open	Rainfed - Sloping Areas
Undifferentiated, closed & open	Rainfed - with sheet erosion
Sparse	Rainfed - with orchards
Hydrological Land Covers	Irrigated and agriculture
Large & small water bodies	Grassland
Perennial & seasonal wetlands	Grassland
River banks	Degraded grassland
Shrubland	
Shrubland, closed & open	



Figure 9 Example of resampling of the pansharpened imagery to different resolutions

2.4 Image segmentation

One of the advanced but now standard techniques used in the FAO methodology for land cover mapping is “Image Segmentation”. This procedure, as applied to satellite imagery and/or aerial photographs, is essentially a technique that entails automatic computer-aided delineation of spatially continuous and spectrally homogeneous regions within a multispectral or panchromatic image. The segmentation process is nowadays an indispensable part of modern land cover mapping, replacing the traditional and now out dated procedure for land cover mapping in which land cover classes were visually discerned and manually mapped by interpreters.

The use of segmentation techniques has considerably facilitated the image interpretation stage of the land cover mapping and has enabled interpreters to effectively undertake image interpretation of large areas of land and assign appropriate land covers to these regions more accurately and in much shorter time spans that was possible using traditional techniques.

The output of the image segmentation procedure is a polygon vector layer, in which each polygon represents regions with similar color, tone and texture as expressed by the pixel values and other characteristics of the multispectral imagery. The number of polygons and the accuracy of the polygons representing a particular land cover type depend on the level of detail desired and the parameters used in the segmentation process. Tests are normally performed in order to select the optimum segmentation parameters for achieving the best compromise between the levels of detail (preferably as high as possible) and the number of polygons (preferably as low as possible). This trade-off process is usually undertaken by applying different so-called scale factors.

For the generation of the Lesotho 2014 LCDB, a review was undertaken to determine the optimum modality of segmentation to be utilized in the project. The results of this review indicated that since the segmentation of the 0.5m Pansharpened datasets would yield an unacceptably high number of polygons in the segmentation process, it was essential to first reduce the resolution of the fused 50 cm pansharpened imagery through resampling to larger cell sizes, before affecting segmentation. Following a substantial set of trials and with an eye on the relative importance of the various regions of Lesotho, the pansharpened image datasets covering the lowlands and foothills regions were resampled at 1.5 m

and the rest of the country, comprising primarily the mountainous northeast and eastern parts of Lesotho at 2.0 m. Differences in discernibility of image features at different resampling scenarios are shown in Figure 9.

The trials for selection of an optimum level of resampling resulted in 30 tiles at 1.5 m resolution (mainly for the Lowlands and Foothills) and 30 tiles at 2.0 m resolution (mostly covering the Highlands). The layout of the final 60 pansharpened tiles is shown in Figure 10

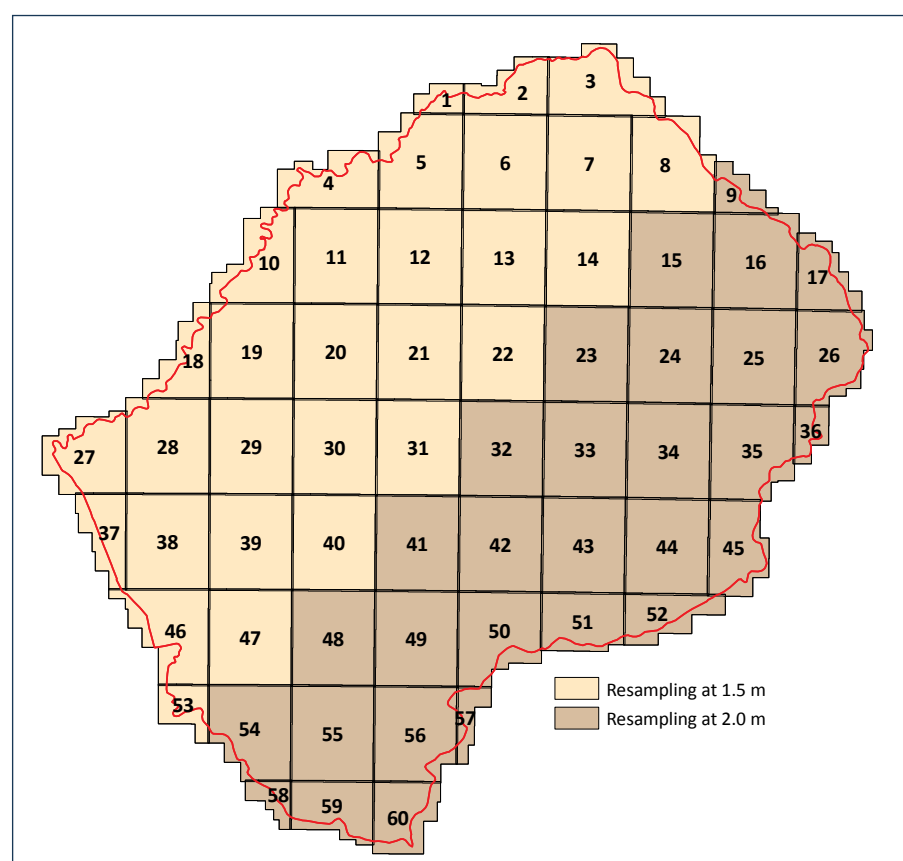


Figure 10 1.5 m and 2.0 m resampling of pansharpened imagery for segmentation

Segmentation was affected on the resampled pansharpened datasets using different parameters in order to attain the optimum segmentation scale factors. Figure 11 shows examples of results attained in the segmentation trials using

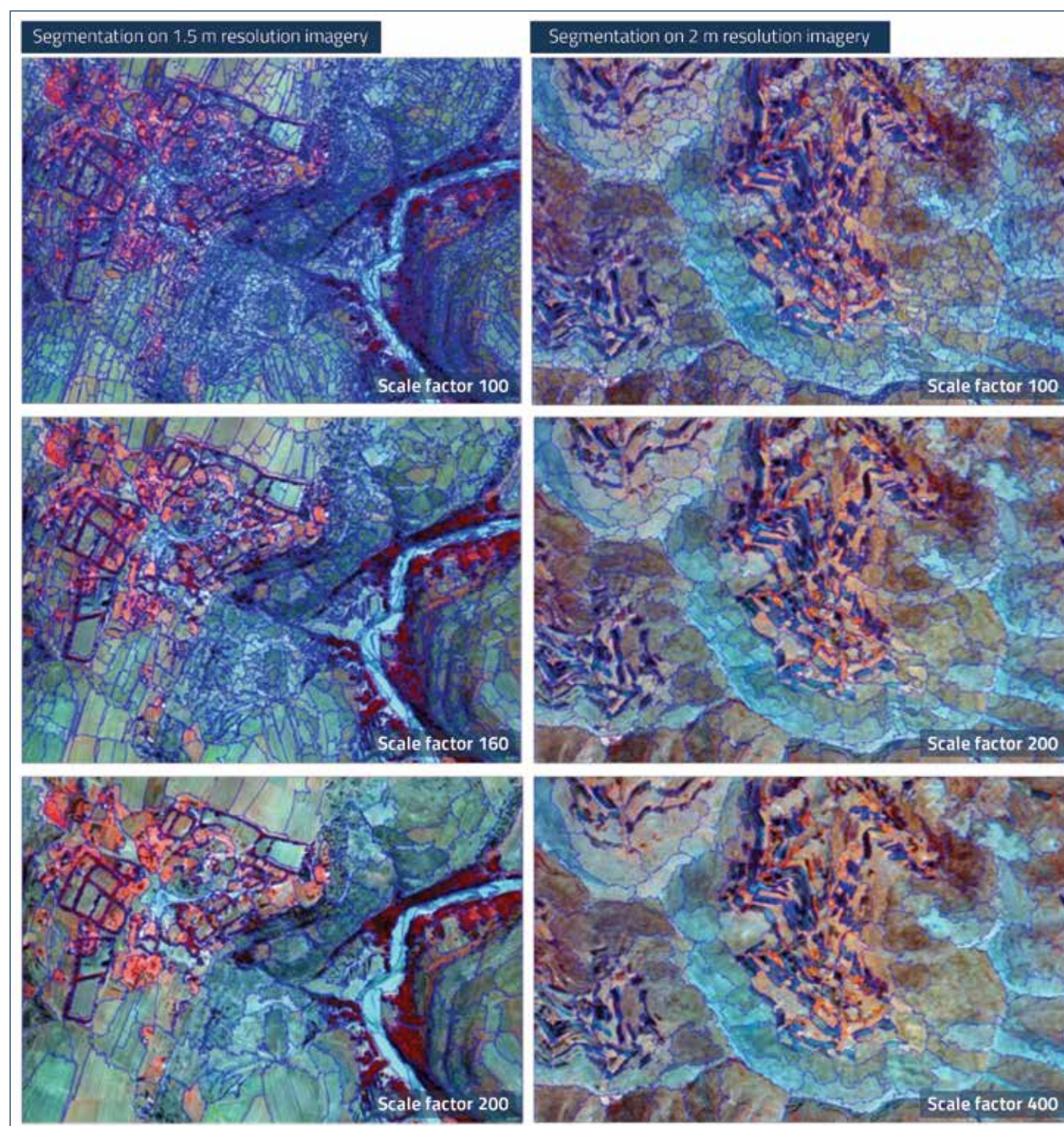


Figure 11 Segmentation variations using different scale factors

different segmentation parameters on the 1.5 m and 2.0 m resolution Pansharpened datasets. Following these trials, the segmentation levels eventually selected for the Lesotho LCDB were as follows:

- Segmentation Level 200 for the mainly agricultural regions covering the lowlands and parts of the foothills, encompassing 30 tiles, and resulting in the generation of about 3.5 million polygons
- Segmentation Level of 160 for the mainly non-agricultural regions of the northeast and eastern Lesotho, encompassing 30 tiles, and resulting in the generation of approximately 2 million polygons.

The total number of polygons generated by the segmentation of the selected pansharpened images, using these scale factors was about 5 million, with the number of segmentation polygons in the various tiles ranging from about 50,000 to 350,000 polygons, resulting in an average of about 170 polygons per sq.km. The fact that these figures are substantially higher than those normally encountered when using satellite imagery of around 5-10 m resolution (higher by as much as 600 percent), is an indication of the very high detail attained through the fusing of the aerial photos with the RapidEye satellite imagery. As the last task in the segmentation procedure, simplification procedures were affected to further reduce the size of the datasets to be used in image interpretation. The final pre-image interpretation segmentation dataset comprised 60 tiles, each corresponding to one of Lesotho's 1:50,000 Topographic Map series. As was mentioned above, all

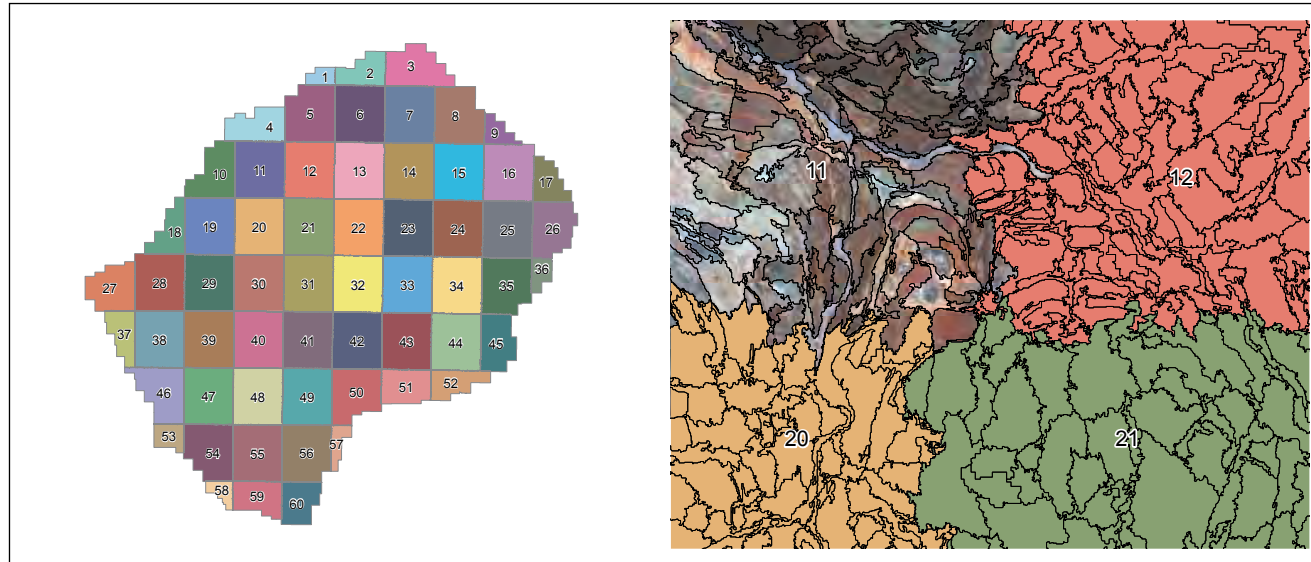


Figure 12 Layout of the 60 segmentation tiles used in the Lesotho LC Mapping

other image datasets, such as the RapidEye multispectral imagery, and the aerial photographs were also cut into 60 tiles to match the segmentation tiles. This procedure not only allowed for better handling of the various datasets in the image interpretation phase, but also greatly facilitated post-interpretation vector cleaning and topology activities. The layout of the 60 segmentation vector mosaics/tiles derived from the pansharpened image datasets is shown in Figure 12.

2.5 Image interpretation and land cover mapping

In the FAO methodology for land cover mapping, the primary mapping tools and techniques employed in the interpretation of satellite imagery comprise the LCCS land cover legend, the segmentation datasets, and the specially designed FAO software suite, MADCAT (Mapping Device – Change Analysis Tool). The first two elements have been discussed above. In this section, a brief overview of the MADCAT software suite and the manner of the image interpretation is presented.

In a nutshell, the image interpretation task can be described as the application of the LCCS land cover legend in the MADCAT software suite, to affect labeling of the vector polygons of the segmentation datasets derived from selected imagery datasets. The MADCAT software was designed to cater for the best implementation of this task. A unique feature of this software is its ability to handle very large numbers of segmentation polygons together with the ability to display large raster datasets in a typical PC environment. The display and manipulation of large image datasets is made possible through the use of a compression and pyramiding module embedded in the MADCAT software suite (RADEX Builder). In addition to making possible the rapid viewing of these large image datasets, MADCAT also provides the interpreter with common image enhancement capabilities essential for image analysis and accurate assignment of land cover classes.

In the MADCAT software environment, in addition to having access to features such as a variety of interactive coding tools, change detection capabilities, and an extremely useful direct link to Google Earth, the interpreter is also able to utilize a substantial range of classical image processing and GIS algorithms, such as classification of imagery as well as arithmetic operations and tools for working with polygon vectors and attribute tables. The capability to generate average raster data by polygon, outstanding toggle/transparency tools together with specially designed change detection modules complete MADCAT's unique software

capabilities. To all this should be added the fact that the MADCAT software suite is available at no cost. In the interpretation process, the selection of a particular land cover class and its assignment to any polygon or group of polygons is affected in the MADCAT environment. Once a land cover class has been selected by the image interpreter for polygons in a certain area of the image, using the LCCS legend, MADCAT provides a variety of tools for readily assigning a land cover class to the segmentation polygons corresponding to that area. This procedure is sometimes referred to as Polygon Labeling. Repetition of this procedure until all polygons within a segmentation dataset have been assigned to their respective land cover classes, essentially constitutes the preliminary image interpretation of the land cover mapping cycle. It is here that the number of polygons in a segmented dataset plays such an important role in the effort involved in the land cover mapping. The higher the number of polygons, the more effort required for the labeling. In this process of selecting land cover classes, the image interpreters were assisted by a land cover Photo Key, showing the typical appearance of the various land covers on the satellite imagery and other image datasets. Such photo keys greatly enhance the harmonization of the LCDB when several different image interpreters are being employed. An example of photo keys utilized in the Lesotho image interpretation is attached as APPENDIX B.

In addition to working with the image datasets described above, taking advantage of the MADCAT capability to assign average NDVI values for each of the segmentation polygons, significant use was also made from the NDVI dataset derived from the multiband RapidEye imagery.⁴ The utilization of the NDVI techniques was found to be effective for classes associated with presence or absence of vegetation, such as Rangelands, Shrubland and Bare Area land cover classes. However, difficulties and constraints were occasionally encountered due to non-contiguous NDVI datasets, as a consequence of the different dates of acquisition of the RapidEye imagery. In the case of the Lesotho land cover project, the above described image interpretation process was implemented separately for each of the above mentioned 60 segmentation tiles.

⁴ NDVI (Normalized Difference Vegetation Index) is the most commonly used vegetation index. It is useful for assessing the health and density of vegetation. The NDVI normalizes green leaf scattering in the near-infrared wavelength and chlorophyll absorption in the red wavelength. NDVI is commonly computed as: $NDVI = (NIR - RED) / (NIR + RED)$. The value range of an NDVI is -1 to 1 where healthy vegetation generally falls between values of 0.20 to 0.80. NDVI values near 0 indicate very sparse vegetation. Very dense vegetation is indicated by NDVI values approaching 1.

Land Cover name	Code	Air photos	Pansharp	RapidEye & NDVI	Topo maps	Existing datasets	Ground truth
Urban	UA1						
Urban commercial Industrial	UA2						
Rural settlements Plan areas	RH1						
Rural settlements Sloping areas	RH2						
Rainfed agriculture Plain areas	HCP						
Rainfed agriculture Sloping regions	HCSM						
Rainfed agriculture Sheet erosion	HCER						
irrigated agriculture	HCIR						
Rainfed agriculture Rainfed orchards	HCT						
Trees, Needleleaved (closed)	TNL1						
Trees, Needleleaved (open)	TNL2						
Trees, Broadleaved (closed)	TBL1						
Trees, Broadleaved (open)	TBL2						
Trees, Undifferentiated (closed)	TM1						
Trees, Undifferentiated (closed)	TM2						
Trees (sparse)	TS						
Large waterbody	WB1						
Small waterbody	WB2						
Wetland (perennial or seasonal)	WET						
River bank	RB						
Shrubland (closed)	SH1						
Shrubland (open)	SH2						
Grassland	GR						
Grassland - Degraded	GRD						
Bare Rock	BR						
Bare area	BA						
Boulders & loose rocks	BLR						
Gullies	GU						
Mines & Quarries	MQ						

Figure 13 LC mapping and image dataset interpretation matrix

Figure 14 shows the above described process of image interpretation resulting in the land cover dataset. With respect to the relative effectiveness and value of the different datasets utilized in the image interpretation task, Table 1 is a general overview showing which datasets were found to be more effective in the mapping of the various land cover classes in the legend. Lastly, it should be added that existing large scale Lesotho Land Cover Database (apparently generated using 10m-30m resolution satellite imagery) was often referred to and utilized in the interpretation stage of the land cover mapping.

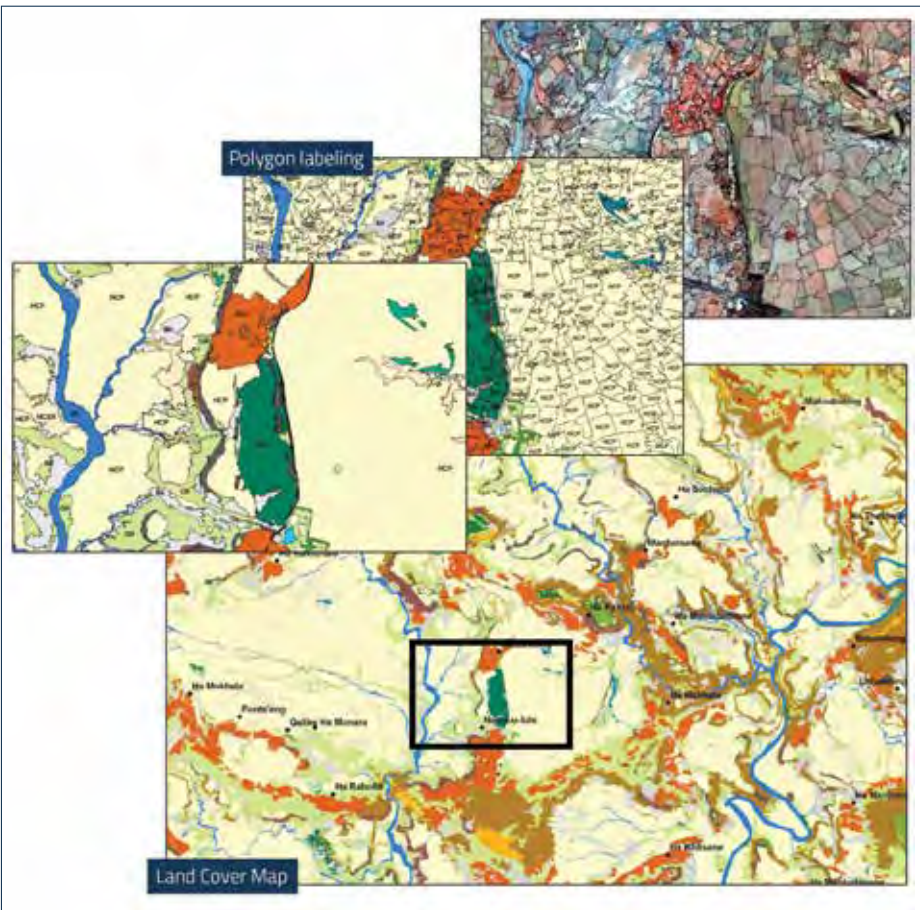


Figure 14 Flow chart of tasks resulting in the LCDB

2.6 Field verification and database validation

With view to the nature of the task at hand, that is, mapping of land cover classes from remotely acquired imagery, validation of all preliminary image interpretations and land cover mapping is necessary to ensure integrity of the final land cover database. Such validation procedures result in significant reduction of preliminary image interpretation errors and lead to a more accurate and reliable land cover database. The validation process is normally undertaken through extensive field work and so-called “ground truthing”, both during and after completion of the preliminary image interpretation phase. In the case of Lesotho, the following activities were undertaken to enhance the results of the image interpretation and to validate the preliminary image interpretation results:

- Undertaking of a comprehensive 3-day field trip by FAO consultants involved in the image interpretation task together with local Lesotho experts to observe manifestations of different land covers in the field.
- Compilation and collection of all existing geocoded ground photos and generation of a ground photo library/database for correlation with the preliminary image interpretation results.
- Remotely implemented interaction with different experts in Lesotho for clarification regarding removal of ambiguities concerning mapping of land cover types from the various image datasets.

In this respect, a Field Trip was undertaken on 14th, 15th and 17th of June 2015, during which time a substantial part of Lesotho was traversed and information



Figure 15 Field trip participants

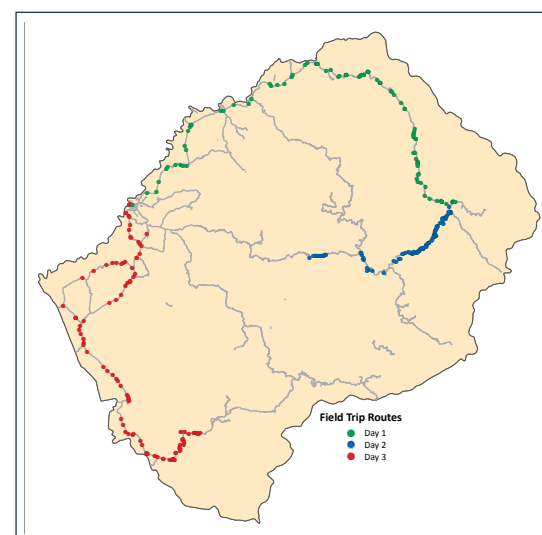


Figure 16 Field trip routes

gathered using several GPS equipped cameras. A team of Lesotho experts accompanied the FAO consultants during the trip (Figure 15). The advice and guidance received from this team during this field trip was extremely valuable. The routes traversed in these three days are shown in Figure 16. The results of this ground truthing exercise, reported in the project's Field Trip Report, dated July 2016, were very effectively utilized by image analysts in their land cover mapping activities and subsequent validation of their image interpretations. Furthermore the undertaking of the field surveys with experts familiar with the different land cover types not only proved to be valuable for the enhancement of the preliminary image interpretation, but was also instrumental in facilitating the follow-on remote interaction between the image interpreters and the local experts for final validation. Figures 17 shows typical geocoded ground photos attained during the field trip and received from Lesotho. The utilization of the photos and videos attained during the 3-day field trip together with geocoded ground photos received from Lesotho greatly assisted the validation of the preliminary image interpretation. Hopefully, the compilation of these geocoded ground photos will be considered as the start of the generation in Lesotho of a comprehensive ground photo library for all future projects involving agriculture and natural resources. In addition to the

above validation activities, maximum use was made of the opportunities offered to the project for interacting with local experts with view to clarification of land cover issues encountered in the preliminary interpretation. On such occasions, such as training courses and workshops, the project availed itself of the comprehensive knowledge of Lesotho experts in respect of land cover characteristics and land management practices in Lesotho.

Although time and resource limitations restricted the scope of the envisaged validation activities, nevertheless, the validation effort undertaken markedly improved the preliminary image interpretation results. Undertaking of similar validation activities by local experts in the future is highly recommended, since such efforts will further improve and enhance this valuable land cover database.

2.7 Ancillary datasets

In addition to the land cover dataset described above, other complimentary datasets were also incorporated in the generation of the Lesotho 2014 Land Cover Map. These ancillary datasets include the following:

Senqu River and adjacent areas



Needleleaved & broadleaved trees



Rocky river bank



Dense Shrubland

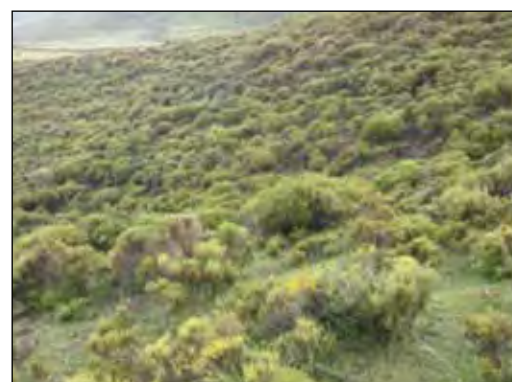


Figure 17 Examples of geocoded ground photos from Lesotho

2.7.1. Administrative dataset

Various administrative datasets were received at the start and during the implementation of the project. These datasets were found to be inadequate in terms of accuracy and quite often out of date, since most seemed to have been generated from older maps with scales not compatible with the resolution of the 2014 LC database.

As a consequence, with close coordination and cooperation of pertinent authorities in Lesotho, an updated administrative dataset was generated by the project. With view to the detailed nature of the LCDB, in this effort especial attention was given to full juxtaposition of all administrative boundaries with physiographic features such as rivers and streams, where these boundaries were defined by such features. The Lesotho 2014 LCDB Administrative Dataset consists of the International, District, Community Council and Urban/Municipality Council boundaries of Lesotho. Figure 18 shows this administrative dataset, which consists of 10 Districts, 64 Community Councils, 12 Urban Councils and 2 Municipality Councils.

Also included in the Administrative dataset is the so-called “villages” dataset received from Lesotho comprising point locations for District Centers, Towns, Principle Villages, Villages and some Border Control Points, together with names. This dataset would also benefit from updating and a review of some of its data.



Figure 18 The 2014 Lesotho LCDB administrative dataset

2.7.2. Hydrological dataset

RIVERS NETWORK - Various rivers datasets were received from different organizations during the project implementation, most apparently extracted from 1:250,000 base maps. As was the case for the Administrative dataset, the Rivers datasets received from Lesotho were found to be inadequate for integration with the 2014 LCDB. As a result, a new Rivers dataset was generated with considerable use of internet-available datasets, in particular the OSM Lesotho Rivers dataset. The 2014 LCDB Rivers dataset presently comprises 3 vector layers corresponding to Main Rivers, Rivers and Streams. Figure 19 shows the 2014 LCDB Rivers dataset. This dataset, though greatly superior to existing datasets, can be improved by further refinement.

