STRATEGIC ENVIRONMENTAL ASSESSMENT FOR EXPANSION OF ELECTRICITY GRID INFRASTRUCTURE IN SOUTH AFRICA

Biodiversity and Ecological Impacts (Terrestrial Ecosystems and Species) - Indian Ocean Coastal Belt Biome

STRATEGIC ENVIRONMENTAL ASSESSMENT FOR THE EXPANSION OF ELECTRICITY GRID INFRASTRUCTURE IN SOUTH AFRICA

Draft v3 Specialist Assessment Report for Stakeholder Review

INDIAN OCEAN COASTAL BELT BIOME

Contributing Authors	Simon Bundy[1], Alex Whitehead[1]

[1] SDP Ecological and Environmental Services

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ABBREVIATIONS AND ACRONYMS

CB 1	Maputaland Coastal Belt
CB 2	Maputaland Wooded Grassland
CB 3	Kwazulu-Natal Coastal Belt
CB 4	Pondoland-Ugu Sandstone Coastal Sourveld
CB 5	Transkei Coastal Belt
CBA	Critical Biodiversity Area
CSIR	Council for Scientific and Industrial Research
DEA	Department of Environmental Affairs
EGI	Electricity Grid Infrastructure
EKZNW	Ezemvelo KZN Wildlife
ESA	Ecological Support Area
GIS	Geographic Information System
ha	Hectares
IOCB	Indian Ocean Coastal Belt
kV	Kilovolt
KZN	KwaZulu-Natal Province
NPAES	The National Protected Areas Expansion Strategy
SANBI	South African National Biodiversity Institute
SEA	Strategic Environmental Assessment
Spp	Species

1 SUMMARY

This assessment aims to identify the potential impacts of constructing and maintaining Electricity Grid Infrastructure (EGI) (i.e. the transmission (and distribution) power lines and associated infrastructure, such as, but not limited to, substations, service roads, and access roads as described in the Project Description Chapter of this SEA Report) in the Indian Ocean Coastal Belt Biome (IOCB) of South Africa.

This biome, chiefly located along the east coast of Southern Africa, consists of five dominant and six associated azonal and intrazonal vegetation units. Of the vegetation units under consideration in the south eastern coastal extent, two of the five units within the IOCB are considered to be "endangered", while three are considered to be "vulnerable". Comparatively, two of the four forest types are considered "critically endangered", while the rest are considered to be "least threatened". Clusters and potential hotspots of threatened plant species appear to be concentrated in or around formally protected areas. The IOCB is characterised by diverse ranges of habitat and a concomitantly diverse faunal assemblage due to the Biome's location in a climatic niche in a topographically diverse environment with a relatively recent history of human settlement.

The purpose of this assessment was to review available GIS data relevant to the IOCB and terrestrial ecology and assign a sensitivity rating to the feature layers, which could then be used to inform a more detailed powerline infrastructure servitude. The IOCB covers only a small portion of the Expanded Eastern EGI corridor, but is diverse in terms of habitat and land use. The study area included the IOCB that stretched from the Mozambique border to the greater Durban area.

The activities associated with EGI construction and maintenance may pose a risk of disturbance and transformation of natural vegetation (including habitat loss and spread of alien invasive vegetation); and disturbance of fauna.

The IOCB has been extensively transformed by agriculture, forestry plantations and urban development over a relatively short timeframe and as such, much of the EGI corridor may be aligned outside or distal from ecologically important habitats within the IOCB. Any proposed infrastructure routes within the corridors should be planned and placed to align with existing transformed areas as close as possible.

This assessment serves to evaluate the nature of habitat within the proposed corridor and makes recommendations and suggestions in respect of these routes, including features and areas to be avoided and management actions that may impact on habitat form and structure.

2 INTRODUCTION

The proposed establishment of Electricity Grid Infrastructure (EGI) that will in part, traverse portions of the eastern extent of South Africa holds the potential to affect a number of habitats that lie within this region. More specifically the Indian Ocean Coastal Belt (IOCB) is the dominant biome on the east coast of KwaZulu-Natal (KZN) and comprises of a number of vegetation units or veld types, some of which are ecologically important and are of conservation importance. This report forms one of a number of environmental investigations that have been undertaken to evaluate and provide recommendations on the alignment of the expanded EGI corridors on the Eastern and Western coast of South Africa. The report therefore focusses specifically on the IOCB, with some consideration being given to azonal and intrazonal habitats that may be located within or adjacent to the IOCB coinciding with the proposed expanded Eastern EGI corridor.

3 SCOPE OF THIS STRATEGIC ISSUE

The IOCB is a habitat form or biome that is driven primarily by its proximity to the coast and the ameliorating effects of the coastal climate and prevailing geophysics of the south eastern coastline of South Africa (Figure 1). The IOCB is one of approximately 9 recognized biomes that have been categorised for the country, based on plant associations and affiliations with climatic and other variables (Box, 1981; Mucina & Rutherford, 2006). The IOCB comprises only 1.1% of the land area of South Africa, extending between Mozambique to a point just north of East London (Eastern Cape), with a maximum inland extent approximating 50 kilometres in the north of KwaZulu-Natal. The scope of this assessment includes the extent of the IOCB as described in the proposed expanded Eastern EGI corridor only (Figure 1).

This Strategic Environmental Assessment (SEA) of the proposed expanded Eastern EGI corridor through the IOCB has been compiled to provide a high-level approach to evaluation of the proposed corridor and the potential influence and effect that routing and placement of EGI within the corridor may have on the various vegetation units within the biome, as well as the various faunal affiliates. This study gives consideration to powerlines, servitudes, substations, service roads, access roads as described in the Project Description Chapter of this SEA Report.
This assessment provides guidance from a broad, eco-morphological perspective that can be utilised for decision-making on and planning for the establishment and routing of EGI corridors within the extent of the IOCB, while offering an overview of opportunities to avoid and/or moderate impacts. It also offers opportunities to ameliorate technical issues that may arise in the establishment of infrastructure.

This study evaluates a number of available spatial data sets relevant to the IOCB and assigns specific sensitivity ratings to relevant layers and features. Through this analysis, recommendations can be made regarding the potential routing of the power line and associated infrastructure within the corridor. Relevant data includes readily available GIS data sets provided by the South African National Biodiversity Institute (SANBI), the Council for Scientific and Industrial Research (CSIR), Provincial Conservation Authorities and National Departments. Since this particular study is a broad scale ecological study, datasets highlighting areas of ecological importance and relevant land uses were prioritised. The key focus was the terrestrial environment within the IOCB. Wetlands, watercourses, estuaries, bats and avifauna have been separately assessed in detail by relevant specialists, although this study does touch on these aspects where pertinent to the IOCB.

As noted above, the region of emphasis in this study is the expanded Eastern EGI corridor between the Mozambique border and Durban, extending from the coastline to approximately 100 km inland. The IOCB only comprises a narrow portion of this corridor, along the coastline (Figure 1). Although defined as a clear finite area for the purposes of this study, practically, the IOCB can be variable and merge with neighbouring biomes and vegetation types, sharing common characteristics, climatic features and biota.

