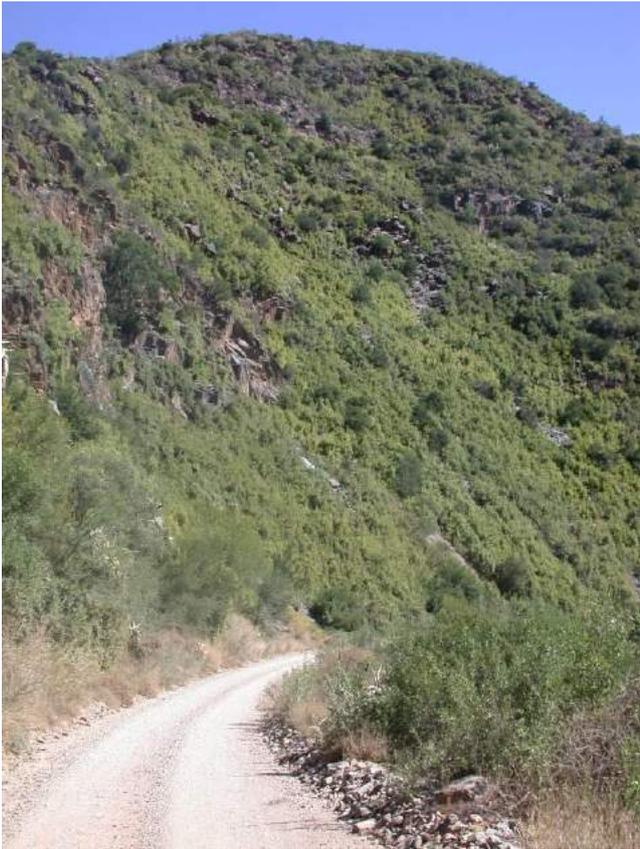


# **RETENTION AND RESTORATION OF THE BIODIVERSITY OF THE LITTLE KAROO**

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**August 2008**



**Prepared for:** Critical Ecosystem Partnership Fund

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## **1. INTRODUCTION**

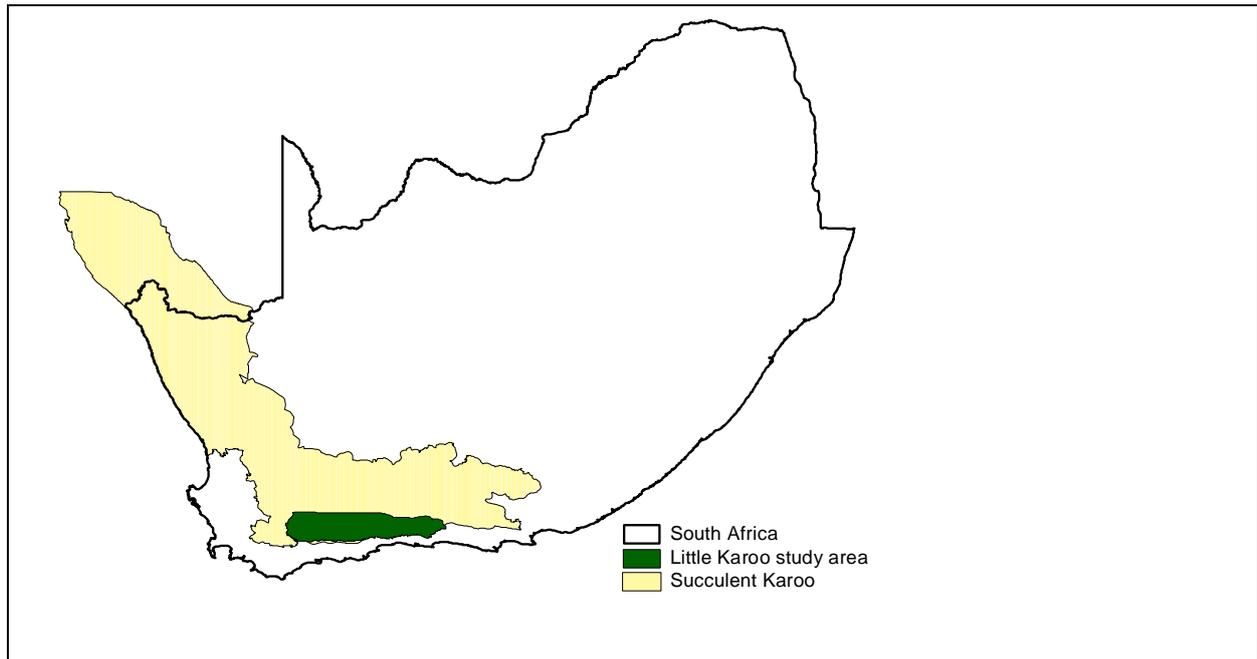
The Little Karoo region, which falls within the Succulent Karoo Biome is an area of great biodiversity (Figure 1). One of the major threats facing this biodiversity is the lack of useful information on sound management practices within the natural vegetation of the region. This lack of information is largely due to the collapse of extension services which government agencies previously supplied. These services are no longer provided and landowners and -managers (especially at the municipal level) urgently require spatial information on the ecosystems they manage. This study aimed to develop four of these information products to ensure that the natural resources in the Little Karoo region are utilised in a sustainable manner. These are:

1. A map that indicates the extent of grazing capacity of the natural vegetation for the ostrich industry.
2. Maps that indicate the extent of grazing capacity of the natural vegetation for the game industry for species appropriate to this area.
3. A map that indicates urgent restoration needs and potential, especially in the lowland areas currently and previously targeted by agriculture.
4. A map that provides a flammability index and fire regime requirements of the natural vegetation in the Little Karoo region.