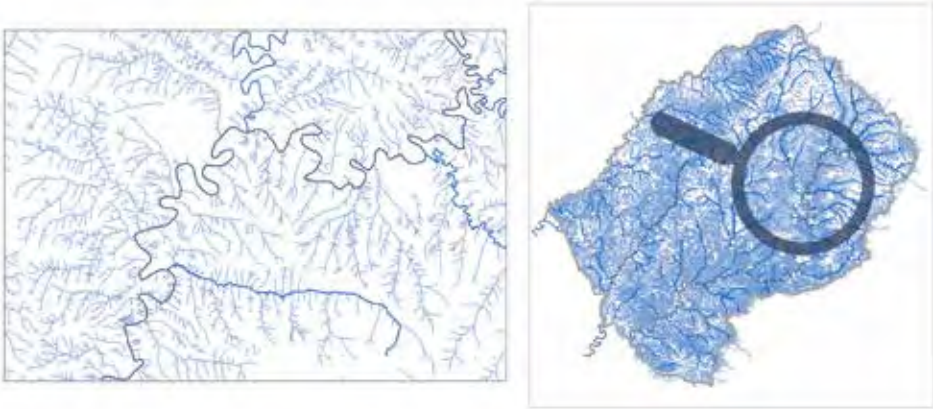


Figure 19 River network incorporated into the Lesotho 2014 LCDB

MAIN CATCHMENT AND SUB-CATCHMENTS DATASETS - The boundaries of the main catchments and sub-catchments employed in the 2014 LCDB were received from the relevant water authorities in Lesotho. The Catchment Dataset comprises 6 Main Catchment areas with a total of 74 sub-catchments as shown in Figure 20. These are as follows:

- Upper Caledon/Mohokare Main Catchment with 9 sub-catchments.
- The Middle Caledon/Mohokare Main Catchment with 6 sub-catchments.
- The Lower Caledon/Mohokare Main Catchment with 6 sub-catchments.
- The Makhaleng Main Catchment, with 8 sub-catchments.
- The Upper Senqu Main Catchment with 34 sub-catchments.
- The Lower Senqu Main Catchment with 11 sub-catchments.

The percentage of each main catchment per district and the percentage of each district per main catchment are showed in the tables of Appendix C.

It should be added that while the boundaries of the Main Catchment Areas as received from Lesotho were refined and adjusted to match Lesotho’s international boundaries as defined by the LCDB Administrative Layer, no other modification has been applied. Further adjustments and refinement of the catchment area boundaries within Lesotho and better definition of these boundaries with view to the more detailed nature of the LCDB, will improve the accuracy of the Catchments Dataset.

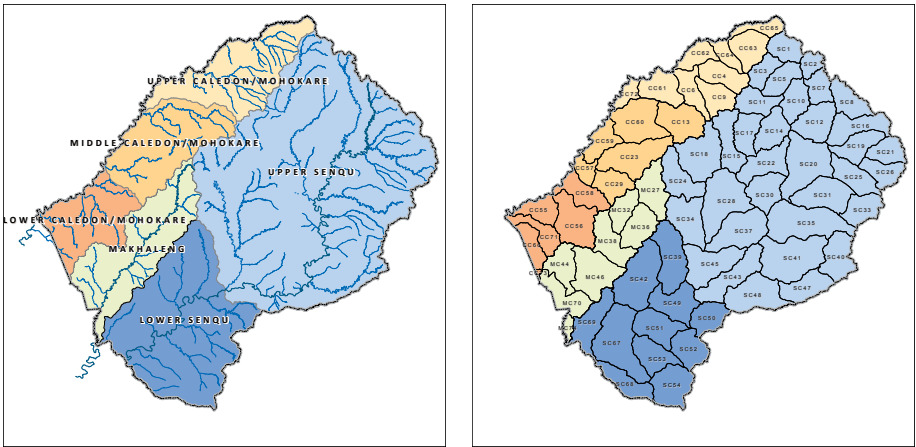


Figure 20 Water Catchment areas of Lesotho as utilized in the 2014 LCDB

2.7.3. Roads network

As was the case for the Rivers dataset and for similar reasons, the various Roads datasets received from Lesotho were found to be inadequate for the 2014 LCDB. The detail and output scales possible with the 2014 LCDB are such that the Roads datasets received could not be utilized in the 2014 LCDB. As a consequence, the Roads Network dataset utilized in the 2014 Lesotho LCDB was obtained from internet-available sources, such as the OSM Roads dataset. This dataset has the necessary detail and accuracy, but requires review, updating and completion.

The 2014 LCDB Roads Dataset comprises four classes of roads, namely Primary Roads, Secondary Roads, Tertiary Roads and Tracks. In addition to these country datasets, a Residential Roads layer has also been included which reflect the road/street arrangement within urban areas. No modification has been made to the Roads dataset attained from OSM. Updating and completion of the present 2014 LCDB Roads Network is necessary and will greatly improve the existing dataset. Figure 21 shows the Roads Network layer of the 2014 LCDB.

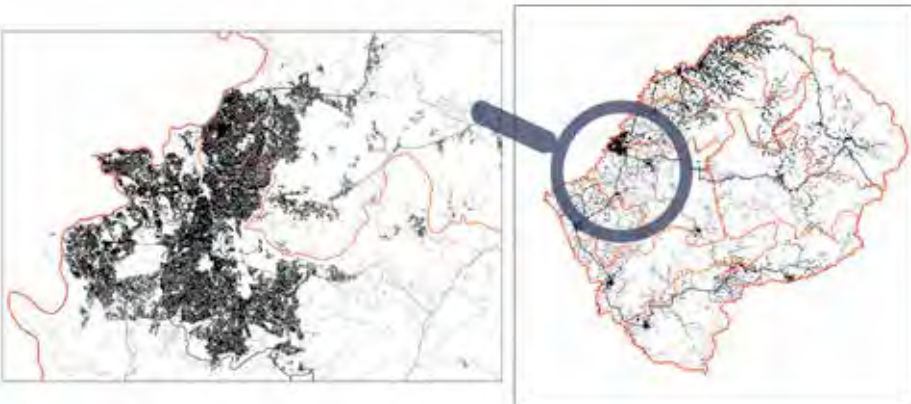


Figure 21 Roads network dataset in the 2014 LCDB

2.8 Harmonization and database compilation

Following the completion of the image interpretations and land cover mapping of the 60 tiles mentioned above, and pursuant to the described validation phase, the land cover datasets generated for each tile/mosaic were combined with adjacent mosaics and appropriate homogenization and harmonization of the whole land cover dataset was undertaken to form an integrated land cover database for the whole country. The activities undertaken in this respect comprised the following:

- Homogenization of the land cover interpretations carried out by different interpreters, bringing about the desired uniformity in the land cover database.
- Harmonization of the vector datasets including polygon edge matching and spatial verification to assure integrity of topology, including adjustments for bordering polygons, overlaps, gaps etc.

- Homogenization of the cartographic specifications of all datasets in the LCDB, which in the case of the 2014 Lesotho LCDB is UTM Zone 35S, WGS 84.

The compilation and submission of the digital 2014 Lesotho LCDB (DVD appended to this Atlas) has been affected as follows:

- Country level, comprising 4 LCDBs.
- District Level, comprising 10 LCDBs.
- Main Catchments, comprising 7 LCDBs.
- Ancillary Datasets, comprising, Administrative Boundaries, Rivers and Roads.

These LCDBs are described in more detail below:

- The 2014 LCDB at the country level is being submitted as four separate LCDBs: North, East, West and South Lesotho. This manner of presentation has become necessary as a consequence of the very large size of the 2014 LCDB (over 5.5 GB) and is being presented with the aim facilitating the handling of this large LCDB. The regional coverage of these LCDBs, shown in Figure 21, is described below:
 - LESOTHO North: The districts of Butha Buthe, Leribe and Berea.
 - LESOTHO West: The Districts of Maseru and Mafeteng.
 - LESOTHO East: The Districts of Mokhotlong, Thaba Tseka and Qacha’s Nek.
 - LESOTHO South: The Districts of Mhale’s Hoek and Quthing.
- In addition to the above country level presentation, the LCDBs for each of Lesotho’s Districts have been submitted separately as the District LCDBs.
- The land cover database for the water catchments of Lesotho has been submitted as 7 separate LCDBs, one for each of the 6 Main Catchments, with the exception of Upper Senqu Main Catchment which has been submitted in two parts (Upper Senqu-1 and Upper Senqu-2), due to its size (Figure 22).

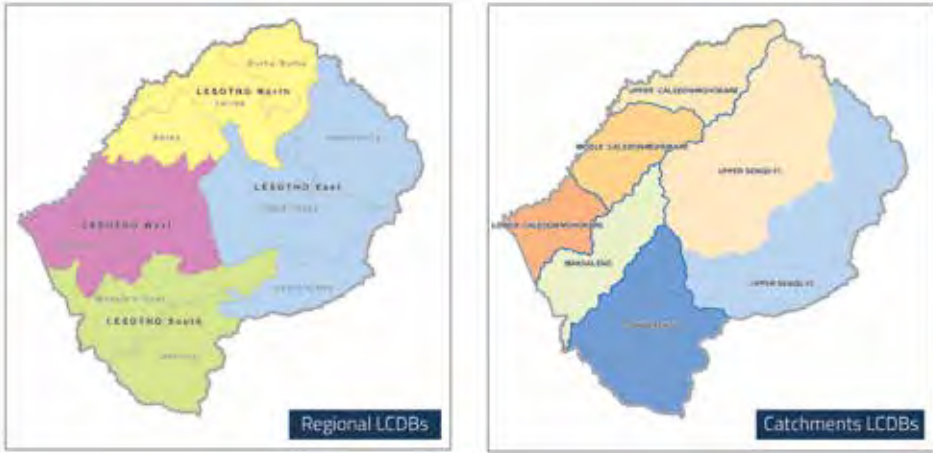


Figure 22 Coverage of the Land Cover databases of Lesotho

2.9 Land cover aggregation and land cover statistics

Once the homogenization, harmonization and spatial verifications of the LCDB is completed, the LCDB is ready for extraction of land cover statistics. The presentation of the statistical information extracted from such a database is usually implemented using administrative and/or environmental regions as a basis. In the Lesotho Land Cover Atlas, two sets of land cover statistics are presented.

These are based on Administrative Boundaries and River Catchment Areas. Since in most cases the desired statistics from a land cover database is limited to a few of the more important land cover classes, it is usual, at this stage, to aggregate the total number of land cover classes to a lesser number by combining similar land cover classes together.

Such an aggregation provides the basis for presentation of summary statistics for the most important land covers, without presenting data for land covers that may be of no immediate interest. In the case of the Lesotho LCDB, the land cover class aggregation comprised the aggregation of the original 29 land cover classes into 8 generalized land cover classes, as shown in Figure 23.

With view to the unique role played by wetlands in water availability in Lesotho, the individual Wetland Class (WET) has been included in the aggregated land cover statistics to reflect this important role, rather than be aggregated in the water related land covers (AGWT), as would be the norm.

It should be added that, notwithstanding this aggregation, should there be interest in information regarding the separate components of an aggregated class, for instance areas exposed to Gully Erosion (GU) or differentiation of Rural Settlements based on their location in flat or mountainous regions (RH1 or RH2), land cover statistics and the spatial distribution of such classes are readily accessible from the digital database since they exist as discreet datasets within the LCDB.

Aggregated LC Classes	Code	LC Classes Components
Built-up	AGBU	UA1, UA2, RH1, RH2
Agricultural land	AGAG	HCP, HCSM, HCER, HCIR, HCT
Trees/Plantations	AGTR	TNL1, TNL2, TBL1, TBL2, TM1, TM2, TS
Shrubland	AGSH	SH1, SH2
Grassland	AGGR	GR, GRD
Wetland	WET	WET
Water Bodies & Rivers	AGWT	WB1, WB2, RB
Barrenland	AGBR	BR, BA, GU, BLR, MQ

Figure 23 Aggregation of the 2014 LCDB land covers

A comprehensive set of land cover statistics comprising land cover statistics for Lesotho as a whole, each of Lesotho’s 10 Districts together with statistics for the corresponding Community / Urban / Municipality Councils, and (iii) for Water Catchment Areas and their related Sub-Catchments, are provided separately in the following pages of this Atlas, each accompanied by their respective Land Cover Map and related graphic charts for quick evaluation.

Furthermore, to provide a quick overview, a brief summary of the hectarage of the main aggregated land cover classes of Lesotho as mapped in the 2014 LCDB are presented in Figure 24.

From this summary, it will be noted that, based on the 2014 Lesotho LCDB, while 50% of Lesotho can be classed as Grassland and about 20% as Shrubland, 18.9% of the country, equivalent to about 580,000 hectares, can be considered as Agricultural land. The summary aggregated land cover statistics related to the Main Catchment areas of Lesotho are shown in Figure 25 (next page).

The Catchment land cover statistics summary indicates that based on the 2014 LCDB, with over 293,000 hectares of agricultural land, the Caledon/Mohokare Catchment Area contains about 51% of all mapped agricultural land in Lesotho (Upper Caledon:16%, Middle Caledon:19%, Lower Caledon: 16%), while the Makhalleng and Senqu Catchment Areas contain 13% and 36% respectively (Upper Senqu:24% , Lower Senqu: 12%).

Aggregated LC Classes	Code	Hectarage (ha)	% of Lesotho
Built-up	AGBU	126,091	4.1
Agricultural land	AGAG	578,039	18.9
Trees	AGTR	38,404	1.3
Shrubland	AGSH	584,328	19.1
Grassland	AGGR	1,516,051	49.6
Wetland	WET	32,580	1.1
Water Bodies & Rivers	AGWT	28,241	0.9
Barrenland	AGBR	151,581	5.0
TOTAL		3,055,314	100

Figure 24 Summary Land Cover statistics of Lesotho

Aggregated LC Classes	Upper Caledon	%	Middle Caledon	%	Lower Caledon	%	Makhaleng	%	Upper Senqu	%	Lower Senqu	%
Built-up	20,886	8.0	32,370	12.6	19,903	10.9	13,936	4.7	20,595	1.4	18,401	3.3
Agricultural land	91,103	35.1	110,318	42.8	92,240	50.6	75,248	25.3	138,784	9.2	70,346	12.7
Trees	10,096	3.9	12,005	4.7	3,201	1.8	2,851	1.0	4,361	0.3	5,889	1.1
Shrubland	38,706	14.9	22,213	8.6	8,054	4.4	53,850	18.1	312,648	20.8	148,857	27.0
Grassland	84,670	32.6	63,645	24.7	40,561	22.2	134,308	45.2	917,318	60.9	275,549	49.9
Wetland	508	0.2	481	0.2	403	0.2	617	0.2	25,562	1.7	5,008	0.9
Water Bodies & Rivers	1,365	0.5	2,027	0.8	2,015	1.1	2,745	0.9	15,171	1.0	4,918	0.9
Barrenland	12,448	4.8	14,523	5.6	16,039	8.8	13,615	4.6	71,981	4.8	22,975	4.2
TOTAL	259,783	100	257,582	100	182,415	100	297,170	100	1,506,419	100	551,944	100

Figure 25 Summary Land Cover statistics of Lesotho's main water Catchments




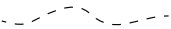




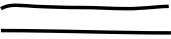


2.10 Concluding remarks

The 2014 Land Cover Map of Lesotho will be an important addition to the base data that will be needed to properly manage the natural resources and agricultural sector in Lesotho. Such baseline information can play an important role in identification of areas with possible food security risks, in particular in respect of the extensive land degradation and the observed encroachment of urbanization into traditionally cultivated areas. Last, but certainly not least, the 2014 Land Cover Database will no doubt play an important role in the planning and development of appropriate strategies for the country’s agricultural development, including dealing with the land degradation of existing rainfed agricultural regions and development of plans for the establishment of a viable irrigated farming sector, the lack of which has plagued Lesotho for so long.

Lastly, it is in place to emphasize that further upgrading of the 2014 Lesotho LCDB should be considered as an essential future activity; both in respect of further enrichment of the LCDB using existing air photo datasets, and undertaking of additional field verification, in particular in respect of the tree and shrub land cover classes.

MAP SYMBOLS LEGEND


Legend for the Land Cover maps that will follow

	NATIONAL BOUNDARY
	CATCHMENT BOUNDARY
	DISTRICT BOUNDARY
	SUB-CATCHMENT BOUNDARY
	CAPITAL
	DISTRICT TOWN
	MAIN TOWN
	PRIMARY ROAD
	SECONDARY ROAD
	MAIN RIVER
	RIVER

Appendix A / Land cover legend

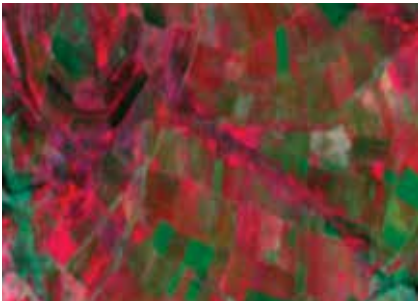

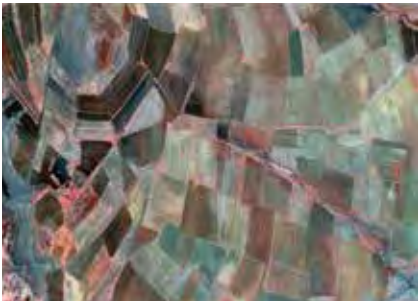






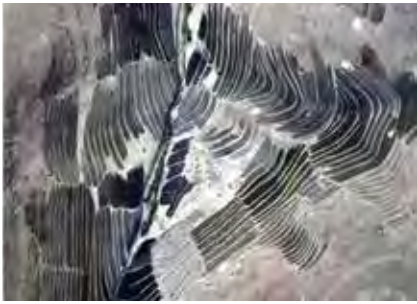

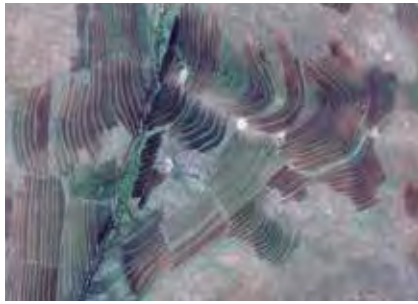
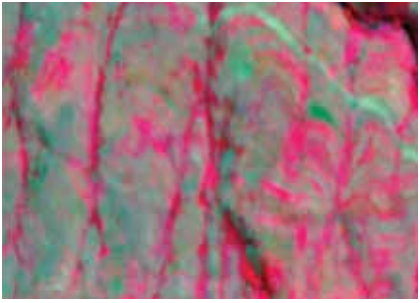
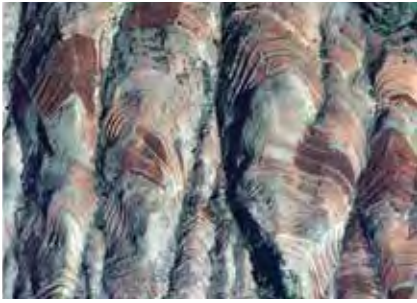
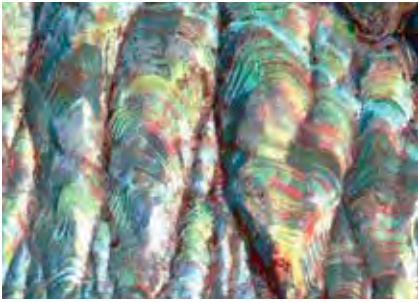
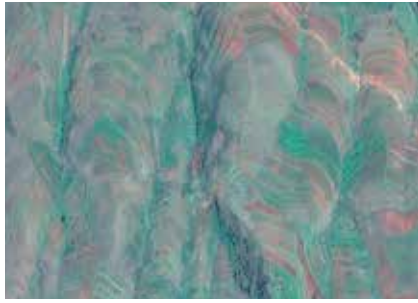
Land Cover Type	Land Cover name	Code	Land Cover Description
BUILT-UP 4 classes	Urban	UA1	Relatively larger urban built-up areas, commonly with presence of trees, occasionally with small cultivated fields; scattered open areas observed in some areas.
	Urban commercial Industrial	UA2	Commercial and/or industrial built-up areas, occasionally outside main urban and rural built-up areas.
	Rural settlements Plan areas	RH1	Rural houses in flat lying plain areas (slope up to 5 degrees) + small cultivated herbaceous crops + closed herbaceous natural vegetation, often together with trees and/or shrubs employed for demarcation; scattered open areas observed in some areas.
	Rural settlements Sloping areas	RH2	Rural houses in sloping and mountainous areas (slope greater than 5 degrees) + herbaceous natural vegetation, occasionally with small fields and sometimes with shrubs employed for demarcation, usually treeless.
AGRICULTURE 5 classes	Rainfed agriculture Plain areas	HCP	Rainfed herbaceous crops cultivated in flat-lying plains (slope up to 10 degrees) relatively larger sized fields.
	Rainfed agriculture Sloping regions	HCSM	Rainfed herbaceous crops in sloping land and mountains (slope greater than 10 degrees) with terracing and/or contour ploughing, small and medium sized fields, sometimes with lines of shrubs demarcating fields.
	Rainfed agriculture Sheet erosion	HCER	Rainfed herbaceous crops with visible water sheet erosion, commonly with associated gully erosion.
	irrigated agriculture	HCIR	Small size irrigated herbaceous crops near water courses.
	Rainfed agriculture Rainfed orchards	HCT	Small rainfed herbaceous crops + regular rainfed orchard plantations (usually as rows of fruit trees separating elongated fields).
TREES 7 classes	Trees, Needleleaved (closed)	TNL1	Closed evergreen needle-leaved trees, sometimes occurring as plantations.
	Trees, Needleleaved (open)	TNL2	Open evergreen needle-leaved trees + herbaceous natural vegetation.
	Trees, Broadleaved (closed)	TBL1	Closed deciduous broadleaved trees, commonly along river beds, sometimes observed as plantations.
	Trees, Broadleaved (open)	TBL2	Open deciduous broadleaved trees + herbaceous natural vegetation.
	Trees, Undifferentiated (closed)	TM1	Closed undifferentiated trees, sometimes mixed broadleaved and needle-leaved; occasionally with shrubs.
	Trees, Undifferentiated (closed)	TM2	Open undifferentiated trees + herbaceous natural vegetation.
	Trees (sparse)	TS	Sparse scattered trees + herbaceous natural vegetation (closed-open).
HYDROLOGY 4 classes	Large waterbody	WB1	Large perennial fresh water lake or dam reservoir.
	Small waterbody	WB2	Small fresh water seasonal and/or perennial reservoir, pool, etc. sometimes associated with nearby wetland areas.
	Wetland (perennial or seasonal)	WET	Natural perennial and/or seasonal fresh waterbody + Perennial closed-open natural vegetation.
	River bank	RB	River Bank (soil/sand deposits) + perennial or periodic flowing fresh water (river), occasionally with loose scattered rocks, often with adjacent trees and shrubs.
SHRUBLAND 2 classes	Shrubland (closed)	SH1	Closed Natural Shrubs (H=0.5 to 1.5m), commonly observed on river valley slopes, occasionally with scattered rocks and boulders.
	Shrubland (open)	SH2	Closed Natural Shrubs (H=0.5 to 1.5m), commonly observed on river valley slopes, occasionally with scattered rocks and boulders.
GRASSLAND 2 classes	Grassland	GR	Grassland - Relatively dense natural vegetation, occasionally with sparse shrubs.
	Grassland - Degraded	GRD	Degraded Grassland with low vegetative cover, occasionally bare with scattered rock outcrops; noticeably in sloping areas adjacent to main river valley.
BARREN LAND 5 classes	Bare Rock	BR	Rock outcrops, commonly located at plateau edges.
	Bare area	BA	Bare areas/undifferentiated areas not used for cultivation and usually devoid of grass or shrub cover, commonly associated with degraded land and erosion effects, sometimes within or adjacent to urban and rural areas.
	Boulders & loose rocks	BLR	Areas with large scattered boulders and/or unconsolidated loose rocks, commonly sloping and associated with rock outcrops, usually together with open-closed natural vegetation and/or shrubs and/or natural trees.
	Gullies	GU	Gully erosion, commonly associated with river beds, occasionally with trees and/or tall shrubs.
	Mines & Quarries	MQ	Major mines and quarries as well as temporary building material extraction and dumping sites.


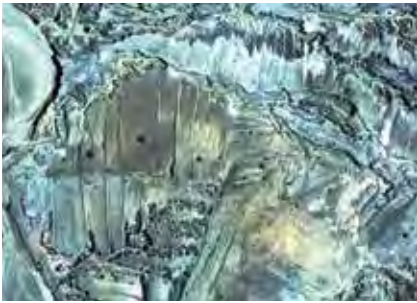
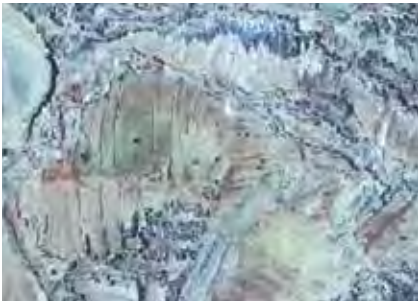
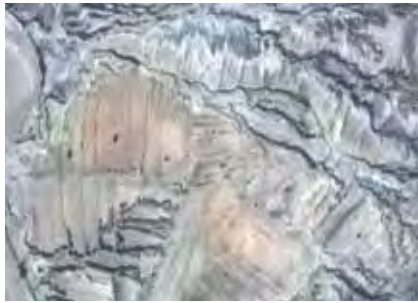
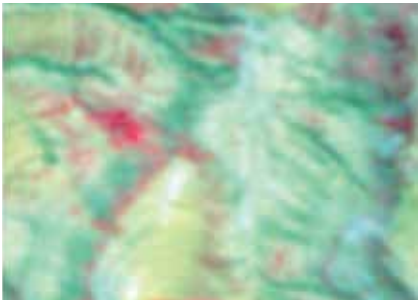



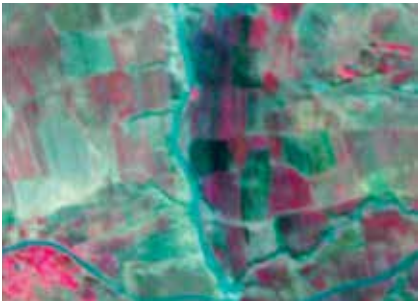

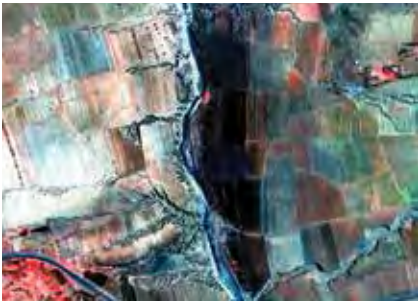

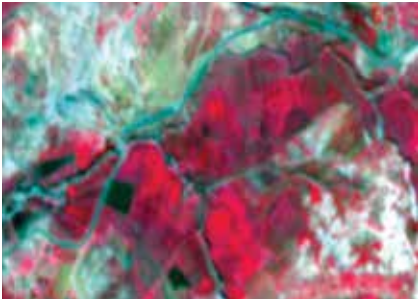

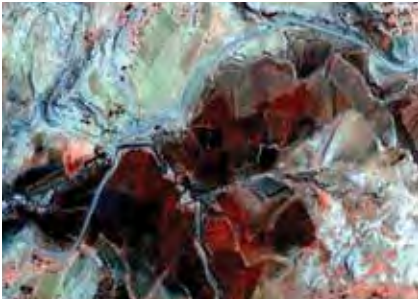
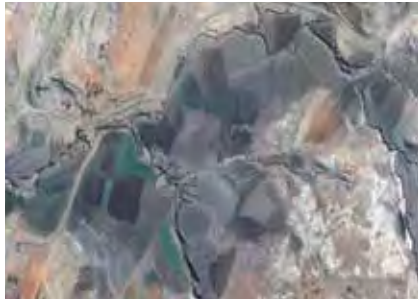
Appendix B / Photo Key examples used in the image interpretation

CLASS CODE	RAPIDEYE (5m Color)	AERIAL PHOTOGRAPH	PANSHARPEN	GOOGLE EARTH
UA1				
				
CLASS NAME Description	URBAN AREAS - Relatively larger urban built-up areas, commonly with presence of trees, occasionally with small cultivated fields; scattered open areas observed in some areas.			
UA2				
				
CLASS NAME Description	URBAN COMMERCIAL AND/ OR INDUSTRIAL AREAS - Commercial and/or industrial built-up areas, occasionally outside main urban and rural built up areas.			

