

**An evaluation of the plant and vertebrate diversity for the proposed route for the optic fibre cable between Johannesburg and Bloemfontein**

**February 2011**

**2010**

**An evaluation of the vegetation and plant diversity along the proposed route between the Eskom Merensky and Foskor substations**

February 2012

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Prepared for:

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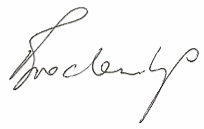
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# DECLARATION OF INDEPENDENCE

I, George Johannes Bredenkamp, Id 4602105019086, declare that I:

* Am the owner of Eco-Agent CC, CK 95/37116/23
* am committed to biodiversity conservation but concomitantly recognize the need for economic development. Whereas we appreciate the opportunity to also learn through the processes of constructive criticism and debate, we reserve the right to form and hold our own opinions and therefore will not willingly submit to the interests of other parties or change our statements to appease them;
* abide by the Code of Ethics of the S.A. Council for Natural Scientific Profession;
* Act as independent specialist consultants respectively in the fields of ecology, vegetation science and botany,
* am assigned as specialist consultant by Nsovo Environmental Consulting for the proposed project “An evaluation of the vegetation and plant diversity along the proposed route between the Eskom Merensky and Foskor substations” described in this report;
* do not have or will not have any financial interest in the undertaking of the activity other than remuneration for work performed;
* have or will not have any vested interest in the proposed activity proceeding;
* have no and will not engage in conflicting interests in the undertaking of the activity;
* undertake to disclose to the client and the competent authority any material information that have or may have the potential to influence the decision of the competent authority required in terms of the Environmental Impact Assessment Regulations 2006;
* will provide the client and competent authority with access to all information at our disposal, regarding this project, whether favourable or not.



JC

GJ Bredenkamp

# EXECUTIVE SUMMARY

The vegetation of all four alternatives was investigated. From the desktop study, confirmed by the field survey, option 3, which runs from Burgersfort to Ohrigstad along the R555, was eliminated. This is because the route along the R555 runs for most of the way in a narrow valley, with the Mabitsana River and the tarred R555 in this valley. The line will have to run for most of the way on the sensitive mountain foot slopes and cross the river and road several times. Furthermore, many irrigated agricultural enterprises occur in the Ohrigstad area, stretching all the way to Marapeng. This mosaic of narrow river valley, river, mountain slopes and agriculture where-ever the valley is a bit broader, causes the route to be unsuitable. From an ecological perspective both the riverine vegetation and the vegetation of the mountain slopes have a high ecological sensitivity. Therefore this entire valley forms an ecologically sensitive ecosystem. This is also a much longer route.

Furthermore, from the desktop study, confirmed by the field survey, option 4, was eliminated. The line of this option runs through nine vegetation types, and over very high and steep mountains of Sekhukhune Mountain Bushveld and Ohrigstad Mountain Bushveld with two endangered ecosystems (Sekhukhune Mountainlands and Sekhukhune Norite Bushveld, SANBI & DEAT 2009), Poung Dolomite Mountain Bushveld with endangered Malmani Karstland (SANBI & DEAT 2009), the vulnerable Northern Escarpment Quartzite Sourveld (Mucina & Rutherford (2006), Northern Mistbelt Forest area and the vulnerable Tzaneen Sour Bushveld (SANBI & DEAT 2009). Especially the Great Escarpment area consists of very rugged and high mountains, resulting in a very difficult route with several threatened ecosystems.

Alternative Routes 1 and 2 were further investigated in more detail by field surveys. The vegetation along these routes is described in detail, including the protected and red data species. Medicinal plants and aliens and weeds are indicated.

The most difficult part of the route is from the Merensky substation through Orichstad Mountain Bushveld which is an extremely mountainous area with sensitive vegetation. This part of the line transects quite sensitive vegetation and it is suggested that a walkthrough in this area is essential.

The most serious limitation on the Lowveld plains where the line transects the Granite Lowveld vegetation type, is the abundance of the protected tree *Sclerocarya birrea.* It is certain that several of these trees will be in the way of the transect.

Locally are also the river and spruit crossings. No river or spruit is very wide, so the lines can easily cross these rivers or spruits systems. Care should be taken to place pylons adequately away from river or spruit banks, avoiding any damage to the banks or water courses. Erosion should be avoided at all times.

Another factor in this area is that large properties are game farms and lodges. These areas are effectively conserved by the owners, and it is realised that the public participation is an important issue. After finalisation of the exact transect, a walkthrough will have to confirm any issues regarding vegetation.

From an ecological perspective, Alternative 1 is the preferred route.

# THE PROPOSED DEVELOPMENT

Eskom proposed the development of a new power line from the Merensky substation near Steelpoort to the Foskor substation near Phalaborwa. This power line is more than 120 km long. Alternative routes were proposed.

# 2. ASSIGNMENT

EcoAgent Ecological Consultants CC was appointed by Nsovo Environmental Consulting to assess the vegetation and flora for the entire route of proposed routes. This assignment is in accordance with the 2010 EIA Regulations (No. R. 543-546, Department of Environmental Affairs and Tourism, 18 June 2010) emanating from Chapter 5 of the National Environmental Management Act, 1998 (Act No. 107 of 1998).

The assignment is interpreted as follows: Compile a study of the vegetation and flora of the route, with emphasis on Red Data or Protected plant species that occur or may occur along the route. In order to compile this, the following had to be done:

**2.1. Initial preparations:**

* Obtain relevant maps and information on the natural environment of the concerned area.
* This includes information on Red Data plant species that may occur in the area.
* Obtain the Vegetation Types (Mucina & Rutherford, 2006) along the routes.

**2.2. Vegetation and habitat survey:**

* Use the Vegetation Types as basis for ecosystem delimitation.
* List the plant species (trees, shrubs, grasses and herbaceous species) present in the ecosystem recognised.
* Identify potential red data plant species, alien plant species, and medicinal plants.

**2.3. Plant community delimitation and description**

* Describe the habitat and vegetation.
* Determine the sensitivity of the site for biodiversity, veld condition and presence of rare or protected species.

**2.4. General**

* Identify and describe particular ecologically sensitive areas.
* Identify problem areas in need of special treatment or management, e.g. bush encroachment, erosion, water pollution, degraded areas, reclamation areas.
* This includes information on Red Data plant species that may occur in the area.

# 3. RATIONALE

It is widely recognised that it is of the utmost importance to conserve natural resources in order to maintain ecological processes and life support systems for plants, animals and humans. To ensure that sustainable development takes place, it is therefore important that the environment is considered before relevant authorities approve any development. This led to legislation protecting the natural environment. The Environmental Conservation Act (Act 73 of 1989), the National Environmental Management Act, 1998 (NEMA) (Act 107 of 1998) and the National Environmental Management Biodiversity Act, 2004. (Act 10 0f 2004) ensure the protection of ecological processes, natural systems and natural beauty as well as the preservation of biotic diversity in the natural environment. They also ensure the protection of the environment against disturbance, deterioration, defacement or destruction as a result of man-made structures, installations, processes or products or human activities. A draft list of Threatened Ecosystems was published (Government Gazette 2009) as part of the National Environmental Management Biodiversity Act, 2004 (Act 10 0f 2004). These Threatened Ecosystems are described by SANBI & DEAT (2009).

All components of the ecosystems (physical environment, vegetation, animals) of a site are interrelated and interdependent. A holistic approach is therefore imperative to include effectively the development, utilisation and where necessary conservation of the given natural resources in an integrated development plan, which will address all the needs of the modern human population (Bredenkamp & Brown 2001).

It is therefore necessary to make an inventory of the plant communities and biodiversity on the alternative routes, in order to evaluate the biodiversity and possible rare species. This inventory should then serve as a scientific and ecological basis for the planning exercises.

# 4. STUDY AREA

## 4.1. General

The different options suggested for the Merensky - Foskor Eskom power line are indicated in Figure 1. The northern parts of all options will traverse through conservation areas (Figure 2). All options start at the Merensky substation near Steelpoort. As the area is very large, many spruit systems are found along the routes (Figure 3). A few larger rivers or spruits are mentioned, but the numerous smaller spruit systems will have to be identified during a walk-down.

Option 1 (the preferred option) will run along the Steelpoort – Burgersfort road (R555) but before reaching Burgersfort it will turn north-eastwards and cross the rugged mountainous area towards the Strydom tunnel on the R36. It will then cross the mountains east of the Strydom tunnel and run towards Mica and from there towards the Foskor substation south of Phalaborwa.

Option 2 will follow the same route as option 1 up to the Mica area, but will then turn more east to run south and east of option 1, in the direction of Hoedspruit, and then turn northwards to the Foskor substation.

Option 3 will initially also follow the same route as option 1 for a short distance, but at Burgersfort it will turn eastwards and follow the R555 to Ohrigstad and further on to the Strydom tunnel. From here on the route is similar to that of option 1.

Option 4 will run northwards from the Merensky substation, over undulating and mountainous area towards Penge and then over the rugged mountains over the great escarpment to cross the R36 between Trichardsdal and Diputhi and then run through the Kapama / Madrid Nature Reserve area toward Phalaborwa.

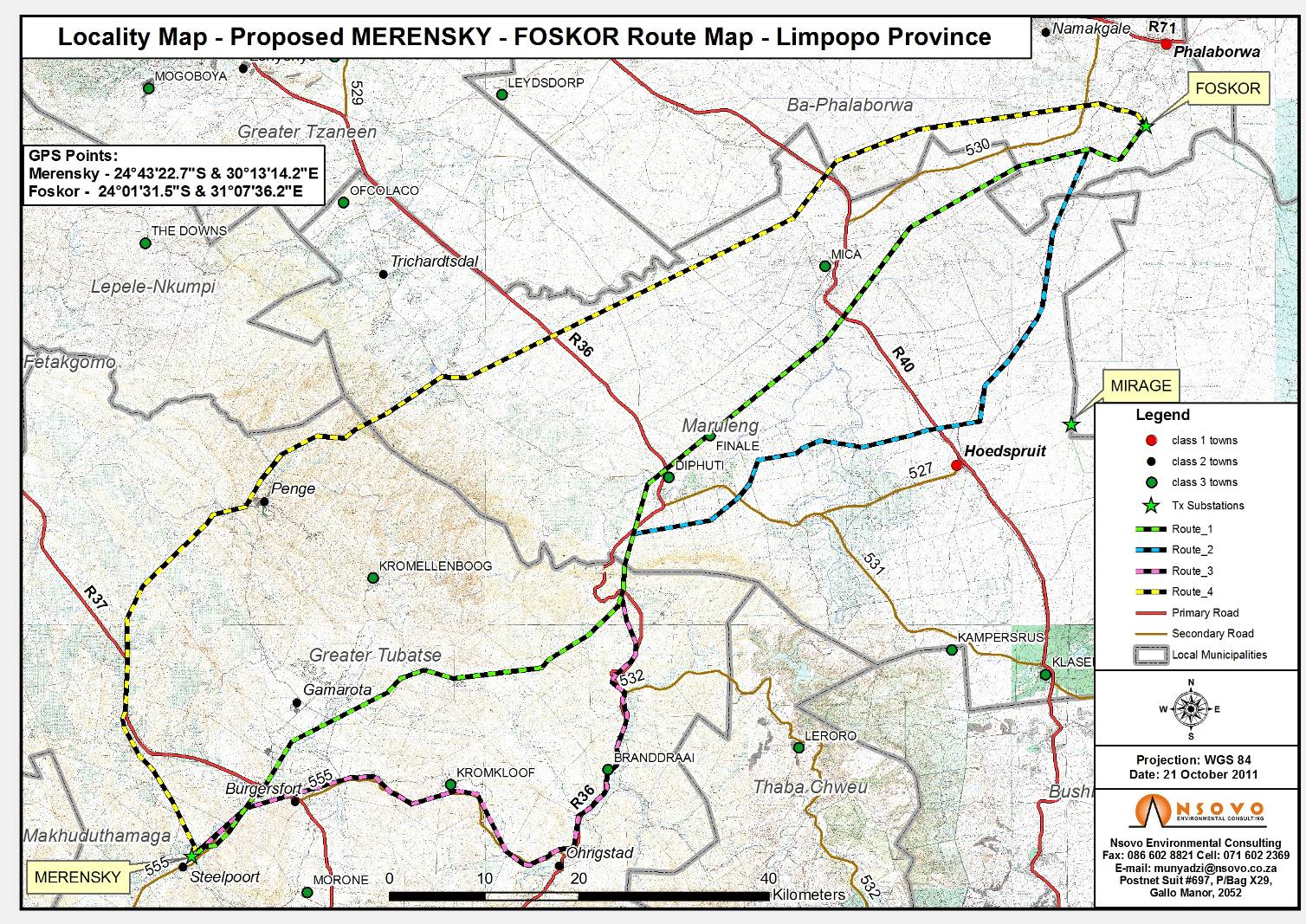
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Figure 1: A locality map showing the different options for the Merensky Foskor Eskom power line