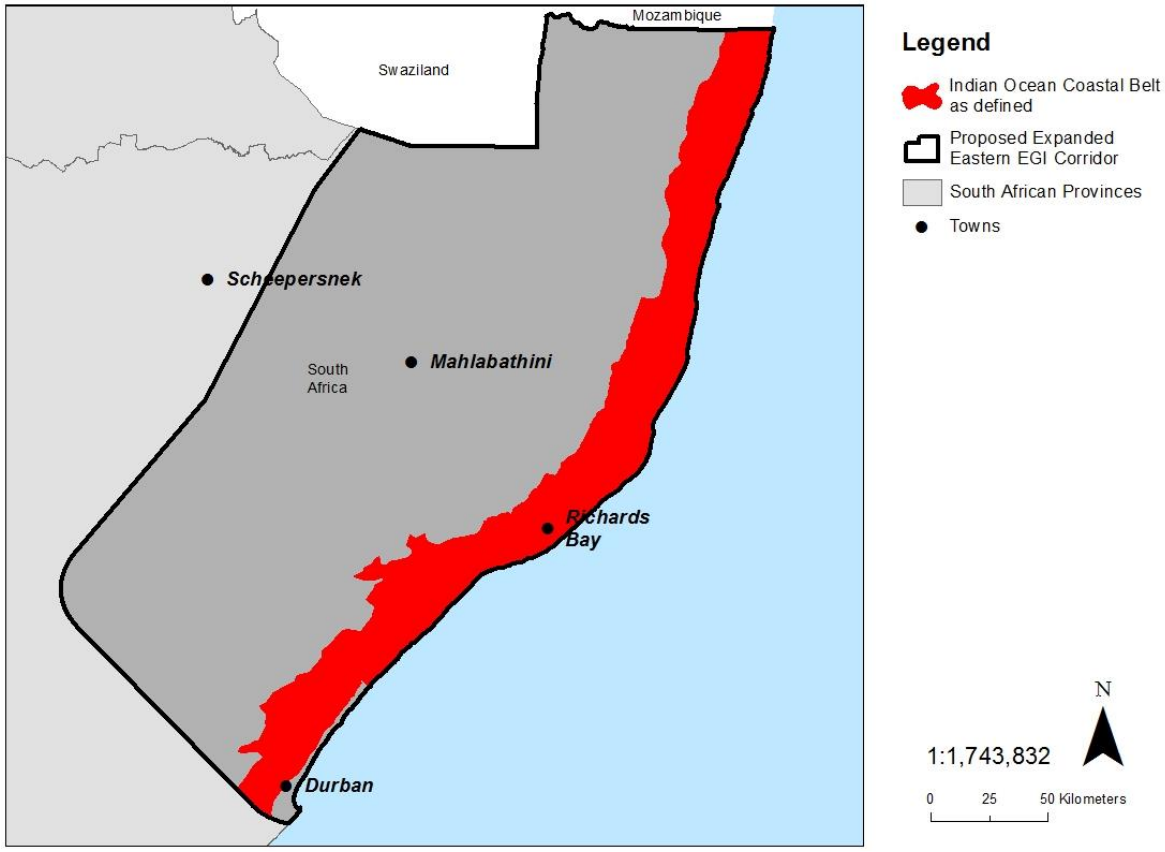

Figure 1: The extent of the IOCB as defined within the proposed expanded Eastern EGI corridor.

4 APPROACH AND METHODOLOGY

4.1 Study Methodology

The assessment of the proposed corridor and its relationship to the IOCB was undertaken using the following:

- GIS – mapping tools information and data;
- The review of current and available data and databases (Section 4.2 below);
- The analysis and handling of data to align with the IOCB region including the extraction of relevant layers;
- The review of draft environmental sensitivity ratings (provided by SANBI) in relation to the proposed EGI development within the corridors, and amendment thereof;
- Designation of sensitivity ratings of new feature layers.

Using the above information specific consideration was given to the alignment of the EGI corridors and its intersections with the IOCB. The refinement of data was undertaken, based on recent aerial imagery (Arc GIS online, Google Earth circa 2015 to 2018) and specific historical imagery (based on 1937 historical imagery for specific areas including the greater Durban area and Isimangaliso Wetland Park). Specialist knowledge of the subject area and high level verification of areas was undertaken where data was deficient or required updating.

The information was then further interrogated against an understanding of the required activities associated with the establishment and maintenance of EGI and the forecasting and projection of expected changes in the habitat or its drivers.

4.2 Data Sources

The following data and literature sources presented in Table 1 were considered and assessed in this report.

Table 1: A summary of data reviewed and applicable to the IOCB.

Data title	Source and date of publication	Data Description
Protected Areas	• National Department of Environmental Affairs (DEA) South African Protected Areas Database, (SAPAD), 2017. • SANBI Protected Areas Database, 2011. • Ezemvelo KZN Wildlife Protected Areas updated 2017	DEA Protected Areas database was compared against the SANBI Protected Areas database, and discrepancies were resolved. This data was provided by the CSIR. Provincial data was added for KwaZulu-Natal.
Protected Area Expansion Areas	• DEA Priority areas for protected area expansion 2017	This data was provided by the CSIR and used without modification.
Critical Biodiversity Areas (CBA)	• Ezemvelo KZN Wildlife CBA 2016	A CBA layer was provided by the CSIR, which included national CBA data. This layer was given a default sensitivity rating of "Very High." This was retained however the KZN CBA data was added separately and specific sensitivity ratings assigned to each CBA category within KZN. The National data aligned with the "irreplaceable" layer of the KZN CBA. The "Optimal" and "Ecological Support Area" (ESA) layers provided additional sensitivity contrast.
Private Nature Reserves and game farms	• Ezemvelo KZN Wildlife Private Nature Reserves 2016 • Provincial Game Farm Data	The game reserve data was provided by the CSIR. Additional private nature reserves were added to the data which includes areas that are recognised as game farms.
Stewardship	• Ezemvelo KZN Wildlife Stewardship areas (draft)	This layer was added un-modified and reflects the areas actively being pursued by the Ezemvelo KZN Wildlife

Data title	Source and date of publication	Data Description
	2016	Stewardship Programme. Although not protected areas, these areas are of conservation importance and are being actively managed as such.
Forest Nature Reserve	• National DEA SAPAD, 2017.	Provided by SANBI/DEA
Ramsar Sites	• National DEA SAPAD, 2017.	Provided by SANBI / DEA
World Heritage Sites	• National DEA SAPAD, 2017.	Provided by SANBI / DEA
Vegetation	• SANBI Vegetation Map 2012. • Ezemvelo KZN Wildlife Vegetation Conservation Status 2011	Vegetation Map as was the vegetation type conservation status data. This data set provides the conservation status of the specific vegetation types within KZN based on various attributes. This layer was used to derive the vegetation sensitivity ratings.
Landcover	• National Land Cover 2013/2014/DEA and Habitat Modification Layer SANBI 2017 • Field Crop Boundaries, Department of Agriculture, Forestry and Fisheries 2017	The modified and agricultural layers were retained and applied. These indicate the transformed areas that characterise much of the KZN coastal hinterland – sugar cane farms and plantations.
Ecoregions	• SANBI undated (based on Burgess 2004)	Basic ecoregion layer, applied unmodified.
National Forests	• National Forest Inventory, Department of Agriculture, forestry and Fisheries, 2016.	The extent of the National Forests. This layer complements the vegetation layers above and due to their protected status allow for a higher sensitivity to be applied to relevant areas.

All the above features were cropped to the extent of the IOCB within the proposed Extended Eastern EGI corridor. Sourced data sets that did not illustrate any presence with the IOCB were discarded, as well as data that was not considered to be of ecological relevance. Assigning sensitivity rating to the layers was done based on a four-tier rating system (Section 0). Assigning sensitivities to the layers discussed above varied from layer to layer. Complex layers, such as the KZN Vegetation conservation status layer was broken down according to the conservation status ratings of the vegetation types. The data for each of the 4 conservation status layers was extracted and exported to a separate layer and assigned a corresponding sensitivity, as conservation-worth status and sensitivity were deemed to be directly related. Other simpler layers were assigned sensitivity ratings based on expert knowledge and the nature of the feature (Section 7.1).

4.3 Assumptions and Limitations

4.3.1 Spatial data

Much of the spatial information utilised in this investigation was sourced from Provincial and National institutions. While the data utilised may be verified by the institutions concerned, the following factors must be considered;

- As use has been made of primarily secondary data, the verification of accuracy cannot be provided by the primary source nor by the authors, although knowledge of the region has assisted in identifying anomalies.
- The data presented has been collected over an extended time period and has been subject to differing forms of manipulation and evaluation by the various compilers.
- As noted above, the IOCB can be considered to be a variable habitat complex and is often found to merge and overlap with neighbouring biomes and vegetation types, sharing common characteristics. On the ground, IOCB aligned habitat may at points be found to lie beyond the western extent indicated in the spatial mapping provided.

- KZN's coastal environment, and therefore IOCB, is a rapidly growing economic region. The information presented may be subject to change over the short term.

A summary of all GIS data used is provided in Appendix 1.