These four products relate directly to management decisions that a new generation of landowners and managers must take on a regular bases in the region, e.g;

- ◆ Financial viability of sustainable farming with game or ostriches on natural vegetation. Here sound information is required on current carrying capacity of the affected land.
- ◆ Best sites to establish vegetation restoration projects in the region, as job creation opportunities, carbon sequestration projects relating to global warming and/or prevention of flood damage.
- ◆ Best configuration to develop fire protection associations, especially in relation to sites where fire prevention measures (e.g. fire breaks) must be established and maintained.

The purpose of this project was to develop this urgently required spatial data, thereby capacitating land-use decision makers within the Little Karoo to take sound decisions on vital aspects that affect the ecology, biodiversity and economy of the Little Karoo region. In order to achieve this, the end products were developed in conjunction with stakeholders. This approach was adopted in the hope that these partners and stakeholder groups would endorse and take ownership of these end products and in turn distribute them to their stakeholders.



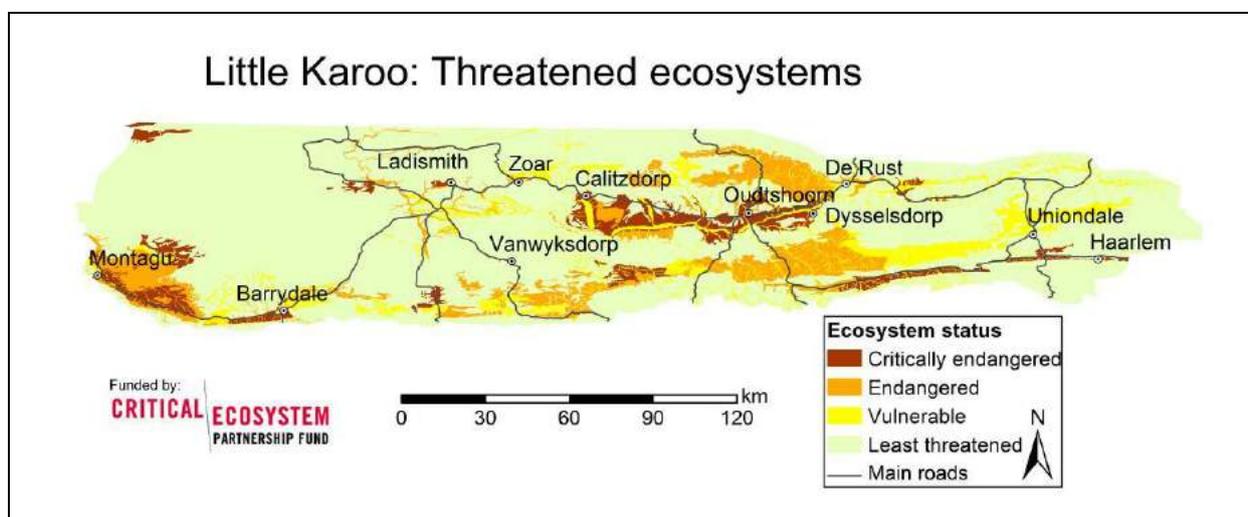
*Figure 1: Little Karoo study area showing its location within the Succulent Karoo and South Africa*

The main deliverables of this project were;

1. Workshops with the relevant partners and stakeholders to collaboratively develop maps, decide on format and discuss dissemination approach.
2. A map in electronic format (pdf and shapefiles for GIS systems) of the present grazing carrying capacity of the natural vegetation for ostriches.
3. Maps in electronic format (pdf and shapefiles for GIS systems) indicating suitable habitat and the present carrying capacity of the natural vegetation for each of the herbivore game species that could be considered in the region (e.g. eland, kudu, mountain zebra, hartebeest, springbok, duiker, etc).
4. A map in electronic format (pdf and shapefiles for GIS systems) that provides a flammability index and fire frequency regime of the natural vegetation in the region.
5. Maps in electronic format (pdf and shapefiles for GIS systems) that indicate restoration needs and potential sites for projects in relation to urban areas, where there are high unemployment levels, for gannaveld and spekboom vegetation.
6. One workshop / presentation at a GI forum to present products and to disseminate data to the stakeholders.
7. Presentations on national radio and/or printed media to inform stakeholders of products.
8. Deposition of all relevant data and materials on easily available websites (e.g. BGIS and Elsenburg database).

All the maps and underlying spatial data produced through this grant used the Little Karoo Vegetation Map compiled by Vlok, J.H.J., Cowling, R.M. and Wolf, T. in 2005 as a basis. This original work was done for the SKEP and Gouritz Initiative projects supported by CEPF grant no. 1064410304. Additional data in the form of a detailed land cover and degradation map of the Little Karoo (Thompson et al. 2008), also funded by the CEPF, were fundamental to this study.