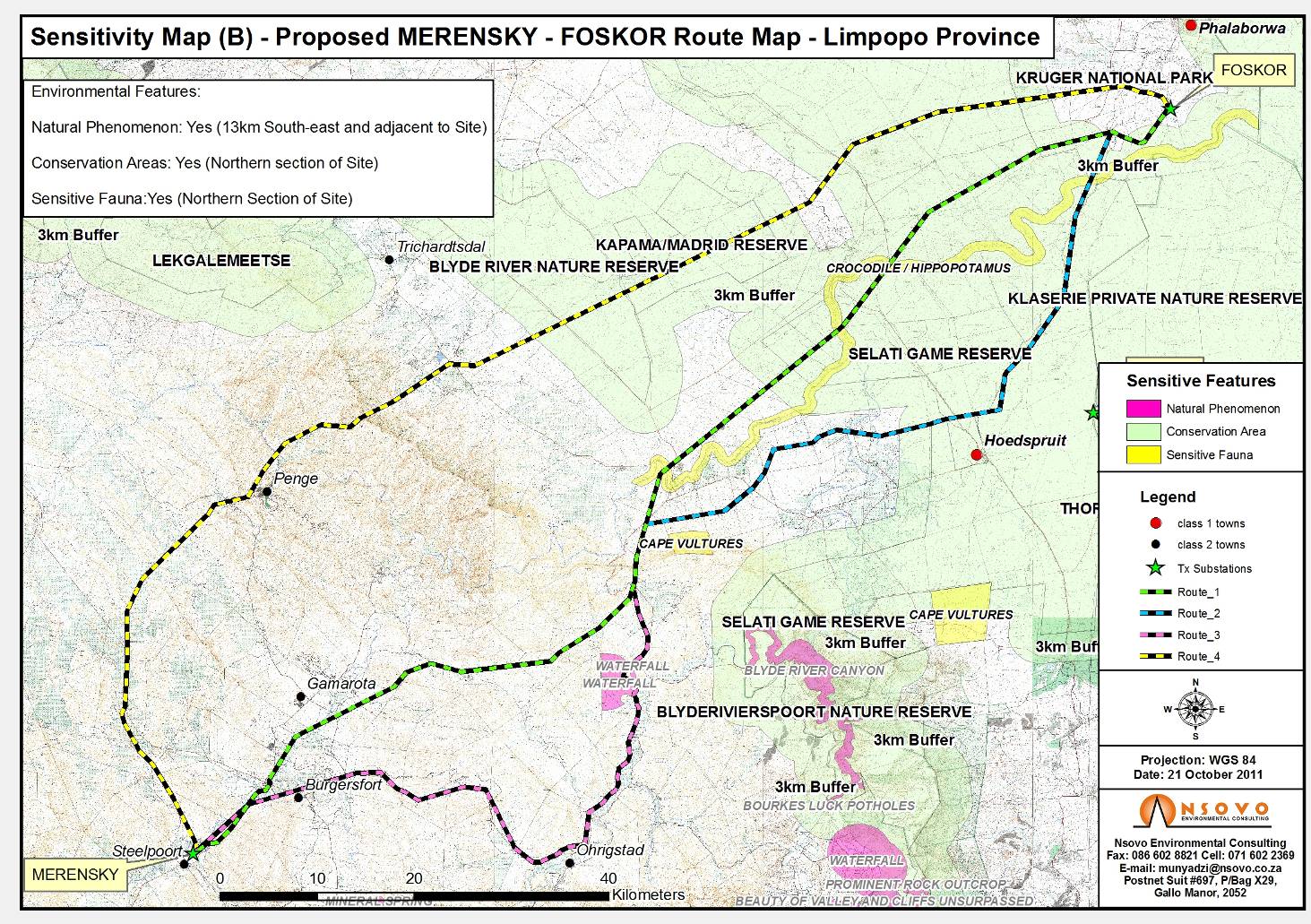
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Figure 2: A locality map showing the different options for the Merensky Foskor Eskom power line with conservation and sensitive areas

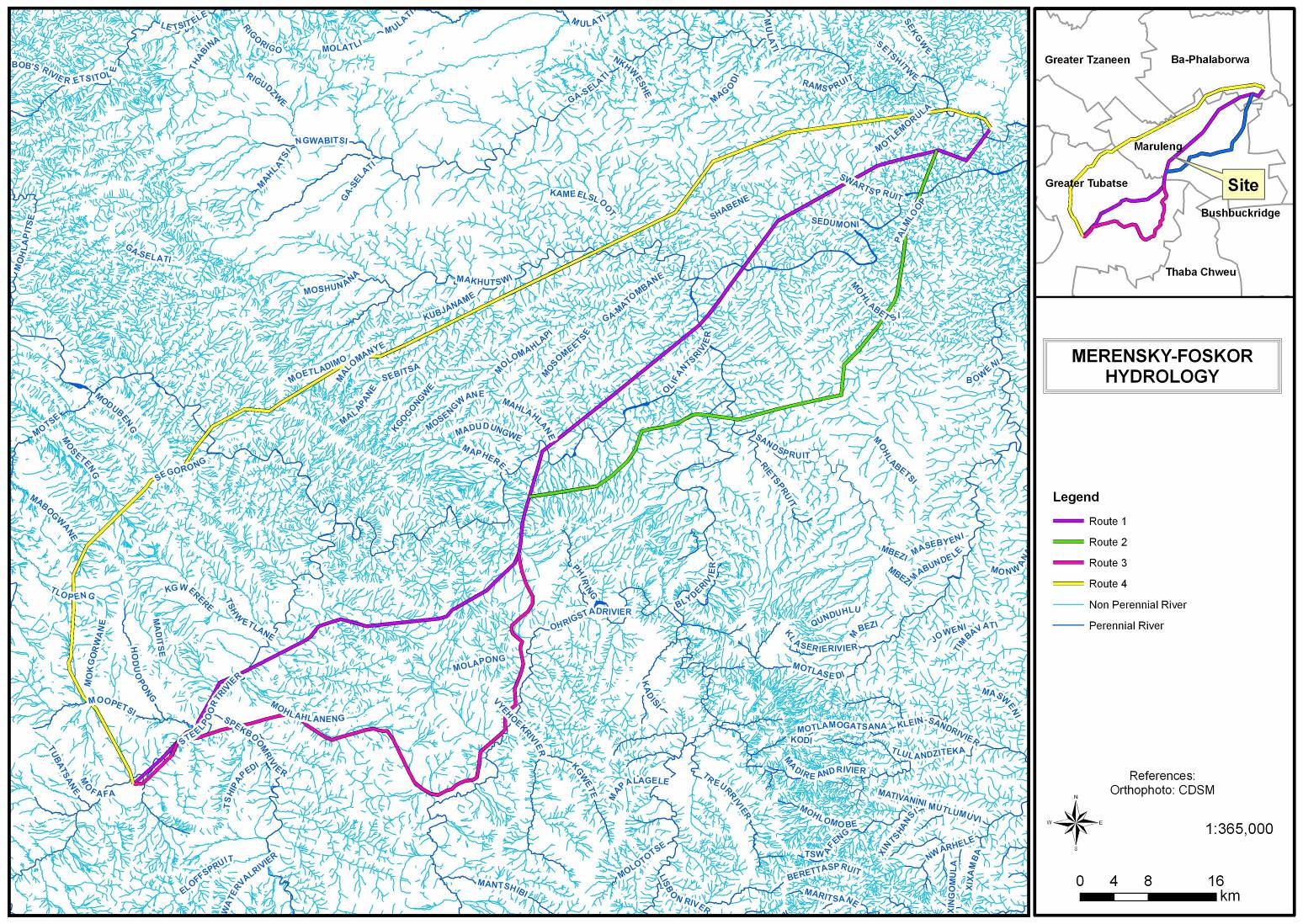


Figure 3: The hydrology of the area showing major river systems and numerous smaller spruits along all the route options

# 6. METHODS

## 6.1 Vegetation and habitat survey

A desktop study was made on the vegetation and flora fauna and general ecology and ecological sensitivity of the area along all options suggested for this power line. A site visit followed the desktop study.

The routes were driven on 24 and 25 October 2011 by Prof G.J. Bredenkamp, a delegation of Nsovo Environmental Consulting and also a delegation of Eskom. Staff members of Eskom gave guidance in the field on the location of the various options. Parts of the route, especially the south-western mountainous parts, were again visited during February 2012.

The vegetation of the route was stratified into relatively homogeneous units based on Vegetation Type Units (Mucina & Rutherford 2006). Regular stops were made in each vegetation unit identified, to record vegetation and plant species present and also on the conservation status, sensitivity and condition of the vegetation. Special features were identified as major river crossings, wetlands, rocky ridges or any other features considered to be of importance for the biodiversity assessment.

The general vegetation of the unit was described using both the desktop study and the field observations. For the particular vegetation type a description of the dominant and characteristic species was made at several sites within each Vegetation Type unit. These descriptions were based on total floristic composition, following established vegetation survey techniques (Mueller-Dombois & Ellenberg 1974; Westhoff & Van der Maarel 1978). Data recorded included a list of the plant species present, including trees, shrubs, grasses and forbs. Comprehensive species lists were therefore derived for each plant community / ecosystem present on the site. These vegetation survey methods have been used as the basis of a national vegetation survey of South Africa (Mucina *et al*. 2000) and are considered to be an efficient method of describing vegetation and capturing species information. Notes were additionally made of any other features that might have an ecological influence.

The identified systems are not only described in terms of their plant species composition, but also evaluated in terms of the potential habitat for red data plant species.

Red data plant species for the area were obtained from the SANBI data bases, with updated threatened status, (Raimondo *et al* 2009). These lists were then evaluated in terms of habitat available on the site, and also in terms of the present development and presence of man in the area.

Protected trees are according to the list provided by the National Forests Act 1998 (Act 84 of 1998). Other protected plants are according to the National Environmental

Management: Biodiversity Act, 2004 (Act No. 10 of 2004), or provincial regulations.

Alien invasive species, according to the Conservation of Agricultural Resources Act (Act No.43 of 1983) as listed in Henderson (2001), are indicated.

Medicinal plants are indicated according to Van Wyk, Van Oudthoorn & Gericke (1997), these are mentioned in the species lists.

### 6.2 Conservation Priority / Sensitivity

The following **conservation priority** / **ecological sensitivity** categories were used for each site:

**High**: Ecologically sensitive and valuable land with high species richness and/or sensitive ecosystems or red data species that should be conserved and no developed allowed.