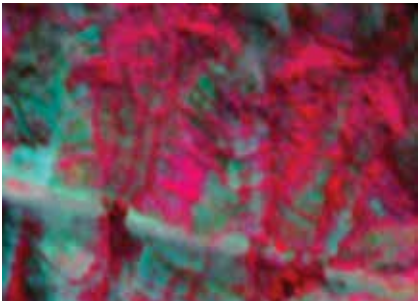

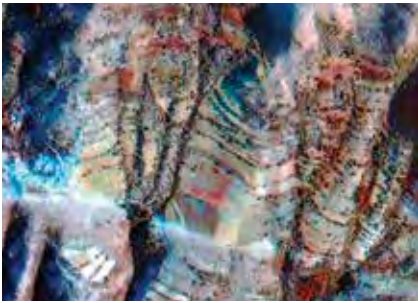
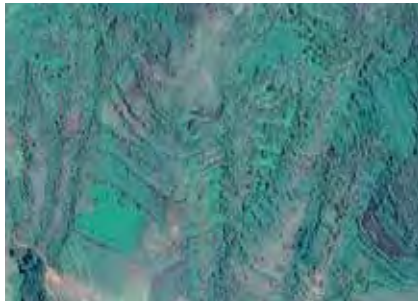
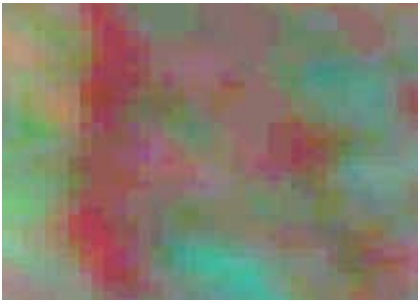

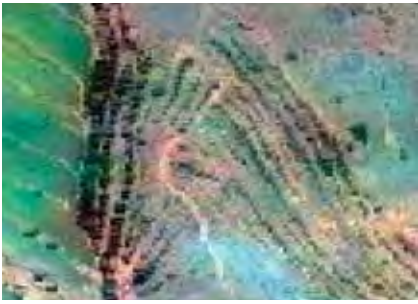
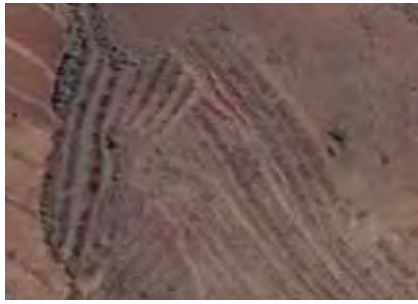
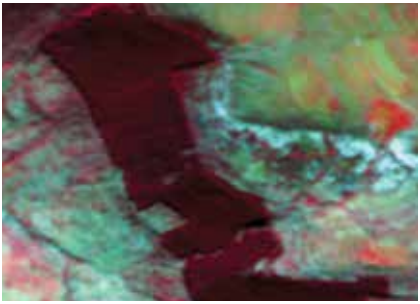



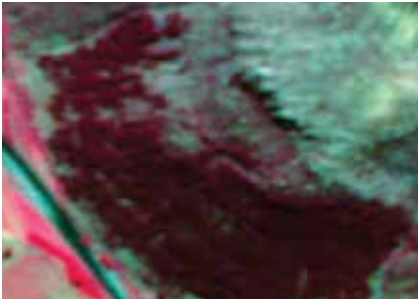
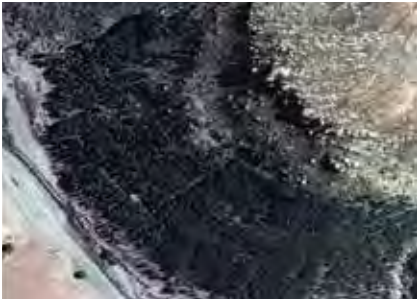


CLASS CODE	RAPIDEYE (5m Color)	AERIAL PHOTOGRAPH	PANSHARPEN	GOOGLE EARTH
RH1				
CLASS NAME Description	RURAL SETTLEMENTS, PLAIN AREAS - Rural houses in flat lying plain areas (slope up to 5 degrees) + small cultivated herbaceous crops+ closed herbaceous natural vegetation, often together with trees and/or shrubs employed for demarcation; scattered open areas observed in some areas.			
RH2				
CLASS NAME Description	RURAL SETTLEMENTS, SLOPING & MOUNTAINOUS AREAS - Rural houses in sloping and mountainous areas (slope greater than 5 degrees) + herbaceous natural vegetation, occasionally with small fields and sometimes with shrubs employed for demarcation, usually treeless.			





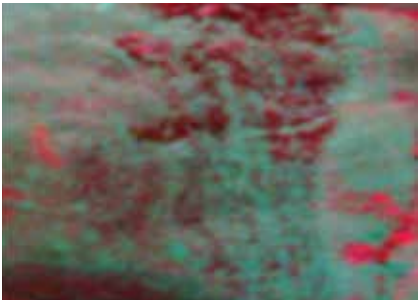



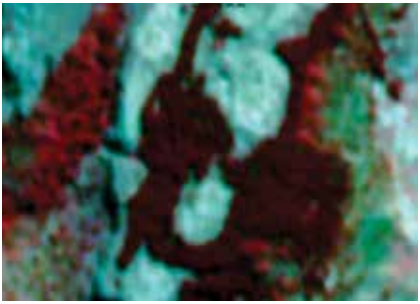



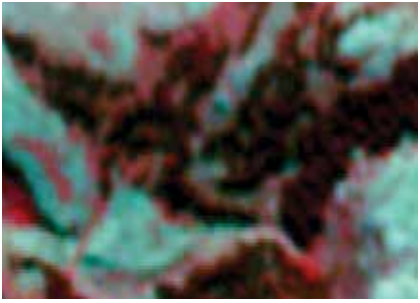
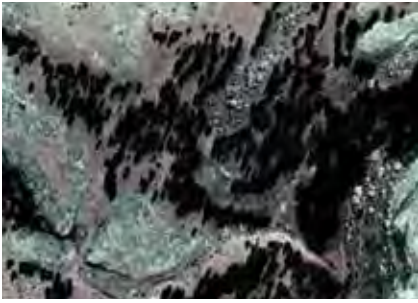

Appendix B / Photo Key examples used in the image interpretation

CLASS CODE	RAPIDEYE (5m Color)	AERIAL PHOTOGRAPH	PANSHARPEN	GOOGLE EARTH
HCP				
				
CLASS NAME Description	RAINFED AGRICULTURE, PLAIN AREAS - Rainfed herbaceous crops cultivated in flat-lying plains (slope up to 10 degrees) relatively larger sized fields.			
HCSM				
				
CLASS NAME Description	RAINFED AGRICULTURE, SLOPING & MOUNTAINOUS REGIONS - Rainfed herbaceous crops in sloping land and mountains (slope greater than 10 degrees) with terracing and/or contour ploughing, small and medium sized fields, sometimes with lines of shrubs demarcating fields.			



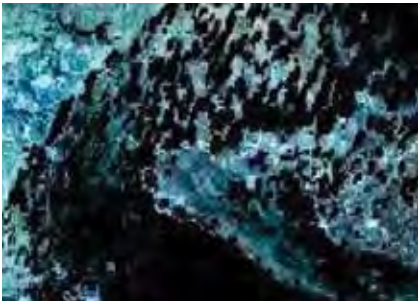





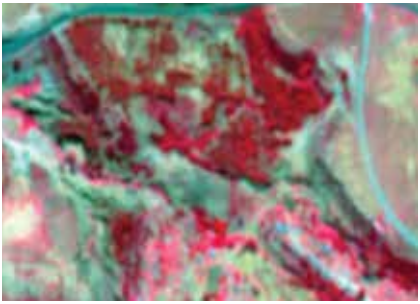

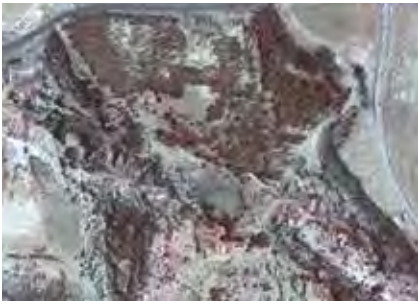

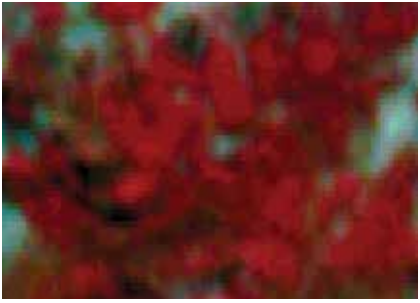



CLASS CODE	RAPIDEYE (5m Color)	AERIAL PHOTOGRAPH	PANSHARPEN	GOOGLE EARTH
HCER				
				
CLASS NAME Description	RAINFED AGRICULTURE, SHEET EROSION - Rainfed herbaceous crops with visible water sheet erosion, commonly with associated gully erosion.			
HCIR				
				
CLASS NAME Description	IRRIGATED AGRICULTURE - Small size irrigated herbaceous crops near water courses.			

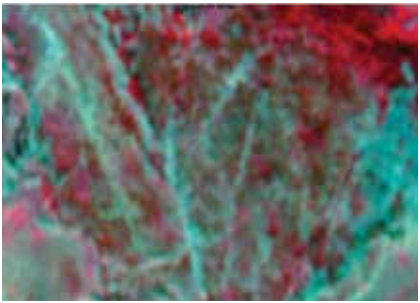

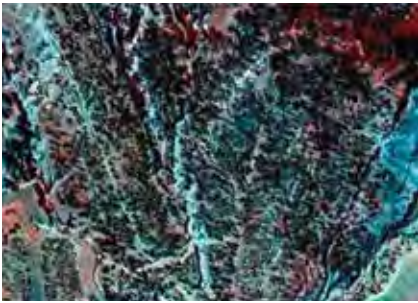
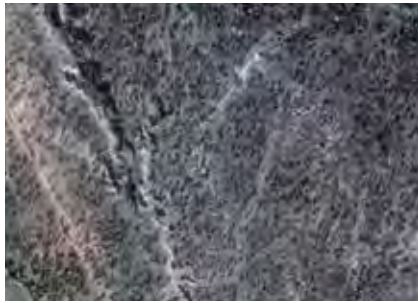
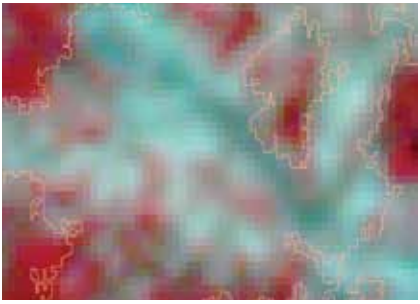



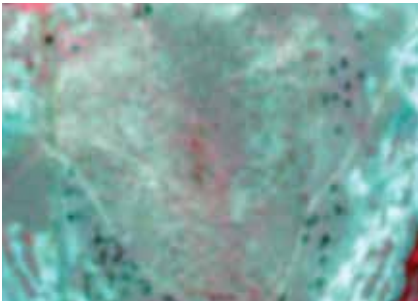







Appendix B / Photo Key examples used in the image interpretation

CLASS CODE	RAPIDEYE (5m Color)	AERIAL PHOTOGRAPH	PANSHARPEN	GOOGLE EARTH
HCT				
				
CLASS NAME Description	RAINFED AGRICULTURE AND RAINFED ORCHARDS - Small rainfed herbaceous crops + regular rainfed orchard plantations (usually as rows of fruit trees separating elongated fields).			
TNL1				
				
CLASS NAME Description	TREES, NEEDLE-LEAVED, (CLOSED) - Closed evergreen needle-leaved trees, sometimes occurring as plantations.			

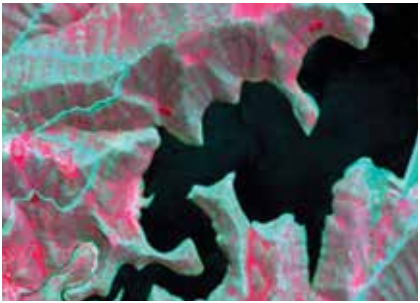

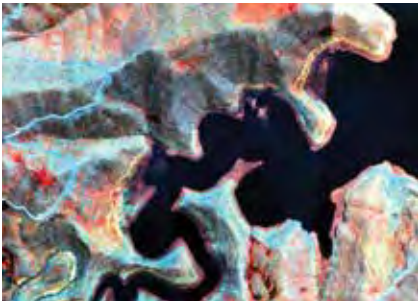

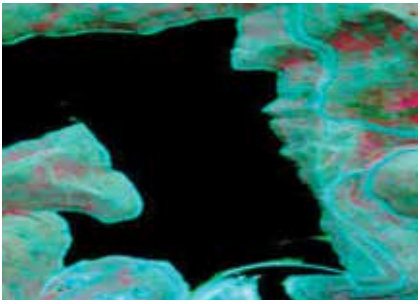



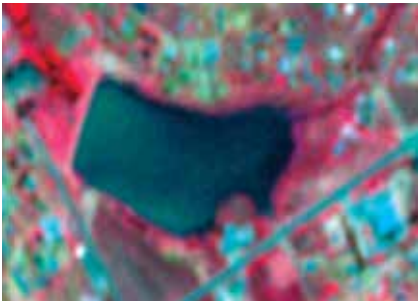







CLASS CODE	RAPIDEYE (5m Color)	AERIAL PHOTOGRAPH	PANSHARPEN	GOOGLE EARTH
TNL2				
				
CLASS NAME Description	TREES, NEEDLE-LEAVED, (OPEN) - Open evergreen needle-leaved trees + herbaceous natural vegetation.			
TBL1				
				
CLASS NAME Description	RURAL TREES, BROADLEAVED, (CLOSED) - Closed deciduous broadleaved trees, commonly along river beds, sometimes observed as plantations.			

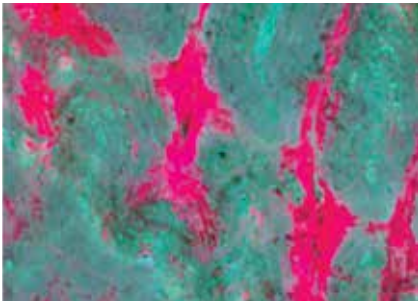

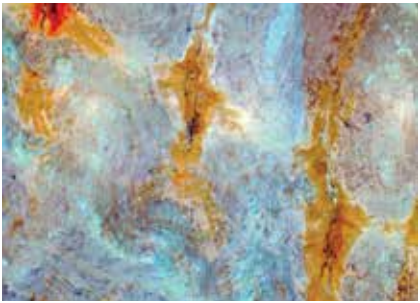

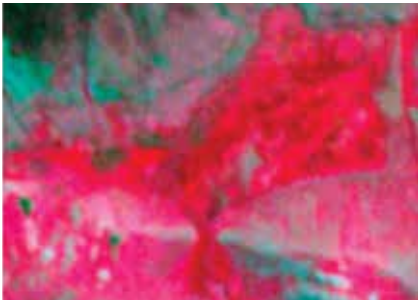

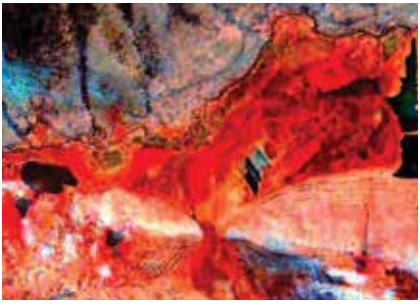

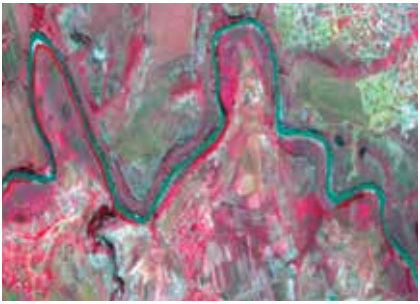

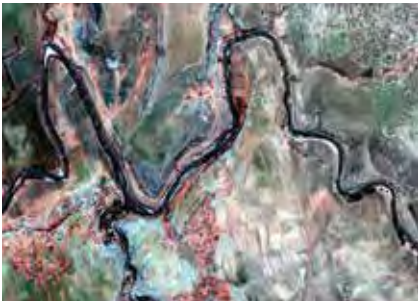

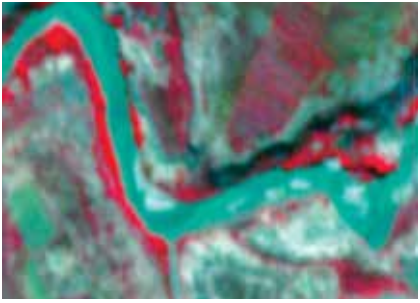


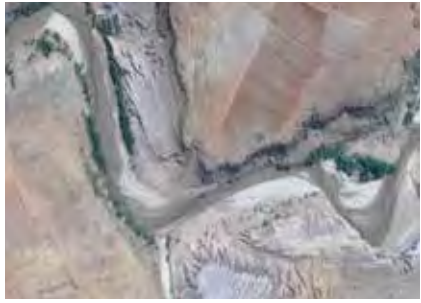
Appendix B / Photo Key examples used in the image interpretation

CLASS CODE	RAPIDEYE (5m Color)	AERIAL PHOTOGRAPH	PANSHARPEN	GOOGLE EARTH
TBL2				
				
CLASS NAME Description	TREES, BROADLEAVED, (OPEN) - Open deciduous broadleaved trees + herbaceous natural vegetation.			
TM1				
				
CLASS NAME Description	TREES, UNDIFFERENTIATED (CLOSED) - Closed undifferentiated trees, sometimes mixed broadleaved and needle-leaved; occasionally with shrubs.			

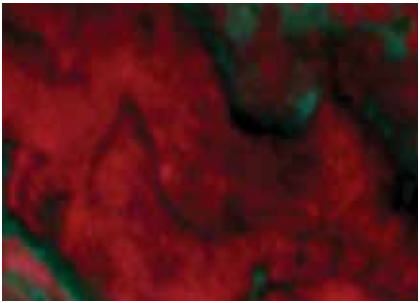

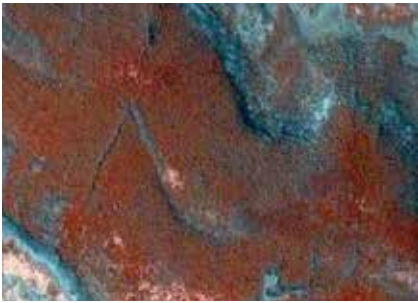

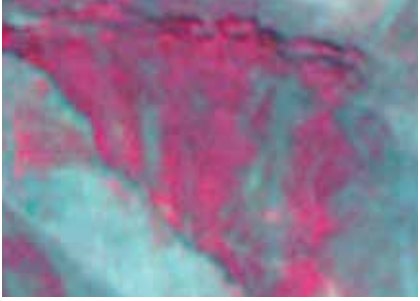



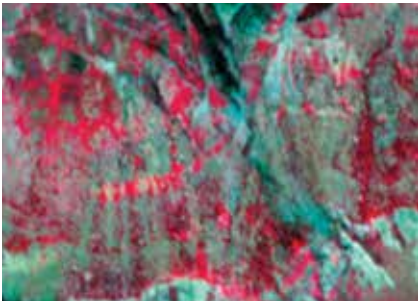

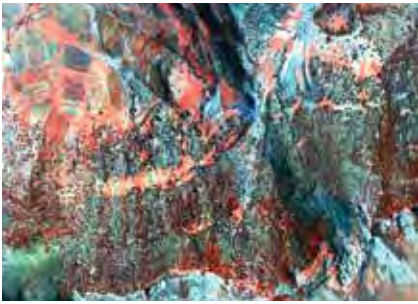

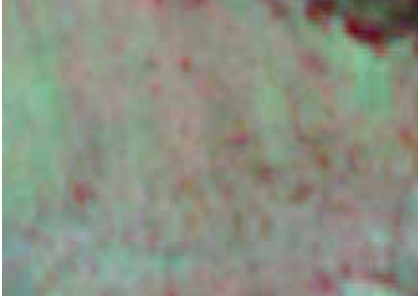



CLASS CODE	RAPIDEYE (5m Color)	AERIAL PHOTOGRAPH	PANSHARPEN	GOOGLE EARTH
TM2				
				
CLASS NAME Description	TREES, UNDIFFERENTIATED, (OPEN) - Open undifferentiated trees + herbaceous natural vegetation.			
TS				
				
CLASS NAME Description	TREES (SPARSE) - Sparse scattered trees and herbaceous natural vegetation (closed - open).			

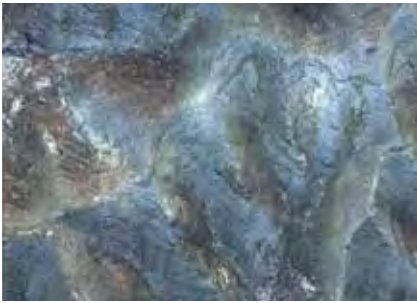


Appendix B / Photo Key examples used in the image interpretation

CLASS CODE	RAPIDEYE (5m Color)	AERIAL PHOTOGRAPH	PANSHARPEN	GOOGLE EARTH
WB1				
				
CLASS NAME Description	LARGE WATERBODY - Large perennial fresh water lake or dam reservoir.			
WB2				
				
CLASS NAME Description	SMALL WATERBODY- Small fresh water seasonal and/or perennial reservoir, pool, etc. sometimes associated with nearby wetland areas.			

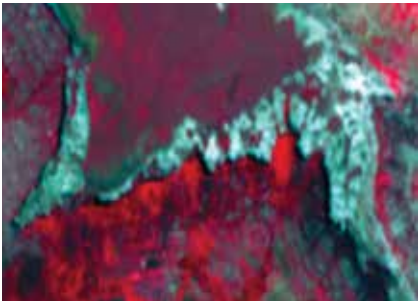

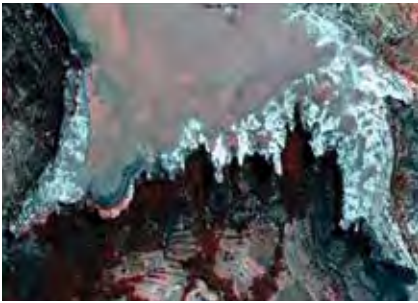

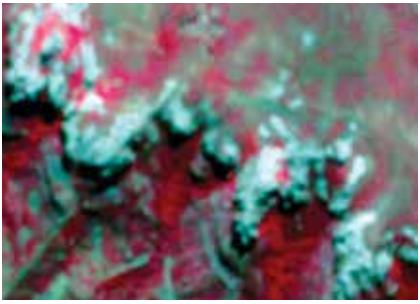

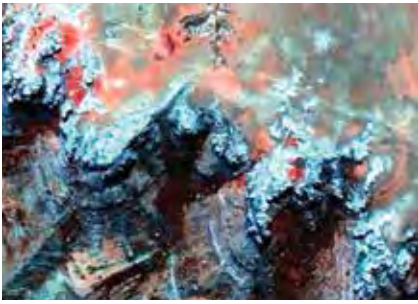


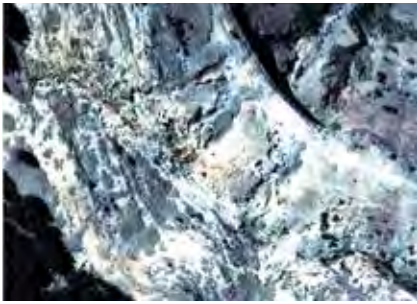
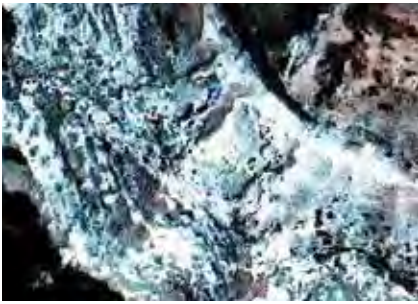




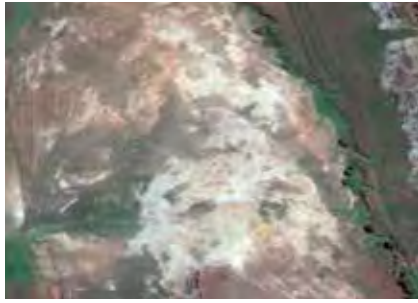
CLASS CODE	RAPIDEYE (5m Color)	AERIAL PHOTOGRAPH	PANSHARPEN	GOOGLE EARTH
WET				
				
CLASS NAME Description	WETLAND (PERENNIAL AND/OR SEASONAL) - Natural perennial and/or seasonal fresh waterbody + Perennial closed-open natural vegetation.			
RB				
				
CLASS NAME Description	RIVER BANK - River Bank (soil/sand deposits) + perennial or periodic flowing fresh water (river), occasionally with loose scattered rocks, often with adjacent trees and shrubs.			




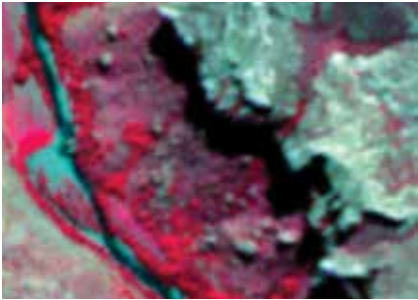






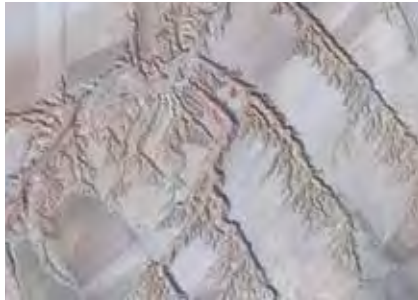
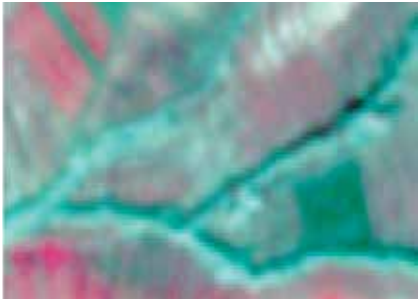

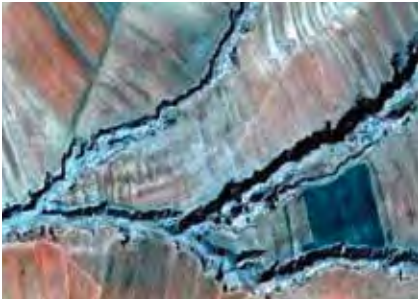



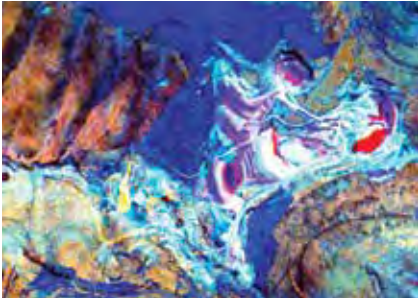


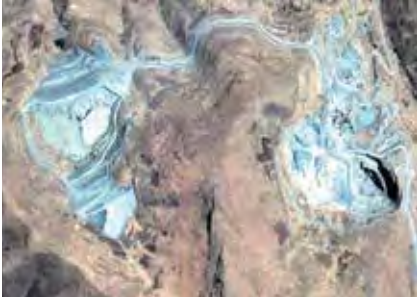
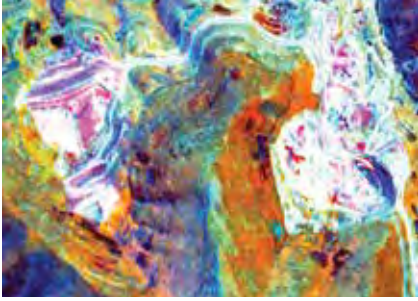

Appendix B / Photo Key examples used in the image interpretation

CLASS CODE	RAPIDEYE (5m Color)	AERIAL PHOTOGRAPH	PANSHARPEN	GOOGLE EARTH
SH1				
				
CLASS NAME Description	SHRUBLAND (CLOSED) - Closed Natural Shrubs (H=0.5 to 1.5m), commonly observed on river valley slopes, occasionally with scattered rocks and boulders.			
SH2				
				
CLASS NAME Description	SHRUBLAND (OPEN) Open Natural Shrubs (H=0.5 to 1.5m) + Natural herbaceous vegetation (Open-Closed), occasionally with scattered rocks and boulders.			