We used these to first map the distribution of threatened ecosystems in the Little Karoo. These are vegetation types which are at risk of extinction due to the loss of natural vegetation. The assessment of threatened ecosystems is based on the classification scheme developed by IUCN to categorize species into, among other categories, critically endangered, endangered, and vulnerable. This study, following the approach and guidelines developed by the South African National Biodiversity Institute, classified vegetation types into ecosystem status categories of critically endangered, endangered, and vulnerable, based on the difference between the conservation target and the extant habitat of each vegetation type. Vegetation types with extant habitat >60% were classified as least threatened (LT) and were assumed to have no significant disruption of ecosystem functioning and minimal species loss. As extant habitat dropped to < 60%, some ecosystem functions become impaired and species start to disappear. These vegetation types were classified as vulnerable (VU). If the amount of extant habitat drops to less than the conservation target<sup>1</sup> of the vegetation type, it was classified as critically endangered (CR). Vegetation types with more than their conservation target extant, but less than the conservation target plus 15% were classified as endangered (EN). This layer of threatened ecosystems, together with the guidelines for threatened ecosystems, must be used in interpreting all the subsequent products (Figure 2).



*Figure 2: Threatened ecosystems of the Little Karoo.*

<sup>1</sup> Conservation targets for the Little Karoo vegetation types were defined using the method development by Desmet and Cowling (2004) and data from Jan Vlok on beta diversity

In this report we detail the development of each of these products, as well as their purpose, communication and review.

## 2. OSTRICH MAP

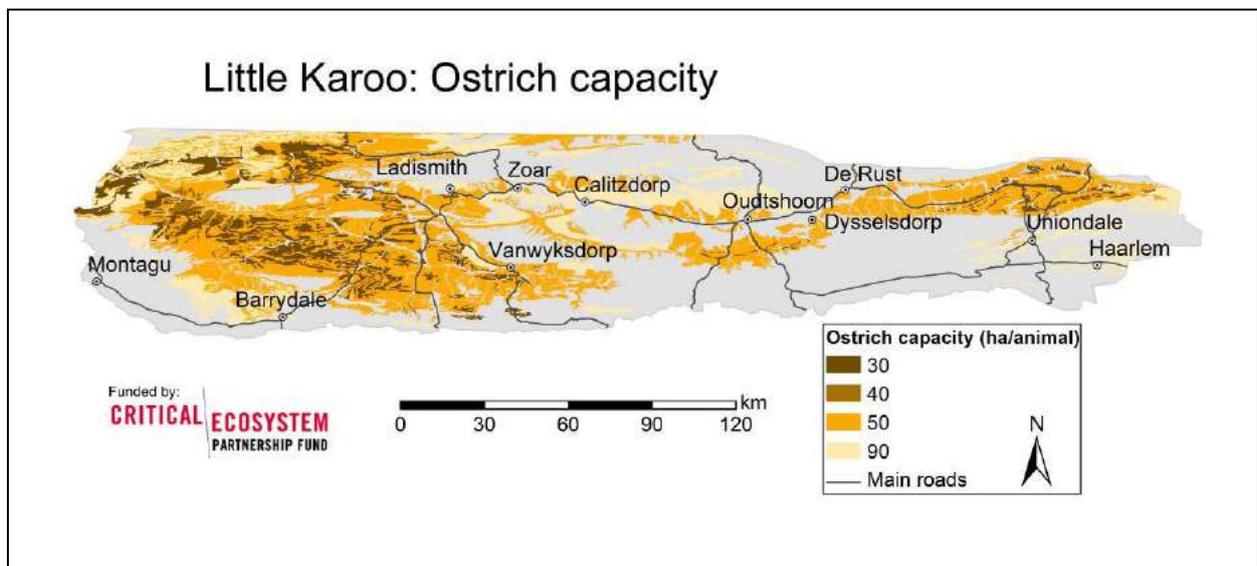
### 2.1 Purpose

This map was developed to assist the Ostrich Business Chamber's detailed study on impacts of the ostrich industry on biodiversity.

### 2.2 Product

The 56 habitat types representing the vegetation of the Little Karoo were amalgamated into 10 habitat classes. Each of these amalgamated habitat classes were scored according to the number of hectares required per ostrich if the vegetation were to be maintained in an ecologically healthy state. The map is shown in Figure 3. The map shows the estimate area (hectares) required per ostrich if the natural vegetation is to be maintained in a good ecological condition. Figure 2 must be consulted in the identification of areas suitable for ostrich farming as areas already threatened as a result of the ostrich industry should be avoided and stocking levels adjusted accordingly.

In addition all areas under cultivation are areas where ostriches can be kept, but land managers need to be mindful of erosion potential, as many of these areas are located within river flood plains. Thompson et al. (2008) land-cover map aids in identifying these areas.



*Figure 3: Ostrich grazing capacity for the Little Karoo*

### **2.3 Stakeholder interaction, review and dissemination**

The South African Ostrich Business Biodiversity Project was consulted during the development of this product. In addition consultants currently revising Eden District Municipality's Spatial Development Framework (SDF) have been made aware of this product. Hopeful they will be able to incorporate the environmental information generated through this project directly into the regional development planning process.

The resultant map was reviewed by Kobus Nel and Stephan Pieterse of the Western Cape Provincial Department of Agriculture's Land Care programme as well as Susan Botha and Gavin Shaw of the South African Ostrich Business Chamber Biodiversity project. This project is aimed at encouraging ostrich farmers to use their natural vegetation in a sustainable way.

The ostrich carrying capacity map was presented at the Gouritz Initiative Forum held in Oudtshoorn on 22<sup>nd</sup> July 2008. The product is being disseminated through the Gouritz Initiative Forum and will soon also be available from the Biodiversity GIS (BGIS) unit responsible for the management of the South African National Biodiversity Institute's spatial biodiversity planning information (<http://bgis.sanbi.org>).

## **3. GAME STOCKING MAPS**

### **3.1 Purpose**

This product aims to inform CapeNature land managers and private landowners interested in stocking their properties with game animals on which species they can stock and at what densities.