4.3.2 Intrazonal vegetation

In addition to the above, "intrazonal" forest forms may be evident at points within the IOCB, more specifically Sand Forest (FOz8) and Northern Coastal Forest (FOz7). These forest types (and other azonal vegetation types) were not classified as being part of the IOCB but may be evident at points within the corridor, particularly in the Maputaland region. The original data defining the extent of the IOCB was revised and the outer extent of the IOCB redefined to include such azonal and intra zonal vegetation types.

4.3.3 The IOCB and neighbouring Biomes

The IOCB makes up only a small portion of the corridor and its review and deduced conclusions must therefore be seen in context. Inconsistencies in interpretations and alignment with neighbouring biomes, vegetation and habitat specialists may be expected to arise.

4.3.4 Fauna data

Comment and integration with existing faunal population data has been presented in this report, however the integration of such data may be of limited value as such data is based on observation records, which may be over-represented at particular points, such as protected areas. It is recommended that matters relating to fauna should be considered as an independent and site-specific aspect in terms of the construction and operation of the EGI (i.e. detailed faunal assessments should be conducted on a project specific basis, once a route has been determined). Fauna-related data, presented as point data at the spatial level of evaluation, may be over-represented in protected areas. Due to protected areas being mostly the focus of research and sampling efforts and are thus better represented in data, as such, data representing faunal populations outside of these areas can be expected to be less complete.

Therefore, faunal data was not included in the sensitivity mapping – areas of importance mentioned above have been included/covered or considered by other data sets, primarily protected areas and KZN CBAs. Faunal data was used as supplementary or supporting data for descriptive and illustrative purposes.

4.3.5 Information deficiencies

Available data for the study area is well established and of reasonable accuracy (Jewitt 2015 et. al.). The area is however, currently subject to relatively rapid land use changes associated primarily with continuous peri-urban expansion, outside of formal agricultural areas and urban centres. Anthropogenic influences and land use change in the region therefore renders older data a less reliable indicator of the present state. Attempts to verify the available data were undertaken with varying degrees of success. An attempt has thus been made to rationalise this transformation and limit contradiction through the incorporation of land use data and specialist knowledge to provide recommendations that may be more applicable to conditions on the ground.

4.4 Relevant Regulatory Instruments

The legal environment that may be applicable to habitats found within the IOCB is presented in Table 2 below. These include various legal instruments that regulate activities within portions of the IOCB and include international, national and provincial, as well as municipal laws and regulations (Table 2).

1 Table 2: Relevant legislation and regulatory instruments applicable to the IOCB.

Instrument	Key objective
International Instrument	
Ramsar Convention (The Convention of Wetlands of International Importance (1971 and amendments)	Protection and conservation of wetlands, particularly those of importance to waterfowl and waterfowl habitat.
Convention concerning the Protection of the World Cultural and Natural Heritage, adopted by UNESCO in 1972 (World Heritage Convention)	Preservation and protection of cultural and natural heritage throughout the world.
National Instrument	
National Environmental Management: Protected Areas Act (Act Number 57 of 2003)	No development, construction or farming may be permitted in a nature reserve without the prior written approval of the management authority (Section 50 (5)). Also in a 'protected environment' the Minister or MEC may restrict or regulate development that may be inappropriate for the area given the purpose for which the area was declared (Section 5).
National Environmental Management Act (Act Number 107 of 1998), as amended	Restrict and control development and potential harmful activities through the EIA regulations and the undertaking of relevant assessments prior to commencement of listed activities (Section 24 (5) and 44). Imposes "duty of care" (Section 28) which means that all persons undertaking any activity that may potentially harm the environment must undertake measures to prevent pollution and environmental degradation.
National Water Act (Act Number 36 of 1998)	Restriction of water use activities (Section 21) and disturbance of water resources (wetlands, rivers and ground water).
National Environmental Management: Integrated Coastal Management Act (Act Number 24 of 2008)	To determine the coastal zone of South Africa and to preserve and protect coastal public property. To control use of coastal property (Section 62, 63 and 65) and limitation of marine pollution (Chapter 8).
National Forest Act (Act Number 84 of 1998)	Protection of natural forests and indigenous trees species through gazetted lists of Natural Forests and Protected Trees (Sections 7 (2) and 15 (3) respectively). Disturbance of areas constituting natural forest or the disturbance of a protected tree species requires authorisation form the relevant authority.
National Environmental Management: Biodiversity Act (Act Number 10 of 2004)	Protection of national biodiversity through the regulation of activities that may affect biodiversity including habitat disturbance, culture of and trade in organisms, both exotic and indigenous. Lists of alien invasive organisms, threatened and protected species and threatened ecosystems published and maintained (Sections 97 (1), 56 (1) and 52 (1)(a) respectively).
Provincial Instrument	
Natal Nature Conservation Ordinance No. 15 of 1974 and KwaZulu-Natal Nature Conservation Management Act, 1997 (Act Number Act 9 of 1997)	According to the Natal Nature Conservation Ordinance No. 15 of 1974 and the KwaZulu-Natal Nature Conservation Management Act, 1997 (Act 9 of 1997), no person shall, among others: damage, destroy, or relocate any specially protected indigenous plant, except under the authority and in accordance with a permit from Ezemvelo KZN Wildlife (EKZNW). A list of protected species has been published in terms of both acts.
Municipal bylaws varied	Numerous municipalities have promulgated bylaws that relate to conservation of the environment and these may include the application of land uses through the town planning scheme. e.g. eThekwini Municipality's Open Space System as well as the iLembe and uMhlathuze Municipal bylaws. These will need to be considered in more detail during the detailed planning and EIA phases.

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5 IMPACT CHARACTERISATION

In order to understand the potential impacts and identify sensitive features that may be affected by the construction and operation of the EGI, specifically power lines, it is important to consider and characterise the nature and extent of impacts associated with EGI development on relevant features. The following impacts have been identified and are discussed:

5.1 Habitat loss

Major power lines require a wide servitude that is rendered and maintained free of significant woody or larger plant species. Such a state facilitates the management and maintenance of the power lines. Establishment of a servitude will require the clearance of natural vegetation and regular vegetation management. These factors generally maintain the natural vegetation within the servitudes at an early seral stage, preventing secondary and more advanced seral processes (Figure 2a and 2b). Under some situations, such vegetation clearance may serve to bisect habitats and changes in vegetation form and structure may extend beyond the servitude boundary. The following habitat forms are likely to be affected:

- Natural forest, on account of the initial stringing requirements and the need to prevent the growth and establishment of trees. This may include Northern Coastal Forest, Scarp Forest and particularly threatened forest types such as Sand Forest.
- Grasslands – on account of the fact that grasslands are often considered preferential routes for power lines, due to the evident avoidance of felling activities and general bush clearing.
- Azonal vegetation – including scrub and swamp forest habitats, where features such as rivers and wetland environments are traversed.

5.2 Alien invasive plants

Electrical line servitudes are areas of high physical disturbance, that are subject to regular vehicular traffic and periodic clearance. This sustained level of disturbance presents suitable conditions for the establishment and spread of alien invasive plants. Servitudes often act as repositories and vector corridors of exotic plant propagules and thereby promote and facilitate the spread of alien invasive plants.

5.3 Faunal disturbance

With a loss of habitat and/or its transformation within both the servitude and areas immediately adjacent to them, such change is likely to affect faunal populations within particular areas, or alternatively give rise to change in species' behaviour. Thus the clearance of large swathes of land is likely to affect faunal populations both directly and indirectly and in the medium to long term lead to the ousting of specific faunal populations or alternatively promote the establishment of others. A case in point, may be the clearance of forest and establishment of a scrub or graminoid veld form within a servitude that will favour grazers but may lead to the ousting of frugivorous species that were reliant upon fruiting species. In addition, such transformation may also alter transitory niche or migratory routes of certain species or act as physical barriers to others. In the case of the latter, mortalities may arise through, for example collision, leading to avian mortalities (however, the impact on avifauna is subject to a separate specialist assessment).

