



# **PROTECTED TREE SURVEY FOR THE MUSINA-MAKHADO ENERGY AND METALLURGY SPECIAL ECONOMIC ZONE (SEZ) DEVELOPMENT**

**Musina, Limpopo**

January 2020

**CLIENT**



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Declaration	<p>The Biodiversity Company and its associates operate as independent consultants under the auspice of the South African Council for Natural Scientific Professions. We declare that we have no affiliation with or vested financial interests in the proponent, other than for work performed under the Environmental Impact Assessment Regulations, 2014 (as amended). We have no conflicting interests in the undertaking of this activity and have no interests in secondary developments resulting from the authorisation of this project. We have no vested interest in the project, other than to provide a professional service within the constraints of the project (timing, time and budget) based on the principles of science.</p>	

## DECLARATION

I, Martinus Erasmus, declare that:

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing any decision to be taken with respect to the application by the competent authority; and the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of Regulation 71 and is punishable in terms of Section 24F of the Act.



Martinus Erasmus

Terrestrial Ecologist

The Biodiversity Company

January 2020

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## 1 Introduction

The Biodiversity Company (TBC) was appointed to conduct a Protected Trees Survey for the proposed Musina –Makhado Special Economic Zone (SEZ). The proposed Musina-Makhado SEZ falls in the Musina and Makhado local municipalities which is managed by the Vhembe District Municipality in the Limpopo Province. The nearest towns to the project area are Makhado (located 31 km south) and Musina (located 36 km north). The location of the project area is presented in Figure 1-1.

The Musina-Makhado SEZ development will be established across eight farms. The total farm sizes are approximately 8000 hectares of which 6000 hectares will be utilised by the SEZ. The Musina-Makhado SEZ will comprise an offering of mixed land uses and infrastructure provision to ensure the optimal manufacturing operations in the energy and metallurgical complex. For a full project description refer to Digby Wells (2019).

According to the National Forests Act, 1998 (Act No.84 of 2014) in terms of section 15 (1) of the Forests Act, 1998 (DAFF, 2014), no person may cut, disturb, damage or destroy any protected tree or possess, collect, remove, transport, export, purchase, sell, donate, or in any other manner acquire or dispose of any protected tree or any product derived from a protected tree, except under a license or exemption granted by the Minister to an applicant and subject to such period and conditions as may be stipulated. Contravention of this declaration is regarded as a first category offence.

TBC was tasked with determining if protected trees will be affected, calculating of estimated protected trees per species and age classes (juveniles, sub- adults and adult trees) as well as marking of these trees and finally the compilation and submission of a protected tree permit application.



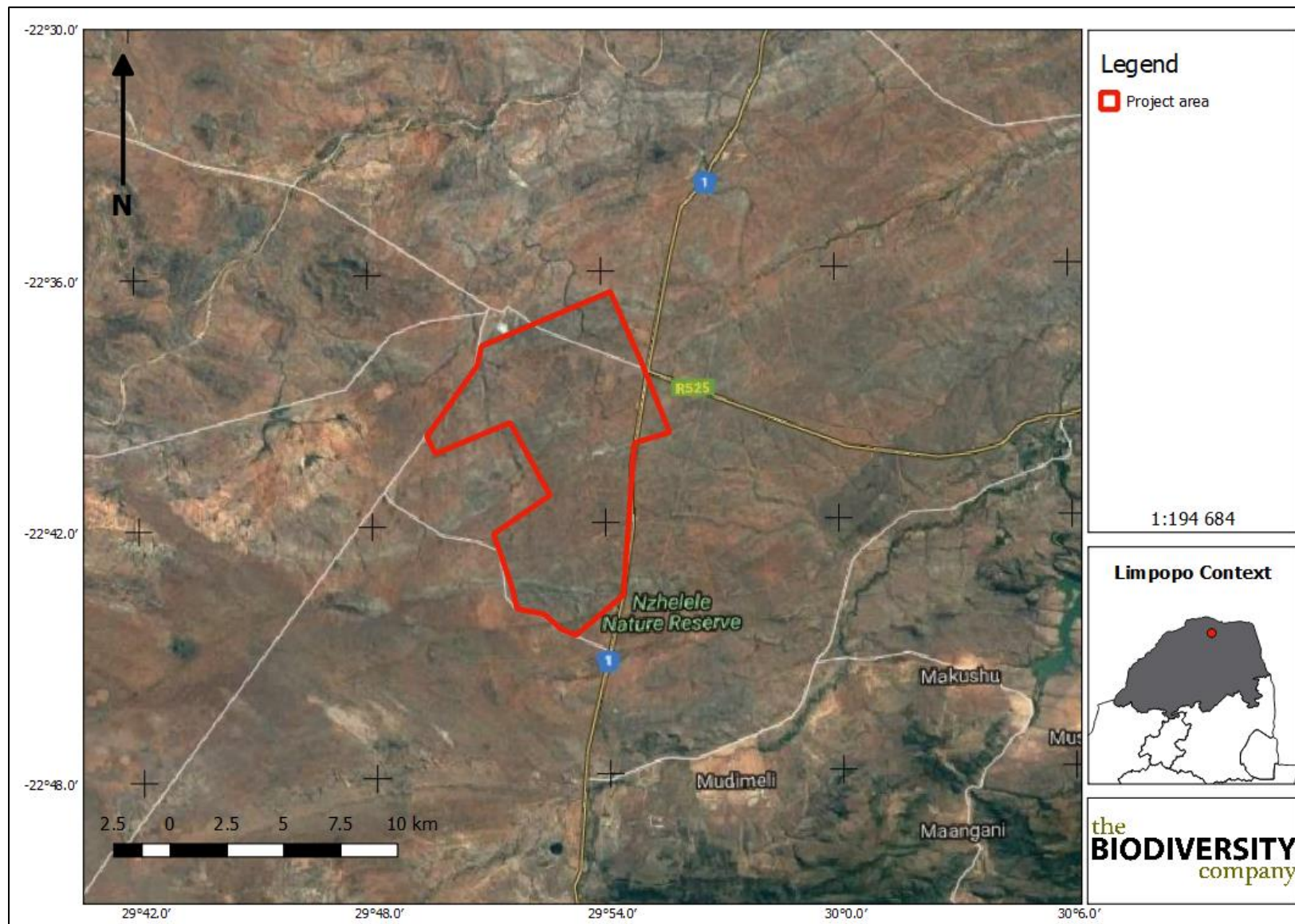


Figure 1-1 The general location of the project area

## 2 Scope of Work

The Terms of Reference (ToR) included the following:

- Identification of homogenous plant communities (using aerial photographs/existing vegetation maps, Google maps), randomly selected sites for transects within the different plant communities and different tree densities;
- Comprehensive protected tree assessment;
- Calculation of estimated protected trees per species and age classes (juveniles, sub-adults and adult trees), including the marking of trees; and
- The compilation and submission of protected tree permit applications.