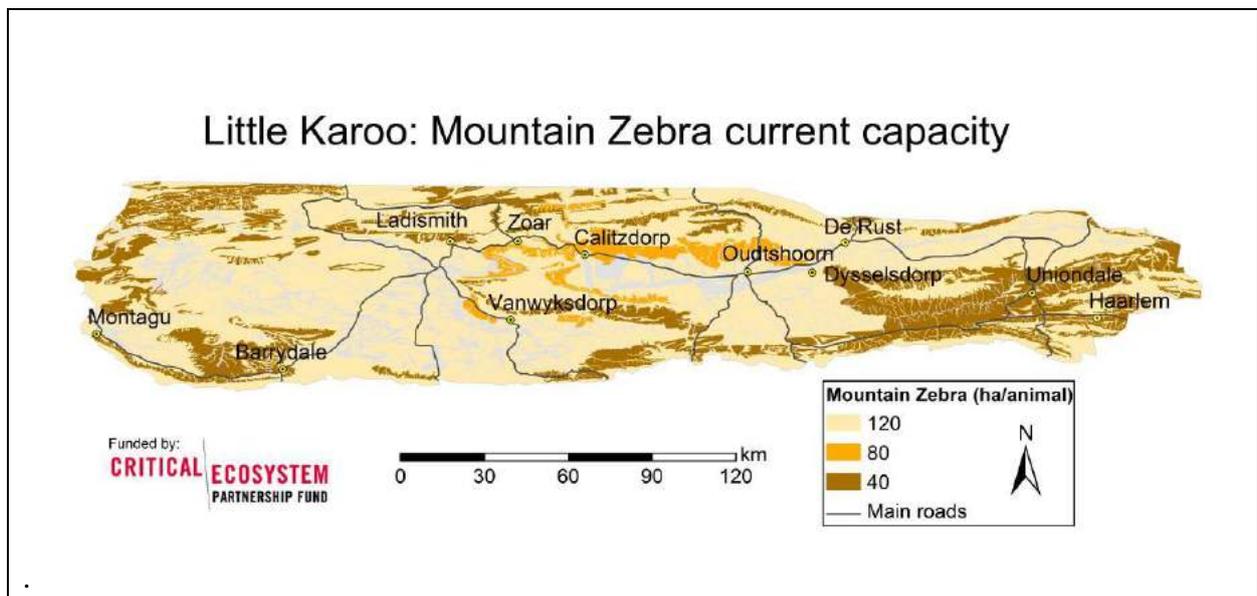
### **3.2 Product**

Table 1 lists the game species which are considered suitable for introduction into the Little Karoo area. These are the species which are known to have occurred in the Little Karoo area in the historical past according to Skead (1980). These 16 larger game species suitable for the Little Karoo were matched to habitats and recommended stocking densities were developed. The objective was to refine previous agricultural recommendations regarding the carrying capacity of natural vegetation types as it was too generalised. A species specific map was developed for each of the large game species (See Figures 4 for an example). These maps show the estimated number of hectares required per animal for the major habitat types present. It is a guideline with the purpose of assisting landowners to utilize their natural vegetation at sustainable levels.

Carrying capacity was estimated considering present degradation levels per habitat type. For example, in the *gannaveld* the Department of Agriculture recommends 60 ha per large stock unit (LSU), but this reduces to 85 ha per LSU for moderately degraded natural vegetation and 110 for severely degraded natural vegetation.

*Table 1: Game animals suited to the Little Karoo.*

COMMON NAME	SCIENTIFIC NAME
Black rhinoceros	<i>Diceros bicornis</i>
Hippopotamus	<i>Hippopotamus amphibious</i>
Cape mountain zebra	<i>Equus zebra zebra</i>
Plains zebra (replaces quagga)	<i>Equus burchelli</i>
Buffalo	<i>Syncerus caffer</i>
Eland	<i>Tragelaphus oryx</i>
Greater kudu	<i>Tragelaphus strepsiceros</i>
Red hartebeest	<i>Alcelaphus buselaphus</i>
Springbok	<i>Antidorcas marsupialis</i>
Common duiker	<i>Sylvicapra grimmia</i>
Steenbok	<i>Raphicerus campestris</i>
Grysbok	<i>Raphicerus melanotis</i>
Klipspringer	<i>Oreotragus oreotragus</i>
Grey rhebok	<i>Pelea capreolus</i>
Bushpig	<i>Potamochoeris porcus</i>
Ostrich (only indigenous strain)	<i>Struthio camelus</i>



*Figure 4: The current capacity for Mountain Zebra (*Equus zebra zebra*). This is an example of the 16 game potential maps that were produced for each of the game animals listed in Table 1*

### 3.3 Stakeholder interaction, review and dissemination

The revised carrying capacities were reviewed by local officials of the Department of Agriculture involved with LandCare (Kobus Nel and Stephan Pieterse). Louis van Rensburg,

chairman of Suid-Kaap Jagters Vereeniging (Southern Cape Hunters Association) and Dr AnneLise Schutte-Vlok Ecologist: Gouritz Region CapeNature also reviewed the final maps.

Jan Vlok participated in a 30 minute panel discussion on Landbou Radio broadcast during January 2008. This national Afrikaans radio station is most appropriate to reach the target audience of local landowners and managers in the Little Karoo 80%. The discussion dealt with problems in the game industry related to extra- limital species and the carrying capacities of different vegetation types in the Southern Cape including the Little Karoo. Mention was made of the development of the game carrying capacity maps during the broadcast. Members of the public were invited to e-mail and phone in after the programme. The resultant comments were evaluated and the pertinent ones used to refine the approach used in developing the game carrying capacity maps.