**Medium-high**: Land where sections are disturbed but which is in general ecologically sensitive to development/disturbances.

**Medium**: Land on which low impact development with limited impact on the vegetation / ecosystem could be considered for development. It is recommended that certain portions of the natural vegetation be maintained as open space.

**Medium-low**: Land of which small sections could be considered to conserve but where the area in general has little conservation value.

**Low**: Land that has little conservation value and that could be considered for developed with little to no impact on the vegetation.

**Species status**

Plant species recorded in each plant community with an indication of the status of the species by using the following symbols:

A = Alien woody species

D = Dominant

d = subdominant

G = Garden or Garden Escape

M = Medicinal plant species

P = Protected trees species

p = provincially protected species

RD = Red data listed plant

W = weed

The field observations were supplemented by literature studies from the area (Bredenkamp 1982, Gertenbach 1983a, 1983b, Mathews 1991, Siebert 2001, Siebert *et al.* 2002a, 2002b, 2002c, 2002d 2002e and 2003).

# 7. RESULTS:

## 7.1 Vegetation Classification

According to the new vegetation map of South Africa (Mucina *&* Rutherford2006) the routes transect the following vegetation types, Threatened Ecosystem Status is according to SANBI & DEAT (2009):

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Vegetation Type** | **Route** | **Conservation status**  **(Mucina & Rutherford 2006)** | **Threatened Ecosystems**  **(SANBI & DEAT 2009)** | **Threatened Status** |
|  |  |  |  |  |
| 1. Sekhukhune Plains Bushveld | 1, 3, 4 | Vulnerable |  |  |
| 2. Sekhukhune Mountain Bushveld | 4 | Least Threatened | Sekhukhune Mountainlands  Sekhukhune Norite Bushveld | Endangered  Endangered |
| 3. Ohrigstad Mountain Bushveld | 1, 3, 4 | Least Threatened | Sekhukhune Mountainlands | Endangered |
| 4. Lydenburg Thornveld | 1 | Vulnerable |  |  |
| 5. Poung Dolomite Mountain Bushveld | 1, 3, 4 | Least Threatened | Malmani Karstlands | Endangered |
| 6. Northern Escarpment Quartzite Sourveld | 4 | Vulnerable |  |  |
| 7. Northern Mistbelt Forest | 4 | Least Threatened |  |  |
| 8. Tzaneen Sour Bushveld | 4 (1, 2) | Least Threatened | Tzaneen Sour Bushveld | Vulnerable |
| 9. Granite Bushveld | 1, 2, 4 | Least Threatened |  |  |
| 10. Lowveld Rugged Mopaneveld | 1, 2 | Least Threatened |  |  |
| 11. Phalaborwa-Timbavati Mopaneveld | 1, 4 | Least Threatened |  |  |
| 12. River Crossings | all |  |  |  |

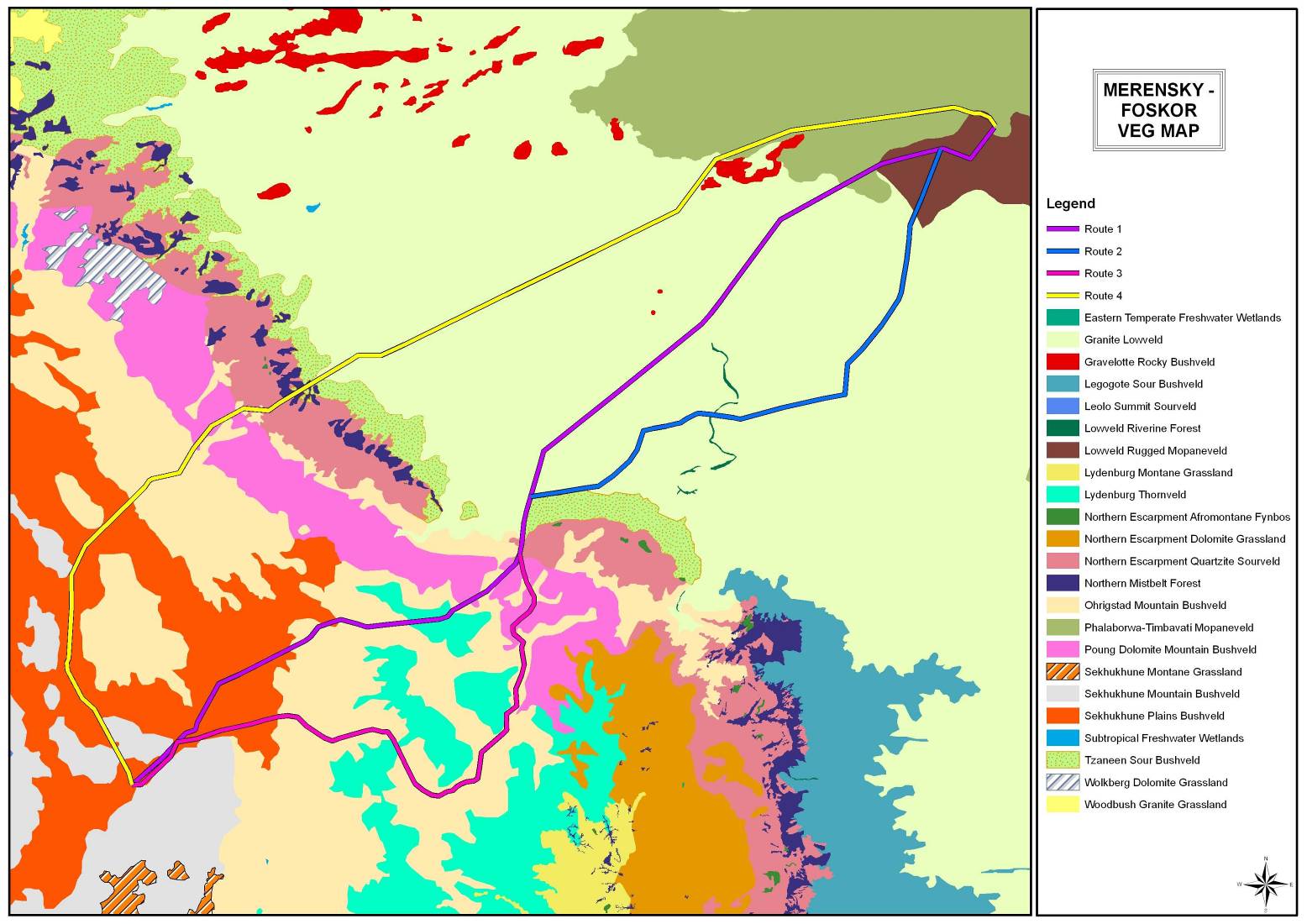


Figure 4: The vegetation types (Mucina & Rutherford 2006) along the optional routes

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Furthermore, from the desktop study, confirmed by the field survey, option 4, was eliminated. The line of this option runs through nine vegetation types, and over very high and steep mountains of Sekhukhune Mountain Bushveld and Ohrigstad Mountain Bushveld with two endangered ecosystems (Sekhukhune Mountainlands and Sekhukhune Norite Bushveld, SANBI & DEAT 2009), Poung Dolomite Mountain Bushveld with endangered Malmani Karstland (SANBI & DEAT 2009), the vulnerable Northern Escarpment Quartzite Sourveld (Mucina & Rutherford (2006), Northern Mistbelt Forest area and the vulnerable Tzaneen Sour Bushveld (SANBI & DEAT 2009). Especially the Great Escarpment area consists of very rugged and high mountains, resulting in a very difficult route with several threatened ecosystems.

## 7.2 Description of the vegetation types

## Sekhukhune Plains Bushveld (Vulnerable)

The Merensky substation is located in the Sekhukhune Plains Bushveld. Although the vegetation of these plains falls within the Sekhukhune Centre of plant endemism (Siebert 2001, Siebert *et al.* 2002a-e) this area is highly transformed by many villages and their agricultural fields. Within the study area this bushveld is restricted to the valley floors of the rivers that dissect the mountains. These areas are heavily grazed and often not in prime condition. This resulted in Mucina & Rutherford (2006) labelling the conservation status of this vegetation as Vulnerable.

Large parts of these plains are dominated by *Dichrostachys cinerea, Acacia tortilis, Acacia mellifera* and *Acacia nilotica.* Otherplantspecies found here include the trees *Boscia foetida, Euclea linearis, Searsia batophylla* (along spruits and dongas) with the forbs *Felicia clavipilosa, Hermannia odorata, Gisekia africana, Melhania rehmannii* and the grasses *Aristida congesta, Enneapogon cenchroides, Urochloa mosambicensis.* Alien plant species are often found close to villages or along roads and tracks.

The following species were listed for this plant community:

**TREES AND SHRUBS**

*Acacia gerrardii*

*Acacia mellifera* d

*Acacia nilotica* d

*Acacia tortilis* D

*Agave americana* A

*Aloe castanea* p

*Aloe cryptopoda* p

*Aloe globuligemma* p

*Balanites maughamii* P

*Boscia foetida*

*Dichrostachys cinerea* D

*Ehretia rigida*

*Euphorbia tirucalli*

*Grewia bicolor*

*Grewia flava*

*Lantana camara* A

*Melia azedarach* A

*Rhigozum obovatum*

*Sarcostemma viminale*

*Schotia latifolia* RD

*Sclerocarya birrea* P

*Searsia batophylla* RD

*Searsia engleri*

*Tinnea rhodesiana*

*Triaspis glaucophylla*

*Ziziphus mucronata* M

**GRASSES**

*Aristida adscensionis*

*Aristida congesta s. barbicollis*

*Cenchrus ciliaris*

*Chloris virgata*

*Dactyloctenium aegyptium*

*Enneapogon cenchroides*

*Enneapogon scoparius*

*Eragrostis heteromera*

*Eragrostis lehmanniana*

*Eragrostis superba*

*Fingerhuthia africana*

*Melinis repens s. repens*

*Panicum maximum*

*Sporobolus ioclados*

*Stipagrostis hirtigluma*

*Themeda triandra*

*Tragus berteronianus*

*Urochloa mosambicensis*

**FORBS**

*Abutilon angulatum*

*Acalypha indica*

*Achyranthes aspera v. sicula*

*Asparagus suaveolens*

*Bidens bipinnata* W

*Blepharis integrifolia*

*Clerodendrum ternatum*

*Corchorus asplenifolius*

*Datura stramonium* WM

*Felicia clavipilosa*

*Flaveria bidentis* W

*Galenia sarcophylla*

*Geigeria burkei*

*Gossypium herbaceum*

*Hermannia modesta*

*Hermbstaedtia odorata*

*Hibiscus caesius*

*Hibiscus micranthus*

*Jamesbrittenia atropurpurea*

*Jatropha latifolia*

*Justicia flava*

*Justicia protracta s. rhodesiana*

*Kohautia cynanchica*

*Lantana rugosa*

*Kleinia longiflora*

*Leonotis ocymifolia*

*Melhania acuminata*

*Melhania rehmannii*

*Monechma divaricatum*

*Ocimum americanum*

*Pavonia burchellii*

*Phyllanthus maderaspatensis*

*Pollichia campestris*

*Schkuhria pinnata* W

*Seddera fruticosa*

*Sesamum triphyllum* W

*Sesbania bispinosa*

*Sida alba*

*Solanum panduriforme* W

*Tephrosia purpurea*

*Tribulus terrestris* W

*Vernonia poskeana*

*Waltheria indica* W

*Zinnia peruviana* W

|  |  |  |  |
| --- | --- | --- | --- |
| **Sekhukhune Plains Bushveld** | | | |
| **Status** | Dense to Disturbed plains bushveld | | |
| **Soil** | Clay-loam | **Rockiness**  **%** | 5-25 |
| **Conservation priority:** | Medium | **Sensitivity:** | Medium |
| **Agricultural potential:** | Medium-Low | **Need for rehabilitation** | Medium |
| **Dominant spp.** | *Acacia tortilis, Acacia mellifera, Dichrostachys cinerea, Euclea linearis* | | |

### Species of Conservation Concern

A list of Species of Conservation Concern for the Grid 2627BB was obtained from the database on the SANBI website. Threatened species are those that are facing high risk of extinction, indicated by the categories Critically Endangered (CE), Endangered (EN) and Vulnerable (VU). Species of Conservation Concern include the Threatened Species, but additionally have the categories Near Threatened (NT), Data Deficient (DD), Critically Rare (CR), Rare (R) and Declining (D). This is in accordance with the new Red List for South African Plants (Raimondo *et al*. 2009).