## 3 Limitations

The following limitations should be noted for the study:

- It is assumed that information presented in the Digby Wells (2019) report is true and accurate. This information informed the approach for this study;
- Only protected trees were surveyed; shrubs, herbs, forbs, grasses were not included in this report;
- Due to flooding at the time of the survey, access to the north-eastern section of the property was limited;
- The focus was placed on the four protected tree species identified by Digby Wells (2019); and
- The habitats considered for this study were as per the Digby Wells (2019) report, the subtypes were identified but not spatially represented as such the main habitats were used for this study.

## 4 Background Review

### 4.1 Vegetation Type

The project area is situated in the Savanna biome. The savanna vegetation of South Africa represents the southernmost extension of the most widespread biome in Africa (Mucina & Rutherford, 2006). Major macroclimatic traits that characterise the Savanna biome include:

- a) Seasonal precipitation; and
- b) (Sub) tropical thermal regime with no or usually low incidence of frost (Mucina & Rutherford, 2006).

Most savanna vegetation communities are characterised by an herbaceous layer dominated by grasses and a discontinuous to sometimes very open tree layer (Mucina & Rutherford, 2006).

The savanna biome is the largest biome in South Africa, extending throughout the east and north-eastern areas of the country. Savannas are characterised by a dominant grass layers,



over-topped by a discontinuous, but distinct woody plant layer. At a structural level, Africa's savannas can be broadly categorised as either fine-leaved (microphyllous) savannas or broad-leaved savannas. Fine-leaved savannas typically occur on nutrient rich soils and are dominated by microphyllous woody plants of the Mimosaceae family (Common genera include *Acacia* and *Albizia*) and a generally dense herbaceous layer (Scholes & Walker, 1993).

The project area falls within the Limpopo Ridge Bushveld and Musina Mopane Bushveld vegetation types (Mucina & Rutherford, 2018 vegetation delineation) (Figure 4-1). A full description of these vegetation types can be found in Mucina and Rutherford (2006) and Digby Wells (2019).

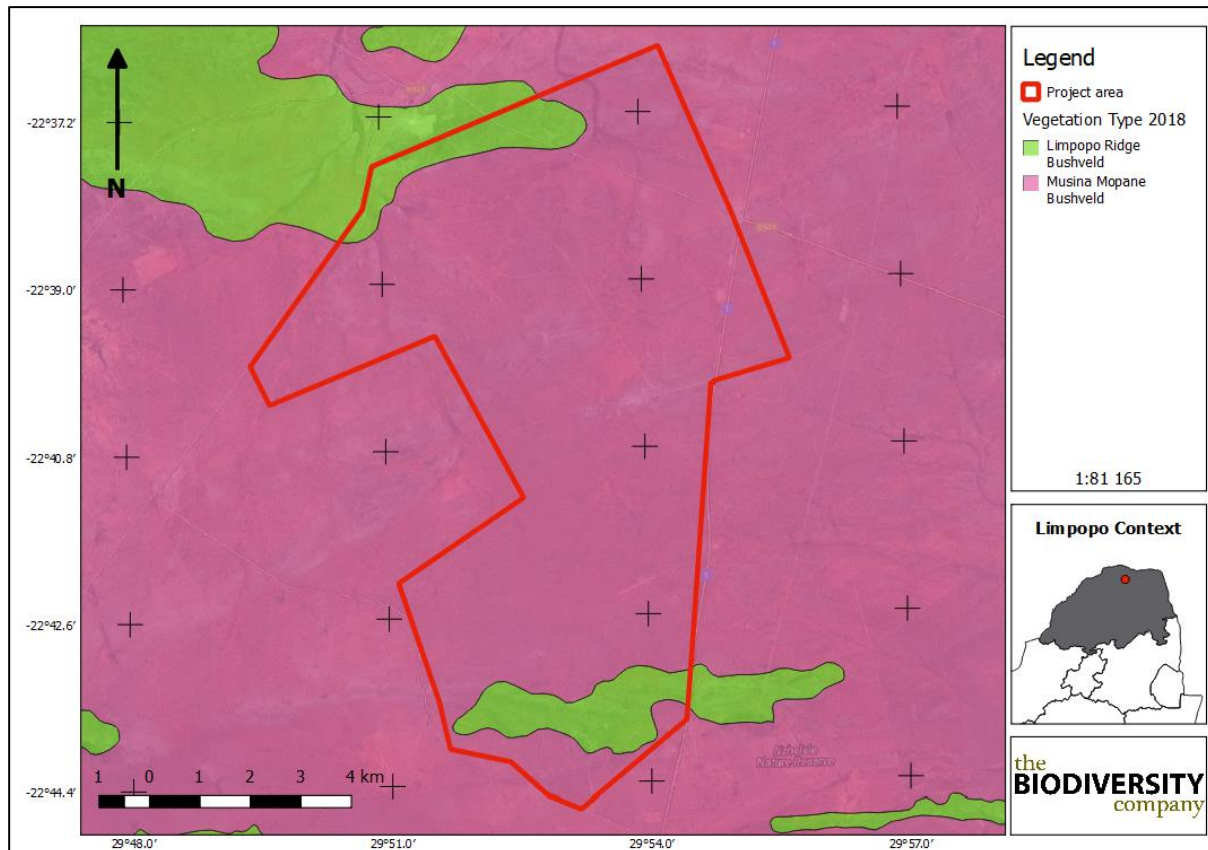


Figure 4-1 Vegetation types as per SANBI 2019

## 4.2 Habitat Type

The habitats used in this study are based on the Digby Wells (2019) Fauna and Flora Impact Assessment report, where the Limpopo Ridge Bushveld, Musina Mopane Bushveld and Riparian habitats were identified (Figure 4-2).