The game carrying capacity maps were presented at the Gouritz Initiative Forum held in Oudtshoorn on 22<sup>nd</sup> April 2008. Representatives from the Suid-Kaap Jagters Vereniging, an association of hunters, were in attendance. They were also presented to CapeNature staff at their quarterly ecological meeting for the Gouritz Cluster. This meeting was held in George on 29<sup>th</sup> May 2008.

The product is being disseminated through the Gouritz Initiative Forum and will soon also be available from the Biodiversity GIS (BGIS) unit responsible for the management of the South African National Biodiversity Institute's spatial biodiversity planning information (<http://bgis.sanbi.org>). Additional efforts to disseminate the game carrying capacity maps included supplying data to private landowners who were in the process of purchasing land in the Little Karoo, e-mailing information to all Gouritz Initiative Forum members, making information available to the Elsenburg office of the Western Cape Department of Agriculture and supplying maps to lecturers in game management (Anton Schmidt and Dr Lawrence Watson) at the Saasveld Campus of the Nelson Mandela Metropolitan University.

## **4. FIRE MANAGEMENT MAPS**

### **4.1 Purpose**

Information on fire potential and return periods were required in the design of the emergent fire protection agencies in the region, as well as to inform the policies of the Department of Water Affairs and Forestry. District councils that are mandated with a fire fighting function are also seen as users of this product.

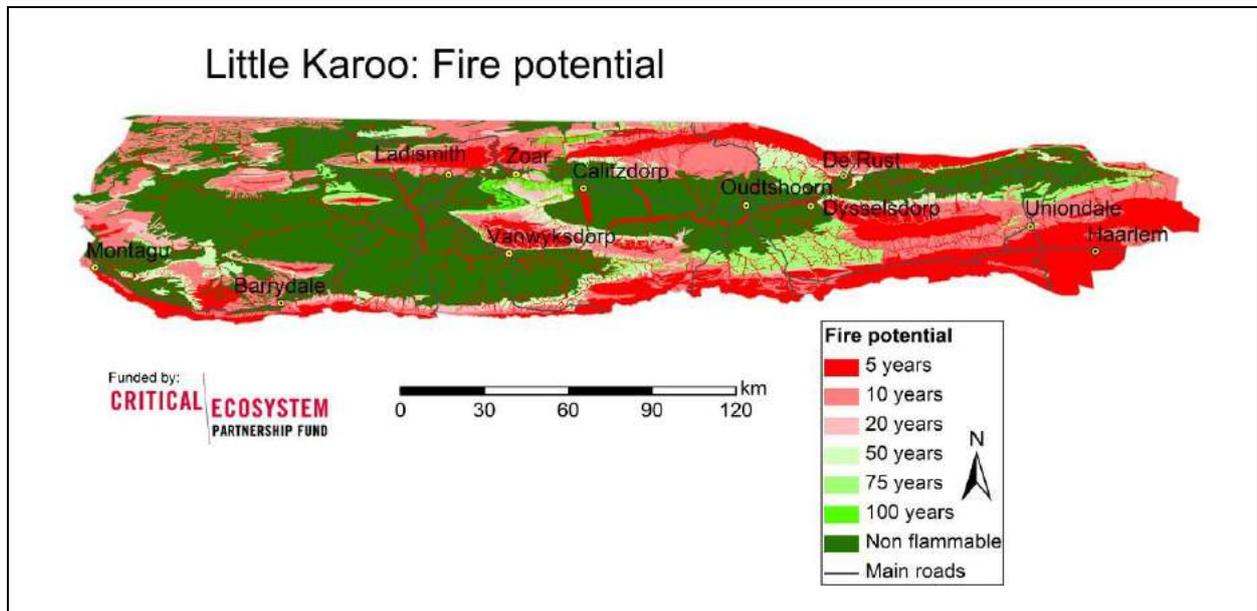
### **4.2 Products**

The project aimed to develop a flammability index map showing the potential reoccurrence of fire in untransformed examples of the 56 habitat types of the Little Karoo (Figure 5). Two further maps showing the minimum and maximum fire frequency regimes required (upper and

lower thresholds in years) to maintain the biodiversity of these habitat types were developed as supporting material (Figures 6 and 7).

### *Fire potential (flammability index) map*

The minimum potential fire return period was assigned for each of the 56 habitat types of the Little Karoo. This was based on the phytomass and structural characteristics of each habitat type. Non-flammable types were assigned a fire return interval of >100 years while a highly flammable type, such as grassy fynbos, was assigned a 5 year fire return period. The flammability index is most useful in terms of developing appropriate boundaries for emerging fire protection associations.