CLASS CODE	RAPIDEYE (5m Color)	AERIAL PHOTOGRAPH	PANSHARPEN	GOOGLE EARTH
GR				
				
CLASS NAME Description	GRASSLAND - Relatively dense natural vegetation, occasionally with sparse shrubs.			
GRD				
				
CLASS NAME Description	GRASSLAND DEGRADED - Degraded Grassland with low vegetative cover, occasionally bare with scattered rock outcrops; noticeably in sloping areas adjacent to main river valley.			

Appendix B / Photo Key examples used in the image interpretation

CLASS CODE	RAPIDEYE (5m Color)	AERIAL PHOTOGRAPH	PANSHARPEN	GOOGLE EARTH
BR				
				
CLASS NAME Description	BARE ROCK - Rock outcrops, commonly located at plateau edges.			
BA				
				
CLASS NAME Description	BARE AREA - Bare areas/undifferentiated areas not used for cultivation and usually devoid of grass or shrub cover, commonly associated with degraded land and erosion effects, sometimes within or adjacent to urban and rural areas.			

CLASS CODE	RAPIDEYE (5m Color)	AERIAL PHOTOGRAPH	PANSHARPEN	GOOGLE EARTH
BLR				
				
CLASS NAME Description	BOULDERS & LOOSE ROCKS - Areas with large scattered boulders and/or unconsolidated loose rocks, commonly sloping and associated with rock outcrops, usually together with open -closed natural vegetation and/or shrubs and/or natural trees.			
GU				
				
CLASS NAME Description	GULLIES - Gully erosion, commonly associated with river beds, occasionally with trees and/or tall shrubs.			
MQ				
				
CLASS NAME Description	MINES & QUARRIES - Major mines and quarries as well as temporary building material extraction and dumping sites.			

Appendix C / Districts and Catchments in percentage

CATCHMENTS: percentage of area under each District

		MAIN CATCHMENTS						TOTAL %
		Lower Caledon MOHOKARE	Lower Senqu	Makhaleng	Middle Caledon MOHOKARE	Upper Caledon MOHOKARE	Upper Senqu	
MAIN DISTRICTS	Butha-Buthe	0	0	0	0	46.13	53.87	100
	Leribe	0	0	0	5.22	58.81	35.96	100
	Berea	0	0	0.04	79.85	5.63	14.48	100
	Maseru	13.87	10.77	31.58	21.30	0	22.47	100
	Mafeteng	57.61	0.05	42.34	0	0	0	100
	Mohale's Hoek	0.92	57.32	21.72	0	0	20.05	100
	Quthing	0	97.35	0	0	0	2.65	100
	Qacha's Nek	0	3.74	0	0	0	96.26	100
	Mokhotlong	0	0	0	0	0	100	100
	Thaba-Tseka	0	0	0	0	0	100	100

DISTRICTS: percentage of area under each Catchment

		MAIN DISTRICTS										TOTAL %
		Butha-Buthe	Leribe	Berea	Maseru	Mafeteng	Mohale's Hoek	Quthing	Qacha's Nek	Mokhotlong	Thaba-Tseka	
MAIN CATCHMENTS	Lower Caledon MOHOKARE	0	0	0	30.36	67.79	1.85	0	0	0	0	100
	Lower Senqu	0	0	0	7.79	0.02	38.33	52.42	1.44	0	0	100
	Makhaleng	0	0	0.02	42.42	30.58	26.98	0	0	0	0	100
	Middle Caledon MOHOKARE	0	5.73	61.26	33.01	0	0	0	0	0	0	100
	Upper Caledon MOHOKARE	31.75	63.97	4.28	0	0	0	0	0	0	0	100
	Upper Senqu	6.39	6.75	1.90	5.95	0	4.91	0.52	13.60	27.72	32.26	100

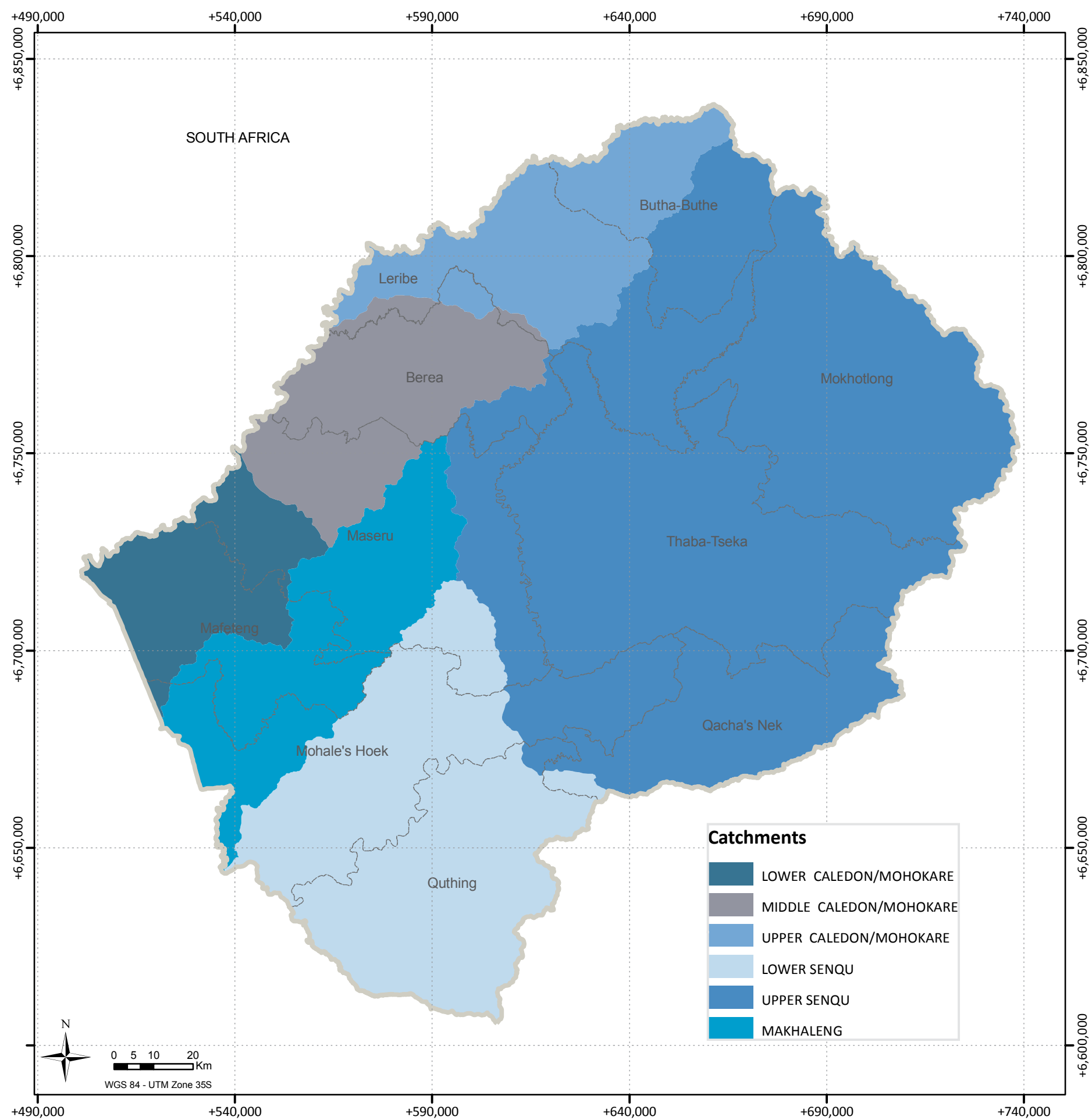
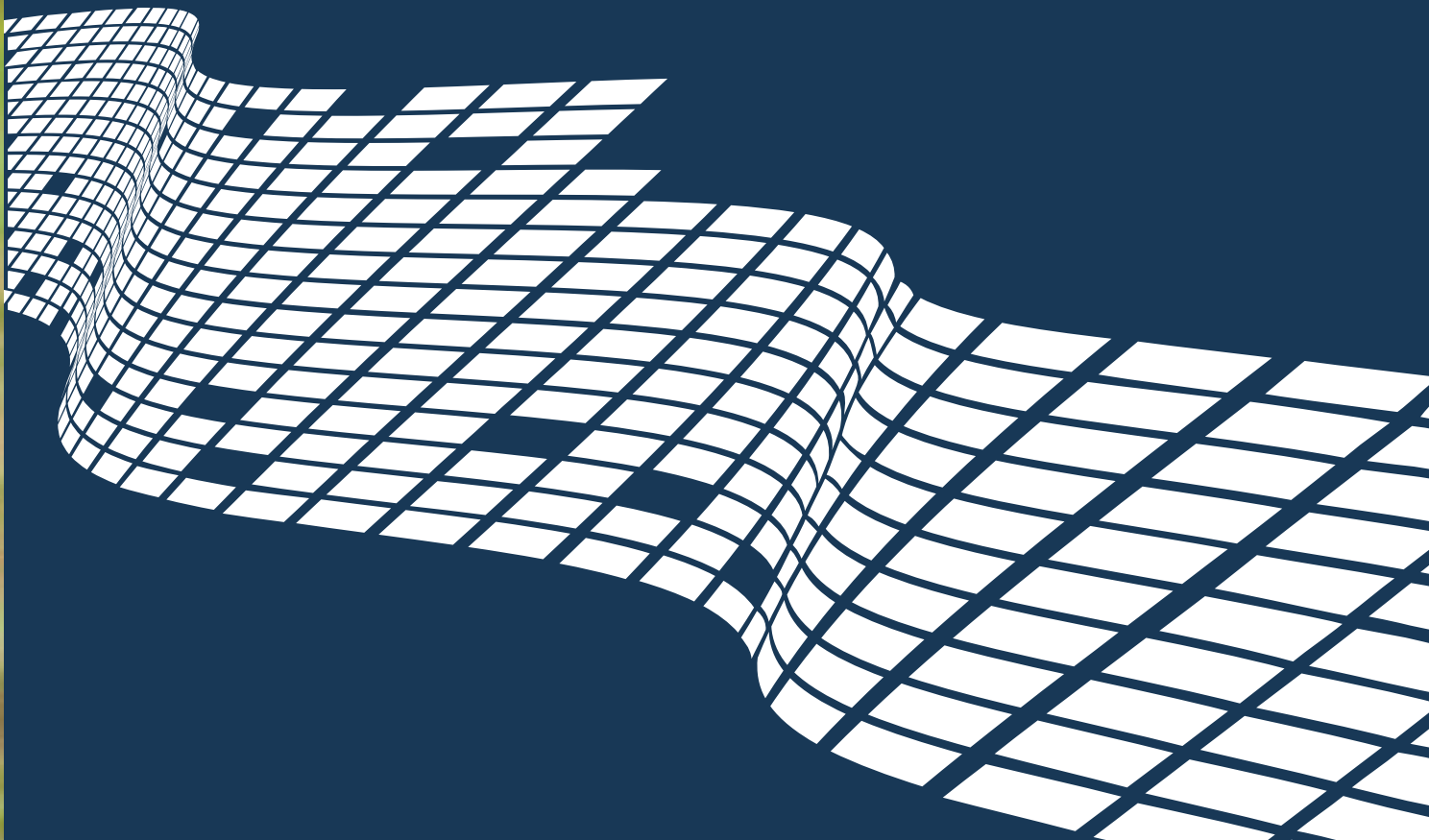




Photo credits: ©FAO/Gianluigi Guercia



Land Cover of the COUNTRY



Lesotho

COUNTRY AGGREGATED LAND COVER



AGGREGATED LAND COVER STATISTICS

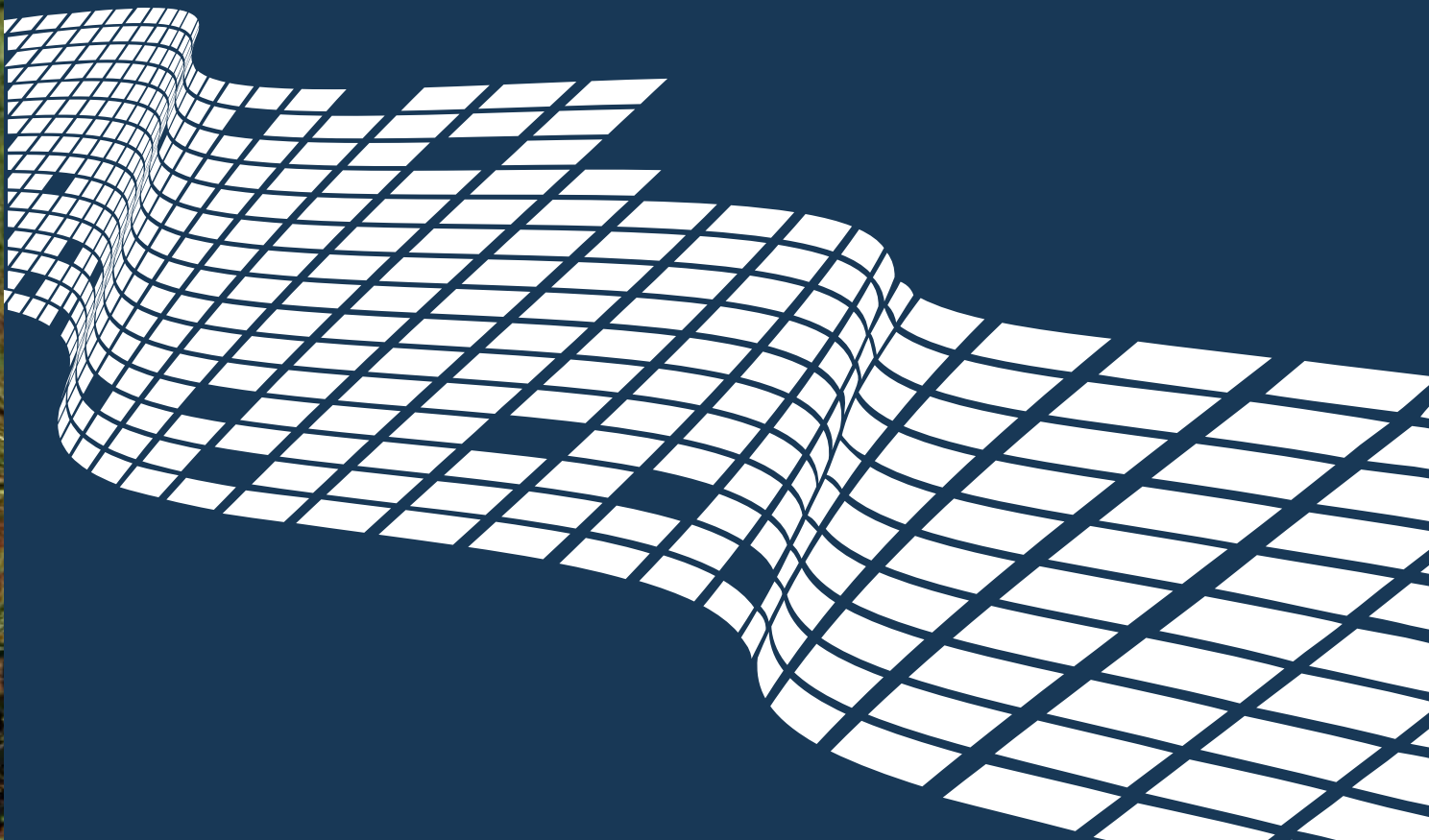
DISTRICTS	Built-up	Agricultural Land	Trees	Shrubland	Grassland	Wetland	Water Bodies & Rivers	Barrenland	TOTAL LAND
	AGBU	AGAG	AGTR	AGSH	AGGR	WET	AGWT	AGBR	
	UA1, UA2, RH1, RH2	HCP, HCSM, HCER, HCIR, HCT	TNL1, TNL2, TBL1, TBL2, TM1, TM2, TS	SH1, SH2	GR, GRD	WET	WB1, WB2, RB	BR, BA, GU, BLR, MQ	
Butha-Buthe	5,787	22,792	2,235	46,913	86,064	2,979	1,082	10,933	178,785
Leribe	17,087	83,711	8,574	44,201	111,033	1,531	4,291	12,132	282,559
Berea	15,086	75,212	7,741	21,376	67,683	339	1,162	9,008	197,606
Maseru	29,073	89,401	7,115	55,775	195,842	2,204	4,023	15,714	399,146
Mafeteng	18,370	95,534	2,410	16,887	63,981	384	2,218	14,847	214,641
Mohale's Hoek	14,042	71,381	2,952	79,862	173,386	2,430	4,190	20,861	369,102
Quthing	10,942	34,997	3,935	84,388	146,572	2,157	2,508	11,675	297,174
Qacha's Nek	4,557	24,015	1,796	43,028	118,774	3,068	1,802	15,728	212,768
Mokhotlong	3,644	32,857	595	106,887	235,973	12,826	2,631	22,132	417,544
Thaba-Tseka	7,504	48,129	1,051	85,012	316,745	4,662	4,335	18,550	485,989
TOTAL (ha)	126,091	578,039	38,404	584,328	1,516,051	32,580	28,241	151,581	3,055,314
TOTAL (%)	4.1	18.9	1.3	19.1	49.6	1.1	0.9	5.0	100



Photo credits: ©FAO/Gianluigi Guercia

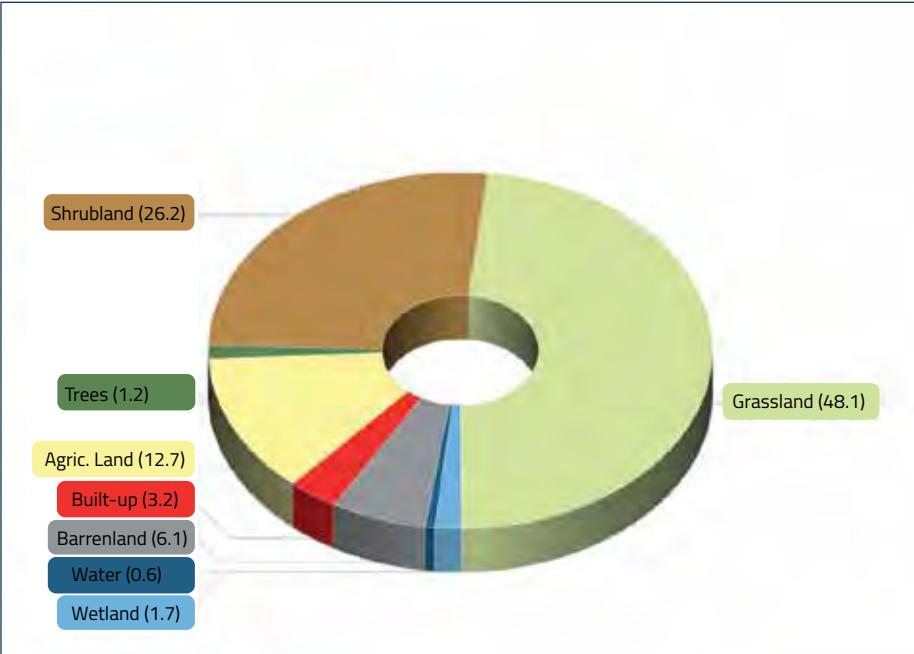


Land Cover by DISTRICTS



Butha-Buthe

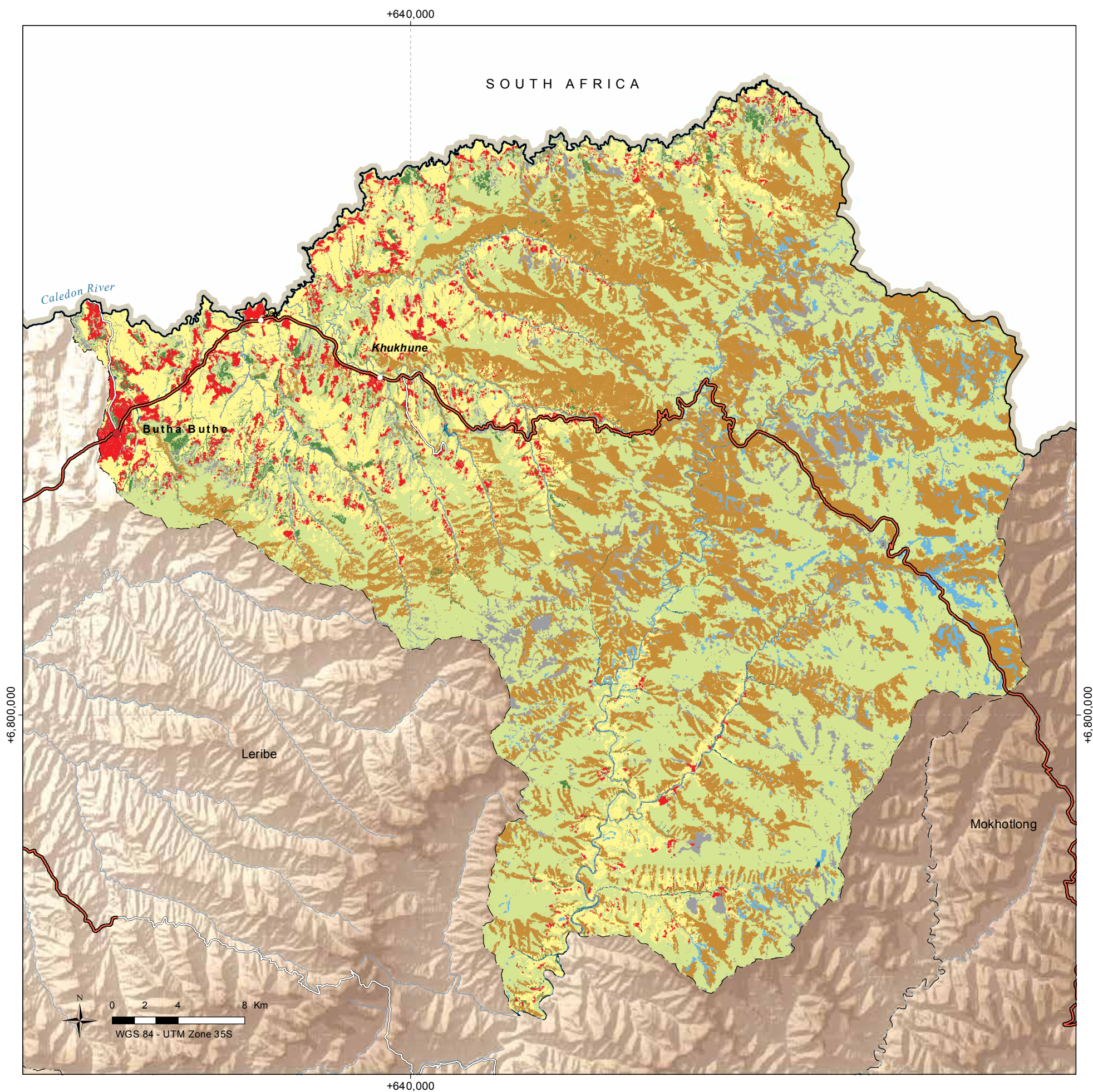
Index Map



Land Cover in percentage

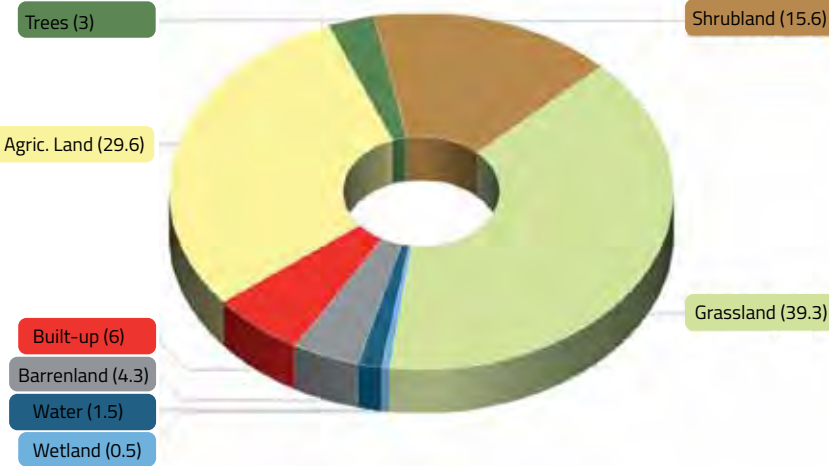
AGGREGATED LAND COVER STATISTICS

URBAN AND COMMUNITY COUNCILS	Built-up	Agricultural Land	Trees	Shrubland	Grassland	Wetland	Water Bodies & Rivers	Barrenland	TOTAL LAND
	AGBU	AGAG	AGTR	AGSH	AGGR	WET	AGWT	AGBR	
	UA1, UA2, RH1, RH2	HCP, HCSM, HCER, HCIR, HCT	TNL1, TNL2, TBL1, TBL2, TM1, TM2, TS	SH1, SH2	GR, GRD	WET	WB1, WB2, RB	BR, BA, GU, BLR, MQ	
Butha-Buthe U.C.-Butha-Buthe	1,443	2,455	385	133	1,650	12	25	435	6,537
Ngoajane B01	1,127	4,878	684	10,489	13,313	124	84	1,411	32,110
Likila B02	1,288	4,751	371	2,707	5,417	5	92	641	15,272
Nqoe B03	949	6,465	314	32,219	60,266	2,831	829	7,640	111,513
Tsa-le-Moleka B04	979	4,243	481	1,365	5,417	7	52	806	13,352
TOTAL (ha)	5,787	22,792	2,235	46,913	86,064	2,979	1,082	10,933	178,785
TOTAL (%)	3.2	12.7	1.2	26.2	48.1	1.7	0.6	6.1	100