The Musina Mopane Bushveld habitat is characterised by undulating to very irregular plains with some hills (Digby Wells, 2019). It is dominated by *Kirkia acuminata* (White Seringa), *Colophospermum mopane* (Mopane), *Combretum. apiculatum* (Red Bushwillow) and *Grewia spp.* (Raisin bushes). The report further divides this vegetation type into sub classes: *Combretum* thorny bushveld, *Terminalia* Bushveld sub type and *Kirkia acuminata* open bushveld subtype. The subtypes were identified but not spatially represented as such the bigger habitats were used for this study.

The Limpopo Ridge Bushveld was mainly found in the southern portion of the project area and consisted of irregular hills and ridges. The dominant trees species found in this habitat type was identified as *Kirkia acuminata*, *Colophospermum mopane* and *Terminalia prunioides*. *Adansonia digitata* and *Boscia albitrunca* were also present. No Subtypes were identified for this vegetation type.

The Riparian habitat consists of the wetland and freshwater features in the area. A total of 17 pans, covering 1.3 ha were identified, along with 296.21 ha of drainage lines and 6.23 ha of artificial impoundments. The trees found in and around these areas include: *Colophospermum mopane*, *Digitaria velutina*, *Terminalia prunioides*, *Ximenia americana*, *Vachellia tortilis*, *Commiphora glandulosa*, *Boscia albitrunca*, *B. foetida*, *Combretum apiculatum*, *Commiphora viminea* and *Dichrostachys cinerea*.

### 4.3 Protected Trees

The Botanical Database of Southern Africa (BODATSA) was accessed to compile a list of tree species previously recorded from the area. The protected trees considered were based on the List of Protected Tree Species under the National Forests Act, 1998 (Act No. 84 of 1998). The Red List of South African Plants website (SANBI, 2016) was utilized to provide the most current account of the national conservation status of these flora species. The IUCN (2019) was used for the international conservation status and the Limpopo Environmental Management Act (Act No. 7 of 2003) (LEMA) was consulted for the provincial protection status.

The following protected species are expected in the project area based on the Red List of South Africa and the revised protected tree species of 2016. Of these 15 nationally protected trees, three are also protected under the Limpopo Environmental Management Act (Act No. 7 of 2003) (LEMA) (Table 4-1). The four protected trees that were identified by Digby Wells (2019) namely *Adansonia digitata*, *Combretum imberbe*, *Boscia albitrunca* and *Sclerocarya birrea subsp. caffra* in the three main habitat types formed the focus for this study. No other protected trees were identified during the survey; however this does not negate the possibility of some of these other protected species being located in the area.

Table 4-1 Protected trees expected in the area.

Botanical Name	English Common	Other Common Names	SANBI Status	IUCN 2019	LEMA
<i>Vachellia erioloba</i>	Camel Thorn	"Kameeldoring (A), Mogohlo (NS), Mog"tlh" (T)"	LC	Unlisted	
<i>Adansonia digitata</i>	Baobab	"Kremetart (A), Seboi (NS), Mowana (T)"	LC	Unlisted	Schedule 12
<i>Boscia albitrunca</i>	Shepherds Tree	"Witgat (A), Mohl"pi (NS), Motlh"pi (T),"	LC	Unlisted	
<i>Breonadia salicina</i>	Matumi	"Mingerhout (A), Mohlom" (NS), Mutu-lume (V), Umfomfo (Z)"	LC	Unlisted	
<i>Combretum imberbe</i>	Leadwood	"Hardekool (A), Mohwelere-t'hipi (NS), Motswiri (T), Impondondlovu (Z)"	LC	LC	
<i>Curtisia dentata</i>	Assegai	"Assegai (A), Umgxina (X), Umagunda (Z)"	NT	LC	
<i>Elaeodendron transvaalensis</i>	Bushveld Saffron	"Bosveld-saffraan (A), Monomane (T),"	LC	LC	
<i>Philenoptera violacea</i>	Apple-leaf	"Appelblaar (A), Mphata (NS), Mohata (T),"	LC	Unlisted	
<i>Pittosporum viridiflorum</i>	Cheesewood	"Kasuur (A), Kgalagangwe (NS), Umkhwenkwe (X), Umfusamvu (Z)"	LC	Unlisted	
<i>Podocarpus latifolius</i>	Real Yellowwood	"Opregte-geelhout (A), Mog"bag"ba (NS), Umcheya (X), Umkhoba (Z)"	LC	LC	

<i>Prunus africana</i>	Red Stinkwood	"Rooi-stinkhout(A), Umkhakhase (X),"	VU	VU	
<i>Pterocarpus angolensis</i>	Wild Teak	"Kiaat (A), Mor"t" (NS), Mokwa (T), Mutondo (V), Umvangazi (Z)"	LC	LC	Schedule 12
<i>Sclerocarya birrea subsp. caffra</i>	Marula	"Maroela (A), Morula (NS), Morula (T), Umganu (Z)"	LC	LC	
<i>Securidaca longepedunculata</i>	Violet Tree	"Krinkhout (A), Mmaba (T)"	LC	Unlisted	
<i>Warburgia salutaris</i>	Pepper-bark Tree	"Peperbasboom (A), Molaka (NS), Mulanga (V), Isibaha (Z)"	EN	EN	Schedule 12

*Adansonia digitata* (Baobab) can reach a height of 28m with a cylindrical trunk and branches resembling an upside-down root system. The baobab tree is found in South Africa, Botswana, Namibia, Mozambique and other tropical African countries in hot, dry woodlands on well drained soils. Key species that use this tree for food include bats, bird and monkeys, baboons and various species of antelope. African honey bees can also utilise this tree for their hives (Hankey, 2007).

*Combretum imberbe* (Leadwood) is a semi-deciduous tree that can reach a height of 20m. This species can be found in SA, Mozambique, Namibia and even tropical Africa. The tree play an important role in the ecology, where it functions as food and refuge for various species including kudu, impala, red lechwe, grey duiker, elephant, giraffe (Mtsweni, 2006).