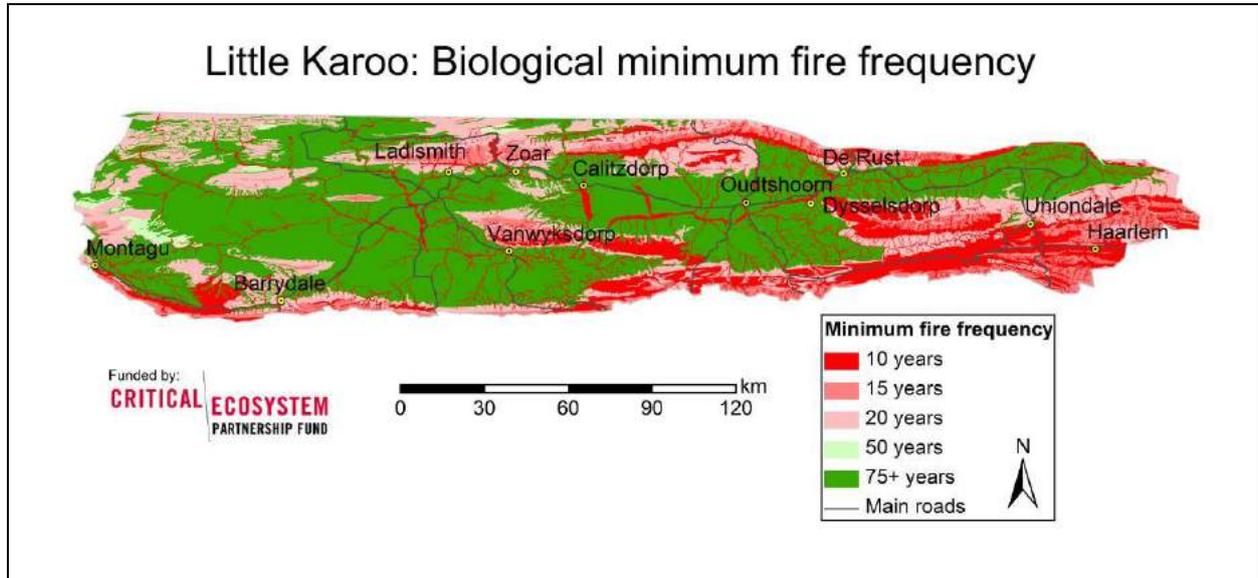
*Figure 5: The minimum potential fire return periods assigned to each of the 56 habitat types present in the Little Karoo.*

### *Development a minimum and maximum fire frequency maps*

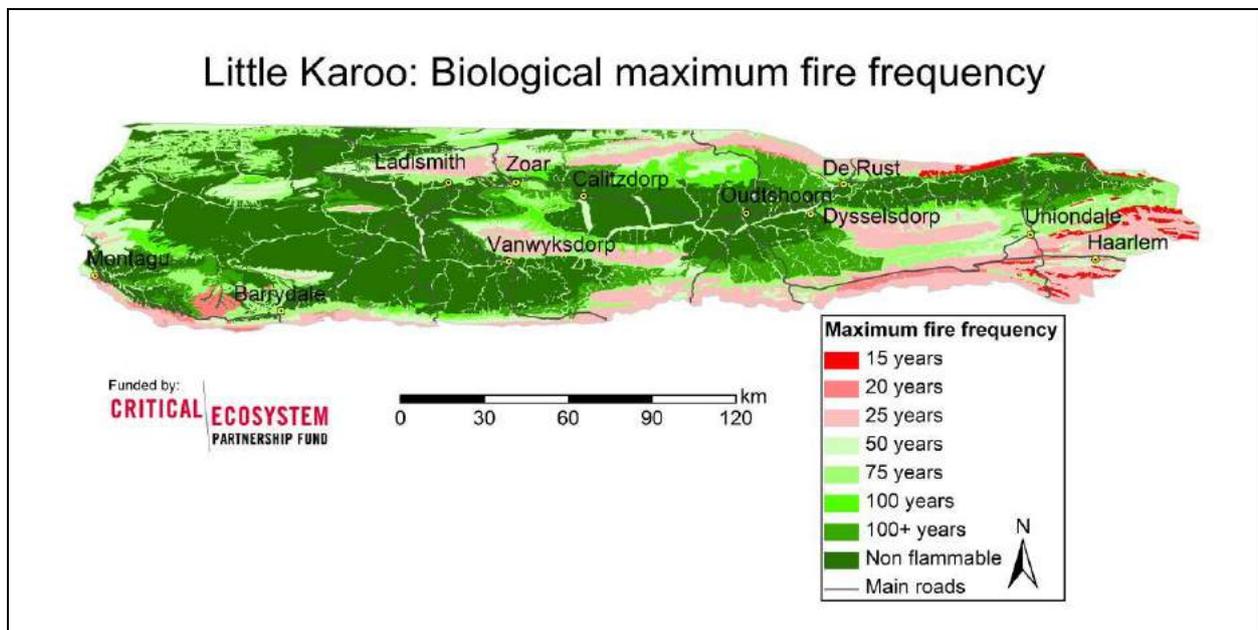
The biological needs in terms of minimum and maximum fire frequencies require to retain maximum biodiversity were assigned for each of the 56 habitat types (Figures 6 and 7). Use was once again made of the 56 habitat types contained in the vegetation map of the Little Karoo. Minimum fire frequencies were determined from published and unpublished monitoring data collected by CapeNature for each habitat type so as to determine the period that the slowest growing plant would require to mature (flower and produce sufficient seed to be able to regenerate) after a fire. The precautionary principle 100% of the plants needing to have flowered at least once or 50% at least three times was applied.

The maximum and minimum life span that obligate reseeder (non sprouting plants) require varied, depending on the habitat type in which they occur. These maps thus indicate the upper and low thresholds for sound ecological management of the different habitat types. The data was sourced from unpublished reports on permanent plant population sites monitored by

CapeNature. The minimum and maximum fire frequency maps are useful for biodiversity management in fire prone systems.