Leribe

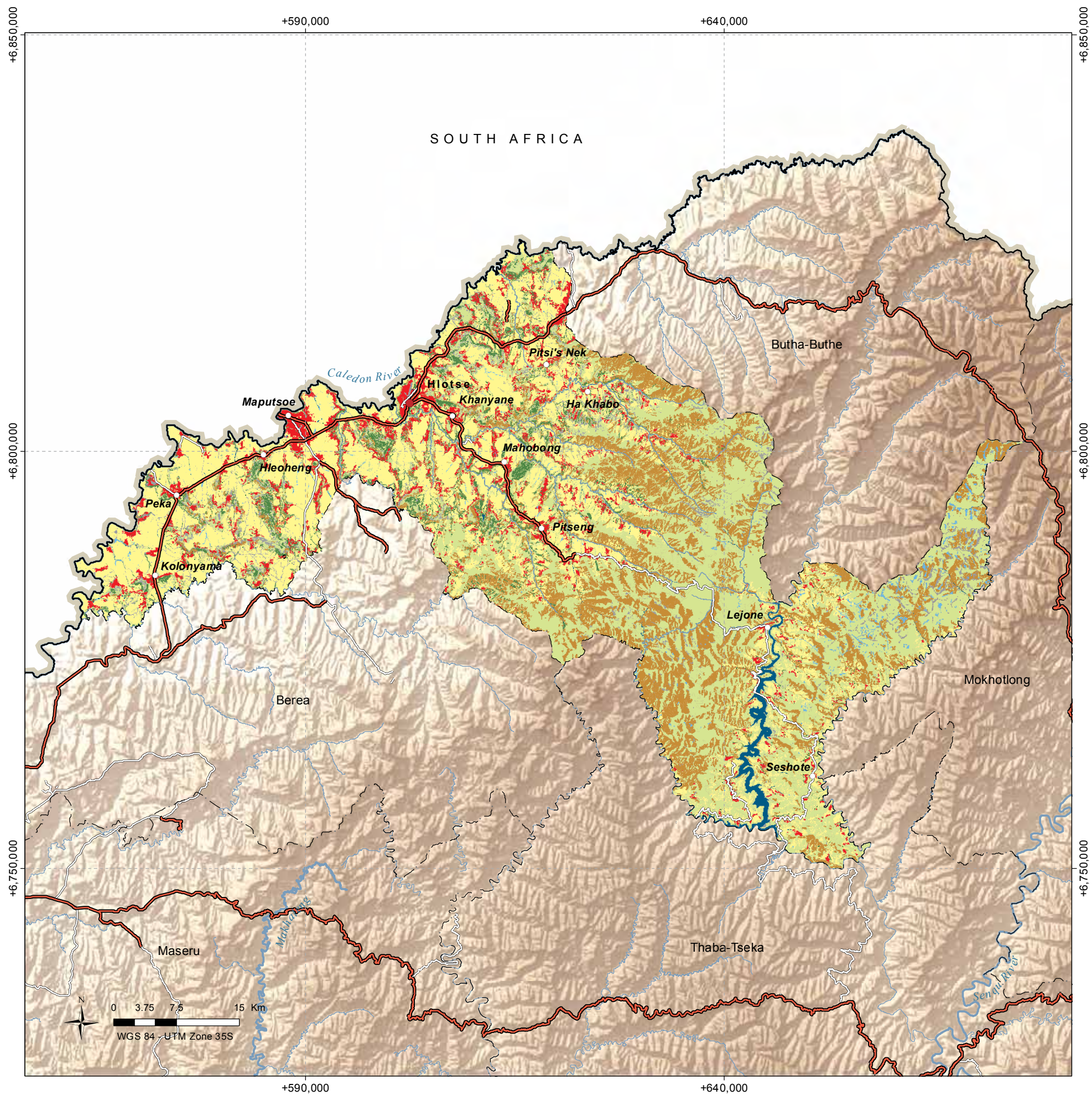
Index Map



Land Cover in percentage

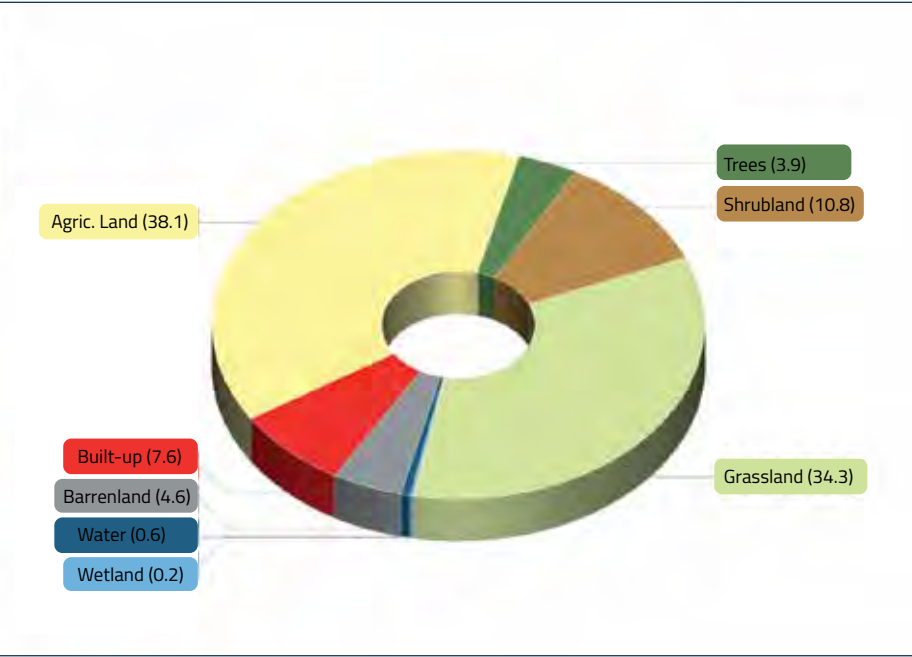
AGGREGATED LAND COVER STATISTICS

URBAN AND COMMUNITY COUNCILS	Built-up	Agricultural Land	Trees	Shrubland	Grassland	Wetland	Water Bodies & Rivers	Barrenland	TOTAL LAND
	AGBU	AGAG	AGTR	AGSH	AGGR	WET	AGWT	AGBR	
	UA1, UA2, RH1, RH2	HCP, HCSM, HCER, HCIR, HCT	TNL1, TNL2, TBL1, TBL2, TM1, TM2, TS	SH1, SH2	GR, GRD	WET	WB1, WB2, RB	BR, BA, GU, BLR, MQ	
Leribe U.C.	1,995	3,570	607	440	1,461	9	83	368	8,534
Maputsoe U.C.	1,715	2,910	192	71	303	32	69	95	5,388
Butha-Buthe U.C.-Leribe	585	1,711	99	58	365	5	1	238	3,061
Matsoku C01	1,477	10,968	322	23,177	57,956	1,195	3,184	2,640	100,920
Bolahla C02	1,007	6,014	438	7,179	12,709	29	218	373	27,967
Ramapepe C03	1,009	6,329	1,025	2,575	8,444	19	66	400	19,868
'Maoa-Mafubelu C04	1,515	6,314	964	1,849	4,174	50	90	459	15,414
Menkhoaneng C05	1,042	5,152	745	7,136	14,607	11	189	1,866	30,748
Maisa-Phoka C06	680	2,947	473	164	1,330	2	22	420	6,038
Sephokong C07	1,587	7,432	1,045	426	3,539	39	47	1,124	15,238
Litjotjela C08	683	3,809	700	303	1,314	9	21	525	7,365
Hleoheng C09	702	4,452	260	99	638	38	25	301	6,515
Manka C10	1,528	9,673	991	540	2,351	25	80	1,785	16,974
Tsuili-Tsuili C11	1,560	12,428	714	186	1,840	68	194	1,539	18,529
TOTAL (ha)	17,087	83,711	8,574	44,201	111,033	1,531	4,291	12,132	282,559
TOTAL (%)	6.0	29.6	3.0	15.6	39.3	0.5	1.5	4.3	100



Berea

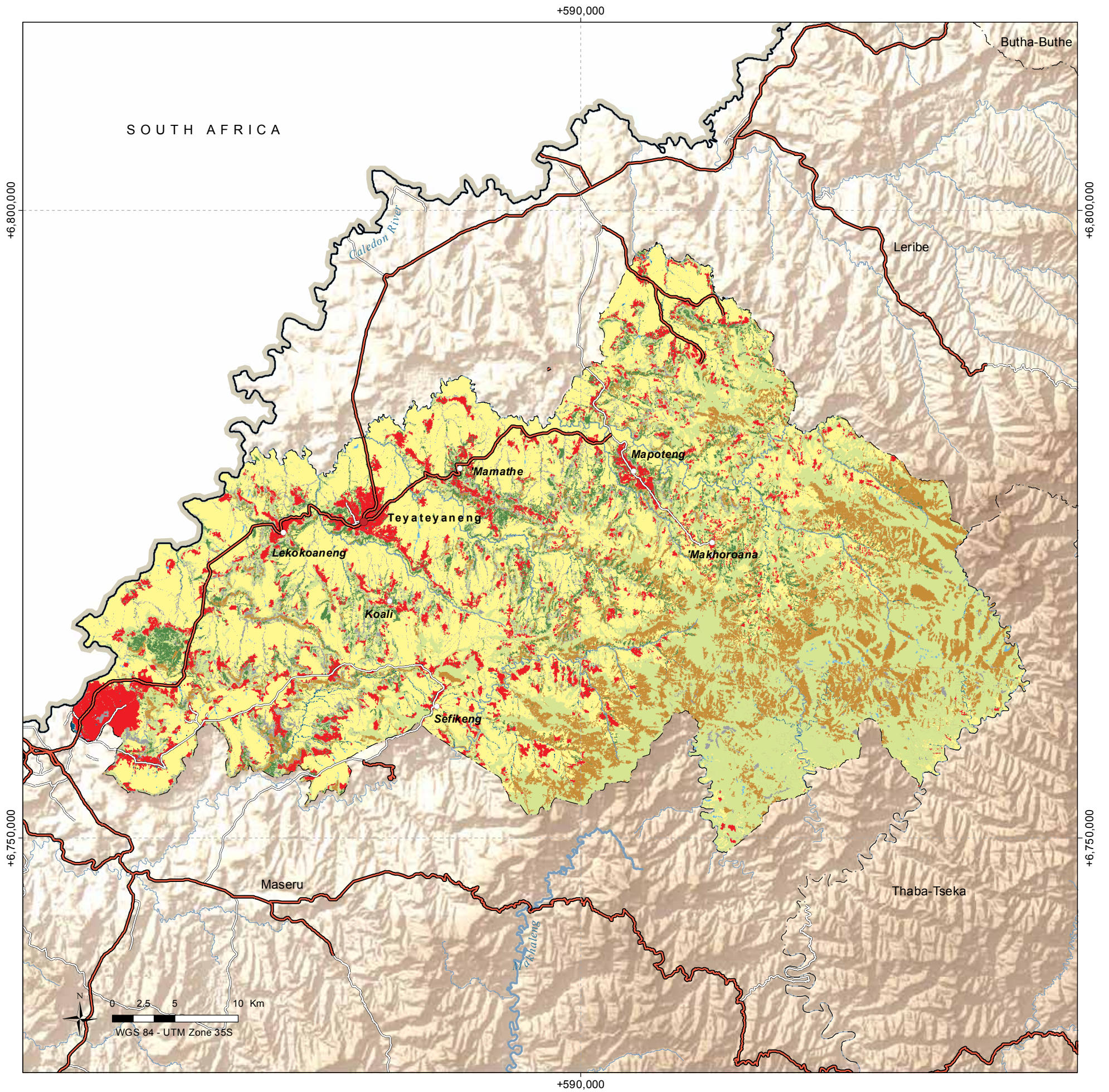
Index Map



Land Cover in percentage

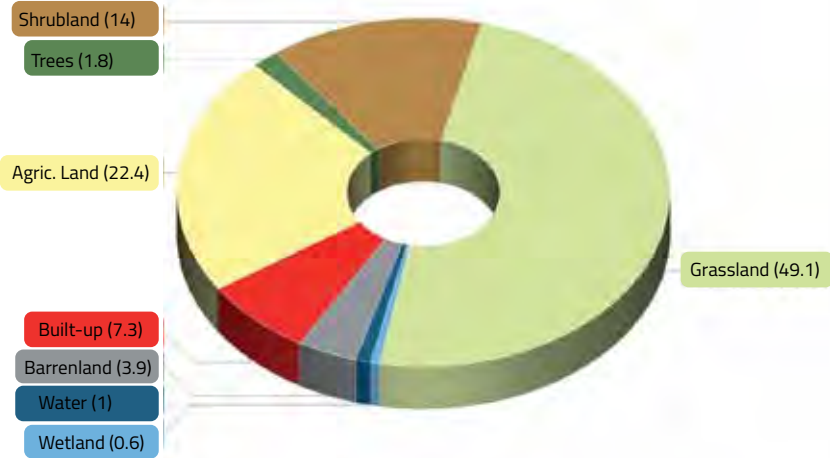
AGGREGATED LAND COVER STATISTICS

URBAN AND COMMUNITY COUNCILS	Built-up	Agricultural Land	Trees	Shrubland	Grassland	Wetland	Water Bodies & Rivers	Barrenland	TOTAL LAND
	AGBU	AGAG	AGTR	AGSH	AGGR	WET	AGWT	AGBR	
	UA1, UA2, RH1, RH2	HCP, HCSM, HCER, HCIR, HCT	TNL1, TNL2, TBL1, TBL2, TM1, TM2, TS	SH1, SH2	GR, GRD	WET	WB1, WB2, RB	BR, BA, GU, BLR, MQ	
Maseru M.C.-Berea	2,102	973	65	134	439	19	42	240	4,014
Tayateyaneng U.C.	1,412	4,836	416	49	684	35	58	294	7,785
Makeoana D01	893	7,673	1,048	12,253	35,931	159	344	541	58,842
Mapoteng D02	1,090	4,613	806	1,097	4,302	1	58	593	12,559
Kueneng D03	1,240	7,543	802	536	3,454	20	37	565	14,198
Tebe-Tebe D04	1,412	8,967	894	2,475	6,879	5	136	981	21,749
Phuthiatsana D05	1,612	10,029	1,325	850	3,111	8	106	1,451	18,491
Motanasela D06	1,864	11,321	657	2,808	7,200	16	193	936	24,996
Senekane D07	2,346	13,157	1,028	936	4,088	45	140	2,728	24,468
Kanana D08	1,115	6,099	701	237	1,595	31	48	679	10,505
TOTAL (ha)	15,086	75,212	7,741	21,376	67,683	339	1,162	9,008	197,606
TOTAL (%)	7.6	38.1	3.9	10.8	34.3	0.2	0.6	4.6	100



Maseru

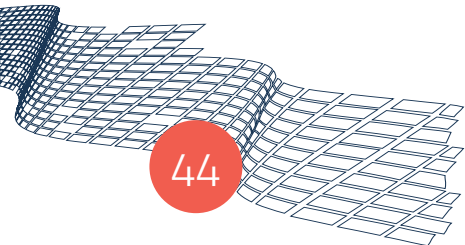
Index Map



Land Cover in percentage

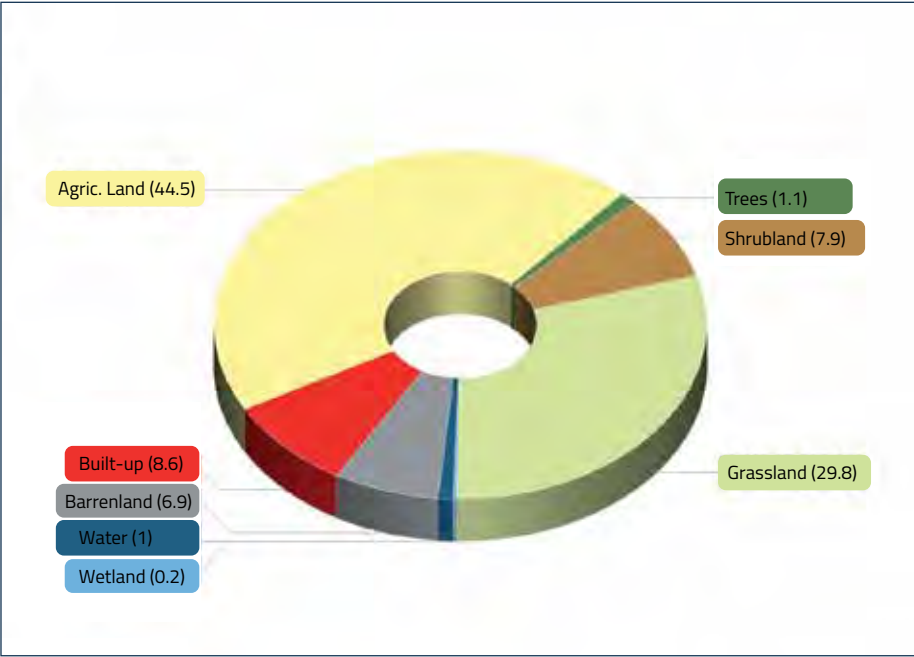
AGGREGATED LAND COVER STATISTICS

URBAN AND COMMUNITY COUNCILS	Built-up	Agricultural Land	Trees	Shrubland	Grassland	Wetland	Water Bodies & Rivers	Barrenland	TOTAL LAND
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	UA1, UA2, RH1, RH2	HCP, HCSM, HCER, HCIR, HCT	TNL1, TNL2, TBL1, TBL2, TM1, TM2, TS	SH1, SH2	GR, GRD	WET	WB1, WB2, RB	BR, BA, GU, BLR, MQ	
Maseru M.C.-Maseru	7,972	2,415	689	311	1,750	37	247	761	14,182
Semonkong U.C.	751	1,392	64	664	4,351	79	37	133	7,472
Qiloane A01	1,109	5,146	657	588	942	23	97	1,305	9,868
Ratau A02	2,464	9,905	465	2,621	5,462	89	320	642	21,968
Likolobeng A03	2,142	11,152	508	19,601	74,502	828	1,657	2,176	112,566
Manonyane A04	1,608	4,610	749	1,201	3,992	26	78	863	13,129
Mohlakeng A05	2,540	8,066	704	292	1,823	99	142	716	14,381
Thota-ea-Mali A06	1,620	4,799	290	296	2,770	53	70	847	10,746
Lilala A07	2,745	13,151	676	3,120	5,507	20	408	2,992	28,618
Makhoarane A08	2,515	9,962	859	1,581	5,319	78	113	1,469	21,896
Kubake A09	2,166	10,885	1,327	9,754	26,975	62	451	2,055	53,676
Makhoalipana A10	1,440	7,919	126	15,746	62,448	808	401	1,756	90,643
TOTAL (ha)	29,073	89,401	7,115	55,775	195,842	2,204	4,023	15,714	399,146
TOTAL (%)	7.3	22.4	1.8	14.0	49.1	0.6	1.0	3.9	100



Mafeteng

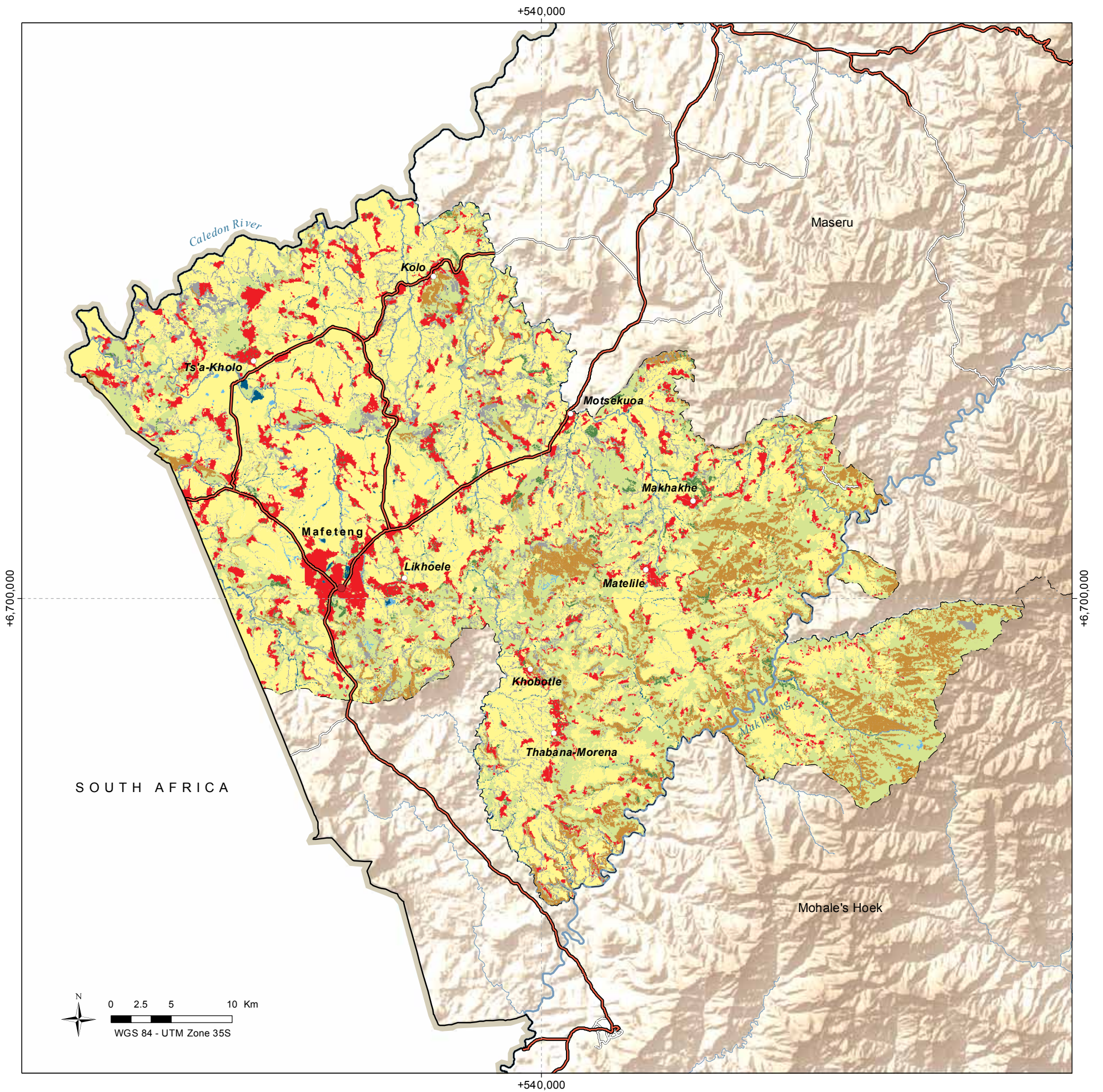
Index Map



Land Cover in percentage

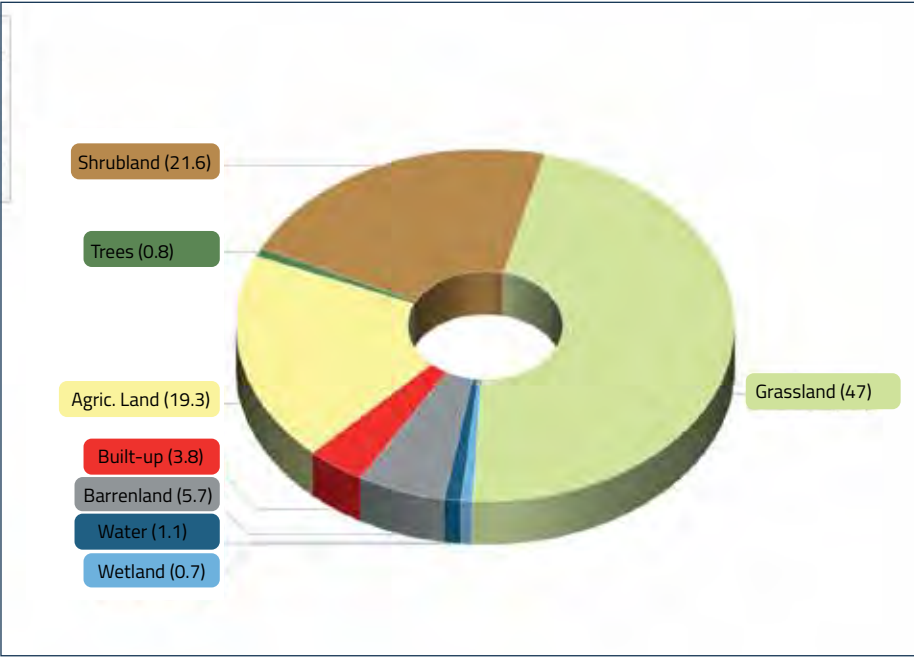
AGGREGATED LAND COVER STATISTICS

URBAN AND COMMUNITY COUNCILS	Built-up	Agricultural Land	Trees	Shrubland	Grassland	Wetland	Water Bodies & Rivers	Barrenland	TOTAL LAND
	AGBU	AGAG	AGTR	AGSH	AGGR	WET	AGWT	AGBR	
	UA1, UA2, RH1, RH2	HCP, HCSM, HCER, HCIR, HCT	TNL1, TNL2, TBL1, TBL2, TM1, TM2, TS	SH1, SH2	GR, GRD	WET	WB1, WB2, RB	BR, BA, GU, BLR, MQ	
Mafeteng U.C.	2,484	2,939	148	107	1,306	63	88	262	7,396
Metsi-Maholo E01	3,083	16,812	153	206	3,911	21	475	2,847	27,508
Mamants'o E02	2,477	13,529	368	958	5,911	19	305	3,318	26,884
Ramoetsana E03	1,792	11,807	567	3,549	12,590	24	222	1,594	32,146
Lehlakaneng E04	1,957	10,629	543	7,997	18,837	45	293	1,331	41,632
Makoabating E05	1,843	12,277	237	2,777	10,848	33	369	2,442	30,825
Tsana-Talana E06	2,050	11,263	227	707	5,275	70	136	1,366	21,094
Quibing E07	2,685	16,287	166	587	5,304	109	331	1,688	27,156
TOTAL (ha)	18,370	95,543	2,410	16,887	63,981	384	2,218	14,847	214,641
TOTAL (%)	8.6	44.5	1.1	7.9	29.8	0.2	1.0	6.9	100