*Boscia albitrunca* (Shepherds tree) reaches a maximum height of 7m, and can be found in SA, Swaziland, Zambia, Zimbabwe and Mozambique in the drier regions. Herbivores such as giraffe, gemsbok and kudu are known to browse on this tree (Govender, 2005).

*Sclerocarya birrea subsp. caffra* (Marula) is a large deciduous tree with a rounded crown. The marula is widespread throughout Africa, were it is found from Ethiopia to South Africa. It naturally occurs in woodlands in sandy soils. The fruit leaves and bark from this tree functions as a crucial part of the food chain for species such as Elephants, antelope, giraffe, zebra and African moth *Argema mimosae* (Mutshinyalo & Tshisevhe, 2003) (Figure 6-1).

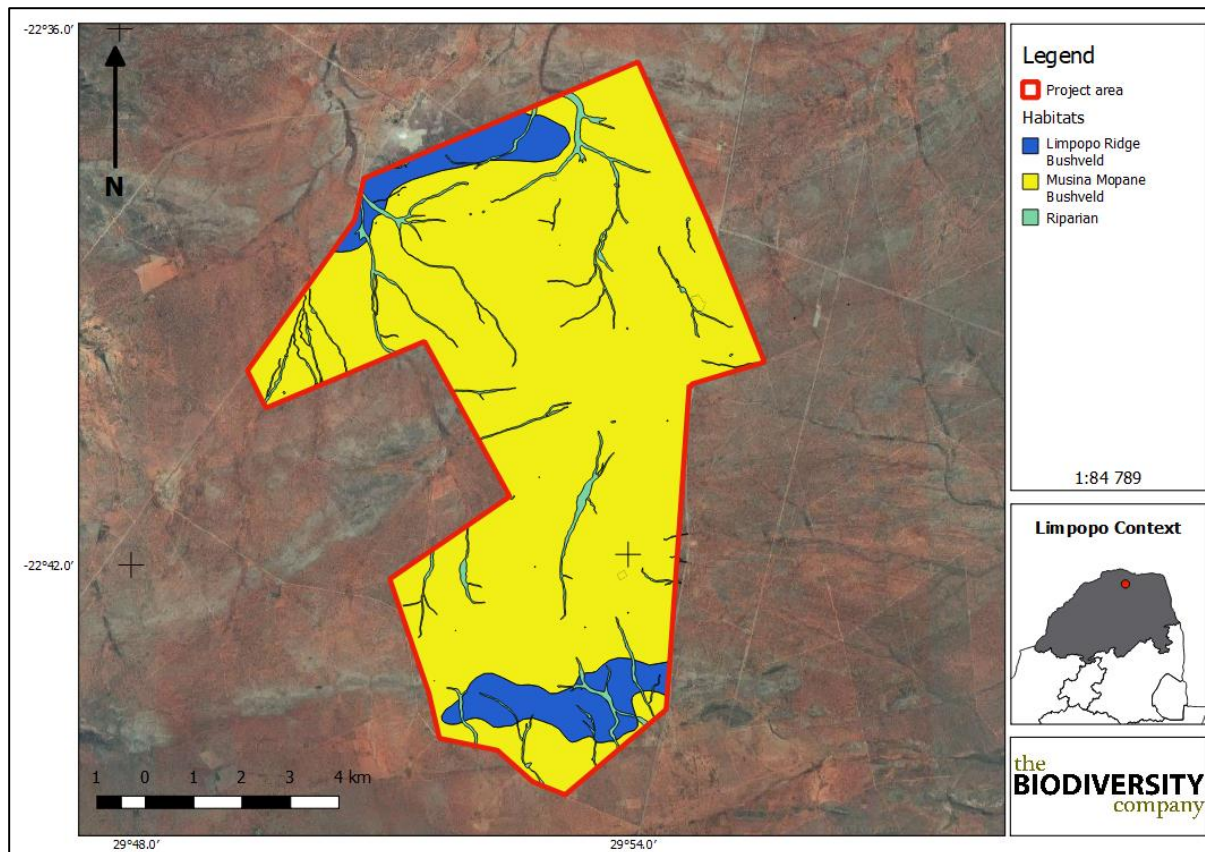


Figure 4-2 Habitats identified in the project area by Digby Wells (2019)

## 5 Methodology

### 5.1 Literature review

Digby Wells (2019) completed an Environmental Impact Assessment for the Musina-Makhado Energy and Metallurgy Special Economic Zone Development (Fauna and Flora Impact Assessment). In the study they highlighted the presence of four protected trees in the area, these species formed the basis of our approach.

### 5.2 Field survey

The protected tree species that were identified and counted were *Adansonia digitata*, *Combretum imberbe*, *Boscia albitrunca* and *Sclerocarya birrea subsp. caffra*.

Surveys were conducted using vehicles and on foot. A total of 25 transects were traversed which covered 141.7 hectares. The drive surveys were completed for the Limpopo Ridge Bushveld and Musina Mopane Bushveld vegetation types. This was done by driving along the internal roads of the property. The survey method was to drive slowly <10 km/hr, identify and record all the protected tree species which fell within a sight-able distance of 10 m on either side of the vehicle. When a protected tree was spotted, the vehicle was stopped and a waypoint, of the tree's location, was taken along with the tree's age class. The density of trees was never severe enough to force the surveyor to decrease the survey distance from the road. Thus, a distance of 10 m was used for all the transects.



The walked surveys were completed within the riparian vegetation. A demarcated GPS line was followed within the Riparian habitat. The protected tree species which fell within 10 m on either side of the surveyor were identified, recorded, aged and the location marked (Figure 5-1).

The number of protected tree species that were counted from the 25 transects were then combined and extrapolated to estimate the number of protected trees species, per vegetation type, and for the entire property.

The trees were aged using height as the subjective parameter. The age classes used were as follows:

- Juvenile 0-2m
- Sub-adult 2-3,5m
- Adult >3,5m

The total area covered in the survey per habitat type is shown in Table 5-1. The total plant approximate area refers to the area that is covered by trees based on the densities of the trees observed.