The following species of conservation concern were previously recorded from the Grid 2430CA (SANBI, POSA website):

|  |  |
| --- | --- |
| Species | Status |
| *Dicliptera fruticosa* K.Balkwill | NT |
| *Elaeodendron transvaalense* (Burtt Davy) R.H.Archer | NT |
| *Lydenburgia cassinoides* N.Robson | NT |
| *Adenia fruticosa* Burtt Davy subsp. *fruticosa* | NT |
| *Searsia sekhukhuniensis* (Moffett) Moffett | Rare |
| *Combretum petrophilum* Retief | Rare |
| *Euphorbia sekukuniensis* R.A.Dyer | Rare |
| *Searsia batophylla* (Codd) Moffett | VU |
| *Zantedeschia jucunda* Letty | VU |
| *Gladiolus sekukuniensis* P.J.D.Winter | VU |
| *Acacia sekhukhuniensis* P.J.H.Hurter | CR |
| *Delosperma rileyi* L.Bolus | DDD |
| *Asparagus intricatus* (Oberm.) Fellingham & N.L.Mey. | DDT |
| *Acalypha caperonioides* Baill. var. *caperonioides* | DDT |
| *Myrothamnus flabellifolius* Welw. | DDT |
| *Ilex mitis* (L.) Radlk. var. *mitis* | Declining |
| *Drimia altissima* (L.f.) Ker Gawl. | Declining |
| *Hypoxis hemerocallidea* Fisch., C.A.Mey. & Avé-Lall. | Declining |
| *Eulophia speciosa* (R.Br. ex Lindl.) Bolus | Declining |

*Searsia batophylla, Hypoxis hemerocallidea* and *Eulophia speciosa* were observed within the transect area. For most of the other species the plains habitat is not suitable, they are present on the mountain areas of Sekhukhuneland.

*Balanites maughamii* and *Sclerocarya birrea* are nationally protected trees observed along the route while the *Aloe* species are all provincially protected.

### Conclusion

The vegetation within on the plains are quite disturbed, there are often villages, roads, tracks and current or old agricultural fields present. As the pylons of the power line will have a relatively small footprint, the impact on the vegetation will be small. However, due to the presence of red data and possibly protected plant species, a walkthrough is recommended for this area, to ensure that sensitive areas are excluded for construction of pylons.



Figure 5: Sekhukhune Plains Bushveld in the foreground and Sekhukhune Mountain Bushveld in the Background

## 2. Sekhukhune Mountain Bushveld

This Open Mountain Bushveld occurs patchy throughout the area, the soils contain high concentrations of heavy metals and the area is often prone to mining operations. In this study very small part of this Bushveld is affected, the largest piece is just north of Steelpoort along route option 4, which was already eliminated. However, being a very sensitive ecosystem, due to several endemic and threatened species, the description is included.

**Trees and Shrubs**

*Acacia ataxacantha,*

*Acacia gerrardii*

*Acacia mellifera s. detinens*

*Acacia nigrescens,*

*Acacia nilotica*

*Acacia senegal v. leiorhachis*

*Acacia senegal v. rostrata*

*Acacia tortilis s. heteracantha*

*Aloe arborescens* p

*Aloe castanea* p

*Aloe cryptopoda* p

*Boscia foetida*

*Brachylaena ilicifolia*

*Carissa bispinosa*

*Celtis africana*

*Combretum apiculatum*

*Combretum hereroense*

*Combretum molle*

*Combretum petrophilum* RD

*Commiphora mollis*

*Croton gratissimus*

*Cussonia transvaalensis*

*Dichrostachys cinerea*

*Elephantorrhiza praetermissa*

*Elaeodendron transvaalense* RD

*Euclea linearis*

*Euclea undulata* M

*Grewia flava*

*Grewia vernicosa*

*Hippobromus pauciflorus*

*Kirkia wilmsii*

*Maerua cafra*

*Maytenus undata*

*Lydenburgia cassinoides* RDP

*Ormocarpum trichocarpum*

*Ozoroa sphaerocarpa*

*Rhoicissus sekhukhuniensis*

*Sclerocarya birrea* P

*Searsia keetii*

*Searsia sekhukhuniensis* RD

*Searsia wilmsii*

*Terminalia prunioides*

*Tinnea rhodesiana*

*Vitex obovata subsp wilmsii*

**Grasses**

*Aristida canescens*

*Aristida canescens,*

*Aristida transvaalensis*

*Bothriochloa insculpta*

*Brachiaria eruciformis*

*Digitaria eriantha*

*Diheteropogon amplectens*

*Elionurus muticus*

*Enneapogon scoparius*

*Eragrostis lehmanniana*

*Eragrostis superba*

*Fingerhuthia africana*

*Heteropogon contortus*

*Loudetia simplex*

*Melinis repens*

*Panicum deustum*

*Sporobolus ioclados*

*Themeda triandra*

**Forbs**

*Abutilon angulatum*

*Adenia fruticosa* RD

*Asparagus cooperi*

*Asparagus suaveolens*

*Barleria kaloxytona*

*Barleria saxatilis*

*Berkheya insignis*

*Blepharis aspera*

*Blepharis integrifolia*

*Clerodendrum ternatum*

*Commelina africana*

*Corchorus asplenifolius*

*Crabbea angustifolia*

*Cyphostemma coddii*

*Ectadiopsis oblongifolia*

*Euphorbia enormis*

*Euphorbia schinzii*

*Evolvulus alsinoides*

*Geigeria burkei*

*Gerbera jamesonii*

*Hibiscus aethiopicus*

*Hypoestes forskaolii*

*Kohautia cynanchica*

*Kyphocarpa angustifolia*

*Melhania rehmannii*

*Merwilla plumbea* RD

*Monechma divaricatum*

*Myrothamnus flabellifolius* RD

*Ocimum americanum*

*Phyllanthus glaucophyllus*

*Polygala hottentotta*

*Ptycholobium plicatum*

*Rhynchosia minima*

*Sansevieria hyacinthoides*

*Seddera capensis*

*Senna italica*

*Stylochiton natalensis*

*Stylochiton* sp

*Syncolostemon concinnus*

*Tephrosia purpurea*

*Tetradenia brevispicata,*

*Tragia dioica*

*Waltheria indica* W

*Xerophyta retinervis*

|  |  |  |  |
| --- | --- | --- | --- |
| **Sekhukhune Mountain Bushveld** | | | |
| **Status** | Dense to Disturbed mountain bushveld | | |
| **Soil** | Clay-loam | **Rockiness**  **%** | 5-25 |
| **Conservation priority:** | High | **Sensitivity:** | High |
| **Agricultural potential:** | Low | **Need for rehabilitation** | Low |
| **Dominant spp.** | *Combretum apiculatum, Grewia vernicosa, Dichrostachys cinerea, Euclea linearis* and *Euclea undulata* | | |

### Species of Conservation Concern

A Threatened species and Species of Conservation Concern list for the Grid 2627BB was obtained from the POSA database on the SANBI website. Threatened species are those that are facing high risk of extinction, indicated by the categories Critically Endangered (CE), Endangered (EN) and Vulnerable (VU). Species of Conservation Concern include the Threatened Species, but additionally have the categories Near Threatened (NT), Data Deficient (DD), Critically Rare (CR), Rare (R) and Declining (D). This is in accordance with the new Red List for South African Plants (Raimondo *et al*. 2009).

The following species of conservation concern were previously recorded from the Grid 2430CA (SANBI, POSA website):

|  |  |
| --- | --- |
| Species | Status |
| *Dicliptera fruticosa* K.Balkwill | NT |
| *Elaeodendron transvaalense* (Burtt Davy) R.H.Archer | NT |
| *Lydenburgia cassinoides* N.Robson | NT |
| *Adenia fruticosa* Burtt Davy subsp. *fruticosa* | NT |
| *Searsia sekhukhuniensis* (Moffett) Moffett | Rare |
| *Combretum petrophilum* Retief | Rare |
| *Euphorbia sekukuniensis* R.A.Dyer | Rare |
| *Searsia batophylla* (Codd) Moffett | VU |
| *Zantedeschia jucunda* Letty | VU |
| *Gladiolus sekukuniensis* P.J.D.Winter | VU |
| *Acacia sekhukhuniensis* P.J.H.Hurter | CR |
| *Delosperma rileyi* L.Bolus | DDD |
| *Asparagus intricatus* (Oberm.) Fellingham & N.L.Mey. | DDT |
| *Acalypha caperonioides* Baill. var. *caperonioides* | DDT |
| *Myrothamnus flabellifolius* Welw. | DDT |
| *Ilex mitis* (L.) Radlk. var. *mitis* | Declining |
| *Drimia altissima* (L.f.) Ker Gawl. | Declining |
| *Hypoxis hemerocallidea* Fisch., C.A.Mey. & Avé-Lall. | Declining |
| *Eulophia speciosa* (R.Br. ex Lindl.) Bolus | Declining |

*Elaeodendron transvaalense, Combretum petrophilum*, *Lydenburgia cassinoides*, *Adenia fruticosa, Myrothamnus flabellifolius* and *Searsia sekhukhuniensis* were observed close to the transect area. *Merwilla plumbea,* not listed above, was also seen. The habitat is also suitable for most of the other threatened species listed.

The protected trees *Lydenburgia cassinoides* and *Sclerocarya birrea* are present.

### Conclusion

The vegetation on the mountains contains several red data and protected plant species, where-ever possible the mountain areas of Sekhukhuneland should be avoided. It seems that although this type of Bushveld is prominent between Steelpoort and Burgersfort, the proposed line will seldom transect these mountains, except for Route 4, which is already eliminated. However, should any line cross this vegetation type, a walkthrough is recommended for this area, to ensure that sensitive areas are excluded for construction of pylons.

## 3. Ohrigstad Mountain Bushveld

Ohrigstad Mountain Bushveld is present in the Burgersfort – Ohrigstad and Penge areas. (present for options 1, 3 and 4, not for option 2). This Mountain Bushveld also has, as the Sekhukhune Mountain Bushveld, high species diversity and several plant species of conservation concern. However, this area consists of mountains and valleys, both being important for this survey. Option 3 runs for most of the way in a prominent valley, containing plains bushveld, but often has to run over the footslopes of the mountains.

Option 3, which runs from Burgersfort to Ohrigstad along the R555, was eliminated. This is because the route along the R555 runs for most of the way in a narrow valley, with the Mabitsana River and the tarred R555 in this valley. The line will have to run for most of the way on the sensitive mountain foot slopes and cross the river and road several times. Furthermore, many irrigated agricultural enterprises occur in the Ohrigstad area, stretching all the way to Marapeng. This mosaic of narrow river valley, river, mountain slopes and agriculture where-ever the valley is a bit broader, causes the route to be unsuitable. From an ecological perspective both the riverine vegetation and the vegetation of the mountain slopes have a high ecological sensitivity. Therefore this entire valley forms an ecologically sensitive ecosystem. This is also a much longer route.

The two main plant communities found in this area are: a) The Plains Bushveld in the Valleys and b) the Mountain slope Bushveld. These are described separately.