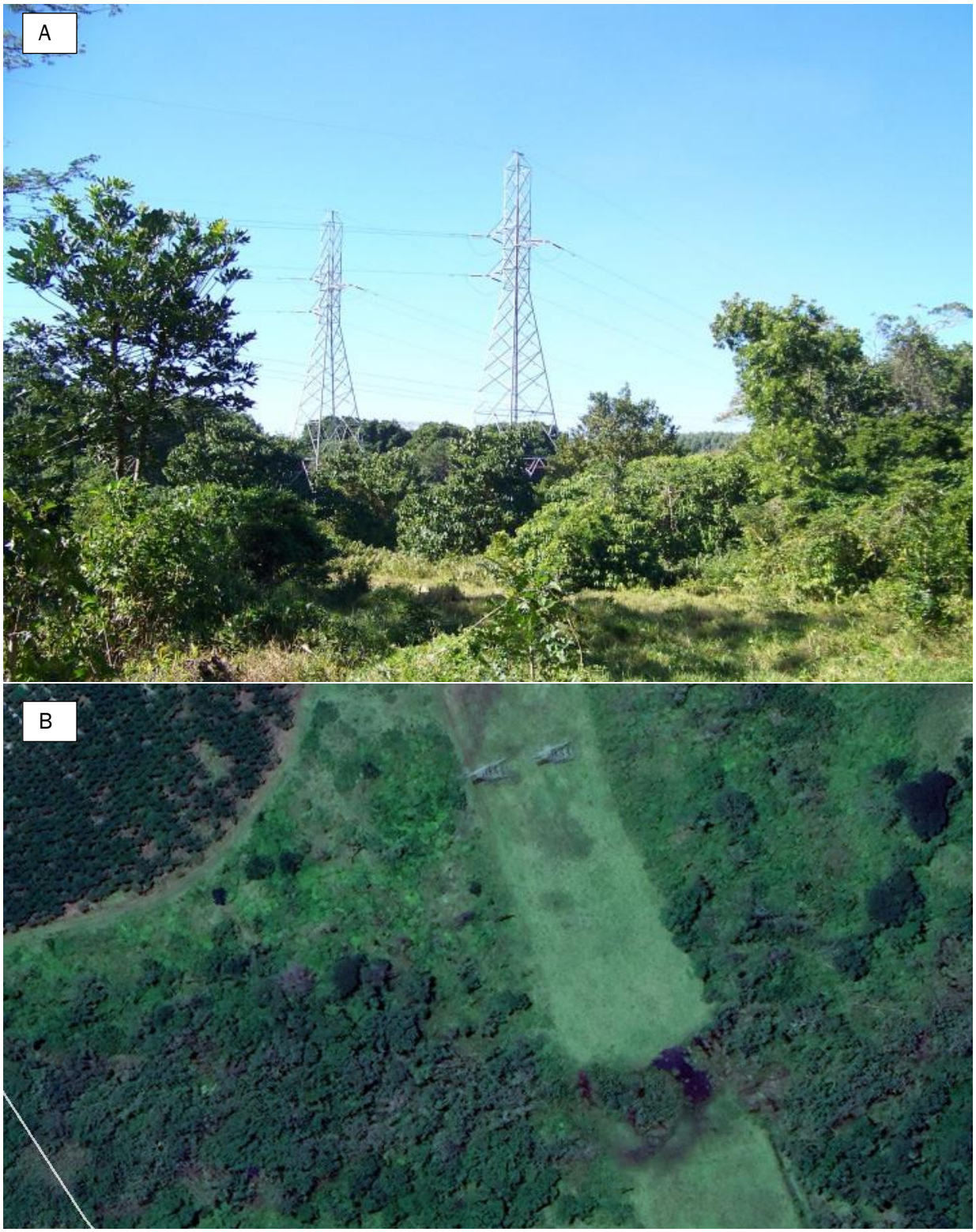

Figure 2: A) An example of vegetation clearance - a 132 kV line passing through a section of swamp forest near Port Durnford south of Richards Bay (Photo: SDP); and B) An aerial image of the same corridor pictured in (a), indicating extent of the cleared vegetation (Google Earth).

6 CORRIDOR DESCRIPTION

6.1 Vegetation and spatial definition

The IOCB is defined by five dominant vegetation types (Mucina & Rutherford, 2006). These are generally termed:

- CB 1 – Maputaland Coastal Belt
- CB 2 – Maputaland Wooded Grassland
- CB 3 – KwaZulu-Natal Coastal Belt
- CB 4 – Pondoland-Ugu Sandstone Coastal Sourveld
- CB 5 – Transkei Coastal Belt

The drivers, characteristics and conservation significance of the abovementioned five vegetation types are summarised in Table 3 below (adapted from Mucina & Rutherford, 2006).

The climate of the east coast of southern Africa is controlled by the presence of a high pressure system lying to the east of the sub-continent and intermittently, the area is influenced by low pressure systems arising from the Southern Ocean, particularly during winter. In the late summer, cyclonic systems moving across the Indian Ocean often lead to catastrophic storm events along the coastline (Tinley, 1985). Such meteorological regime plays a significant role in determining the form of habitats that are found within the IOCB (Mucina and Rutherford 2006, SDP 2015) and (see Table 4), it is clear that there is significant variation and differentiation in the climate regime from the south of the IOCB to the north. This variance gives rise in part, to fundamentally differing habitat types within the IOCB. For example, within the northern areas, grasslands and forest habitats that are proximal to the coastline, are subject to intensive storm activity associated with cyclonic activities (Tinley, 1985), which play a key role in forest gap dynamics (Yamamoto, 1996), while the high level precipitation associated with these events is an important driver in grassland and woodland communities in the north of KZN. Rainfall in the southern extent of the IOCB is comparatively less than that encountered in the north, although less seasonal with a more bimodal rainfall regime. It is perhaps due to these drivers that these vegetation types are primarily grassland and open woodland-mosaic environments which form an association of habitats within any given range.

Table 3: The five defining vegetation groups of the Indian Ocean Coastal Belt (Mucina & Rutherford, 2006).

Vegetation Type	Distribution	Vegetation and Landscape Features	Geology and Soils	Climate	Endemic Taxa
CB 1	KZN Province and Southern Mozambique. Mozambique border to Mtunzini	Flat coastal plain. Densely forested in places. Range of nonforest vegetation communities – dry grasslands/palmveld, hygrophilous grasslands and thicket.	18 000 year old Quaternary sediments of marine origin. Berea and Muzi Formations of the Maputaland Group.	Weak rainfall seasonality at the coast. Summer rainfall inland. Up to 1200 mm rain per annum. High humidity. Mean maximum temperature – 35.3°C and Mean minimum temperature 5.5°C.	Herbs: *Helichrysum adenocarpum* subsp. *Ammophilum. Vahlia capensis* subsp. *Vulgaris var. longifolia*. Geophytic herbs: *Asclepias gordon-grayae, Kniphofia leucocephala, Raphionacme lucens.* Graminoid: *Restio zuluensis.*
CB 2	KZN Province and Southern Mozambique. Mozambique border to Sileza, Sibaya, Mseleni, Mbazwana, Sodwana Bay, Ozabeni, Eastern and Western Shores of Lake St Lucia, Kwambonambi and Richards Bay.	Flat coastal plain. Sandy grasslands rich in geophytic suffrutices, dwarf shrubs, small trees and rich herbaceous flora.	Quaternary redistributed sands of the Berea formation (Maputaland Group). Shallow water table.	Weak rainfall seasonality at the coast. Summer rainfall inland. Up to 1200 mm rain per annum. High humidity. Mean maximum temperature – 35.3°C and Mean minimum temperature 5.5°C, same as CB 1.	Geoxylic suffrutices: *Ochna* sp. nov., *Syzigium cordatum*. Succulent herb: *Aloe* sp. nov. Geophytic herb: *Brachystelma vahrmeijeri*.
CB 3	KZN Province. Mtunzini to Margate and Port Edward	Highly dissected undulating coastal plains. Subtropical coastal forest presumed to have been dominant. *Themeda triandra* dominated primary grassland.	Varying Natal Group Sandstone, Dwyka Tillite, Ecca shale and Mapumulo gneiss. Berea Red Sand in places.	Summer rainfall. High humidity. No frost. Mean maximum temperature – 32.6°C and mean minimum temperature – 5.8°C (Durban).	Herb: *Vernonia africana* (extinct). Geophytic herb: *Kniphofia pauciflora*. Low shrub: *Barleria natalensis* (extinct).
CB 4	Eastern Cape and KZN Province. Port St. Johns to Port Shepstone.	Coastal peneplains and undulating hills with flat table lands and very steep slopes of river gorges. Species rich grassland punctuated with scattered low shrubs or small trees.	Restricted to sandstones of the Msikaba Formation	Summer rainfall. No to infrequent frost. Mean maximum temperature – 32.2°C and mean minimum temperature – 5.8°C (Paddock).	Graminoid: *Fimbristylis vareigata.* Herbs: *Eriosema umtamvunense, Geranium sparsiflorum, Lotononis bachmanniana, Selago peduncularis, Senecio erubuscens var. incisus*. Geophytic herbs: *Brachystelma austral, B. kerzneri, Watsonia inclinata, W. mtamvunae*. Geoxylic suffrutex: *Rhus acocksii*. Low shrubs: *Leucadendron spissifolium subsp. natalense, L. spissifolium subsp.*