Table 5-1 Summary of the area covered during the surveys

Habitat type	Area (ha)	Hectares surveyed
Limpopo Ridge Bushveld	781,7	14,4
Musina Mopane Bushveld	7055,6	121,5
Riparian Area	293,8	5,8
<b>Total</b>	<b>8131,1</b>	<b>141,7</b>
<b>Total plant approx. area</b>	<b>6000</b>	

### 5.3 Density analysis

Heat maps were generated using the QGIS heat maps tool pack version 3,4. This tool pack uses Kernel Density Estimation to make a density (heat map) raster file of an input point vector layer. The density is calculated based on the number of points (trees) in a specific area or location, with more numerous clustered points resulting in bigger values, which are the tree hotspots. Powell (2000) believes that the best assessment techniques for estimating home ranges and home range distributions are Kernel density estimators. The kernel density estimator creates an impartial density estimate straight from data and is not prejudiced by grid size or placement (Silverman, 1986). The kernel density estimation calculates the probability that there will be a point in that location. The more recorded GPS points in an area, the higher the probability of there being a tree in that area.

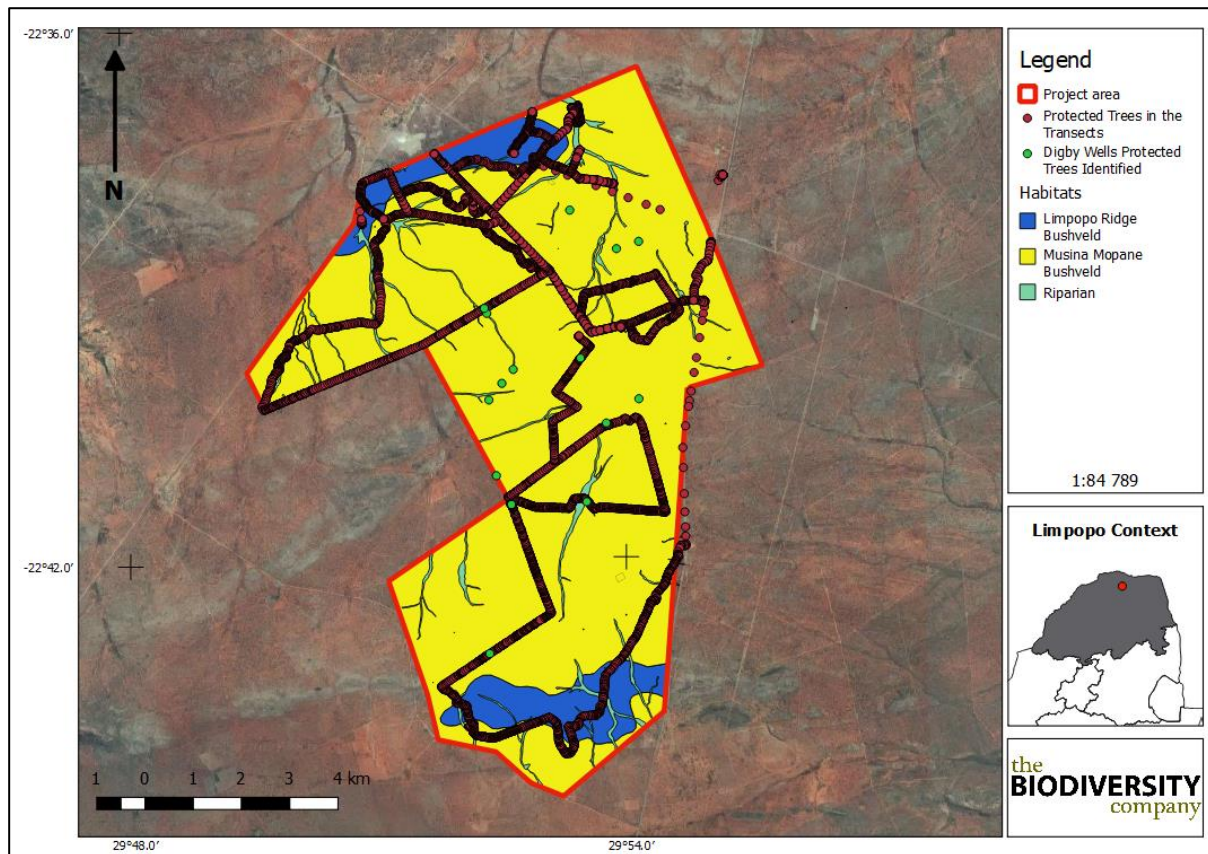


Figure 5-1 Transects followed and the trees that were identified per habitat.

## 6 Results & Discussion

The protected tree species identified and counted in the project area are: *Adansonia digitata* (Baobab), *Combretum imberbe* (Leadwood), *Boscia albitrunca* (Shepherds tree) and *Sclerocarya birrea subsp. caffra* (Marula) (Figure 6-1).