### a. Plains Bushveld

The Dense Plains Bushveld is restricted to the Ohrigstad valley, the route of Option 3. This is degraded to pristine bushveld with a dense woody cover. The vegetation is dominated by *Acacia tortilis, Dichrostachys cinerea, Combretum apiculatum, Euclea linearis* and *Euclea undulata*, while *Eragrostis rigidior, Enneapogon scoparius* and *Themeda triandra* are prominent in the grass layer.

The following plant species were recorded from this plant community:

**Trees and Shrubs**

*Acacia tortilis* d

*Aloe castanea* p

*Aloe marlothii* p

*Berchemia zeyheri* M

*Combretum apiculatum* M

*Dichrostachys cinerea* d

*Ehretia rigida* M

*Euclea linearis* d

*Euclea undulata* dM

*Euphorbia cooperi*

*Euphorbia tirucalli* M

*Grewia monticola*

*Gymnosporia senegalensis* M

*Hexalobus monopetalus*

*Karomia speciosa*

*Mundulea sericea* M

*Ormocarpum trichocarpum*

*Peltophorum africanum* M

*Ptaeroxylon obliquum* M

*Rhoicissus tridentata* M

*Sclerocarya birrea* PM

*Searsia leptodictya*

*Tarchonanthus camphoratus* M

*Ximenia americana* M

*Ziziphus mucronata* M

**Grasses**

*Aristida congesta*

*Aristida congesta* subsp *barbicollis*

*Bothriochloa insculpta*

*Brachiaria nigropedata*

*Cymbopogon excavatus*

*Digitaria eriantha*

*Enneapogon scoparius* d

*Eragrostis rigidior* d

*Eragrostis superba*

*Heteropogon contortus* d

*Melinis repens*

*Panicum maximum*

*Pogonarthria squarrosa*

*Setaria sphacelata*

*Themeda triandra* d

*Urochloa mosambicensis*

**Forbs**

*Abutilon austroafricanum*

*Aloe cryptopoda* p

*Aloe fosteri* p

*Barleria cf guenzii*

*Chascanum hederaceum*

*Commelina africana* M

*Cucumis zeyheri* M

*Datura stramonium* WM

*Evolvulus alsinoides* M

*Hibiscus micrantha*

*Hibiscus trionum*

*Hypoestes aristata* M

*Ipomoea magnusiana*

*Kyphocarpa angustifolia*

*Pentarrhinum insipidum* M

*Senecio tamoides* M

*Solanum incanum* M

*Solanum nigrum* WM

*Solanum panduriforme* M

*Tephrosia* sp

|  |  |  |  |
| --- | --- | --- | --- |
| **Ohrigstad Mountain Bushveld: Plains Bushveld** | | | |
| **Status** | Dense to Disturbed plains bushveld | | |
| **Soil** | sandy-loam | **Rockiness**  **%** | 1 |
| **Conservation priority:** | Medium-High | **Sensitivity:** | Medium-High |
| **Agricultural potential:** | Medium to High (irrigation) | **Need for rehabilitation** | Low |
| **Dominant spp.** | *Acacia tortilis, Combretum apiculatum, Dichrostachys cinerea, Euclea linearis* and *Euclea undulata* | | |



Figure 6**:** The Dense Plains Bushveld of the area

### b. Mountain Slope Bushveld

The mountain slopes, facing in all directions, as the valley curves through the mountains are covered with dense Mountain Slope Bushveld. This is often pristine mountain bushveld with a dense woody cover, though the herbaceous layer is poorly developed due to the dense woody layer. Many woody species occur in this plant community, with *Combretum apiculatum* and *Tarchonanthus camphoratus* prominent. *Aristida congesta* subsp *barbicollis, Eragrostis rigidior, Eragrostis lehmanniana* and *Enneapogon scoparius* are the most conspicuous grass species in the scanty herbaceous layer.

The following plant species were recorded from this plant community:

**Trees and Shrubs**

*Acacia exuvialis*

*Acacia tortilis* d

*Berchemia zeyheri* M

*Combretum apiculatum* DM

*Crotalaria monteiroi*

*Dichrostachys cinerea*

*Ehretia rigida* M

*Elaeodendron transvaalense* PM

*Euclea linearis* d

*Euclea natalensis* M

*Euclea undulata* dM

*Euphorbia ingens*

*Euphorbia tirucalli* M

*Flueggea virosa* M

*Grewia bicolor*

*Grewia monticola*

*Gymnosporia senegalensis* M

*Hexalobus monopetalus*

*Karomia speciosa*

*Mundulea sericea* M

*Opuntia ficus-indica* A

*Ormocarpum trichocarpum*

*Pappea capensis*

*Peltophorum africanum* M

*Phyllanthus reticulatus*

*Ptaeroxylon obliquum* M

*Rhoicissus tridentata* M

*Sclerocarya birrea* P

*Searsia leptodictya*

*Tarchonanthus camphoratus* dM

*Ximenia americana* M

*Ziziphus mucronata* M

**Grasses**

*Aristida congesta* subsp *barbicollis* d

*Digitaria eriantha*

*Enneapogon scoparius* d

*Eragrostis lehmanniana* d

*Eragrostis rigidior* d

*Heteropogon contortus*

*Panicum maximum*

*Sporobolus fimbriatus*

**Forbs**

*Abutilon austroafricanum*

*Aloe cryptopoda* p

*Aloe fosteri* p

*Asparagus* sp

*Barleria cf guenzii*

*Commelina africana* M

*Evolvulus alsinoides* M

*Hibiscus micrantha*

*Kalanchoe paniculata* M

*Kyphocarpa angustifolia*

*Melhania prostrata*

*Pentarrhinum insipidum* M

*Solanum incanum* M

*Stylosanthes fruticosa*

*Waltheria indica* W

|  |  |  |  |
| --- | --- | --- | --- |
| **Ohrigstad Mountain Bushveld: Mountain Slope Bushveld** | | | |
| **Status** | Pristine mountain bushveld | | |
| **Soil** | Rocky shallow sandy | **Rockiness**  **%** | 5-20 |
| **Conservation priority:** | High | **Sensitivity:** | High |
| **Agricultural potential:** | Low | **Need for rehabilitation** | Low |
| **Dominant spp.** | *Combretum apiculatum, Euclea linearis, Euclea undulata, Tarchonanthus camphoratus* | | |

### Species of Conservation Concern

A Threatened species and Species of Conservation Concern list for the Grid 3325DB was obtained from the POSA database on the SANBI website. Threatened species are those that are facing high risk of extinction, indicated by the categories Critically Endangered, Endangered and Vulnerable. Species of Conservation Concern include the Threatened Species, but additionally have the categories Near Threatened, Data Deficient, Critically Rare, Rare and Declining. This is in accordance with the new Red List for South African Plants (Raimondo *et al*. 2009).

The following species of conservation concern were previously recorded from the Grid 2430DA (SANBI, POSA website April 2011):

|  |  |  |
| --- | --- | --- |
| **Species** | **Status** | |
| *Adenia fruticosa* Burtt Davy subsp. *fruticosa* | NT | |
| *Aloe fouriei* D.S.Hardy & Glen | DDT | |
| *Ansellia africana* Lindl. | Declining |
| *Ceropegia distincta* N.E.Br. subsp. *verruculosa* R.A.Dyer | DDD |
| *Combretum petrophilum* Retief | Rare | |
| *Dicliptera fruticosa* K.Balkwill | NT |
| *Dracaena transvaalensis* Baker | Rare | |
| *Eulophia speciosa* (R.Br. ex Lindl.) Bolus | Declining |
| *Euphorbia sekukuniensis* R.A.Dyer | Rare |
| *Gladiolus macneilii* Oberm. | CR | |
| *Gladiolus pavonia* Goldblatt & J.C.Manning | CR | |
| *Indigofera leendertziae* N.E.Br. | DDT |
| *Jamesbrittenia macrantha* (Codd) Hilliard | NT |
| *Khadia alticola* Chess. & H.E.K.Hartmann | Rare | |
| *Lydenburgia cassinoides* N.Robson | NT |
| *Ocimum tubiforme* (R.D.Good) A.J.Paton | CR | |
| *Orbea gerstneri* (Letty) Bruyns subsp. *gerstneri* | Rare | |
| *Pentatrichia alata* S.Moore | DDD | |
| *Rhoicissus laetans* Retief | Rare | |
| *Searsia batophylla* (Codd) Moffett | VU |
| *Thesium davidsonae* Brenan | VU | |

*Lydenburgia cassinoides* was found during the field visit in this area. There is suitable habitat for several of the threatened plant species along the transect of this Option of the power line, especially for *Adenia fruticosa* subsp. *fruticosa, Ocimum tubiforme, Orbea gerstneri* subsp. *gerstneri* and *Combretum petrophilum,* but none of these species were found on the site during the field visit.

### Conclusion

This plant community is high in species richness with several red data species. A few individuals of the protected *Elaeodendron transvaalensis, Sclerocarya birrea, Aloe fosteri* and *Aloe cryptopoda* are found in this vegetation. The conservation value and sensitivity are regarded as being high, due to biodiversity and also due to the ecological function of the mountains and the valley as a dispersal corridor for plants and animals. There is also abundant farming activities in the valley, including irrigated crops. There will be several turning points for the line, as the road winds through the valley. It is suggested that this option not be used due to the several constraints.

****

Figure 7: Cleared Open Plains Bushveld in the foreground, Open Plains Bushveld in the middle and Mountain Slope Bushveld in the background

## 4. Lydenburg Thornveld

The Option 1 route crosses a small section of the Lydenburg Thornveld on the undulating mountain plateau area above the Strydom tunnel. This area is a wooded grassland, quite cold with frost during winter. Species such as the frost hardy *Acacia karroo, Acacia caffra, Cussonia paniculata Diospyros lycioides* and *Euclea crispa* are prominent.

The following plant species were recorded from this plant community:

**Trees and Shrubs**

*Acacia caffra* d

*Acacia karroo* dM

*Acacia robusta*

*Cussonia paniculata*

*Diospyros lycioides*

*Euclea crispa* M

*Dombeya rotundifolia*

*Rubus transvaalensis*

*Ehretia rigida* M

*Gymnosporia buxifolia* M

*Mundulea sericea* M

*Rhoicissus tridentata* M

*Searsia leptodictya*

*Searsia pyroides*

*Ziziphus mucronata* M

**Grasses**

*Aristida congesta*

*Aristida congesta* subsp *barbicollis*

*Aristida diffusa*

*Bewsia biflora*

*Brachiaria serrata*

*Cymbopogon excavatus*

*Digitaria eriantha*

*Diheteropogon amplectens*

*Eragrostis superba*

*Heteropogon contortus* d

*Melinis repens*

*Microchloa caffra*

*Monocymbium ceresiiforme*

*Panicum maximum*

*Panicum natalense*

*Pogonarthria squarrosa*

*Schizachyrium sanguineum*

*Setaria sphacelata*

*Themeda triandra* d

*Tristachya leucothrix*

**Forbs**

*Anthospermum rigidum*

*Commelina africana* M

*Dicoma anomala*

*Elephantorrhiza elephantina* M

*Euphorbia clavarioides*

*Evolvulus alsinoides* M

*Helichrysum cephaloideum*

*Helichrysum rugulosum*

*Hibiscus trionum*

*Kohautia amatymbica*

*Lippia javanica*

*Pentarrhinum insipidum* M

*Schistostephium crataegifolium*

*Senecio coronatus*

*Senecio microglossus*

*Senecio tamoides* M

*Solanum incanum* M

*Solanum panduriforme* M

*Tephrosia* sp

*Vernonia oligocephala*

|  |  |  |  |
| --- | --- | --- | --- |
| **Lydenburg Thornveld** | | | |
| **Status** | Open wooded grassland | | |
| **Soil** | sandy-loam | **Rockiness**  **%** | 1 |
| **Conservation priority:** | Medium | **Sensitivity:** | Medium |
| **Agricultural potential:** | Medium | **Need for rehabilitation** | Low |
| **Dominant spp.** | *Acacia karroo, Acacia caffra, Euclea crispa* | | |

### Species of Conservation Concern

A Threatened species and Species of Conservation Concern list for the Grid 2430CB was obtained from the POSA database on the SANBI website. Threatened species are those that are facing high risk of extinction, indicated by the categories Critically Endangered, Endangered and Vulnerable. Species of Conservation Concern include the Threatened Species, but additionally have the categories Near Threatened, Data Deficient, Critically Rare, Rare and Declining. This is in accordance with the new Red List for South African Plants (Raimondo *et al*. 2009).