Vegetation Type	Distribution	Vegetation and Landscape Features	Geology and Soils	Climate	Endemic Taxa
					oribinum, Acalypha sp. nov., Anthospermum steryi, Erica abbottii, E. cubica var natalensis, Eriosema dregei, E. latifolium, E. luteopetalum, Euryops leiocarpus, Gnidia triplinervis, Leucadendron pondoense, Leucospermum innovans, Raspalia trigyna, Struthiola pondoensis, Syncolostemon ramulosus, Tephrosia bachmannii. Tall shrub: Tephrosia pondoensis.
CB 5	Eastern Cape Province. Port St. Johns to Great Kei River.	Highly dissected, hilly coastal country. Alternating steep slopes of low reach river valleys and coastal ridges. Grasslands on higher elevations alternative with bush clumps and small forests.	Karoo Supergroup Sediments – sandstone and mudstone of the Adelaide Subgroup. Shale, mudstone and sandstone of the Ecca Group and Dwyka tillite.	Summer rainfall with some winter rain. No frost. Mean minimum temperature of 7.7 °C (Bashee Lighthouse).	None listed.

Additionally, edaphic form and structure within the IOCB can also be considered a primary driver of many of these habitats, tempering growth in woody species through the availability of freshwater and nutrients. The influence of anthropogenic factors, mainly fire but often the grazing of livestock, must also be considered one of the major drivers of the habitat forms within the IOCB, particularly over the last 500 years (McCracken, 2008).

Table 4: Comparative meteorological data from urban centres located in the south, centrally and north of the IOCB

		St Lucia	Durban	East London
Temperature (˚C)	Maximum.	29.3	28.1	24.5
	Minimum.	17.5	11.3	9.8
	Annual average	21.7	20.9	18.2
	Variance	11.8	7.7	14.7
Rainfall (mm)	Annual average	1129	975	822
	Average maximum	139	125	97
	Average minimum	58	30	36
Wind velocity (km/h)	1954-1963 (15h00)	20	20	17

(Data source: http://en.climate-data.org)

Associated with the five main IOCB vegetation types are a number of additional zonal, azonal and intrazonal vegetation units such as “sand forest” and “lowveld riverine forest”. These vegetation units are, from a holistic, ecological perspective, interwoven into the broader eco-type that defines the “KZN coastal belt” and, bearing in mind that the definition of “vegetation unit” and “biome” are fundamentally scientific constructs, these units should also be given recognition and considered holistically in any review of coastal habitat in KZN and the IOCB. Table 5 indicates the 11 vegetation units that are considered to be primarily “terrestrial” in nature and lie within or adjacent to the IOCB, as defined.

Where the establishment of the EGI serves to influence and change the ecosystem drivers, it should be expected that ecological change will result (e.g. the cessation of the fire regime).

Notably, of the eleven vegetation units under consideration in the south eastern coastal extent, two of the five units within the IOCB are considered to be “endangered”, while three are considered to be “vulnerable” (Table 5). Comparatively, two of the four forest types are considered “critically endangered”, while the rest are considered to be “least threatened” (Table 5). These ecological aspects are afforded some further consideration below. Figure 4 provides a spatial representation of the IOCB within the expanded Eastern EGI corridor and the various vegetation types associated with the IOCB as well as adjacent vegetation types. Often the boundary between the IOCB and adjacent vegetation types can be indistinct with areas of overlap occurring.

Table 5: Summary of the veld types encountered within or proximal to the IOCB including azonal and intrazonal vegetation units as well as key zonal units that may be encountered within the expanded Eastern EGI Corridor (Mucina and Rutherford 2006)

Vegetation Type	Code	Biome/Veg. Unit	Distribution	No. of endemic taxa	Conservation status (SANBI)	Comment
Sub-tropical dune thicket	AZs3	Eastern strandveld	Azonal, associated with stable secondary dunes and beyond.	2	Least threatened/Not listed	Threatened by heavy metal dune mining - prospecting and extraction. Alien plant invasion is common. Low likelihood of interface with EGI except where corridor arises close to coastline (Northern KZN)
Sub-tropical seashore vegetation	AZd4	Seashore vegetation	Azonal, associated with frontal coastal dunes	5	Least threatened/Not listed	Transformed by tourism development. Low likelihood of interface with EGI
Maputaland Coastal Belt	CB1	IOCB	Mtunzini in KZN northwards to Southern Mozambique - landward up to 35km.	6	Least threatened/Not listed	Transformed by plantations. High levels of plant diversity in northern areas around Mozambique border. Highly transformed in RSA, some well-preserved areas in iSimangaliso Wetland Park and Mozambique. Probable likelihood of interface with EGI corridor
Maputaland Wooded Grassland	CB2	IOCB	Southern Mozambique to south of St Lucia. Primarily on coastal plain surrounding inter dune depressions / wetlands	4	Vulnerable	Exploited primarily for commercial and small scale woodlot plantation. Probable to high likelihood of interface with EGI corridor
Kwazulu-Natal Coastal Belt	CB3	IOCB	South of the uMlalazi River, near Richards Bay to Port Edward	1	Vulnerable	Subject to variable impacts including mining, urban settlement and agriculture. Low likelihood of interface with EGI corridor
Pondoland-Ugu Sandstone Coastal Sourveld	CB4	IOCB	Approximately from Port Shepstone to Port St Johns. Primarily coastal areas but up to 20kms inland at points	33	Endangered	Associated with rocky cliff-type environments. May be associated with EGI inland of Port Shepstone. Possible, but unlikely interface with EGI corridor inland / south coast of KZN
Transkei Coastal Belt	CB 5	IOCB	Coastal areas south of Port St Johns to Kei River. Undulating topography with grassland and valley forests	0	Least threatened/Not listed	Present within IOCB but with little likelihood of interface with EGI corridor

Vegetation Type	Code	Biome/Veg. Unit	Distribution	No. of endemic taxa	Conservation status (SANBI)	Comment
Lowveld Riverine Forest	FOa1	Azonal forest	Azonal forest associated with river systems. Primarily Phongolo, Mkhuze and uSutu Rivers	0	Vulnerable	Under threat from subsistence agriculture and alien invasion as well as changes to river systems
Scarp Forest	FOz5	Azonal forest	Azonal forest associated with rocky areas, distributed from Northern KZN to Eastern Cape.	49	Vulnerable	Intermittent across KZN escarpment and coastal environment. Although “niche” type environment, the EGI poses some, primarily indirect threat to this vegetation unit, where the corridor spans escarpments. Possible points of interface in Northern and Central KZN
Northern Coastal Forest	FOz7	Zonal forest	Extends from Eastern Cape north to Mozambique/Tanzania. Found at 10 -150m msl	1	Endangered	Under threat on coastal dunes. Includes "dune forest" (Acocks, 1954) which is under threat from mineral exploitation and settlement. Limited probability of interface with EGI corridor
Sand Forest	FOz8	Intrazonal forest	Fragmented patches - Mozambique (Tembe region) at between 20 - 160m msl	14	Least threatened/Not listed	Associated with paleo dunes in Northern KZN. Interface with EGI corridor likely in northern region of KZN