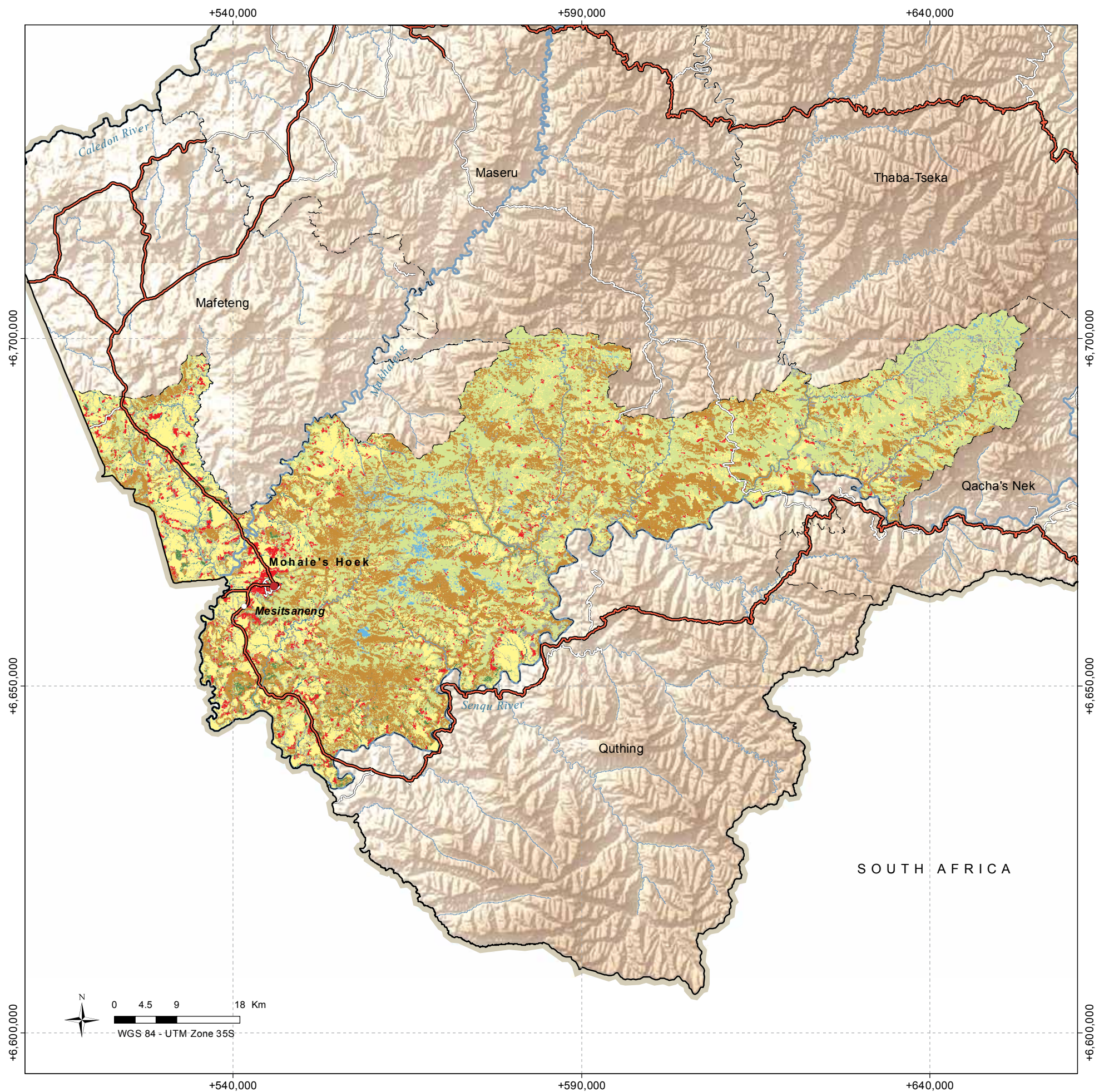
Mohale's Hoek

Index Map



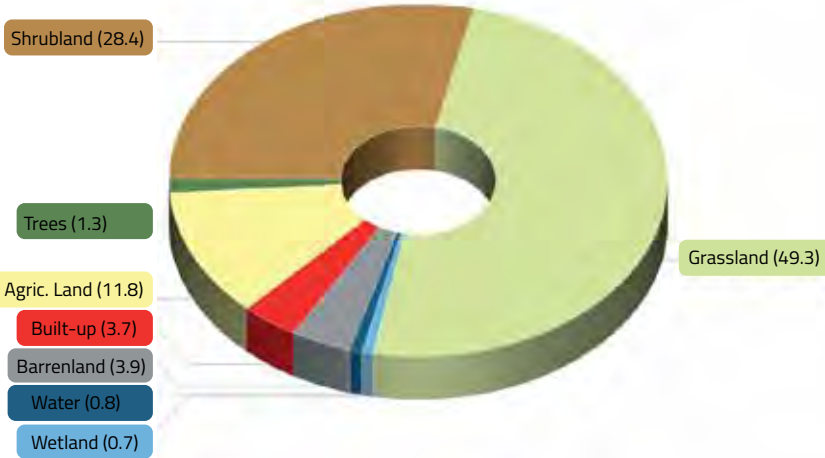
AGGREGATED LAND COVER STATISTICS

URBAN AND COMMUNITY COUNCILS	Built-up	Agricultural Land	Trees	Shrubland	Grassland	Wetland	Water Bodies & Rivers	Barrenland	TOTAL LAND
	AGBU	AGAG	AGTR	AGSH	AGGR	WET	AGWT	AGBR	
	UA1, UA2, RH1, RH2	HCP, HCSM, HCER, HCIR, HCT	TNL1, TNL2, TBL1, TBL2, TM1, TM2, TS	SH1, SH2	GR, GRD	WET	WB1, WB2, RB	BR, BA, GU, BLR, MQ	
Mohale's Hoek U.C.	2,368	4,439	151	1,265	3,582	17	158	851	12,831
Siloe F01	2,264	13,649	328	3,023	8,803	23	439	2,945	31,474
Mashaleng F02	566	3,286	98	789	1,114	14	197	1,132	7,196
Khoelenya F03	2,671	10,151	822	7,538	7,918	9	576	2,530	32,217
Lithipeng F04	1,647	9,037	605	11,658	17,574	478	699	2,279	43,978
Thaba-Mokhele F05	1,251	8,640	216	12,183	21,504	368	379	1,916	46,457
Qhoasing F06	1,907	12,204	503	24,638	58,564	1,162	737	4,659	104,374
Senqunyane F07	1,368	9,975	229	18,766	54,327	359	1,004	4,547	90,575
TOTAL (ha)	14,042	71,381	2,952	79,862	173,386	2,430	4,190	20,861	369,102
TOTAL (%)	3.8	19.3	0.8	21.6	47.0	0.7	1.1	5.7	100



Quthing

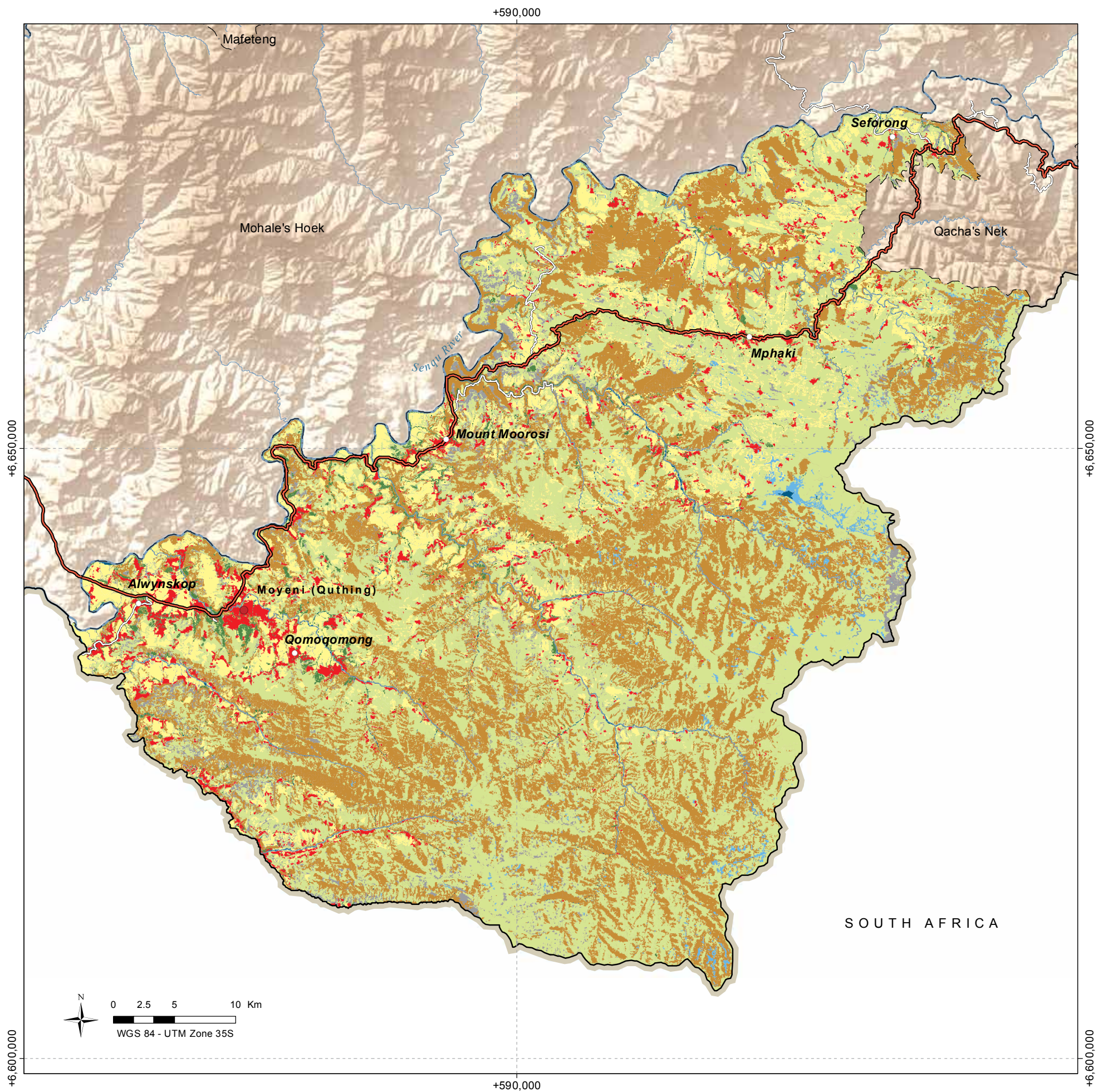
Index Map



Land Cover in percentage

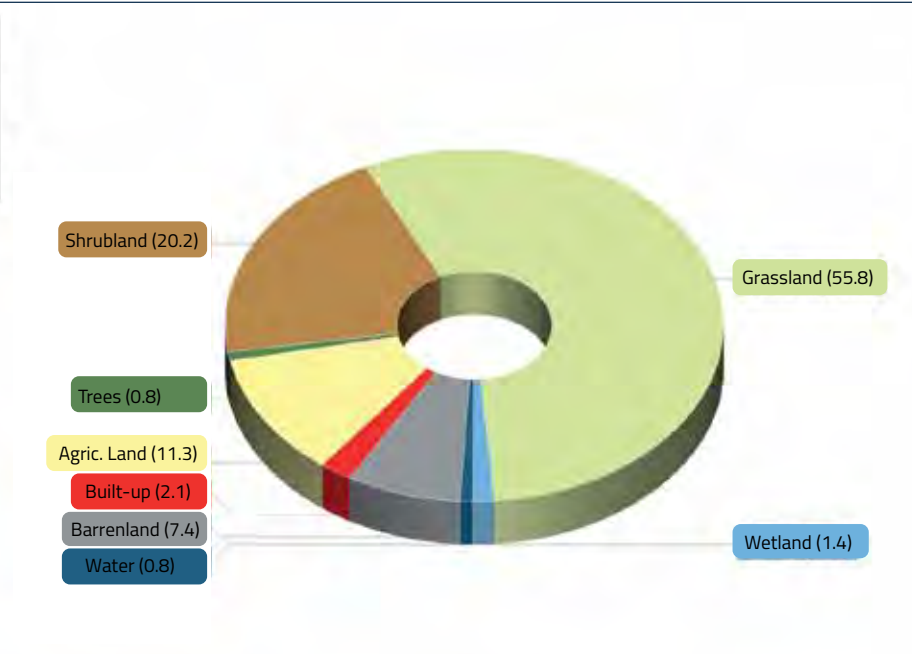
AGGREGATED LAND COVER STATISTICS

URBAN AND COMMUNITY COUNCILS	Built-up	Agricultural Land	Trees	Shrubland	Grassland	Wetland	Water Bodies & Rivers	Barrenland	TOTAL LAND
	AGBU	AGAG	AGTR	AGSH	AGGR	WET	AGWT	AGBR	
	UA1, UA2, RH1, RH2	HCP, HCSM, HCER, HCIR, HCT	TNL1, TNL2, TBL1, TBL2, TM1, TM2, TS	SH1, SH2	GR, GRD	WET	WB1, WB2, RB	BR, BA, GU, BLR, MQ	
Quthing U.C.	2,482	4,677	863	1,569	3,403	1	195	496	13,687
Mjanyane G01	1,800	3,660	288	10,669	15,010	47	334	2,968	34,775
Qomoqomong G02	712	1,658	305	5,307	8,221	0	114	299	16,617
Tosing G03	2,383	8,181	1,045	39,045	67,237	847	751	2,507	121,996
Telle G04	2,055	8,944	994	15,672	26,966	988	737	3,626	59,982
Mphaki G05	1,509	7,878	439	12,126	25,735	274	377	1,778	50,117
TOTAL (ha)	10,942	34,997	3,935	84,388	146,572	2,157	2,508	11,675	297,174
TOTAL (%)	3.7	11.8	1.3	28.4	49.3	0.7	0.8	3.9	100



Qacha's Nek

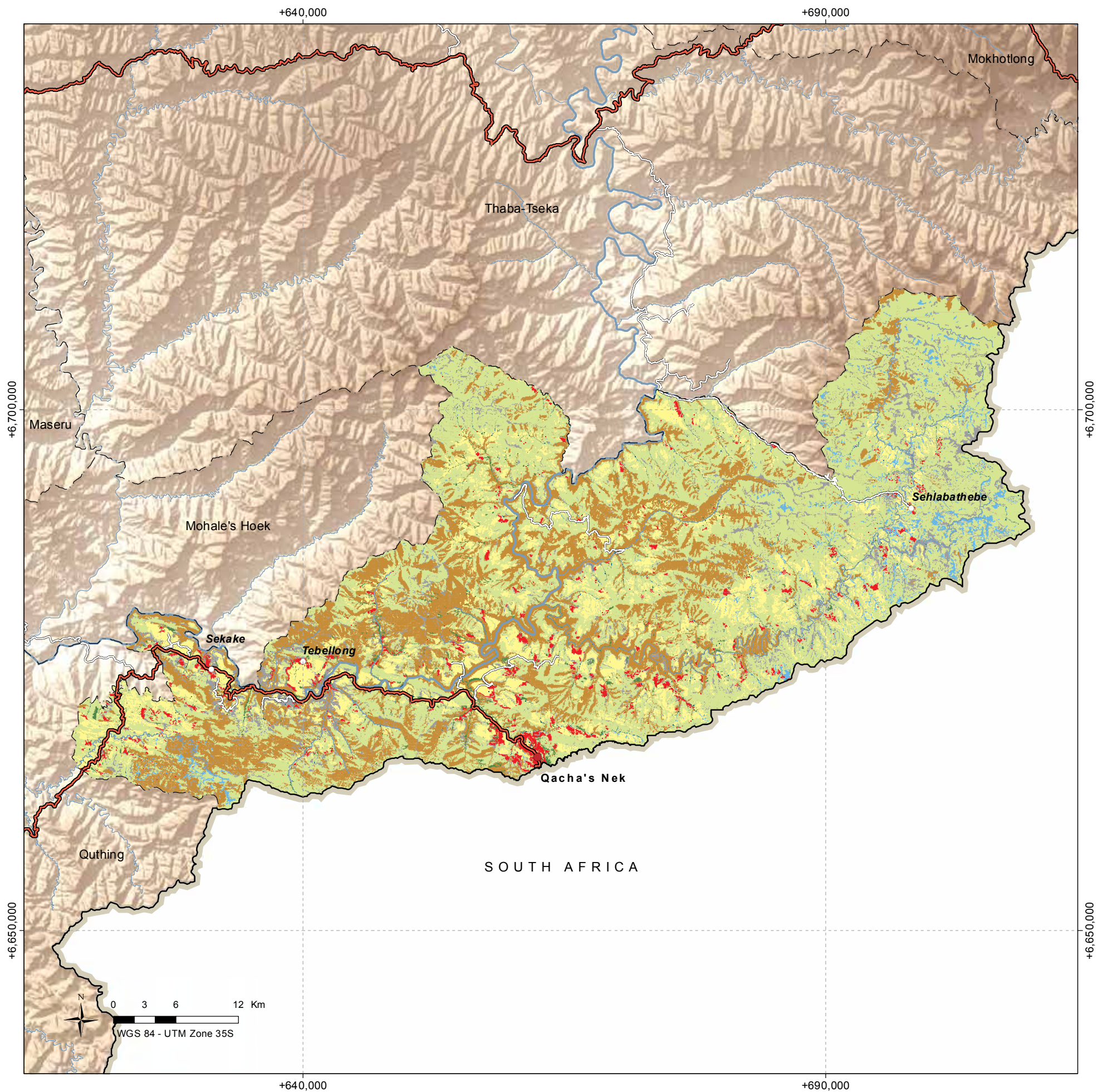
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Land Cover in percentage

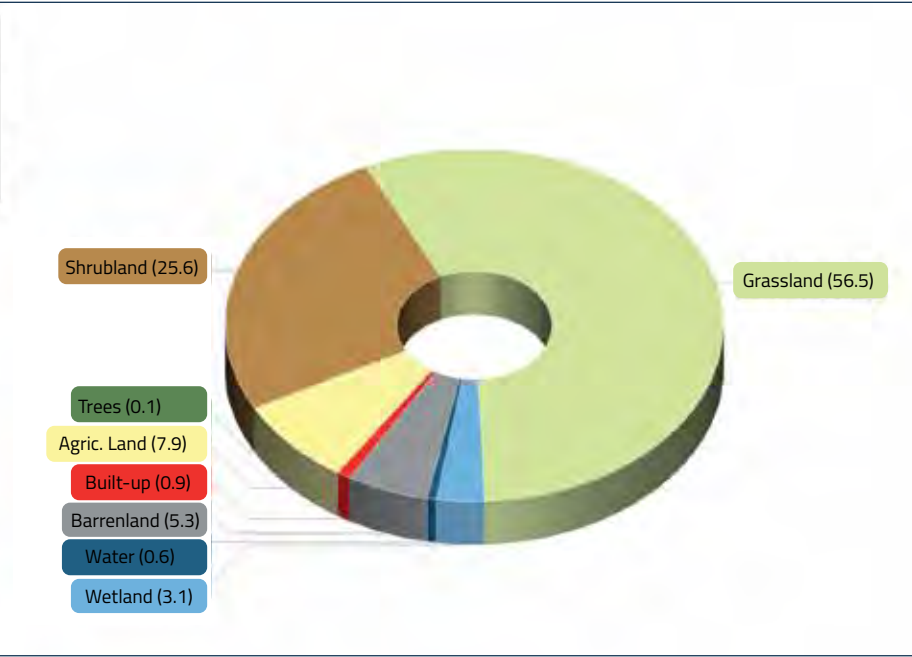
AGGREGATED LAND COVER STATISTICS

URBAN AND COMMUNITY COUNCILS	Built-up	Agricultural Land	Trees	Shrubland	Grassland	Wetland	Water Bodies & Rivers	Barrenland	TOTAL LAND
	AGBU	AGAG	AGTR	AGSH	AGGR	WET	AGWT	AGBR	
	UA1, UA2, RH1, RH2	HCP, HCSM, HCER, HCIR, HCT	TNL1, TNL2, TBL1, TBL2, TM1, TM2, TS	SH1, SH2	GR, GRD	WET	WB1, WB2, RB	BR, BA, GU, BLR, MQ	
Qacha's Nek U.C.	980	1,308	277	1,894	4,805	15	52	693	10,023
Qanya H01	985	4,633	312	9,398	15,914	335	355	4,177	36,109
Ntsupe H02	1,221	10,874	836	25,336	47,272	198	956	4,594	91,286
Tsoelikana H03	1,372	7,200	371	6,400	50,784	2,520	439	6,264	75,349
TOTAL (ha)	4,557	24,015	1,796	43,028	118,774	3,068	1,802	15,728	212,768
TOTAL (%)	2.1	11.3	0.8	20.2	55.8	1.4	0.8	7.4	100



Mokhotlong

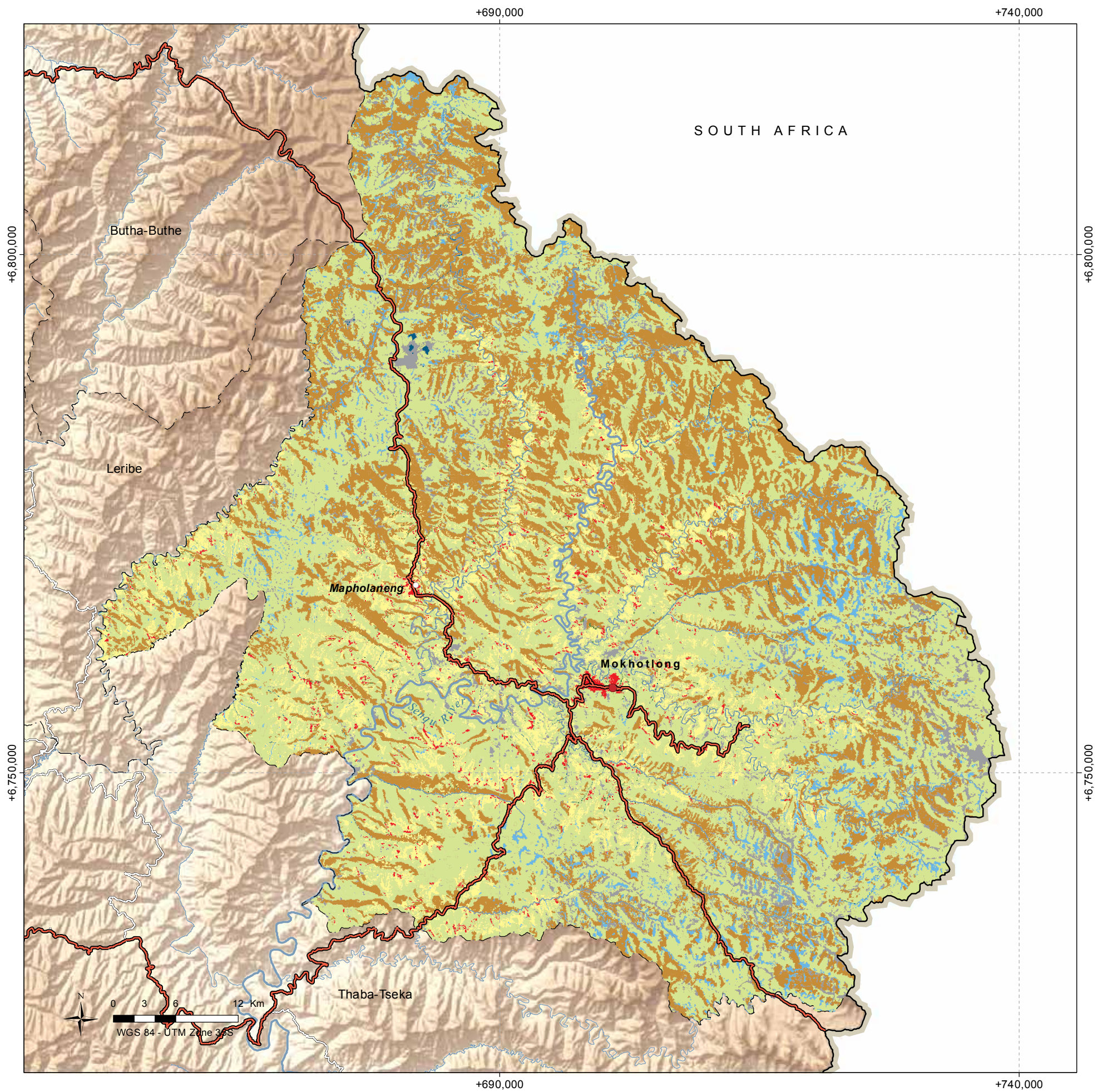
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Land Cover in percentage

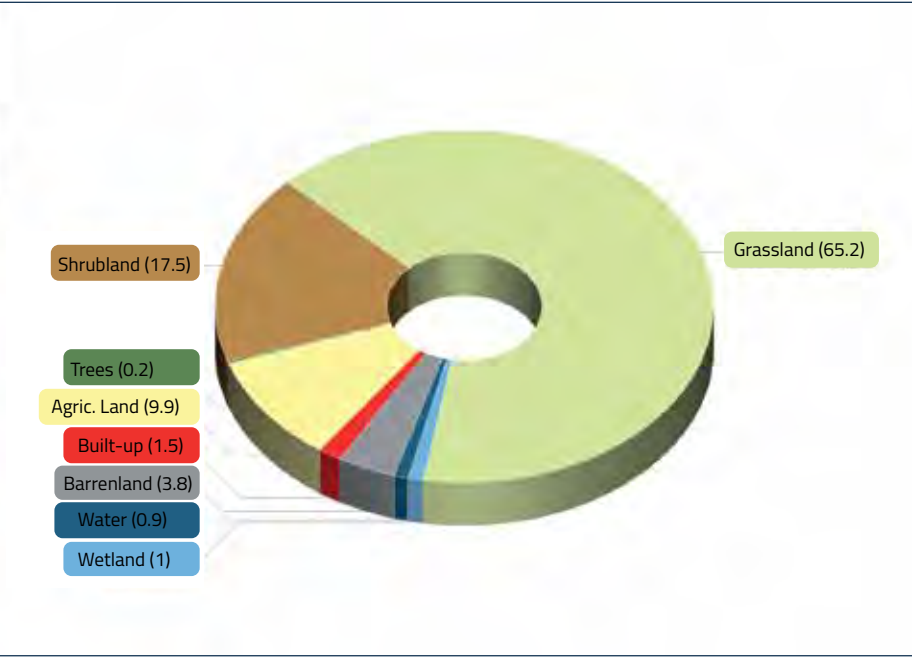
AGGREGATED LAND COVER STATISTICS

URBAN AND COMMUNITY COUNCILS	Built-up	Agricultural Land	Trees	Shrubland	Grassland	Wetland	Water Bodies & Rivers	Barrenland	TOTAL LAND
	AGBU	AGAG	AGTR	AGSH	AGGR	WET	AGWT	AGBR	
	UA1, UA2, RH1, RH2	HCP, HCST, HCER, HCIR, HCT	TNL1, TNL2, TBL1, TBL2, TM1, TM2, TS	SH1, SH2	GR, GRD	WET	WB1, WB2, RB	BR, BA, GU, BLR, MQ	
Mokhotlong U.C.	550	985	55	540	4,679	31	90	574	7,502
Seate J01	887	9,535	219	32,609	63,109	2,631	680	5,708	115,376
Mphokojoana J02	962	9,766	155	37,046	51,967	1,510	1,041	4,018	106,465
Sanqebethu J03	325	4,592	60	21,711	61,678	5,669	400	6,822	101,259
Menoaneng J04	920	7,979	106	14,982	54,541	2,985	419	5,010	86,942
TOTAL (ha)	3,644	32,857	595	106,887	235,973	12,826	2,631	22,132	417,544
TOTAL (%)	0.9	7.9	0.1	25.6	56.5	3.1	0.6	5.3	100



Thaba-Tseka

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Land Cover in percentage

AGGREGATED LAND COVER STATISTICS

URBAN AND COMMUNITY COUNCILS	Built-up	Agricultural Land	Trees	Shrubland	Grassland	Wetland	Water Bodies & Rivers	Barrenland	TOTAL LAND
	AGBU	AGAG	AGTR	AGSH	AGGR	WET	AGWT	AGBR	
	UA1, UA2, RH1, RH2	HCP, HCSM, HCER, HCIR, HCT	TNL1, TNL2, TBL1, TBL2, TM1, TM2, TS	SH1, SH2	GR, GRD	WET	WB1, WB2, RB	BR, BA, GU, BLR, MQ	
Thaba-Tseka U.C.	794	2,210	75	1,731	6,842	22	74	117	11,865
Tenesolo K01	1,597	8,713	160	10,778	75,250	430	1,164	4,831	102,922
Khutlo-se-Metsi K02	1,248	9,010	218	21,213	83,861	1,026	686	5,724	122,987
Litsoetse K03	728	5,482	123	14,750	25,076	92	609	1,383	48,242
Bokong K04	1,912	11,619	195	7,980	43,369	225	786	1,230	67,316
Linakeng K05	1,225	11,096	281	28,560	82,346	2,868	1,016	5,265	132,657
TOTAL (ha)	7,504	48,129	1,051	85,012	316,745	4,662	4,335	18,550	485,989
TOTAL (%)	1.5	9.9	0.2	17.5	65.2	1.0	0.9	3.8	100