The following species of conservation concern were previously recorded from the Grid 2430DA (SANBI, POSA website April 2011):

|  |  |  |
| --- | --- | --- |
| **Species** | **Status** | |
| *Adenia fruticosa* Burtt Davy subsp. *fruticosa* | NT | |
| *Aloe fouriei* D.S.Hardy & Glen | DDT | |
| *Ansellia africana* Lindl. | Declining |
| *Ceropegia distincta* N.E.Br. subsp. *verruculosa* R.A.Dyer | DDD |
| *Combretum petrophilum* Retief | Rare | |
| *Dicliptera fruticosa* K.Balkwill | NT |
| *Dracaena transvaalensis* Baker | Rare | |
| *Eulophia speciosa* (R.Br. ex Lindl.) Bolus | Declining |
| *Euphorbia sekukuniensis* R.A.Dyer | Rare |
| *Gladiolus macneilii* Oberm. | CR | |
| *Gladiolus pavonia* Goldblatt & J.C.Manning | CR | |
| *Indigofera leendertziae* N.E.Br. | DDT |
| *Jamesbrittenia macrantha* (Codd) Hilliard | NT |
| *Khadia alticola* Chess. & H.E.K.Hartmann | Rare | |
| *Lydenburgia cassinoides* N.Robson | NT |
| *Ocimum tubiforme* (R.D.Good) A.J.Paton | CR | |
| *Orbea gerstneri* (Letty) Bruyns subsp. *gerstneri* | Rare | |
| *Pentatrichia alata* S.Moore | DDD | |
| *Rhoicissus laetans* Retief | Rare | |
| *Searsia batophylla* (Codd) Moffett | VU |
| *Thesium davidsonae* Brenan | VU | |

None of these species occur in this plant community as the habitat is not suitable for any of them.

### Conclusion

This plant community is fairly high in species richness with no red data species or protected species found in the survey. It is also a very small area that will be crossed by the line. The construction of the line can be supported.

## 5. Poung Dolomite Mountain Bushveld

This is a narrow band of bushveld on dolomite, in the vicinity of the Strydom tunnel. It is situated along the western drier part of the Escarpment. The vegetation is woodland with a dense shrub layer. It occurs on the low and high mountain slopes in the area. The geology is dolomite and the shallow, rocky soils are of the Mispah soil Form. A very small, almost negligible part of this vegetation is crossed by Options 1, 3 and 4.

|  |  |  |  |
| --- | --- | --- | --- |
| **Poung Dolomite Mountain Bushveld** | | | |
| **Status** | Open to dense bushveld | | |
| **Soil** | sandy-loam | **Rockiness**  **%** | 1 |
| **Conservation priority:** | Medium-High | **Sensitivity:** | Medium-High |
| **Agricultural potential:** | Low | **Need for rehabilitation** | Low |
| **Dominant spp.** | *Acacia nigrescens, Acacia nilotica, Combretum apiculatum* | | |

The vegetation is dominated by the woody layer with several woody species present.

**Trees and Shrubs**

*Acacia ataxacantha,*

*Acacia gerrardii*

*Acacia nigrescens* d

*Acacia nilotica* d

*Acacia tortilis*

*Aloe cryptopoda* p

*Boscia albitrunca* M

*Brachylaena ilicifolia*

*Carissa bispinosa*

*Celtis africana*

*Combretum apiculatum* d

*Combretum hereroense*

*Combretum molle*

*Croton gratissimus*

*Cussonia spicata*

*Dichrostachys cinerea*

*Dombeya rotundifolia*

*Euclea crispa* M

*Euclea undulata* M

*Euphorbia tirucalli* M

*Grewia bicolor*

*Grewia flava*

*Gymnosporia senegalensis* M

*Hippobromus pauciflorus*

*Kirkia wilmsii*

*Ozoroa albicans*

*Pouzolzia mixta*

*Rhoicissus tridentata*

*Searsia leptodictya*

*Senna petersiana*

*Tecoma capensis*

*Vitex obovata subsp wilmsii*

**Grasses**

*Aristida canescens*

*Aristida congesta*

*Aristida transvaalensis*

*Bewsia biflora*

*Bothriochloa insculpta*

*Brachiaria serrata*

*Digitaria eriantha*

*Diheteropogon amplectens*

*Elionurus muticus*

*Enneapogon scoparius*

*Eragrostis lehmanniana*

*Eragrostis superba*

*Heteropogon contortus*

*Loudetia simplex*

*Melinis nerviglume*

*Melinis repens s. repens*

*Panicum deustum*

*Panicum maximum*

*Themeda triandra*

**Forbs**

*Abutilon angulatum*

*Asparagus intricatus*

*Asparagus suaveolens*

*Barleria saxatilis*

*Blepharis integrifolia*

*Cheilanthes dolomitica*

*Clerodendrum ternatum*

*Commelina africana* M

*Corchorus asplenifolius*

*Euphorbia schinzii*

*Evolvulus alsinoides*

*Geigeria burkei*

*Hibiscus aethiopicus*

*Hypoestes forskaolii*

*Kohautia cynanchica*

*Kyphocarpa angustifolia*

*Ocimum americanum*

*Phyllanthus glaucophyllus*

*Polygala hottentotta*

*Rhynchosia nitens*

*Sansevieria hyacinthoides*

*Stylochiton natalensis*

*Tephrosia purpurea*

*Tetradenia brevispicata,*

*Tragia dioica*

*Waltheria indica* W

*Xerophyta retinervis*

### Species of Conservation Concern

Although Matthews (1991), Van Wyk & Smith (2001) and Mucina & Rutherford (2006) mention that several endemic plant species occur on this dolomite area, the area crossed by the lines is so small that none of these species were recorded.

### Conclusion

As far as vegetation is concerned, the development of the power lines can be supported in this area.



Figure 8: Poung Dolomite Mountain Bushveld

## 6. Northern Escarpment Quartzite Sourveld

A very small part of this veld type is close to the proposed route of Route 1, though it is so small that this vegetation is not discussed further.

## 7. Northern Mistbelt Forest

The proposed lines cannot go through indigenous forest. The proposed Route 4 seems to cross a patch of forest, but this will not be allowed by the authorities. This is one of the reasons why Route 4 was eliminated as an option. This vegetation is not discussed further.

## 8. Tzaneen Sour Bushveld

This vegetation stretches in a narrow band on the plains and all along the lower footslopes and hills of the escarpment. The vegetation is tall open bushveld with a tall grass layer. The geological substrate is gneiss and granite and the soils are shallow sandy and rocky lithosols. This is very dense, often tall bushveld, merging into forest-like vegetation. Only the route of Option 4 transects this vegetation, albeit a very narrow band. This vegetation contains many large trees and also has a very high species richness. Large *Ficus* trees (various species) together with several other large trees are prominent. Several threatened species occur in this vegetation.

The following species are present:

**Trees and shrubs**

*Acacia davyi*

*Acacia polyacantha*

*Acacia sieberiana*

*Albizia versicolor*

*Antidesma venosum*

*Bauhinia galpinii*

*Catha edulis* M

*Faurea rochetiana*

*Faurea saligna*

*Ficus burkei*

*Ficus petersii*

*Ficus sansibarica*

*Heteropyxis natalensis*

*Parinari curatellifolia*

*Peltophorum africanum*

*Piliostigma thonningii*

*Pterocarpus angolensis* P

*Pterocarpus rotundifolius*

*Sclerocarya birrea* P

*Searsia pentheri*

*Terminalia sericea*

*Trichilia emetica*

**Grasses**

*Alloteropsis semialata*

*Andropogon schirensis*

*Aristida congesta*

*Bothriochloa bladhii*

*Cymbopogon caesius*

*Cynodon dactylon*

*Diheteropogon amplectens*

*Heteropogon contortus*

*Hyparrhenia cymbaria*

*Hyperthelia dissoluta*

*Setaria nigrirostris*

*Setaria sphacelata*

*Themeda triandra*

**Forbs**

Some forb species occur scattered in the grassy layer, and these are not abundant:

*Agathisanthemum bojeri*

*Barleria elegans*

*Dicliptera clinopodia*

*Polygala producta*

### Species of Conservation Concern

|  |  |
| --- | --- |
| **Species** | **Status** |
| *Aloe hardyi* H.F.Glen | Rare |
| *Combretum petrophilum* Retief | Rare |
| *Dracaena transvaalensis* Baker | Rare |
| *Encephalartos brevifoliolatus* Vorster | EW |
| *Encephalartos cupidus* R.A.Dyer | CR |
| *Encephalartos paucidentatus* Stapf & Burtt Davy | VU |
| *Gladiolus macneilii* Oberm. | CR |
| *Helichrysum junodii* Moeser | Rare |
| *Thesium davidsonae* Brenan | VU |

Several species of conservation concern are present in this dense vegetation. Although none of these were recorded during the field survey, possibly due to the very narrow band of this vegetation, but also due to the inaccessibility, it is certain that some of them will occur on the route. This is one of the reasons why Route 4 is eliminated as an option.

### Conclusion

Due to the dense vegetation, species richness and possible presence of threatened species, it is suggested to avoid this route.

**

Figure 9: Dense Tzaneen Sour Bushveld

## 9. Granite Bushveld

The granite bushveld on the granite Lowveld plains cover the largest part of all the transects in the study site. This large granite plain is covered with the “typical” Lowveld bushveld, well know, for example, from large parts of the Kruger National Park.

Prominent species are *Combretum apiculatum* on the sandy or gravelly upland sites, while *Acacia nigrescens* and other *Acacia* speciesare prominent on the more clayey bottomland sites. Many species could be recorded, as this area is often close to roads and accessible.