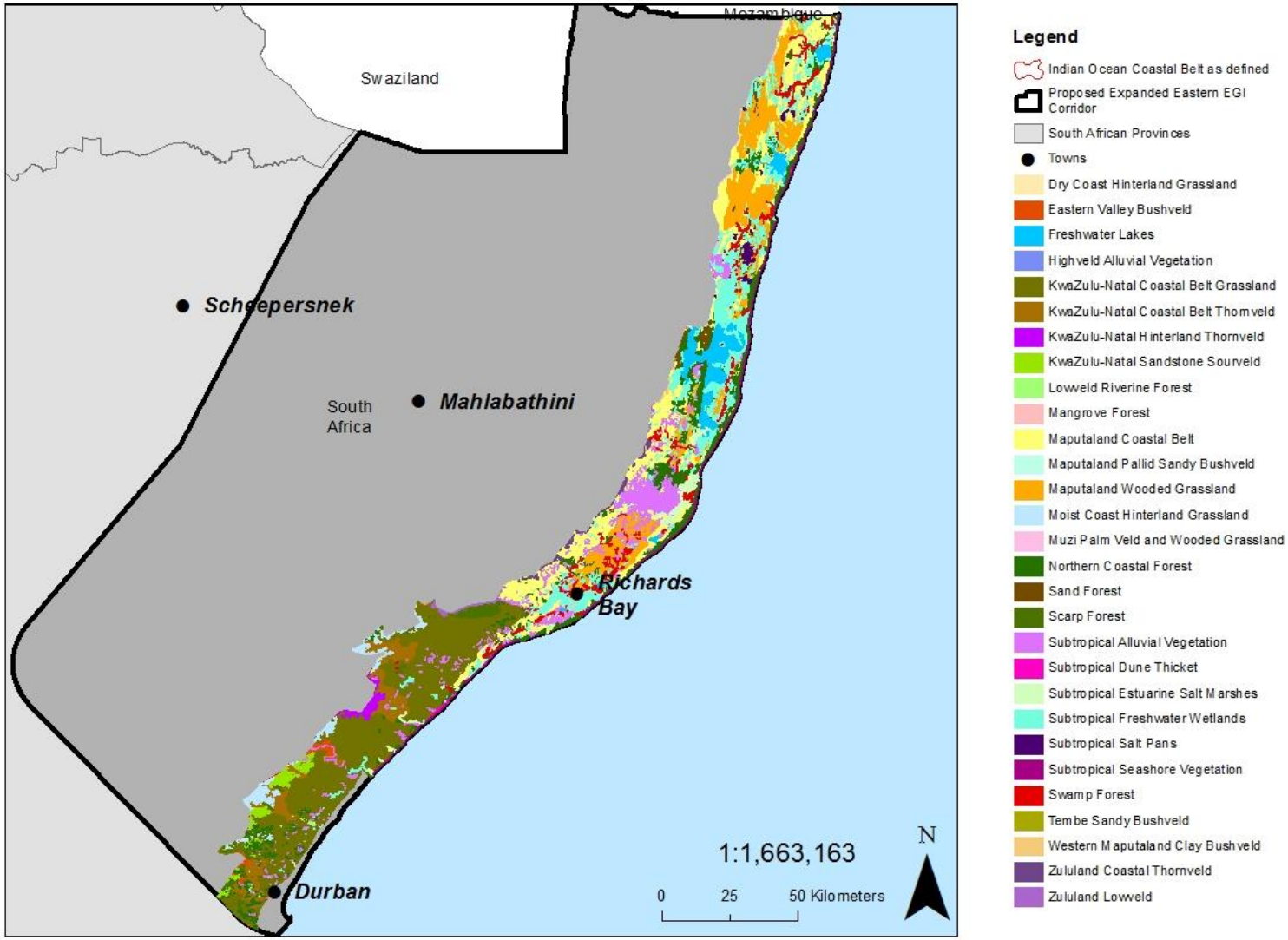

Figure 3: An overview of the vegetation types, including azonal vegetation of the IOCB affected by the expanded Eastern EGI corridor (SANBI 2012).

6.2 Vegetation types of the IOCB

A description of the vegetation types that characterise the IOCB (as defined by Mucina and Rutherford 2006) is provided below.

6.2.1 CB 1 – Maputaland Coastal Belt

The Maputaland Coastal Belt vegetation type is restricted to the north of the Expanded Eastern EGI corridor, primarily to areas north of Richards Bay. The habitat comprises of a grassland mosaic and often secondary forest dominated by species such as *Syzigium cordatum, Acacia natalitia* and *Phoenix reclinata* (Figure 4). In northern KZN the habitat type is found primarily within an undulating terrain of sands to clayey sands, often interspersed with shallow depression wetlands which are paleo dune slacks. The veld type is considered to be "vulnerable" from an ecological conservation perspective, although recent review of habitat destruction around the iSimangaliso Wetland Park suggests that settlement in the region has seen a rate of loss of this veld type of up to 105 ha per year (SDP, 2015) which would suggest that the vegetation unit is under increasing anthropogenic pressures.

Figure 4: Example of Maputaland Coastal Belt vegetation near Mbazwana (Photo: SDP).

6.2.2 CB 2 – Maputaland Wooded Grassland

Maputaland Wooded Grassland has been defined as a "sub-class" of CB1 on account of the absence of wetland environments and variation in species composition (Figure 5). The major threat to this habitat form has been the expansion of the silviculture industry in the north of KZN (primarily *Eucalyptus* spp and in some areas *Pinus* spp) which is the most appropriate economic land use in the nutrient poor sands that dominate this area.

Figure 5: Example of Maputaland Wooded Grassland near Kwandalane (Photo: SDP).

6.2.3 CB 3 – KwaZulu-Natal Coastal Belt

CB3 stretches from south of the uMlalazi River to Port Edward (Transkei) in a broad band that runs parallel to the coastline. The landscape comprises of a mosaic of grassland and forested habitat, the latter normally associated with lower elevations (Figure 6). Notably fire and grazing has played a significant role in the establishment of this veld type. The expanded Eastern EGI corridor may interface with this habitat in northern KZN, but the habitat form is not expected within the corridor through the City of Durban.

Significant transformation has taken place within this vegetation unit, attributed primarily to agriculture and urban expansion. Within abandoned agricultural fields, a secondary habitat may arise of similar form but devoid of a number of key graminoid, herbaceous and woody species.

Figure 6: Typical KwaZulu-Natal Coastal Belt located near Mtunzini (Photo: SDP).

6.2.4 CB 4 – Pondoland-Ugu Sandstone Coastal Sourveld

Pondoland-Ugu Sandstone Coastal Sourveld is a highly diverse habitat form found primarily to the south of KZN and associated with sandstone geologies (Figure 7). The azonal Scarp Forest may be encountered in association with this veld type, particularly in the southern extent of the IOCB. CB4 may also be encountered some distance from the coast, although it is primarily associated with the lower to mid elevations, below the KZN escarpment. This vegetation type does not occur within the expanded Eastern EGI corridor.

6.2.5 CB 5 – Transkei Coastal Belt

The Transkei Coastal Belt (Figure 8) is located along the coastline of the northern Eastern Cape southwards to beyond East London. This vegetation unit will not be affected by the expanded Eastern EGI corridor.

Figure 7: Pondoland-Ugu Sandstone Coastal Sourveld near Margate (Photo: SDP).

Figure 8: Transkei Coastal Belt located near Port St Johns (Photo: SDP).

6.2.6 Azonal, zonal and intra zonal vegetation types

Within the IOCB are embedded a number of zone specific and azonal vegetation types (Table 6). Some are unique to the IOCB, and others have a wider distribution. Azonal vegetation types are thus included in the definition of the IOCB and are themselves often considered to be "sensitive" habitats, worthy of conservation. Table 6 presents the most predominant and significant azonal, terrestrial vegetation types within the IOCB, however most of these vegetation forms are aligned with riverine, wetland or estuarine habitats which are subject to separate review by specific authors covering those habitats. In addition, some consideration and expansion on those vegetation types that are most likely to be encountered in the IOCB is presented below, these vegetation forms being:

- FOa 1 Lowveld Riverine Forest
- FOz 5 Scarp Forest
- FOz 8 Sand Forest
- FOz 7 Northern Coastal Forest
- AZs 3 Subtropical Dune Thicket
- AZd 4 Subtropical Seashore Vegetation

Table 6: Azonal and intrazonal vegetation found within the Indian Ocean Coastal Belt (Mucina and Rutherford 2006).