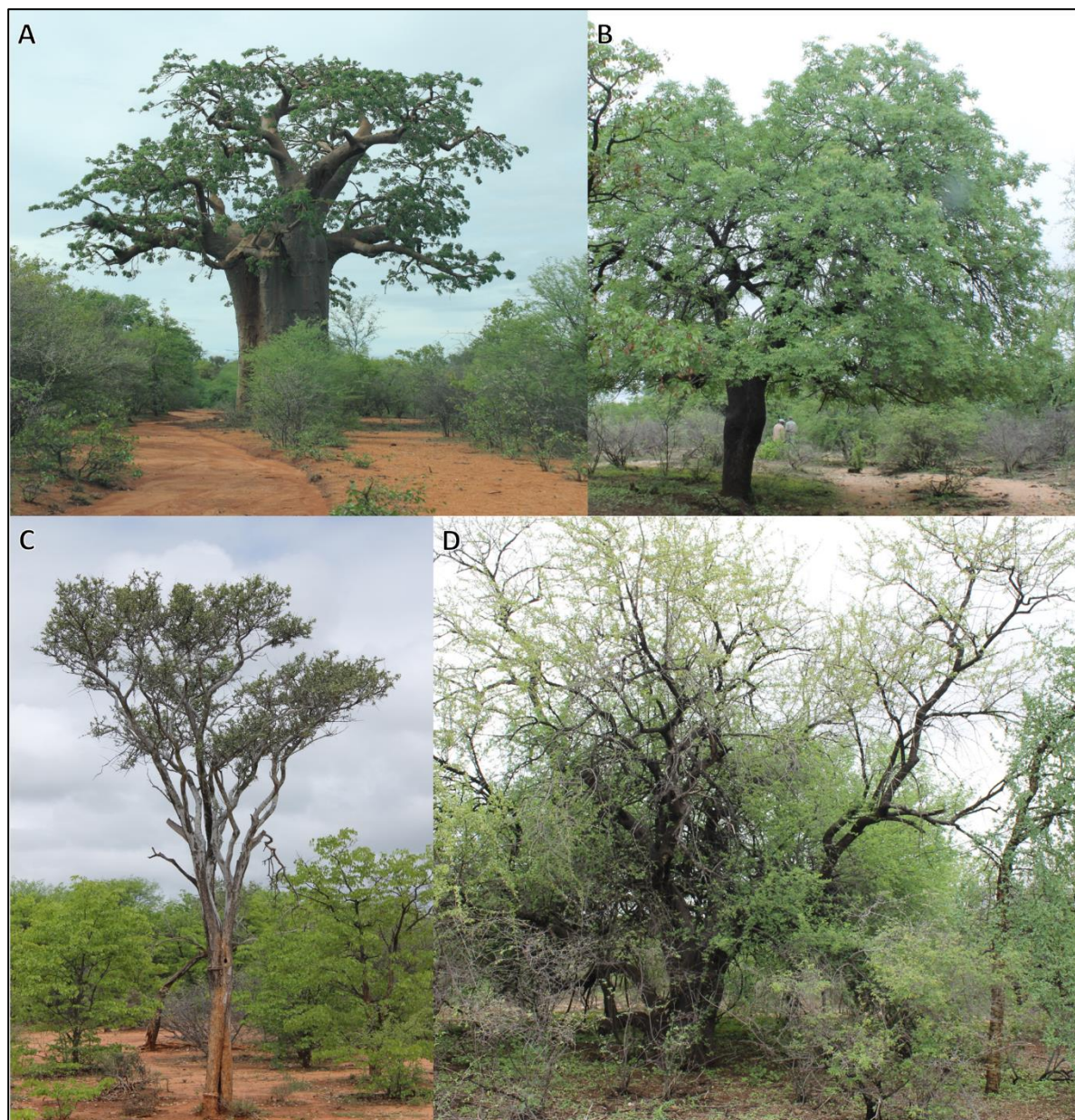


Figure 6-1 Example of the protected trees observed: A) *Adansonia digitata* (Baobab), B) *Sclerocarya birrea* subsp. *caffra* (Marula), C) *Boscia albitrunca* (Shepherds tree) and D) *Combretum imberbe* (Leadwood).

In the Limpopo Ridge Bushveld habitat, the dominant species was the *B. albitrunca* (Shepherds tree) species of which majority of the specimens found were in an adult form, a total of 6.3 trees per hectare was found (Table 6-1).

Table 6-1 Summary of trees per size class in the Limpopo Ridge Bushveld habitat

	Trees per hectare	Trees for total Limpopo ridge bushveld area
Marula adult	0,6	489
Marula sub-adult	0,2	163
Marula juvenile	0,0	0
Shepherds tree adult	6,3	4886

Shepherds tree sub-adult	2,2	1683
Shepherds tree juvenile	0,5	380
Baobab adult	0,1	109
Baobab sub-adult	0,1	109
Baobab juvenile	0,1	54
Leadwood adult	0,0	0
Leadwood sub-adult	0,2	163
Leadwood juvenile	0,0	0

In the Musina Mopane Bushveld habitat the Marula was the dominant species (5.6 trees/ha), followed by the Shepherds tree (4.1 trees/ha). Sub-adults and juvenile trees were also high of both these species (Table 6-2), with a total of 4878 sub adult Shepherd trees and 2904 Marula trees found.

Table 6-2 Summary of trees in the Musina Mopane Bushveld habitat

Age class	Trees per hectare	Trees for total Musina Mopane Bushveld area
Marula adult	5,6	39546
Marula sub-adult	1,8	12369
Marula juvenile	0,4	2904
Shepherds tree adult	4,1	28745
Shepherds tree sub-adult	0,7	4878
Shepherds tree juvenile	0,2	1684
Baobab adult	0,4	2729
Baobab sub-adult	0,2	1568
Baobab juvenile	0,1	581
Leadwood adult	0,1	987
Leadwood sub-adult	0,0	232
Leadwood juvenile	0,0	116

The riparian habitat had the highest densities of Shepard trees (11.7 trees/ha) as well as Baobab trees (1.7 trees/ha) of all the habitat types (Table 6-3). A total of 507 Baobab individuals were observed in the riparian habitat.

Table 6-3 Summary of trees in the Riparian habitat

Age class	Trees per hectare	Trees for total Riparian area
Marula adult	1,2	355
Marula sub-adult	0,2	51
Marula juvenile	0,0	0
Shepherds tree adult	10,3	3039
Shepherds tree sub-adult	0,9	253
Shepherds tree juvenile	0,5	152
Baobab adult	1,0	304
Baobab sub-adult	0,5	152
Baobab juvenile	0,2	51

Leadwood adult	1,0	304
Leadwood sub-adult	0,0	0
Leadwood juvenile	0,0	0

Figure 6-2 gives a graphical representation of the number of trees found per habitat of the three species. Overall the shepherd trees had the highest density followed by the Marula trees.