The following plant species were recorded in this plant community:

**Trees and shrubs**

*Acacia exuvialis*

*Acacia gerrardii*

*Acacia nigrescens* d

*Acacia nilotica*

*Acacia sieberiana* M

*Acacia tortilis* d

*Agave sisalana* A

*Albizia harveyi* d

*Bolusanthus speciosa*

*Capparis tomentosa*

*Cassia abbreviata*

*Combretum apiculatum* D

*Combretum collinum*

*Combretum hereroense*

*Combretum imberbe* P

*Combretum zeyheri* M

*Commiphora africana*

*Cordia ovalis*

*Dalbergia melanoxylon*

*Dichrostachys cinerea* dM

*Dodonaea angustifolia* M

*Dombeya rotundifolia* M

*Ehretia amoena*

*Ehretia rigida* m

*Erythrina lysistemon*

*Euclea divinorum* M

*Euclea natalensis*

*Ficus stuhlmanni*

*Flueggea virosa*

*Gardenia volkensii*

*Grewia bicolor*

*Grewia flava*

*Grewia flavescens*

*Grewia monticola*

*Gymnosporia senegalensis* M

*Lannea discolor*

*Lannea schweinfurthii*

*Lantana camara* A

*Ozoroa engleri*

*Pappea capensis*

*Pavetta schumanniana*

*Pavetta schumanniana* M

*Peltophorum africanum* M

*Philenoptera violacea* PM

*Pterocarpus angolensis* PM

*Pterocarpus rotundifolius*

*Schotia brachypetala*

*Schotia capitata*

*Sclerocarya birrea* PM

*Searsia guenzii*

*Searsia leptodictya*

*Senna didymobotrya* A

*Senna petersiana* DM

*Spirostachys africana* p

*Terminalia prunoides*

*Terminalia sericea* DM

*Xeromphis obovata*

*Ziziphus mucronata* M

**Grasses**

*Aristida adscensionis*

*Aristida congesta*

*Aristida diffusa*

*Bothriochloa insculpta*

*Brachiaria nigropedata*

*Cenchrus ciliaris*

*Digitaria eriantha*

*Enneapogon cenchroides*

*Enneapogon scoparius*

*Eragrostis rigidior*

*Heteropogon contortus*

*Hyperthelia dissoluta*

*Melinis repens*

*Panicum maximum*

*Perotis patens*

*Pogonarthria squarrosa*

*Sporobolus africanus*

*Sporobolus ioclados*

*Tricholaena monachne*

*Trichoneura grandiglumis*

*Urochloa mosambicensis* d

**Forbs**

*Achyranthes aspera*

*Acrotome inflata*

*Agathisanthemum bojeri*

*Aspilia mossambicensis*

*Becium filamentosum*

*Bidens pilosa* W

*Bulbostylis hispidula*

*Chamaecrista absus*

*Commelina benghalensis*

*Commelina erecta*

*Cyperus esculentus* W

*Dicerocaryum zanguebarium* M

*Evolvulus alsinoides* M

*Geigeria burkei*

*Gomphrena celosioides* W

*Helichrysum* sp

*Heliotropium steudneri*

*Heliotropium strigosum*

*Hermannia* sp

*Hermannia tomentosa*

*Hermbstaedtia odorata*

*Hibiscus cannabinus*

*Hibiscus* sp

*Indigofera filipes*

*Kohautia virgata*

*Kyphocarpa angustifolia*

*Leucas glabrata*

*Ocimum americanum*

*Phyllanthus maderaspatensis*

*Rhynchosia totta*

*Richardia braziliensis* W

*Schkruhria pinnata* WM

*Solanum panduriforme* W

*Tagetes minuta* W

*Tephrosia grandiflora*

*Waltheria indica* W

*Zornia milneana*

### Species of Conservation Concern

|  |  |  |
| --- | --- | --- |
| Asphodelaceae | Aloe hardyi H.F.Glen | Rare |
| Asphodelaceae | Aloe thompsoniae Groenew. | Rare |
| Apocynaceae | Brachystelma parvulum R.A.Dyer | VU |
| Combretaceae | Combretum petrophilum Retief | Rare |
| Celastraceae | Elaeodendron transvaalense (Burtt Davy) R.H.Archer | NT |
| Zamiaceae | Encephalartos dyerianus Lavranos & D.L.Goode | CR |
| Zamiaceae | Encephalartos lebomboensis I.Verd. | EN |
| Proteaceae | Protea laetans L.E.Davidson | VU |
| Rosaceae | Prunus africana (Hook.f.) Kalkman | VU |
| Anacardiaceae | Searsia batophylla (Codd) Moffett | VU |

None of these species were recorded during the field survey. The flat granite plains are not suitable habitat for these species, which are all nich specialists, or occur on the mountain areas to the west of the granite plains.

### Conclusion

Several game farms and cattle farms are found in this area.

Special care will be needed in the crossing of the spruit systems within this area.

The construction of the line can be supported.



Figure 10:Typical Granite Lowveld vegetation

## 10. Lowveld Rugged Mopaneveld

Only Routes 1 and 2 will transect this vegetation type in the north-eastern extreme of the study area. The Foskor substation is located on the northern boundary of this vegetation type. This is the rugged hilly area of the Olifants River valley, south of Phalaborwa. The landscape is irregular plains and rocky hills, with moderate to steep slopes. *Colophospermum mopane* is often restricted to valleys, while the hills are dominated by *Acacia nigrescens* with *Combretum apiculatum* also present.

The following plant species were recorded in this plant community:

**Trees and shrubs**

*Acacia exuvialis*

*Acacia nigrescens*

*Acacia nilotica*

*Berchemia discolor*

*Boscia albitrunca* P

*Colophospermum mopane* D

*Combretum apiculatum*

*Combretum hereroense*

*Combretum imberbe* P

*Combretum zeyheri* M

*Commiphora africana*

*Commiphora mollis*

*Dalbergia melanoxylon*

*Dichrostachys cinerea* M

*Dodonaea angustifolia* M

*Dombeya rotundifolia* M

*Ehretia amoena*

*Ehretia rigida* M

*Erythrina lysistemon*

*Euclea natalensis*

*Ficus abutilifolia*

*Flueggea virosa*

*Gardenia volkensii*

*Grewia bicolor*

*Grewia flavescens*

*Grewia hexamita*

*Grewia monticola*

*Grewia villosa*

*Gymnosporia senegalensis* M

*Hexalobus monopetalus*

*Kirkia wilmsii*

*Lannea discolor*

*Manilkara mochisia*

*Ozoroa engleri*

*Pappea capensis*

*Pavetta schumanniana* M

*Peltophorum africanum* M

*Philenoptera violacea* PM

*Pterocarpus rotundifolius*

*Rhigozum zambesiacum*

*Sclerocarya birrea* PM

*Terminalia prunoides*

*Terminalia sericea* DM

**Grasses**

*Aristida adscensionis*

*Aristida congesta*

*Bothriochloa radicans*

*Cenchrus ciliaris*

*Digitaria eriantha*

*Enneapogon cenchroides*

*Enneapogon scoparius*

*Eragrostis rigidior*

*Fingerhuthia africana*

*Heteropogon contortus*

*Melinis repens*

*Panicum maximum*

*Pogonarthria squarrosa*

*Sporobolus panicoides*

*Tricholaena monachne*

*Trichoneura grandiglumis*

*Urochloa mosambicensis* d

**Forbs**

*Achyranthes aspera*

*Agathisanthemum bojeri*

*Aspilia mossambicensis*

*Chamaecrista mimosoides*

*Commelina benghalensis*

*Commelina erecta*

*Crabbea velutina*

*Evolvulus alsinoides*

*Geigeria burkei*

*Gomphrena celosioides*

*Gossypium africanum*

*Heliotropium steudneri*

*Heliotropium strigosum*

*Hemizygia elliottii*

*Hermannia tomentosa*

*Hermbstaedtia odorata*

*Hibiscus sidiformis*

*Kohautia virgata*

*Kyphocarpa angustifolia*

*Leucas glabrata*

*Melhania forbesii*

*Melhania rehmannii*

*Ocimum americanum*

*Phyllanthus asperulatus*

*Solanum panduriforme*

*Waltheria indica*

*Xerophyta retinervis*

*Zornia milneana*

### Species of Conservation Concern

|  |  |
| --- | --- |
| **Species** | **Status** |
| *Ansellia africana* Lindl. | Declining |

This epiphytic orchid is often found growing on threes within this plant community.

### Conclusion

Game farming is a special feature in this area.

Special care will be needed in the crossing of spruit systems.

The construction of the line can be supported.



Figure 11: Lowveld Rugged Mopaneveld in the background

## 11. Phalaborwa-Timbavati Mopaneveld

Only Routes 1 (small part) and 4 will transect this vegetation type in the north-eastern extreme of the study area. The Foskor substation is located on the southern boundary of this vegetation type. This is the flat plains west of Phalaborwa. The landscape is an undulating plain with *Colophospermum mopane* and *Acacia nigrescens* in the lower lying areas*,* while *Combretum apiculatum* and *Terminalia sericea* becomes more prominent on upland sites.

The following plant species were recorded in this plant community:

**Trees and shrubs**

*Acacia exuvialis*

*Acacia nigrescens*

*Acacia tortilis*

*Albizia harveyi*

*Boscia albitrunca* P

*Cassia abbreviata*

*Cissus cornifolia*

*Colophospermum mopane* D

*Combretum apiculatum* d

*Combretum hereroense*

*Combretum imberbe* P

*Combretum zeyheri* M

*Commiphora africana*

*Commiphora mollis*

*Dalbergia melanoxylon*

*Dichrostachys cinerea* M

*Ehretia amoena*

*Ehretia rigida*

*Euclea divinorum*

*Flueggea virosa*

*Gardenia volkensii*

*Grewia bicolor*

*Grewia flavescens*

*Grewia hexamita*

*Grewia monticola*

*Grewia villosa*

*Gymnosporia senegalensis* M

*Lannea discolor*

*Maerua parvifolia*

*Ozoroa engleri*

*Pappea capensis*

*Pavetta schumanniana* M

*Peltophorum africanum* M

*Philenoptera violacea* PM

*Sclerocarya birrea* PM

*Strychnos madagascariensis*

*Terminalia prunoides*

*Terminalia sericea* dM

**Grasses**

*Aristida adscensionis*

*Aristida congesta*

*Bothriochloa radicans*

*Brachiaria nigropedata*

*Cenchrus ciliaris*

*Digitaria eriantha*

*Andropogon gayanus*

*Fingerhuthia africana*

*Enneapogon scoparius*

*Eragrostis rigidior*

*Heteropogon contortus*

*Melinis repens*

*Panicum maximum*

*Perotis patens*

*Pogonarthria squarrosa*

*Schmidtia pappophoroides*

*Themeda triandra*

*Tricholaena monachne*

*Trichoneura grandiglumis*

*Urochloa mosambicensis* d

**Forbs**

*Achyranthes aspera*

*Acrotome inflata*

*Agathisanthemum bojeri*

*Aspilia mossambicensis*

*Chamaecrista mimosoides*

*Clerodendrum ternatum*

*Commelina benghalensis*

*Commelina erecta*

*Evolvulus alsinoides*

*Gomphrena celosioides*

*Heliotropium steudneri*

*Heliotropium strigosum*

*Hemizygia elliottii*

*Hermannia glanduligera*

*Hermannia tomentosa*

*Hermbstaedtia odorata*

*Ipomoea magnusiana*

*Kohautia virgata*

*Kyphocarpa angustifolia*

*Leucas glabrata*

*Melhania forbesii*

*Ocimum americanum*

*Solanum panduriforme*

*Tephrosia polystachya*

*Waltheria indica*

*Zornia milneana*

### Species of Conservation Concern

|  |  |
| --- | --- |
| **Species** | **Status** |
| *Aloe thompsoniae* Groenew. | Rare |
| *Encephalartos dyerianus* Lavranos & D.L.Goode | CR |
| *Encephalartos lebomboensis* I.Verd. | EN |

None of these species were found during the field survey.

### Conclusion

Game farming is a special feature in this area.

Special care will be needed in the crossing of spruit systems.

The construction of the line can be supported.



Figure 12: Game farming in the Lowveld areas.

## 12 River and Spruit Systems

Several River or spruit crossings occur along the transect routes. At the smaller spruits no riparian zone is present, the vegetation is continuous with the adjacent bushveld vegetation. However, the larger rivers have a distinct riparian zone, with large trees for example Faidherbia albida, Acacia galpinii, Acacia robusta and Philenoptera violacea.