Vegetation type	Description	Conservation status (NEMBA 2011)
FOa 1 Lowveld Riverine Forest	Tall forests fringing larger rivers (gallery forest) and pans. Dominated by *Ficus sycamorus* or *Diospyros mepiliformis*. Forests are dense, tall, structured and with a well-developed shrub layer.	Vulnerable
FOz5 Scarp Forest	Stratified forest with high canopy and shrub strata, with a number of epiphytic species associated with sub canopy.	Vulnerable
FOz7 Northern Coastal Forest	Moderately stratified forest with poor herb layer and some dominant shrubs.	Endangered
FOz8 Sand Forest	Stratified forest in patches associated with paleo dunes – well developed shrub strata and poor herb layer.	Least threatened/Not listed
FOa 2 Swamp Forest	12 – 15 m forests with two main strata (canopy and shrub layer). Dominant trees include: *Ficus trichopoda, Barringtonia racemose, Casearia gladiiformis, Cassipourea gummiflua, Syzigium cordatum, Phoenix reclinata, Raphia australis*. Understorey poorly developed.	Vulnerable
FOa 3 Mangrove Forest	Species poor and often monospecific, low and dense forests in tidal zones of coastal lagoons.	Endangered
AZe 3 Subtropical Estuarine Salt Marshes	Estuaries and coastal salt-marsh plains supporting complexes of low herbs dominated by succulent chenopods and other flood tolerant halophytes. Salt marsh meadows dominated by Spartina flooded swards and submerged Zostera sea meadows are often present.	Least threatened/Not listed
AZs 3 Subtropical Dune Thicket	Very dense shrubby thickets of spiny shrubs, large leaved mega herbs, dwarfed tree species, abundant vines and with poorly developed undergrowth due to shading by the closed canopy.	Least threatened/Not listed
AZd 4 Subtropical Seashore Vegetation	Open, grassy, herbaceous, dwarf shrubby and often dominated by a single species of pioneer character. Plant communities are representative of the age of the substrate.	Least threatened/Not listed
AZf 6 Subtropical Freshwater Wetlands	Flat topography supporting low beds dominated by reeds, sedges and rushes, water logged meadows dominated by grasses. Typically associated with depressions, alluvial backwater pans and artificial dams.	Least threatened/Not listed
Aza 7 Subtropical Alluvial Vegetation	Flat alluvial riverine terraces supporting an intricate complex or macrophytic vegetation, marginal reed belts as well as extensive flooded grasslands, ephemeral herblands and riverine thickets.	Least threatened/Not listed

6.2.7 FOa 1 Lowveld Riverine Forest

Lowveld Riverine Forest is confined primarily to riverine environments in and around the northern regions of KZN, extending into Mpumalanga Province. The forest type is generally associated with alluvial soils and may be subject to some level of inundation under flood events. The vegetation form comprises of a stratified forest canopy with a number of tall dominant species - in KZN this species being *Ficus sycamorus*. Lowveld Riverine Forest is particularly abundant on the Phongolo River system (Figure 9), but may be encountered further to the south.

This vegetation type has succumbed to significant levels of clearance to make way for agricultural activities in and around floodplains. The clearance of sub canopy layers within forest systems has also led to invasion by exotic plant species. This forest type is considered to be vulnerable.

Figure 9: Image of Lowveld Riverine Forest on Phongolo River. (Photo: SDP)

6.2.8 FOz 5 Scarp forest

Scarp forest is a stratified forest form that is primarily associated with cliffs and rocky krantzes (Figure 10). This forest type extends from the Lebombo Mountain range in Northern KZN through to the southern extent of the IOCB in the Eastern Cape. The vegetation type is considered to be vulnerable from a conservation perspective on account of the fact that it is associated with steep and rocky areas not generally sought after for settlement and other human land use requirements. Notably, Mucina & Rutherford (2006) recognise this as “the most valuable forest form in South Africa”, counting important taxa such as *Streptocarpus* spp and *Encephalartos* spp as being endemic to this habitat form.

While the anthropogenic impact pressures on Scarp Forest are considered to be limited, the EGI, on account of its linear nature, may have some direct and more predictably indirect, impact on Scarp Forest as power lines traverse over valleys and escarpments. Indirect impacts are difficult to forecast but may relate to the influence that such lines have on fauna associated with this forest type, in particular avifauna.

Figure 10: Image showing Scarp Forest near Ongoye Forest between Mtunzini and Eshowe. (Photo: SDP)

6.2.9 FOz 8 Sand forest

Sand forest does not ostensibly lie within the IOCB as defined in this investigation, however as a highly fragmented and edaphic-driven forest form (Figure 11). Sand Forest is likely to be encountered in small to moderate sized pockets within the IOCB. It is considered to be least threatened from a conservation perspective on account of indiscriminate settlement in northern KZN and its affiliation to ancient aeolian soils. Sand forest is noted as being the "core" of the Maputaland Centre of Endemism (Van Wyk & Smith, 2001). This forest type has a high number of endemic plant species and is also noted to be associated with key faunal species such as the Tonga red squirrel (*Paraxerus palliatus tongensis).*

Figure 11: Image of Sand Forest, located near Ndumo. (Photo: SDP)

6.2.10 FOz 7 Northern Coastal Forest

This forest veld type is particularly well developed in the region between Richards Bay and Kosi Bay, primarily along the upper and landward portions of the high secondary dunes at the coast (Acocks, 1954) (Figure 12). This forest form is common to those areas that have been identified as being subject to the mining of heavy minerals and therefore is presently subject to this and other anthropogenic pressures. Due to the ongoing clearance and loss of this forest form, Northern Coastal Forest is considered to be "endangered" from a conservation perspective, although such classification is perhaps misguided.

The EGI may interface with communities of Northern Coastal Forest in the north, where the corridor is situated proximal to the coastline, however much of the forest in this area lies within the iSimangaliso Wetland Park and should therefore remain outside of the final corridor alignment and associated EGI route.

Figure 12: Northern Coastal Forest within the iSimangaliso Wetland Park. (Photo: SDP)

6.2.11 AZd 4 Subtropical Seashore Vegetation

This azonal vegetation type is located within the Eastern Cape and KwaZulu-Natal provinces, extending from Kei Mouth in the south to the Mozambique border and is associated with coastal dune features, near the shoreline. Vegetation consists of open, grassy, herbaceous, dwarf shrub vegetation. This vegetation type is considered to be "least threatened/not listed" with sufficient coverage in statutorily protected areas to meet conservation targets (Mucina & Rutherford 2006; Tinley, 1985). Due to the confinement of AZd 4 to the near shore environment, this vegetation type is unlikely to be affected by the EGI.

6.2.12 AZs 3 Subtropical Dune Thicket

The distribution of Subtropical Dune Thicket is similar to AZd 4, however this habitat does differ in species composition and structure. Vegetation within Sub tropical Dune Thicket comprises of very dense, shrubby thickets often with dwarf tree species, abundant vines and a poorly developed undergrowth due primarily to shading by the closed canopy (Figure 13). This vegetation type is associated with recent dunes overlying calcretes. This vegetation type is also considered to be "least threatened" and is unlikely to be affected by the expanded Eastern EGI corridor.

Figure 13: Image of Subtropical Dune Thicket located near Sodwana Bay (Photo: SDP).

6.3 Threatened Plant Species

Figure 14 provides an overview of the distribution of threatened plant species within the affected portions of the IOCB. Although the data is not exhaustive, it provides an indication of the areas where threatened plants may be encountered. Clusters and potential “hotspots” appear to be concentrated in or around formally protected areas – Umlalazi Nature Reserve, Ongoye Forest and Isimangaliso Wetland Park – with isolated occurrences outside of these areas. No critically endangered species were identified by the data, with the threatened plant species present characterised as endangered or vulnerable.