*Figure 6: The minimum fire frequencies required to retain maximum biodiversity for each of the 56 habitat types in the Little Karoo.*



*Figure 7: The maximum fire frequencies required to retain maximum biodiversity for each of the 56 fire prone habitat types in the Little Karoo.*

### **4.3 Stakeholder interaction, review and dissemination**

The fire management maps were reviewed by Tony Marshall (Swartberg Nature Reserve), Nigel Wessels (Outeniqua Nature Reserve) and AnneLise Schutte-Vlok (Regional Ecologist: Gouritz District) of Cape Nature as well as Henry Hill of the Eden District Municipality and Paul Gerber (Regional Fire Advisor) of the Department of Water Affairs and Forestry.

The fire management maps were presented at the Gouritz Initiative Forum held in Oudtshoorn on 22<sup>nd</sup> February 2008. CapeNature staff members responsible for fire management in the Little Karoo region were closely consulted in the development of the fire management maps.

The product is been disseminated through the Gouritz Initiative Forum and will soon also be available from the Biodiversity GIS (BGIS) unit responsible for the management of the South African National Biodiversity Institute's spatial biodiversity planning information (<http://bgis.sanbi.org>).

## **5. VELD RESTORATION POTENTIAL MAPS**

### **5.1 Purpose**

Maps of degraded areas with high potential for restoration were identified as key information required in the management of the Little Karoo. These maps provide an idea of areas requiring restoration urgently, where opportunities through carbon credits or improvements in soil protection are also available. The study also focused on job creation potential of these sites.

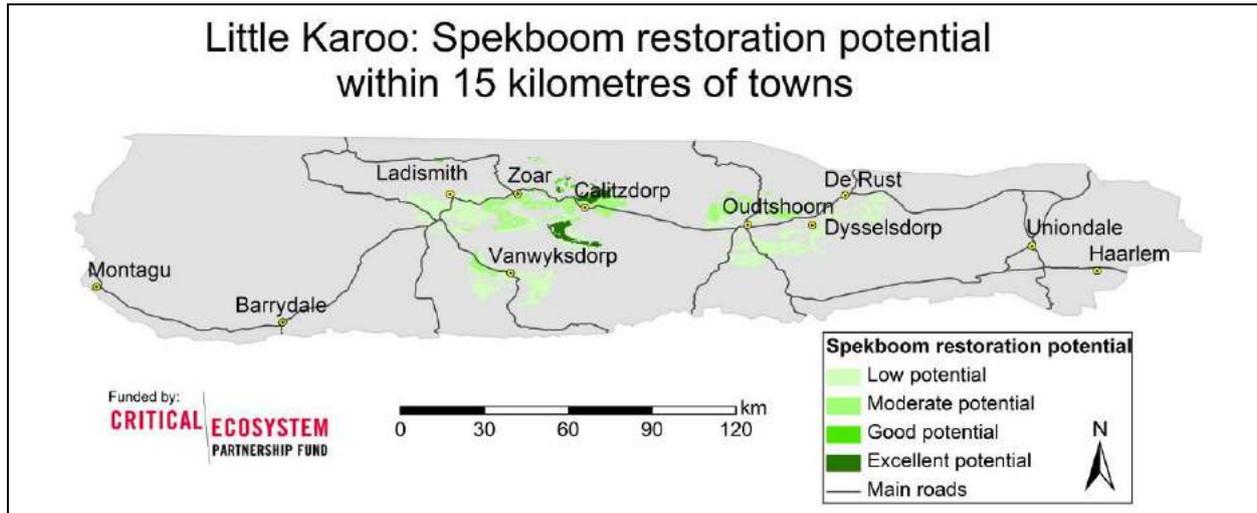
Currently, one of the main users of the spekboom restoration map is the Rhodes Restoration Research Group (R3G), an affiliate of the Working for Woodlands programme. They consulted the map when determining potential sites for pilot spekboom restoration trials. These trials are due to commence during 2008 and results will be monitored by R3G.

### **5.2 Products**

Veld (natural vegetation) restoration maps were produced for both *Spekboom* and *Gannaveld* habitat types. The maps depict degraded areas with good potential for restoration. Only areas within a 15 kilometre radius of towns were depicted, however data on areas outside of these buffers are also available.