The following species were recorded at a larger river:

**Woody species**

*Acacia galpinii*

*Acacia robusta*

*Acacia tortilis*

*Combretum apiculatum*

*Combretum imberbe* P

*Combretum microphyllum*

*Dichrostachys cinerea*

*Diospyros mespiliformis*

*Faidherbia albida* D

*Ficus sycomorus*

*Grewia bicolor*

*Grewia monticola*

*Peltophorum africanum*

*Philenoptera violacea* P

*Phoenix reclinata*

*Sclerocarya birrea* MP

*Terminalia sericea*

*Ziziphus mucronata* M

**Grasses**

*Aristida congesta*

*Cynodon dactylon*

*Dactyloctenium aegyptium*

*Digitaria eriantha*

*Eragrostis heteromera*

*Eragrostis rigidior d*

*Eragrostis superba*

*Heteropogon contortus D*

*Melinis repens*

*Pogonarthria squarrosa d*

*Tricholaena monachne*

*Trichoneura grandiglumis*

**Forbs**

*Agathisanthemum bojeri*

*Ageratum conyzoides* W

*Cyperus sexangularis*

*Lippia rehmannii*

*Schkruhria pinnata* W

*Melanthera scandens*

*Solanum incanum* W

*Solanum panduriforme* W

*Xanthium strumarium* W

|  |  |  |  |
| --- | --- | --- | --- |
| **River and Spruit crossings** | | | |
| **Status** | River and spruit linear wetlands | | |
| **Soil** | Sandy or clayey | Rockiness | 0% |
| **Conservation priority:** | High | Sensitivity: | High |
| **Agricultural potential:** | Low | Need for rehabilitation | Low |
| **Dominant spp.** | *Combretum imberbe, Faidherbia albida, Acacia galpinii, Diospyros mespiliformis, Ficus sycomorus, Acacia robusta, Philenoptera violacea, Phoenix reclinata* | | |

### Conclusion

No river or spruit is very wide, so the lines can easily cross these river or spruit systems. Care should however be taken to place pylons adequately away from river or spruit banks, avoiding any damage to the banks or water courses. Erosion should be avoided at all times.

## 8 DISCUSSION

The vegetation of all four alternatives was investigated. From the desktop study, confirmed by the field survey, option 3, which runs from Burgersfort to Ohrigstad along the R555, was eliminated. This is because the route along the R555 runs for most of the way in a narrow valley, with the Mabitsana River and the tarred R555 in this valley. The line will have to run for most of the way on the sensitive mountain foot slopes and cross the river and road several times. Furthermore, many irrigated agricultural enterprises occur in the Ohrigstad area, stretching all the way to Marapeng. This mosaic of narrow river valley, river, mountain slopes and agriculture where-ever the valley is a bit broader, causes the route to be unsuitable. From an ecological perspective both the riverine vegetation and the vegetation of the mountain slopes have a high ecological sensitivity. Therefore this entire valley forms an ecologically sensitive ecosystem. This is also a much longer route.

Furthermore, from the desktop study, confirmed by the field survey, option 4, was eliminated. The line of this option runs through nine vegetation types, and over very high and steep mountains of Sekhukhune Mountain Bushveld and Ohrigstad Mountain Bushveld with two endangered ecosystems (Sekhukhune Mountainlands and Sekhukhune Norite Bushveld, SANBI & DEAT 2009), Poung Dolomite Mountain Bushveld with endangered Malmani Karstland (SANBI & DEAT 2009), the vulnerable Northern Escarpment Quartzite Sourveld (Mucina & Rutherford (2006), Northern Mistbelt Forest area and the vulnerable Tzaneen Sour Bushveld (SANBI & DEAT 2009). Especially the Great Escarpment area consists of very rugged and high mountains, resulting in a very difficult route with several threatened ecosystems.

Alternative Routes 1 and 2 were further investigated in more detail by field surveys. The vegetation along these routes is described in detail, including the protected and red data species. Medicinal plants and aliens and weeds are indicated.

The most difficult part of the route is from the Merensky substation through Orichstad Mountain Bushveld which is an extremely mountainous area with sensitive vegetation. This part of the line transects quite sensitive vegetation and it is suggested that a walkthrough in this area is essential.

The most serious limitation on the Lowveld plains where the line transects the Granite Lowveld vegetation type, is the abundance of the protected tree *Sclerocarya birrea.* It is certain that several of these trees will be in the way of the transect.

Locally are also the river and spruit crossings. No river or spruit is very wide, so the lines can easily cross these rivers or spruits systems. Care should be taken to place pylons adequately away from river or spruit banks, avoiding any damage to the banks or water courses. Erosion should be avoided at all times.

Another factor in this area is that large properties are game farms and lodges. These areas are effectively conserved by the owners, and it is realised that the public participation is an important issue. After finalisation of the exact transect, a walkthrough will have to confirm any issues regarding vegetation.

From an ecological perspective, Alternative 1 is the preferred route.

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The Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983)

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Van Wyk, B.E., Van Oudtshoorn, B. & Gericke, N. 1997. Medicinal plants of South Africa. Briza, Pretoria.

Westhoff, V. & Van der Maarel, E. 1978. The Braun-Blanquet approach. In: Whittaker, R.H. (ed.) Classification of plant communities. W. Junk, The Hague.

# ABRIDGED CURRICULUM VITAE: GEORGE JOHANNES BREDENKAMP

**Born**: 10 February 1946 in Johannesburg, South Africa.

**Citizenship**: South African

**Marital status**: Married, 1 son, 2 daughters

**Present work address**

Department of Botany, University of Pretoria, Pretoria, 0002, South Africa

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**Qualifications**:

1963 Matriculation Certificate, Kemptonpark High School

1967 B.Sc. University of Pretoria, Botany and Zoology as majors,

1968 B.Sc. Hons. (cum laude) University of Pretoria, Botany.

1969 T.H.E.D. (cum laude) Pretoria Teachers Training College.

1975 M.Sc. University of Pretoria, Plant Ecology .

1982 D.Sc. (Ph.D.) University of Pretoria, Plant Ecology.

**Theses**: (M.Sc. and D.Sc.) on plant community ecology and wildlife management in nature reserves in South African grassland and savanna.

**Professional titles**:

• MSAIE South African Institute of Ecologists and Environmental Scientists

- 1989-1990 Council member

• MGSSA Grassland Society of Southern Africa

* 1986 Elected as Sub-editor for the Journal
* 1986-1989 Serve on the Editorial Board of the Journal
* - 1990 Organising Committee: International Conference: Meeting Rangeland challenges in Southern Africa
* 1993 Elected as professional member

• PrSciNat. South African Council for Natural Scientific Professions **Registration Number 400086/83**

* 1993-1997 **Chairman** of the Professional Advisory Committee: Botanical Sciences
* 1993-1997: **Council** Member
* 1992-1994: Publicity Committee
* 1994-1997: Professional Registration Committee

**Professional career:**

* Teacher in Biology 1970-1973 in Transvaal Schools
* Lecturer and senior lecturer in Botany 1974-1983 at University of the North
* Associate professor in Plant Ecology 1984-1988 at Potchefstroom University for CHE
* Professor in Plant Ecology 1988-2008 at University of Pretoria.
* 2009 – current Professor Extra-ordinary in the Dept of Plant Science, University of Pretoria
* • Founder and owner of the Professional Ecological Consultancy firms Ecotrust Environmental Services CC and Eco-Agent CC, 1988-present.

**Academic career:**

• Students:

- Completed post graduate students: M.Sc. 53; Ph.D. 14.

- Presently enrolled post-graduate students: M.Sc. 4; Ph.D. 2.

• Author of:

- 175 scientific papers in refereed journals

- >150 papers at national and international congresses

- >250 scientific (unpublished) reports on environment and natural resources

- 17 popular scientific papers.

- 39 contributions in books

• Editorial Committee of

- South African Journal of Botany,

* Journal Grassland Society of Southern Africa,
* Bulletin of the South African Institute of Ecologists.
* Journal of Applied Vegetation Science.( Sweden)
* Phytocoenologia (Germany)

• FRD evaluation category: C2 (=leader in South Africa in the field of Vegetation Science/Plant Ecology)

**Membership:**

• International Association of Vegetation Science.

• British Ecological Society

• International Society for Ecology (Intecol)

• Association for the Taxonomic study of the Flora of Tropical Africa (AETFAT).

• South African Association of Botanists (SAAB)

1988-1993 Elected to the **Council** of SAAB.

1989-1990 Elected as **Chairman** of the Northern Transvaal Branch

1990 Elected to the Executive Council as **Vice-President**

1990- Sub-editor Editorial Board of the Journal

1991-1992 Elected as **President** (2-year period)

1993 **Vice-President** and Outgoing President

• Wildlife Management Society of Southern Africa

• Suid-Afrikaanse Akademie vir Wetenskap en Kuns

(=South African Academy for Science and Art).

• Wildlife Society of Southern Africa

1975 - 1988: Member

1975 - 1983: Committee member, Pietersburg Centre

1981 - 1982: **Chairman**, Pietersburg Centre

• Dendrological Society of Southern Africa

1984 - present: Member

1984 - 1988: Committee member, Western Transvaal Branch

1986 - 1988: **Chairman**, Western Transvaal Branch

1987 - 1989: Member, Central Committee (National level)

1990 - 2000: Examination Committee

• Succulent Society of South Africa

1987 - 2000

• Botanical Society of South Africa

2000 – present: Member

2001- 2008: Chairman, Pretoria Branch

2002 – 2006: Chairman, Northern Region Conservation Committee

2002- 2007: Member of Council

**Special committees**:

• Member of 10 special committees re ecology, botany, ran­geland science in South Africa.

• Member of the International Code for Syntaxonomical Nomenclature 1993-present.

**Merit awards and research grants**:

1968 Post graduate merit bursary, CSIR, Pretoria.

1977-1979 Research Grant, Committee re Research Development, Dept. of Co-operation and Development, Pretoria.

1984-1989 Research Grant, Foundation for Research Development, CSIR, Pretoria.

1986-1987 Research Grant, Dept. of Agriculture and Water Supply, Potchefstroom.

1990-1997 Research Grant, Dept. of Environmental Affairs & Tourism, Pretoria.

1991-present Research Grant, National Research Foundation , Pretoria.

* 1. Research Grant, Water Research Commission.

1999-2003 Research Grant, Water Research Commission.

2006 South African Association of Botanists Silver Medal for outstanding contributions to South African Botany

**Abroad**:

1986 Travel Grant, Potchefstroom University for Christian Higher Education, Potchefstroom

Visits to Israel, Italy, Germany, United Kingdom, Portugal.

1987 Travel Grant, Potchefstroom University for Christian Higher Education, Potchefstroom.

Visits to Germany, Switzerland, Austria, The Netherlands, United Kingdom.

1990 Travel Grant, FRD.

Visit to Japan, Taiwan, Hong-Kong.

1991 Travel Grant, FRD.

Visits to Italy, Germany. Switzerland, Austria, France, The Netherlands, United Kingdom.

1993 Travel Grant, University of Pretoria.

Visits to the USA, Costa Rica, Czech Republic, Austria.

1994 Travel Grant FRD.

Visits to Switzerland, The Netherlands, Germany, Czech Republic.

1995 Travel Grant FRD, University of Pretoria

Visits to the USA

1. Travel Grant, University of Pretoria

Visit to the UK.

1. Travel Grant University of Pretoria, Visit Czech Republic, Bulgaria
2. Travel Grant, University of Pretoria, Visit Czech Republic, Italy, Sweden
3. Travel Grant, University of Pretoria, Visit Hungary, Spain, USA
4. Travel Grant, University of Pretoria, Visit Poland, Italy, Greece.
5. Travel Grant, NRF, Visit Brazil

2006 German Grant Invited lecture in Rinteln, Germany

**Consultant**

Founder and owner of Ecotrust Environmental Services CC and Eco-Agent CC

Since 1988 **>250** reports as consultant on environmental matters, including:

* Game Farm and Nature Reserve planning,
* Environmental Impact Assessments,
* Environmental Management Programme Reports,
* Vegetation Surveys,
* Wildlife Management,
* Veld Condition and Grazing Capacity Assessments,

Red data analysis (plants and animals).