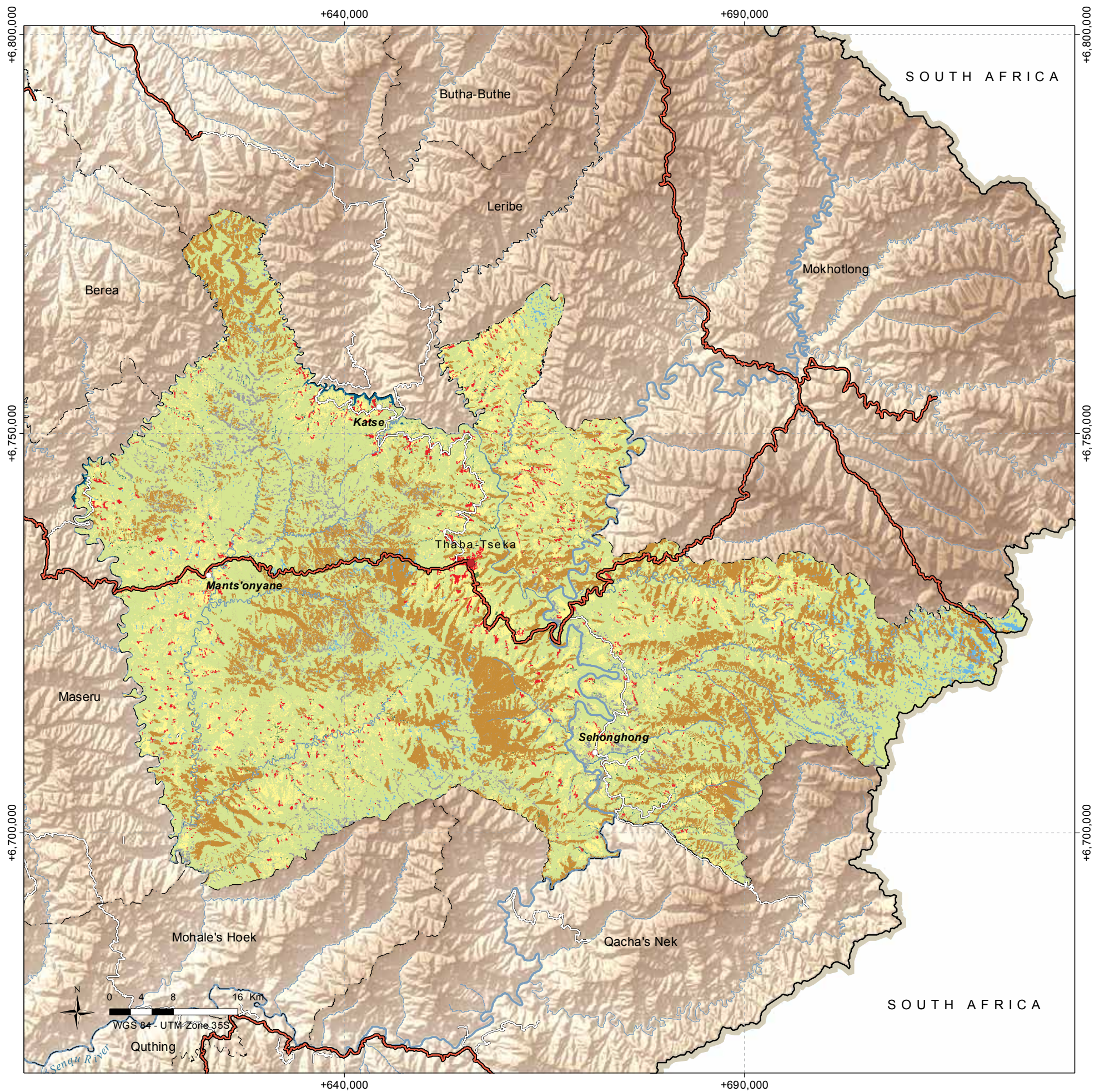




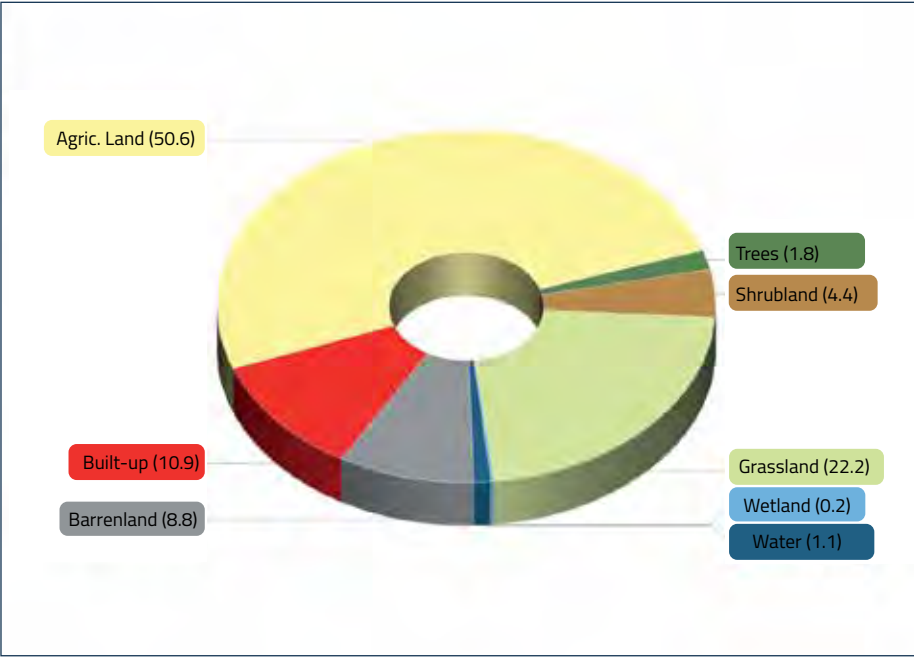
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Land Cover by CATCHMENTS

Lower Caledon Mohokare

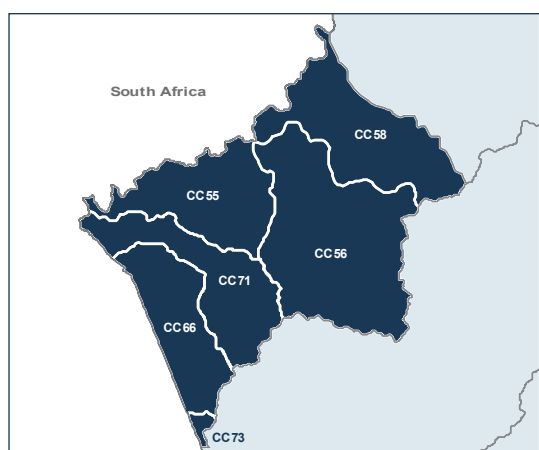
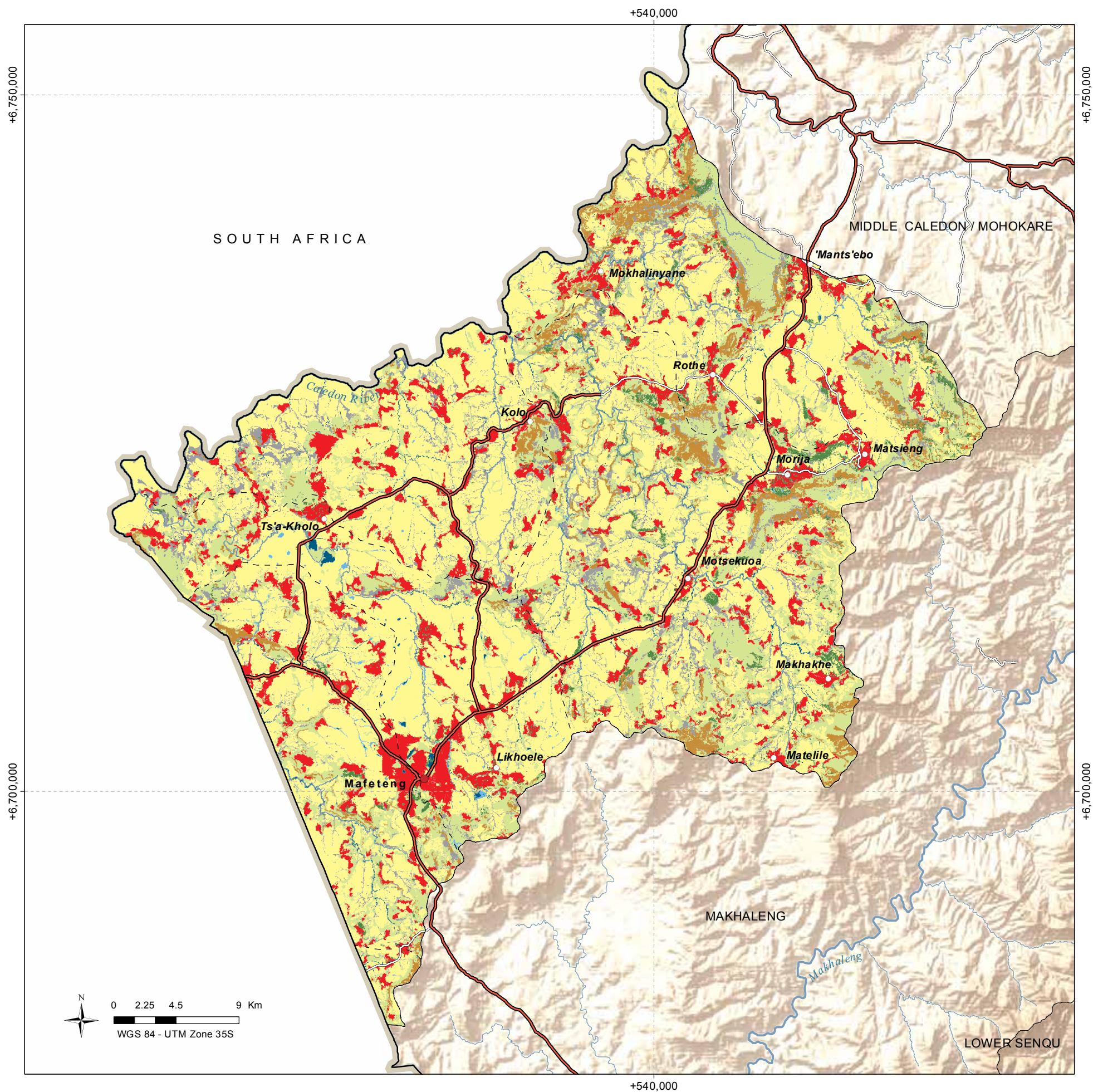
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Land Cover in percentage

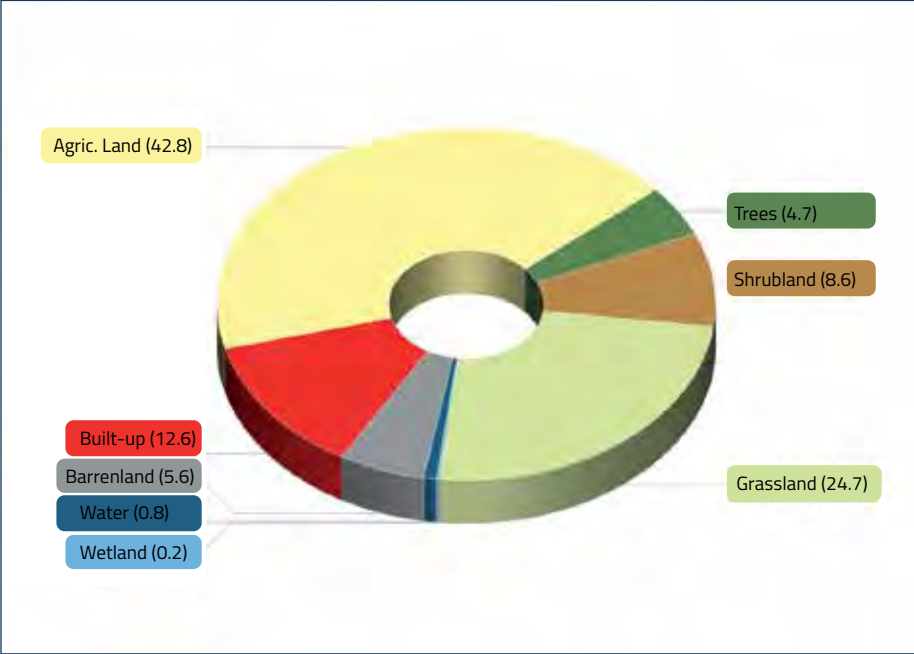
AGGREGATED LAND COVER STATISTICS

SUB-CATCHMENT	Built-up	Agricultural Land	Trees	Shrubland	Grassland	Wetland	Water Bodies & Rivers	Barrenland	TOTAL LAND
	AGBU	AGAG	AGTR	AGSH	AGGR	WET	AGWT	AGBR	
	UA1, UA2, RH1, RH2	HCP, HCSM, HCER, HCIR, HCT	TNL1, TNL2, TBL1, TBL2, TM1, TM2, TS	SH1, SH2	GR, GRD	WET	WB1, WB2, RB	BR, BA, GU, BLR, MQ	
CC55	3,221	18,525	146	409	4,005	12	415	3,236	29,969
CC56	5,579	26,218	1,568	3,457	16,064	76	612	6,074	59,648
CC58	3,470	16,590	989	3,085	9,399	73	367	3,466	37,439
CC66	3,326	13,423	248	670	5,560	72	202	1,633	25,134
CC71	4,148	16,842	245	317	5,155	168	404	1,577	28,856
CC73	160	641	4	117	378	2	15	53	1,371
TOTAL (ha)	19,903	92,240	3,201	8,054	40,561	403	2,015	16,039	182,416
TOTAL (%)	10.9	50.6	1.8	4.4	22.2	0.2	1.1	8.8	100



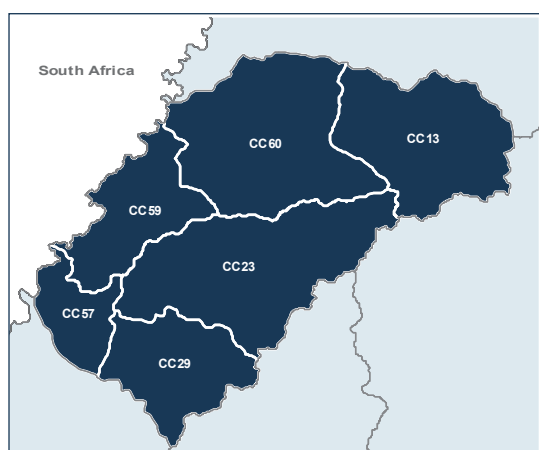
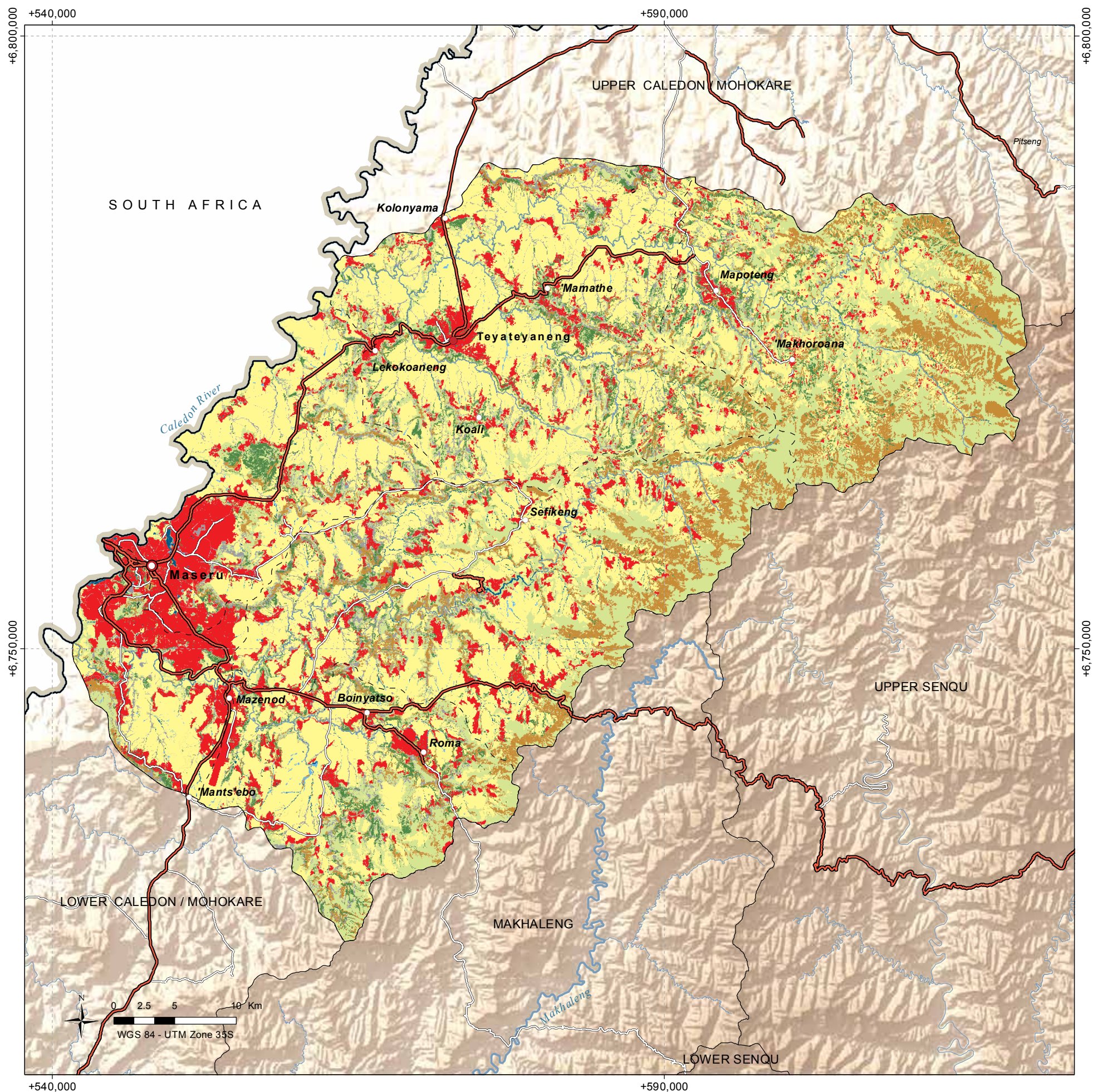
Middle Caledon Mohokare

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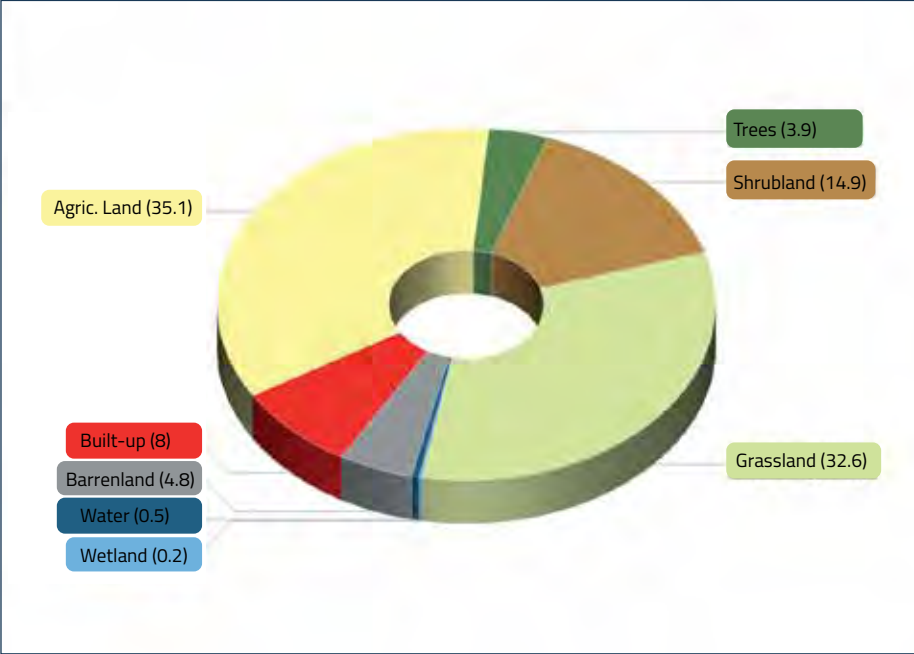
AGGREGATED LAND COVER STATISTICS

SUB-CATCHMENT	Built-up	Agricultural Land	Trees	Shrubland	Grassland	Wetland	Water Bodies & Rivers	Barrenland	TOTAL LAND
	AGBU	AGAG	AGTR	AGSH	AGGR	WET	AGWT	AGBR	
	UA1, UA2, RH1, RH2	HCP, HCSM, HCER, HCIR, HCT	TNL1, TNL2, TBL1, TBL2, TM1, TM2, TS	SH1, SH2	GR, GRD	WET	WB1, WB2, RB	BR, BA, GU, BLR, MQ	
CC13	2,241	13,423	2,406	8,884	21,617	13	230	968	49,780
CC23	6,362	28,193	1,808	8,146	16,462	140	778	3,241	65,131
CC29	4,067	13,973	2,090	1,977	7,862	118	216	2,040	32,343
CC57	6,192	5,724	653	438	2,215	47	203	1,033	16,505
CC59	7,408	13,915	1,439	883	4,237	94	220	2,384	30,581
CC60	6,101	35,090	3,609	1,887	11,252	69	379	4,857	63,243
TOTAL (ha)	32,370	110,318	12,005	22,213	63,645	481	2,027	14,523	257,582
TOTAL (%)	12.6	42.8	4.7	8.6	24.7	0.2	0.8	5.6	100



Upper Caledon Mohokare

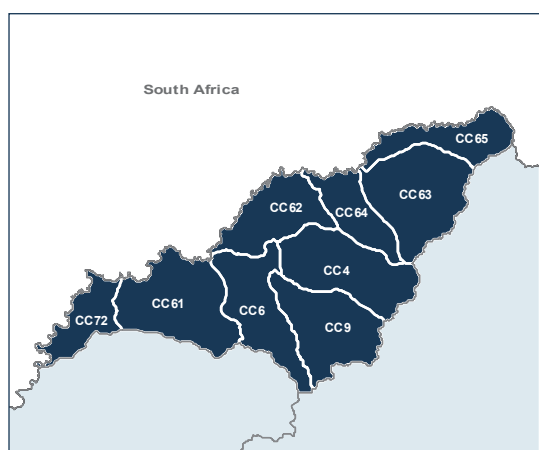
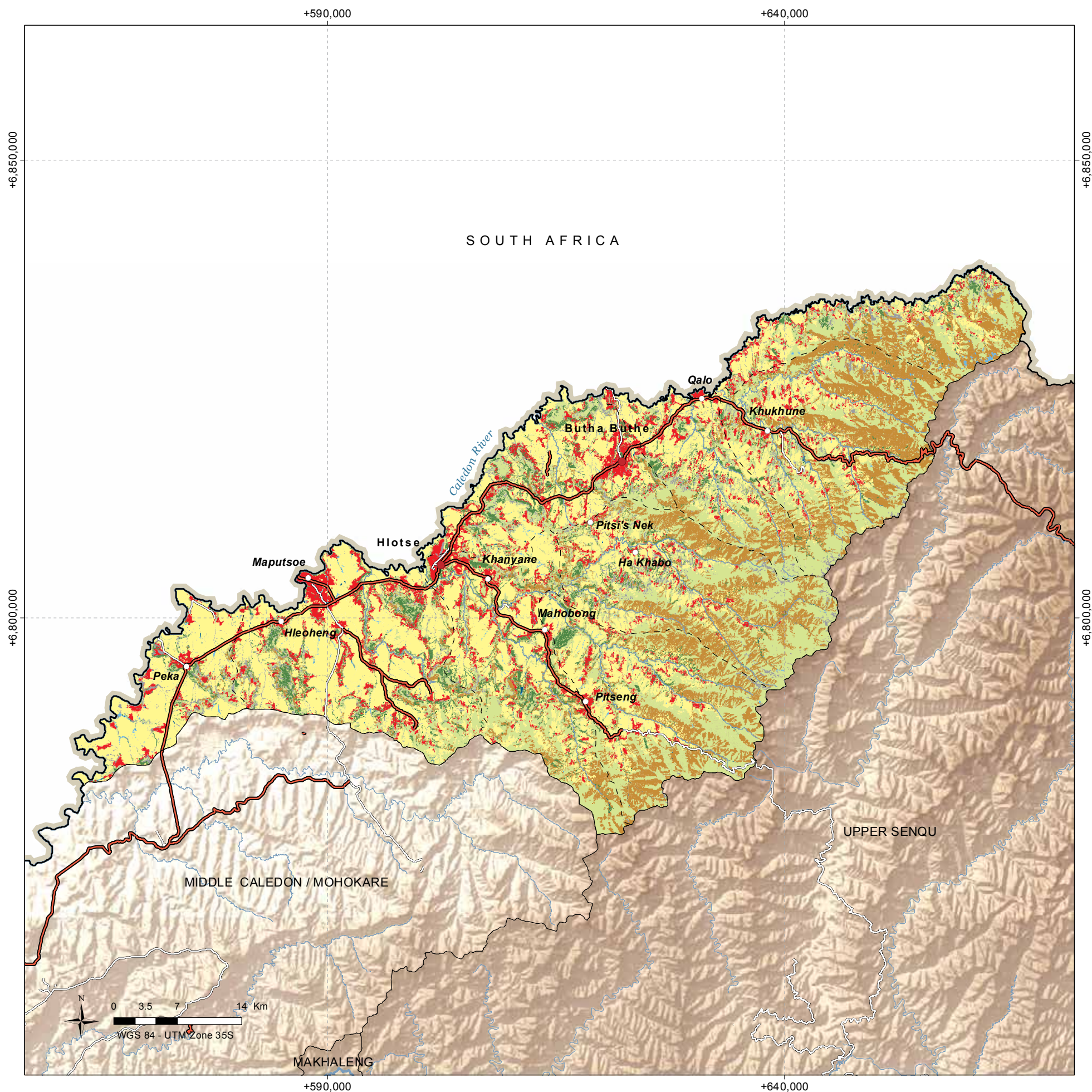
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Land Cover in percentage

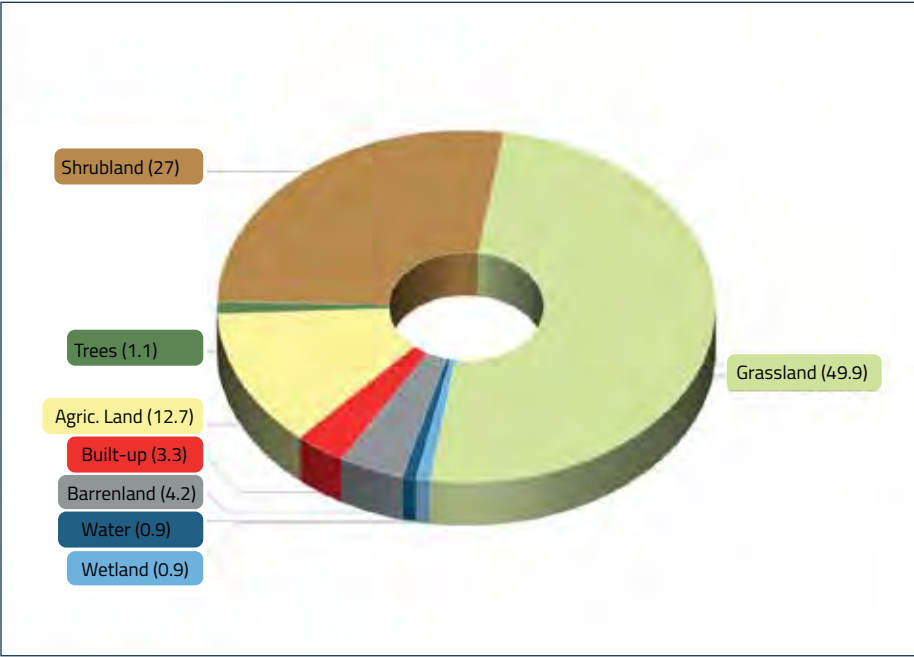
AGGREGATED LAND COVER STATISTICS

SUB-CATCHMENT	Built-up	Agricultural Land	Trees	Shrubland	Grassland	Wetland	Water Bodies & Rivers	Barrenland	TOTAL LAND
	AGBU	AGAG	AGTR	AGSH	AGGR	WET	AGWT	AGBR	
	UA1, UA2, RH1, RH2	HCP, HCSM, HCER, HCIR, HCT	TNL1, TNL2, TBL1, TBL2, TM1, TM2, TS	SH1, SH2	GR, GRD	WET	WB1, WB2, RB	BR, BA, GU, BLR, MQ	
CC4	1,367	6,903	926	7,958	16,422	16	192	2,135	35,920
CC6	3,145	11,891	1,776	3,090	9,479	60	161	815	30,416
CC9	1,510	8,462	865	7,126	13,673	54	265	622	32,578
CC61	5,040	22,400	2,331	1,144	6,729	101	175	2,231	40,150
CC62	3,837	12,032	1,788	689	5,574	42	97	1,839	25,897
CC63	1,876	7,611	544	11,588	16,191	38	223	1,226	39,297
CC64	1,640	6,162	726	1,732	6,757	12	71	1,068	18,168
CC65	1,012	4,186	602	5,177	8,437	109	48	1,214	20,785
CC72	1,459	11,455	538	202	1,408	77	133	1,300	16,571
TOTAL (ha)	20,886	91,103	10,096	38,706	84,670	508	1,365	12,448	259,783
TOTAL (%)	8.0	35.1	3.9	14.9	32.6	0.2	0.5	4.8	100