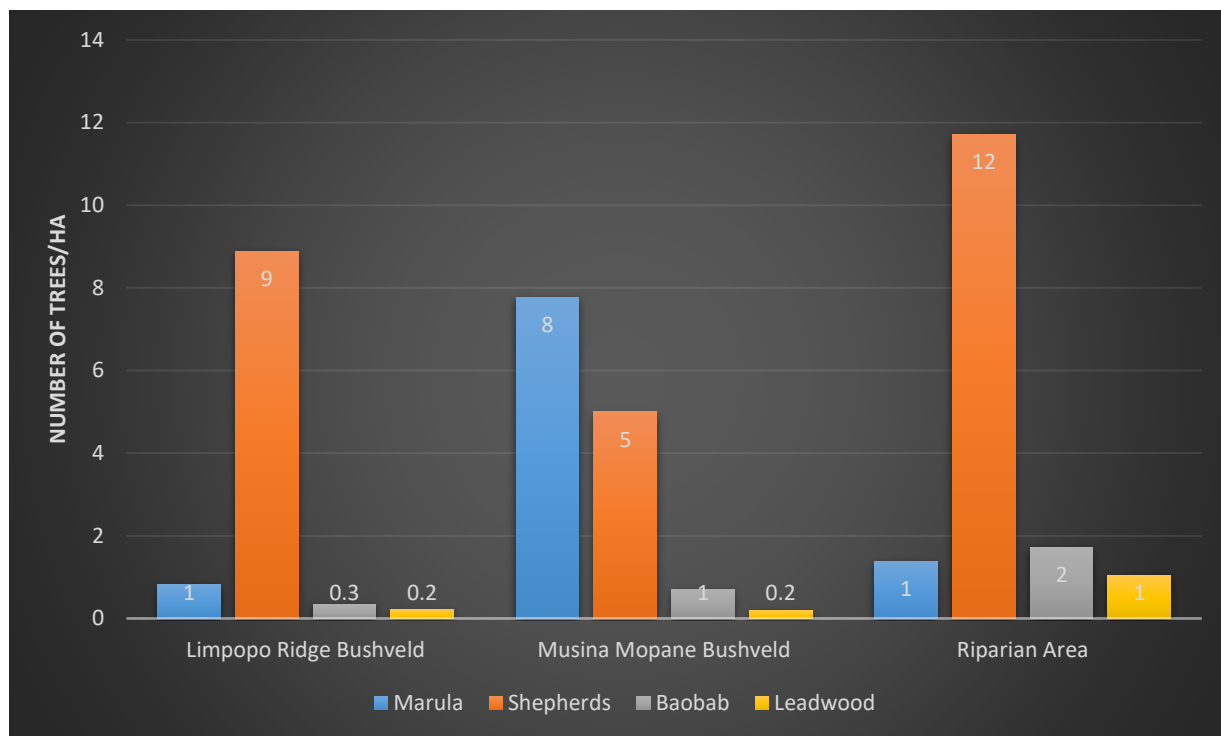


Figure 6-2 Total number of trees per hectare

The total number of species recorded in the area were 109034, of which 51.3% consisted of Marula trees, 41.9% of Shepherds trees, 5.2% of Baobab and 1.65% of Leadwood trees (Table 6-4). The Musina Mopane Bushveld habitat were the largest and consequently had the highest number of protected trees 96336. The Limpopo Ridge Bushveld and the riparian habitat had 8034 and 4661 trees respectively.

Table 6-4 Total number of trees per habitat

Tree species	Limpopo Ridge Bushveld	Musina Mopane Bushveld	Riparian Area	Total trees
Marula	651	54819	405	55875
Shepherds tree	6949	35307	3445	45700
Baobab	271	4878	507	5656
Leadwood	163	1336	304	1802
<b>Total trees</b>	<b>8034</b>	<b>96339</b>	<b>4661</b>	<b>109034</b>

There were varying degrees of density of the protected trees in the project area (Figure 6-3 & Figure 6-4). The heat maps shown in Figure 6-4 and Figure 6-5 are based on the points identified along the transects, it does not necessarily reflect the densities in the areas where the transects did not cross. The high as well as moderately high-density hotspots corresponds with areas where riparian habitat such as pans, and drainage lines were found. However, as this is not the only riparian habitat the overall density per habitat will not reflect this.





Figure 6-3 The overall density of trees in majority of the project area.