#### ***Spekboom restoration potential map***

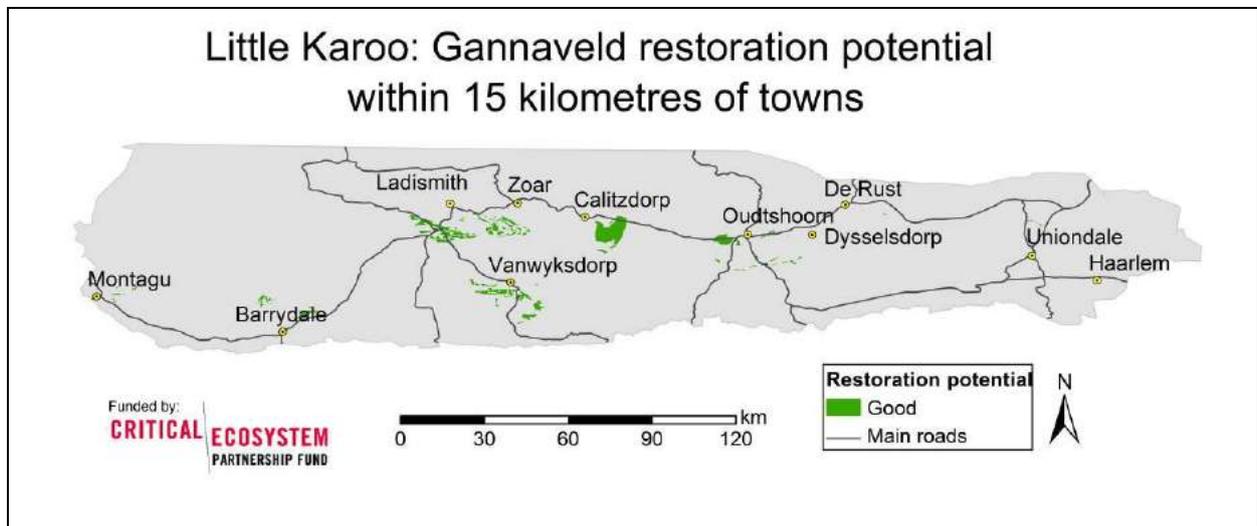
The objective was to identify degraded areas in the Little Karoo, close to centres of employment, where potential exists for spekboom restoration. This potential was divided into four classes based on four major habitat types. The habitat types were classed in terms of growth potential as follows; valley thicket with spekboom = excellent, arid thicket with spekboom = good, valley thicket with spekboom mosaics = moderate, and arid thicket with spekboom mosaics = low.



*Figure 8: Areas within a 15km radius of towns in the Little Karoo where potential exists for **spekboom** restoration.*

### *Gannaveld restoration potential map*

The objective was to identify degraded areas in the Little Karoo where potential exists for *gannaveld* restoration. These sites having good growth potential were derived from areas where *gannaveld*.



*Figure 9: Areas in the Little Karoo within 15km of towns where potential exists for **gannaveld** restoration.*

### **5.3 Stakeholder interaction, review and dissemination**

Rhodes Restoration Research Group, an affiliate of the Working for Woodlands programme has consulted this map in their project design. LandCare programme of the Department of

Agriculture can use the data to do pilot planting as a means of job creation. Landowners can use the map to see if they have any potential for carbon sequestration projects.

Spekboom draft maps and planting trial sites were presented at the Gouritz Initiative Forum held in Oudtshoorn on 22<sup>nd</sup> February 2008.

This work initiated a 15 minute panel discussion on the potential of using spekboom for veld (natural vegetation) restoration and carbon sequestration in the Little Karoo. The programme was broadcast on Landbou Radio during April 2008 and the panel comprised Marina Moller of the Rhodes Restoration Research Group, a local landowner and Jan Vlok. The development of restoration potential maps was mentioned and landowners were requested to contact R3G to establish pilot trials on their farms if they interested. The programme resulted in large number of queries from interested landowners.

Articles on the potential of using spekboom in veld restoration have recently been published in the two main national agricultural weekly magazines aimed at the farming community (Landbou Weekblad and Farmers weekly). In addition an article appeared in the Burger (a widely read regional newspaper) on the potential of spekboom restoration in relation to carbon sequestration. Jan Vlok provided information from this project and reviewed the draft manuscript written Marina Moller, a journalist.

Piet Lodder of the Klein Karoo Co-operative expressed much interest in the veld restoration maps. He discussed the need and potential for spekboom restoration with representatives of local agriculture unions after the Gouritz Forum Meeting in February 2008. This has resulted in several enquires from landowners who are interested in participating in restoration projects over and above the 40 sites identified thus far.

The Gamtoos Irrigation Board has now been appointed to establish the trial sites on the 40 identified sites and a Memorandum of Understanding is being drawn up between interested landowners and the Gamtoos Irrigation Board. Only 10% of the trial sites are on nature reserves while importantly the remainder are on private and communal land.

The Gamtoos Irrigation Board was selected because they already have trained teams capable of establishing the experimental design as well as doing the planting and monitoring of the trial sites. They are in the process of doing similar trials in the Baviaanskloof Mega-Park.

The product is being disseminated through the Gouritz Initiative Forum and will soon also be available from the Biodiversity GIS (BGIS) unit responsible for the management of the South African National Biodiversity Institute's spatial biodiversity planning information (<http://bgis.sanbi.org>).

## 6. CONCLUSIONS

Currently the financial viability of many of the previous agricultural practices in the Little Karoo is marginal at best, and landowners and managers are eager to explore new land use options. The project enabled us to capture much of the required data and to develop some useful maps, as well as to discuss the initial products with important stakeholders. We need a continued forum through in which we can discuss sound natural vegetation management in Little Karoo. We believe the Gouritz Initiative Forum (<http://gouritz.com>) is an ideal opportunity as its meetings are hosted by the Department of Agriculture at their offices in Oudtshoorn. To date it has been well attended by their officials as well as landowners and representatives of agricultural unions.

The game and ostrich maps derived from the project clearly show that animal carrying capacities are very low so many of the current agricultural practises are not sustainable. The lesson emerging from this project is that there really needs to be a change in land management if the people of the region wish to ensure that something remains of the natural capital for the next generation to survive and to build upon.

## 7. ACKNOWLEDGEMENTS

We thank all the participants in the Gouritz Initiative Forum for their contributions, interest in and support of the development of this project. In addition we would like to especially thank AnneLise Schutte-Vlok for her help in producing the spatial data layers, and Ken Coetzee for assisting in the matching of game species to habitats and developing recommended stocking rates.

Our colleague, Patrick O' Farrell is thanked for assisting with editing the document.

The Critical Ecosystem Partnership Fund is thanked for the grant which made this work possible.

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