Lower Senqu

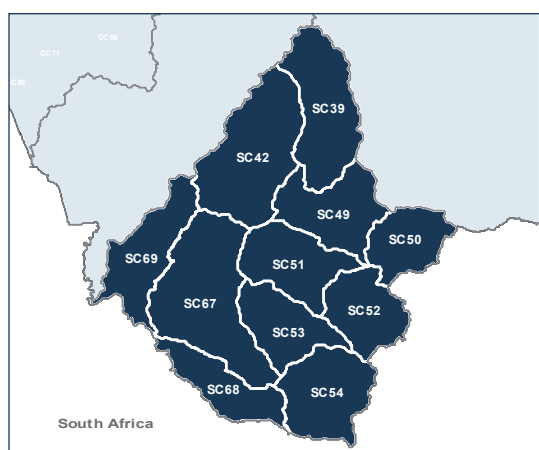
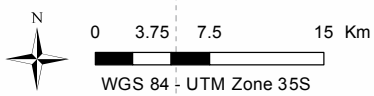
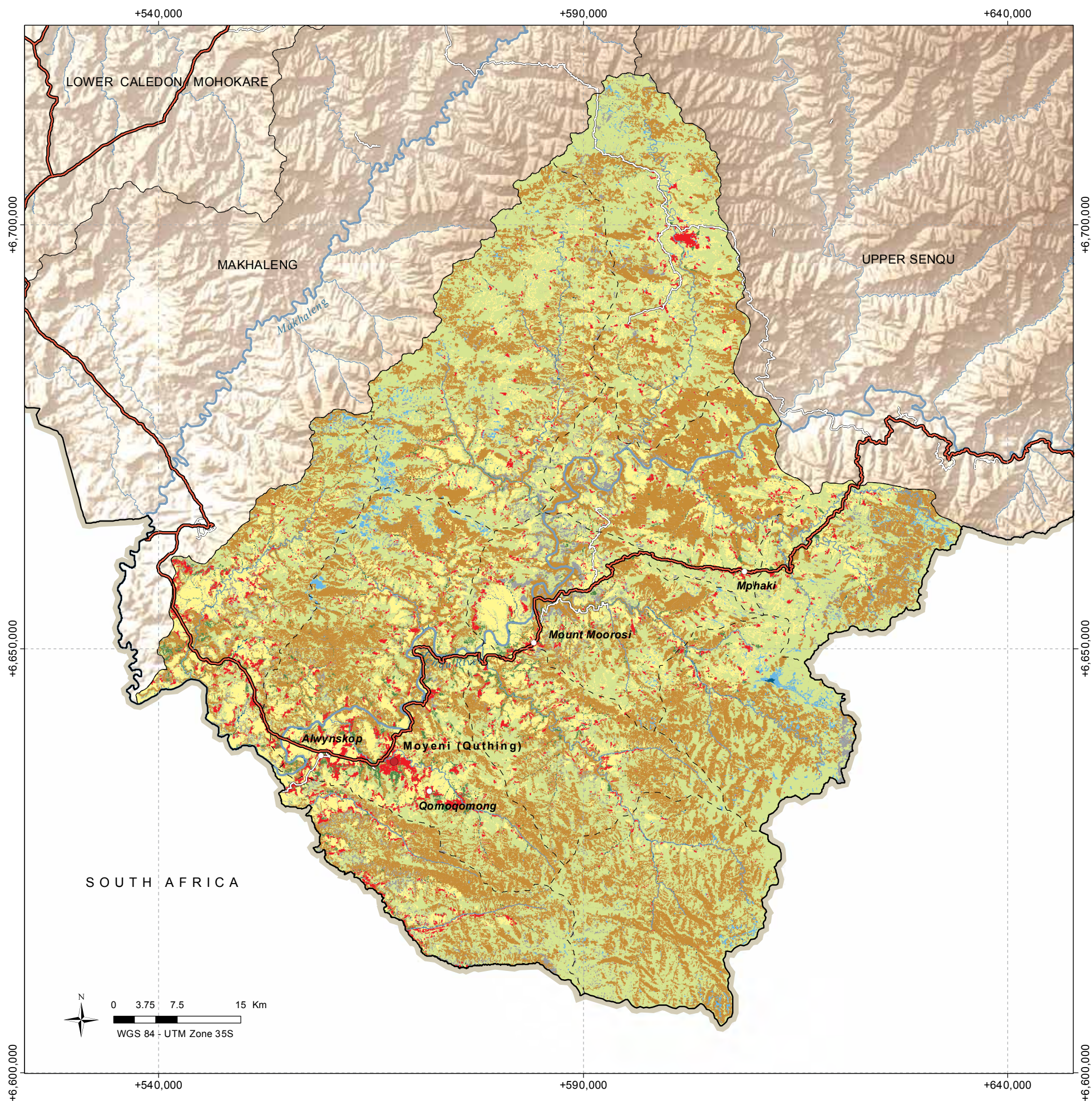
Index Map



Land Cover in percentage

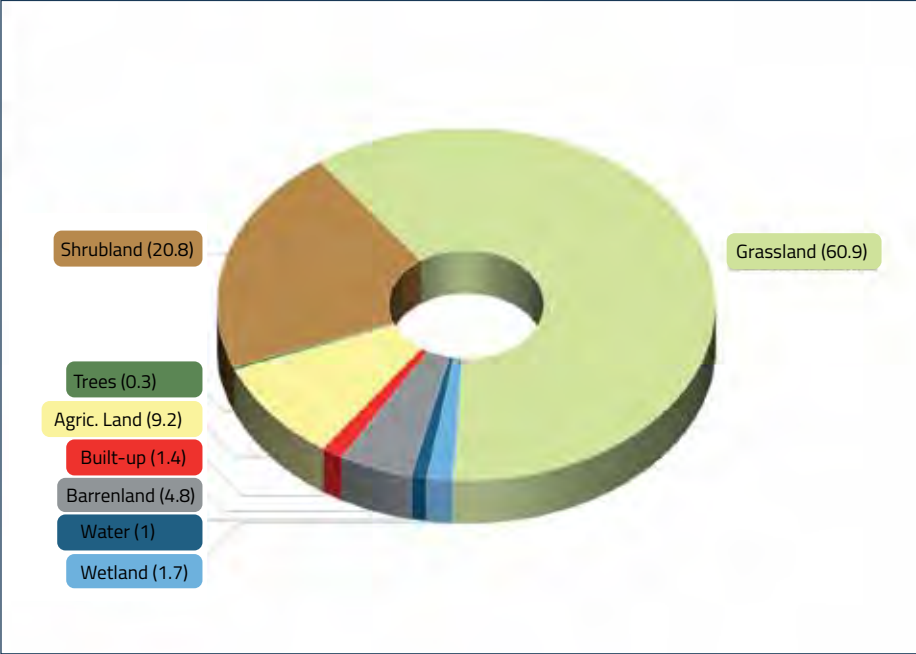
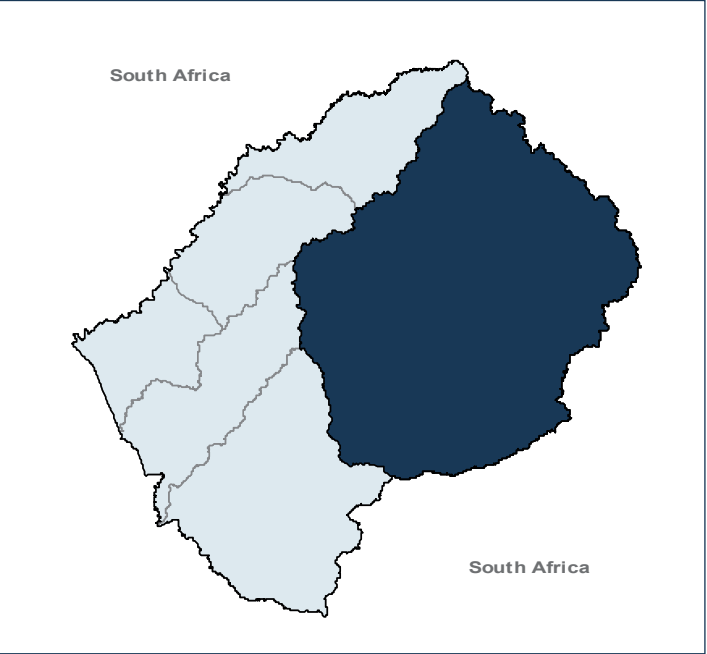
AGGREGATED LAND COVER STATISTICS

SUB-CATCHMENT	Built-up	Agricultural Land	Trees	Shrubland	Grassland	Wetland	Water Bodies & Rivers	Barrenland	TOTAL LAND
	AGBU	AGAG	AGTR	AGSH	AGGR	WET	AGWT	AGBR	
	UA1, UA2, RH1, RH2	HCP, HCSM, HCER, HCIR, HCT	TNL1, TNL2, TBL1, TBL2, TM1, TM2, TS	SH1, SH2	GR, GRD	WET	WB1, WB2, RB	BR, BA, GU, BLR, MQ	
SC39	1,517	5,614	127	13,645	36,672	564	308	1,426	59,873
SC42	1,197	8,076	355	16,657	45,884	961	404	3,011	76,546
SC49	1,438	8,031	334	16,130	18,079	29	805	1,670	46,515
SC50	755	3,908	272	7,245	18,355	584	119	1,603	32,840
SC51	1,717	8,080	795	10,900	18,775	165	628	3,488	44,547
SC52	554	1,930	166	11,399	21,419	1,121	202	698	37,488
SC53	1,405	5,055	656	10,986	18,631	44	266	1,292	38,335
SC54	206	614	51	16,306	30,785	496	202	766	49,425
SC67	5,304	15,559	2,228	24,171	33,808	696	1,119	2,913	85,798
SC68	1,737	3,474	282	10,682	14,957	47	349	2,947	34,473
SC69	2,571	10,005	623	10,737	18,185	302	517	3,162	46,103
TOTAL (ha)	18,401	70,346	5,889	148,857	275,549	5,008	4,918	22,975	551,944
TOTAL (%)	3.3	12.7	1.1	27.0	49.9	0.9	0.9	4.2	100



Upper Senqu

Index Map



Land Cover in percentage

AGGREGATED LAND COVER STATISTICS

SUB-CATCHMENT	Built-up	Agricultural Land	Trees	Shrubland	Grassland	Wetland	Water Bodies & Rivers	Barrenland	TOTAL LAND
	AGBU	AGAG	AGTR	AGSH	AGGR	WET	AGWT	AGBR	
	UA1, UA2, RH1, RH2	HCP, HCSM, HCER, HCIR, HCT	TNL1, TNL2, TBL1, TBL2, TM1, TM2, TS	SH1, SH2	GR, GRD	WET	WB1, WB2, RB	BR, BA, GU, BLR, MQ	
SC1	2	1	0	9,840	14,057	968	135	2,850	27,853
SC2	0	0	0	6,376	7,279	845	133	1,500	16,132
SC3	48	728	35	7,962	12,111	403	272	2,069	23,628
SC5	99	784	19	7,336	17,915	1,143	152	1,693	29,142
SC7	32	414	7	10,087	11,494	648	302	1,867	24,851
SC8	91	1,233	23	14,430	15,727	795	279	1,130	33,708
SC10	24	364	1	8,469	19,422	1,304	182	2,201	31,968
SC11	318	3,772	111	6,070	20,067	459	366	685	31,849
SC12	526	4,640	124	14,643	21,309	391	204	1,883	43,721
SC14	497	5,325	145	5,653	22,545	834	201	627	35,827
SC15	596	2,756	59	11,365	23,916	134	831	1,627	41,285
SC16	451	4,730	83	14,233	21,258	1,295	346	998	43,393
SC17	791	5,360	152	5,810	17,395	69	2,216	430	32,222
SC18	307	2,674	59	10,297	47,195	261	631	2,351	63,774
SC19	772	3,406	92	5,571	21,275	1,250	283	1,783	34,432
SC20	1,375	11,800	159	12,427	46,426	362	732	1,998	75,280
SC21	42	766	10	5,788	17,465	1,078	103	2,388	27,639
SC22	1,260	7,336	153	3,528	30,116	143	635	776	43,948
SC24	970	3,882	107	4,432	32,500	314	1,272	676	44,153
SC25	252	2,625	79	6,116	23,102	1,670	110	3,415	37,368
SC26	70	1,337	8	5,396	18,552	1,646	115	2,015	29,139
SC28	975	5,669	86	10,742	52,146	524	328	4,303	74,774
SC30	1,435	5,665	121	9,292	20,219	272	256	817	38,078
SC31	603	6,417	90	11,899	31,381	1,335	262	1,290	53,277
SC33	25	66	0	7,207	20,869	2,611	117	2,112	33,006
SC34	927	6,392	122	5,872	37,417	580	438	688	52,436
SC35	1,008	7,664	166	20,972	49,874	547	908	3,714	84,853
SC37	665	4,826	156	8,649	43,439	449	256	2,018	60,457
SC40	287	1,763	31	1,924	33,325	2,206	188	4,191	43,915
SC41	755	9,142	413	18,796	51,799	190	944	3,055	85,096

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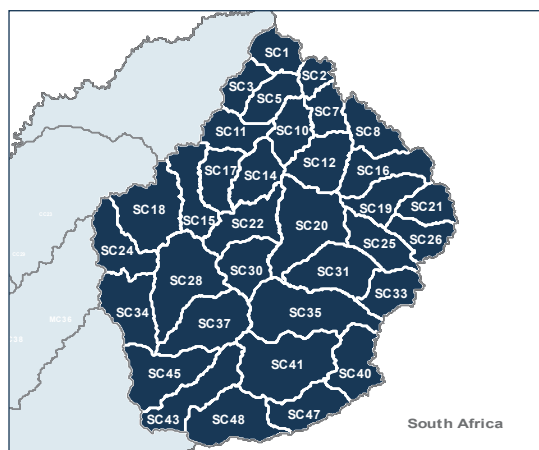
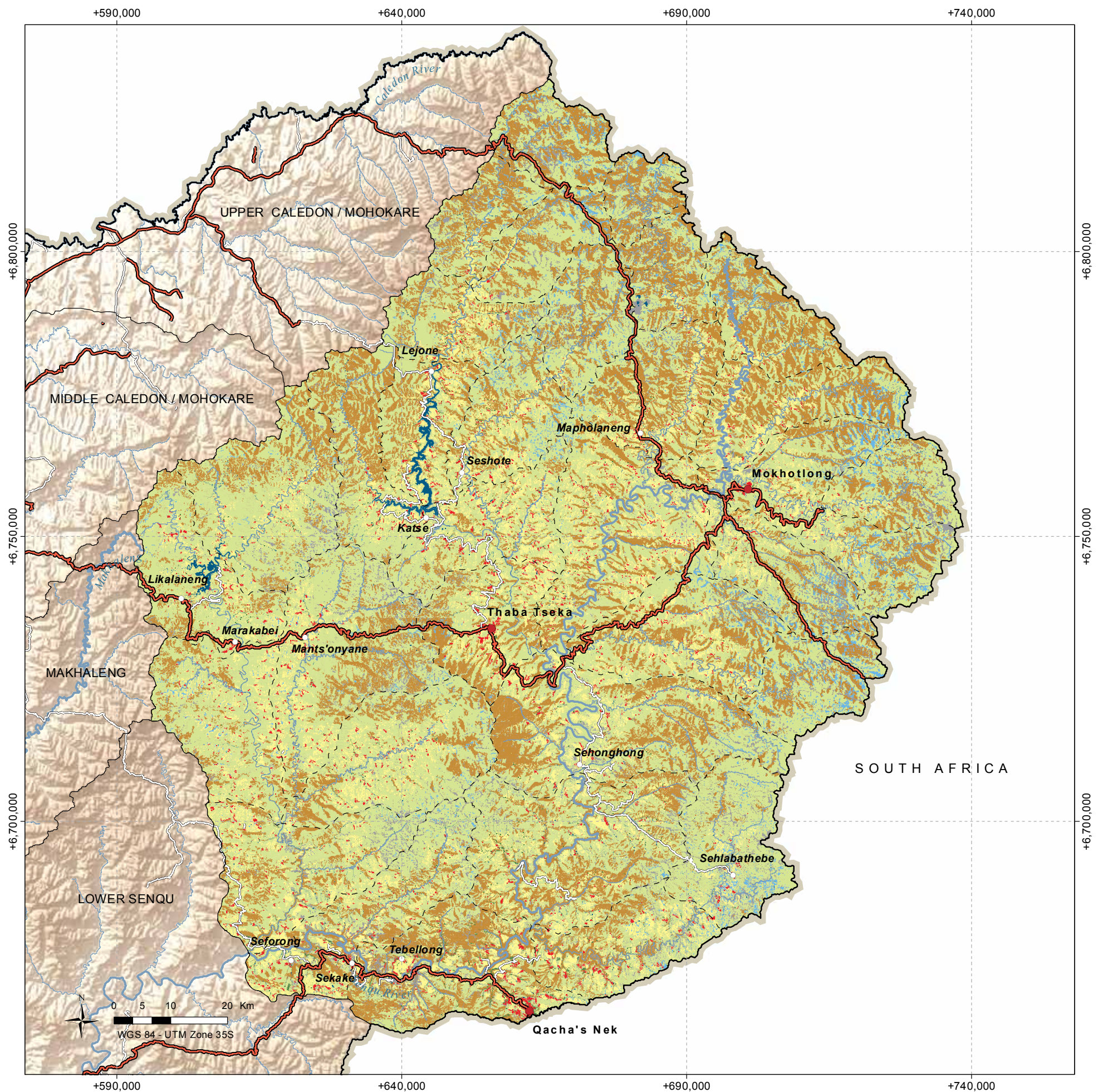
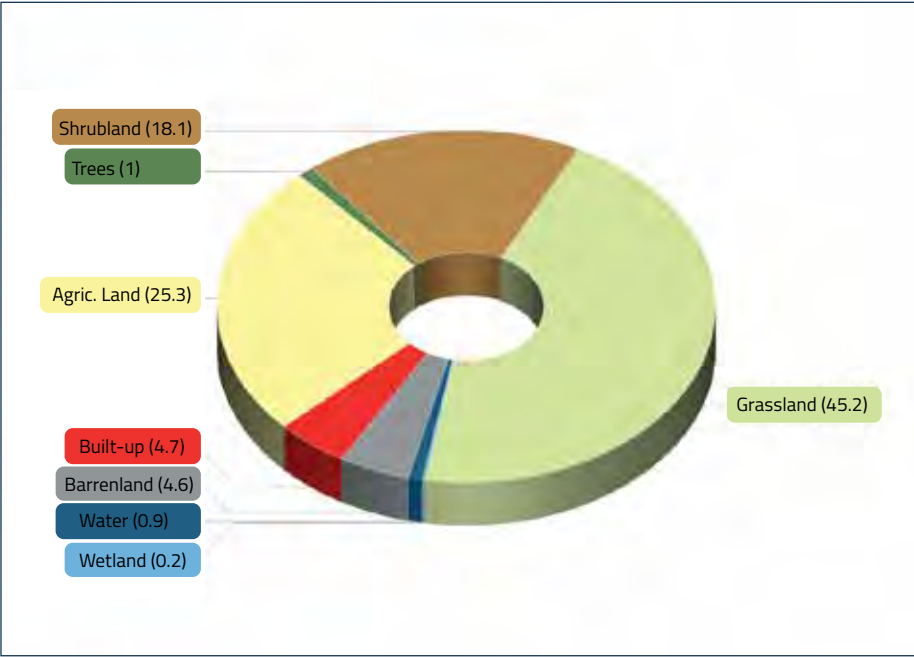


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SUB-CATCHMENT	AGBU	AGAG	AGTR	AGSH	AGGR	WET	AGWT	AGBR	TOTAL LAND
SC43	1,210	6,953	276	8,601	31,023	275	552	3,912	52,801
SC45	1,055	7,035	106	7,833	39,196	162	477	2,310	58,174
SC47	966	5,627	329	6,871	21,861	366	283	2,644	38,768
SC48	2,158	7,634	1,037	18,161	23,824	33	660	5,965	59,473
TOTAL (ha)	20,595	138,784	4,361	312,648	917,318	25,562	15,171	71,981	1,506,419
TOTAL (%)	1.4	9.2	0.3	20.8	60.9	1.7	1.0	4.8	100

Makhaleng

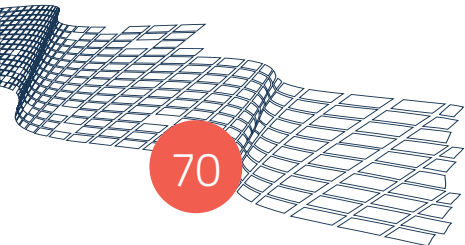
Index Map

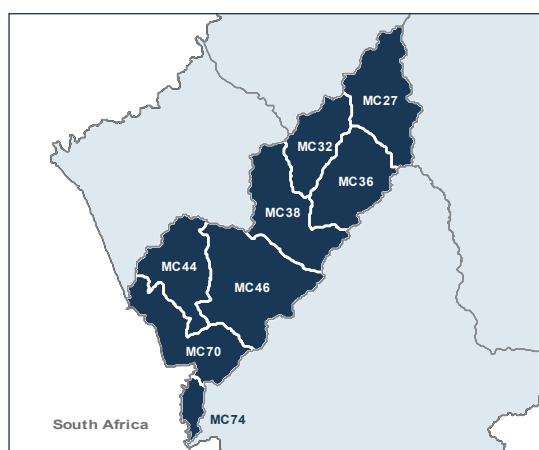
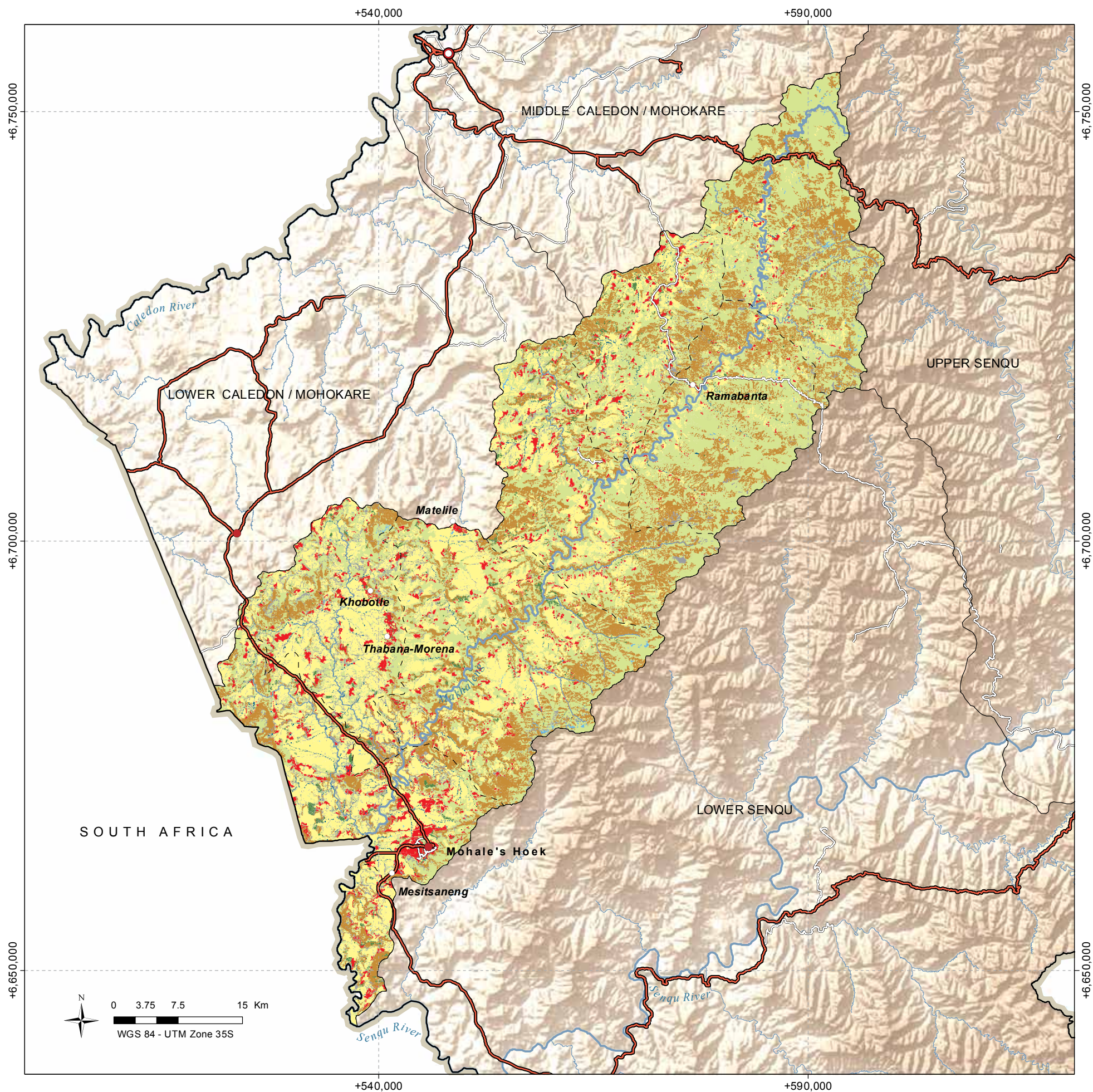


Land Cover in percentage

AGGREGATED LAND COVER STATISTICS

SUB-CATCHMENT	Built-up	Agricultural Land	Trees	Shrubland	Grassland	Wetland	Water Bodies & Rivers	Barrenland	TOTAL LAND
	AGBU	AGAG	AGTR	AGSH	AGGR	WET	AGWT	AGBR	
	UA1, UA2, RH1, RH2	HCP, HCSM, HCER, HCIR, HCT	TNL1, TNL2, TBL1, TBL2, TM1, TM2, TS	SH1, SH2	GR, GRD	WET	WB1, WB2, RB	BR, BA, GU, BLR, MQ	
MC27	602	3,076	252	10,439	27,768	243	221	1,059	43,661
MC32	1,622	6,825	472	4,637	12,838	26	220	929	27,569
MC36	652	3,210	133	9,642	24,555	49	289	773	39,304
MC38	1,701	10,990	503	8,476	20,388	68	339	1,196	43,660
MC44	2,498	13,951	283	2,937	11,604	53	400	3,487	35,215
MC46	2,340	18,541	646	11,618	26,335	138	551	1,661	61,830
MC70	3,922	15,315	435	4,485	9,484	27	615	3,753	38,037
MC74	599	3,340	127	1,615	1,334	11	110	758	7,894
TOTAL (ha)	13,936	75,248	2,851	53,850	134,308	617	2,745	13,615	297,170
TOTAL (%)	4.7	25.3	1.0	18.1	45.2	0.2	0.9	4.6	100



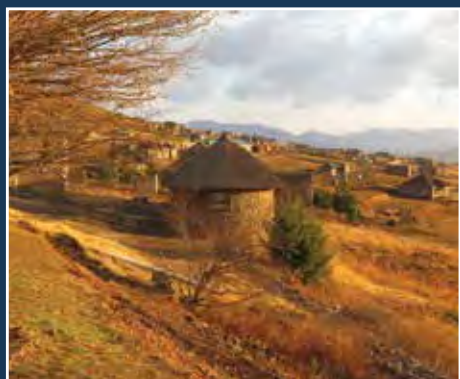




In the framework of the Resilience Strategy, FAO has developed the National Land Cover database of Lesotho, in partnership with the Government of Lesotho through the Committee for Environment Data Management (CEDAMA) chaired by the Bureau of Statistics.



This new LC database, created with financial assistance from the European Commission Humanitarian Aid Department (ECHO) and the Swiss Development Cooperation (SDC), will serve as baseline for assessment and analysis of natural resources and agriculture status, land and water condition, climate and environmental studies, etc.



Furthermore, it will build and support the dialogue and technical information flow among Government institutions, national and local authorities, farmers, stakeholders in Natural Resources management and will provide information for evidence-based decision making.

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Implementation with
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