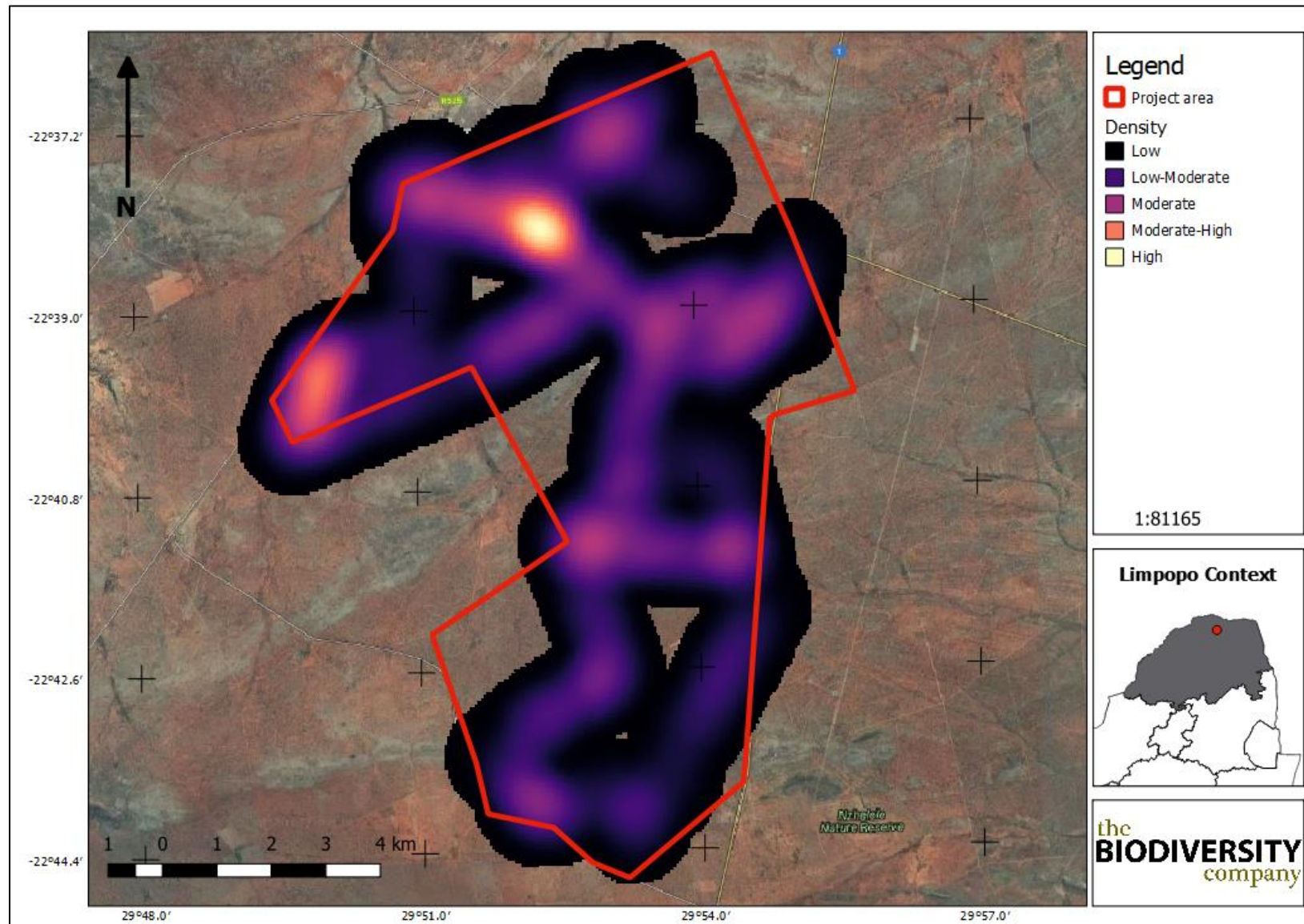


Figure 6-4 Density of the protected trees identified in the project area



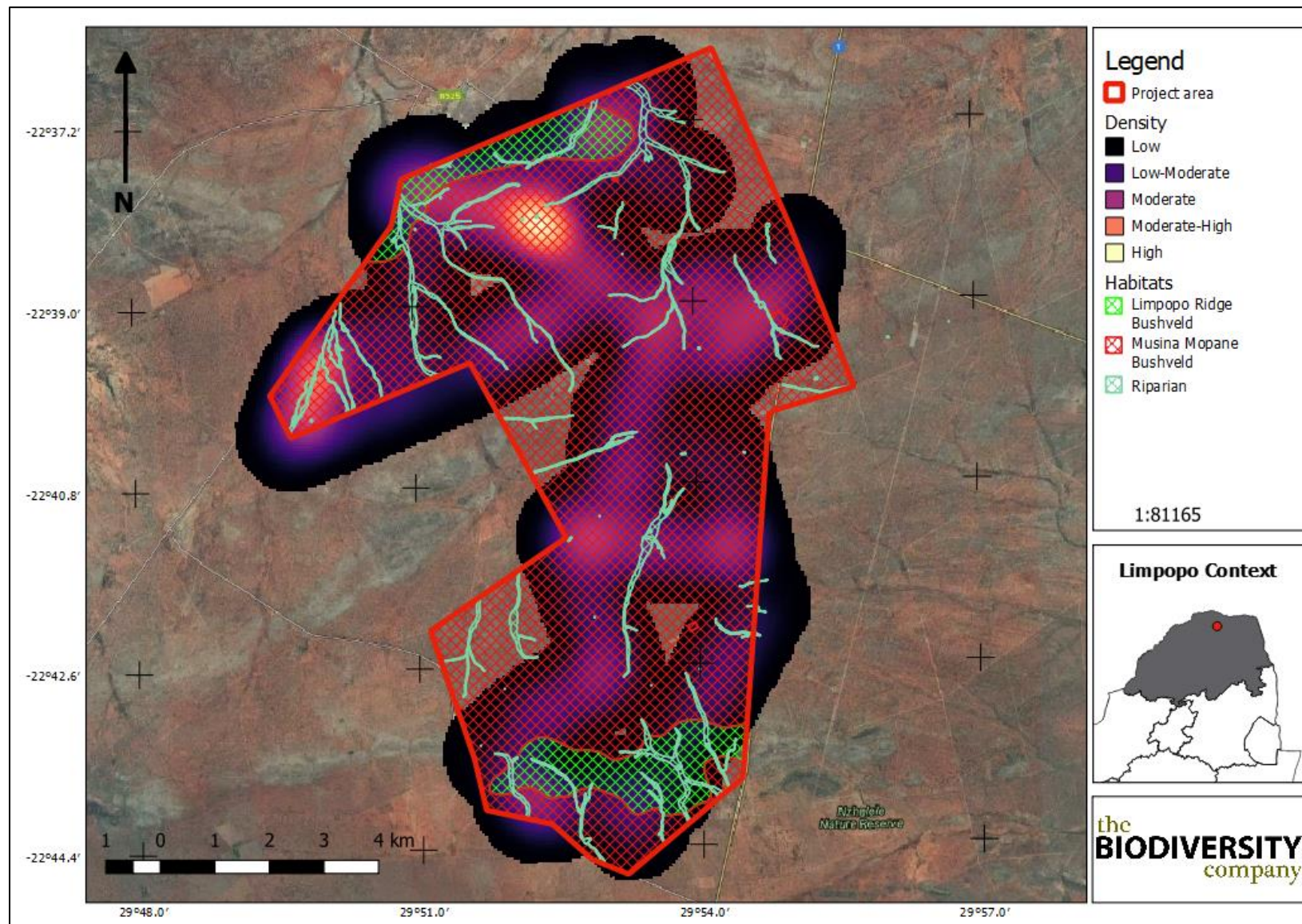


Figure 6-5 The density of the trees in the various habitats



## 7 Recommendations

- It is the recommendation of the specialists that juvenile and sub-adult trees need to be relocated/transplanted, this should be done when the plants are actively growing, and the outside temperature is less than 30 Degrees Celsius. Which would increase the likelihood of successful translocation. This should be done with the input of a horticulturist, or a plant translocation specialist.
- A horticulturist/ plant translocation specialist needs to be consulted on the feasibility of the relocation of the adult trees, successful relocation of Baobab trees was done by De Beers Venetia Mine (2016) and South African National Parks (SAN-Parks) (2005).
- The feasibility of creating tourism opportunities using the larger Baobab trees need to be investigated.
- Should the permit be granted to allow the trees to be removed, the wood must be made available to local communities.

## 8 Conclusion

The protected tree species identified and counted in the project area were: *Adansonia digitata* (Baobab), *Combretum imberbe* (Leadwood), *Boscia albitrunca* (Shepherds tree) and *Sclerocarya birrea* subsp. *caffra* (Marula). The total number of species recorded in the area was estimated 109034, of which 51.3% consisted of Marula trees, 41.9% of Shepherds trees, 5.2% of Baobab and 1.65% of Leadwood trees. The Musina Mopane Bushveld habitat was the largest and consequently had the highest number of protected trees 96336. The Limpopo Ridge Bushveld and the riparian habitat had 8034 and 4661 trees respectively.

## 9 References

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