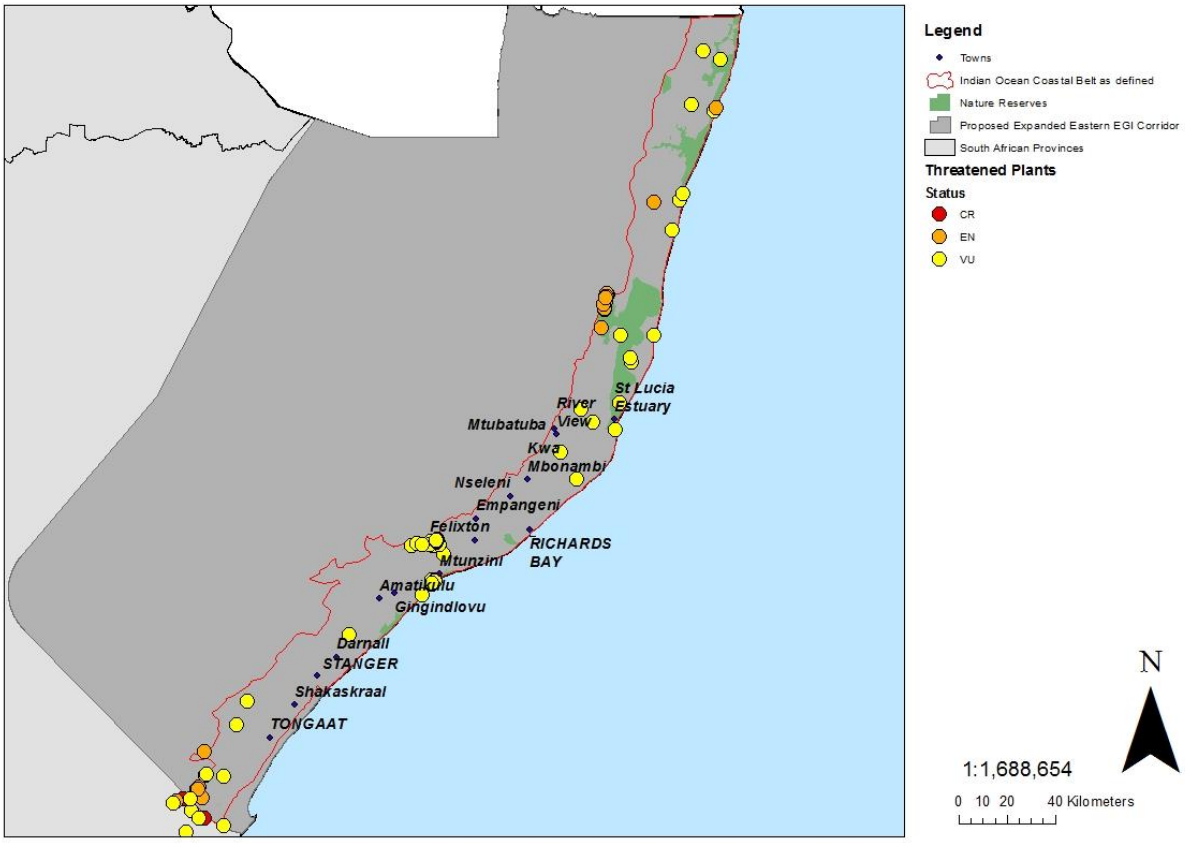

Figure 14: The distribution of recorded threatened plant species within the IOCB portion of the Expanded Eastern EGI Corridor.

With specific reference to Ongoye Forest, a review of the management plan (KZN Wildlife 2009) indicated a list of 18 plants of conservation value (Table 7). These included not only threatened plant species, but other plant species that are important endemics associated with the forest ecosystem or are representative of climax vegetation and habitat. One species is considered to be extinct in the wild. The importance of this and similar isolated pockets of natural vegetation within the IOCB cannot be overstated.

Table 7: Recorded plant species of conservation importance associated with the Ongoye Forest complex and Reserve.

Species	Category/Comment
Asclepias gordon-grayae	EN
Adenia gummifera	LC
Alchornea hirtella	Range outlier
Begonia dregei	EN
Bolusiella maudiae	Endemic
Dahlgrenodendron natalense	EN
Emplectanthus caudatus	Endemic
Encephalartos ngoyanus	VU
Dierama sp nov	Endemic
Melittia sutherlandii	LC, Keystone species for climax forest canopy
Olyra latifolia	Range outlier
Phyllanthus cedrelifolius	Range outlier
Protea caffra	Affected by habitat degradation
Streptocarpus wendlandii	Rare
Senecio ngoyanus	VU
Siphonochilus aethiopicus	CR
Stangeria eriopus	VU
Encephalartos woodii	EW - Extinct in the wild

6.4 Fauna

The IOCB occupies a climatic niche identified using the Koppen – Geiger classification system as Cfa (*warm temperate; fully humid; hot summer*) (Kottek et al., 2006). This climatic regime, as explained above, as well as a topographically diverse environment and a relatively recent history of human settlement has given rise to some diverse ranges of habitat and a concomitantly diverse faunal assemblage.

It follows that both **habitat form and structure** and **faunal presence,** as well as the interface between these two elements forms the guiding pre-requisites for evaluation of suitable line routes within the EGI corridor strategic plan for the IOCB. However, the rapid expansion of human settlement in the region, particularly following the nagana of the 1860s has seen the confinement of much of the larger fauna to protected areas and private game farms, while smaller species, including invertebrates are confined to niche environments, such as scarp forest, that are not affected by human activities. Notably, some species have benefitted from human settlement and agricultural activities, at the expense of others.

The subtropical climate experienced by the IOCB, as well as the availability of water, offer suitable habitat for a wide range of fauna. The network of protected areas, particularly in the northern portion of the IOCB are critical for the maintenance of faunal biodiversity, in the wake of the extensive disturbance which has been associated with urbanisation, peri-urban settlement and agriculture in surrounding area with the IOCB.

Analysis of available species data for amphibians, reptiles and butterflies (SANBI, 2018) indicated clusters of occurrence correlating with protected areas/more intact habitat areas within the IOCB in the Expanded Eastern EGI Corridor (Figure 15). Of the 47 amphibian species present, only two were threatened (near threatened and endangered, Table 8). The reptile species present (17 in total) were all threatened with only one species being deemed “data deficient” and the other not having a listing category (Table 9). The lepidoptera or butterfly data lacked a clear species reference, but data indicated that the majority of species present were classified as endangered or threatened.

Table 8: Recorded amphibian species associated with the portion of the IOCB that falls within the extended Eastern EGI corridor.

Species	Common Name	Redlist Category
Afrixalus aureus	Golden Leaf-folding Frog	LC
Afrixalus delicatus	Delicate Leaf-folding Frog	LC
Afrixalus fornasini	Greater Leaf-folding Frog	LC
Afrixalus spinifrons	Natal Leaf-folding Frog	LC
Arthroleptis stenodactylus	Shovel-footed Squeaker	LC
Arthroleptis wahlbergii	Bush Squeaker	LC
Breviceps adspersus	Bushveld Rain Frog	LC
Breviceps mossambicus	Mozambique Rain Frog	LC
Breviceps sopranus	Whistling Rain Frog	LC
Cacosternum boettgeri	Boettger's Caco	LC
Cacosternum nanogularum	Small-throated Dainty Frog	LC
Cacosternum nanum	Bronze Caco	LC
Cacosternum rhythmum	Rhythmic Dainty Frog	LC
Chiromantis xerampelina	Grey Foam-nest Tree Frog	LC
Hemisus guttatus	Spotted Shovel-nosed Frog	NT
Hemisus marmoratus	Mottled Shovel-nosed Frog	LC
Hyperolius acuticeps	Sharp-nosed Reed Frog	LC
Hyperolius argus	Argus Reed Frog	LC
Hyperolius horstockii	Arum Lily Frog	LC
Hyperolius marmoratus	Painted Reed Frog	LC
Hyperolius pickersgilli	Pickersgill's Reed Frog	EN
Hyperolius poweri	Power's Reed Frog	LC
Hyperolius pusillus	Water Lily Frog	LC
Hyperolius semidiscus	Yellow-striped Reed Frog	LC

Species	Common Name	Redlist Category
Hyperolius tuberilinguis	Tinker Reed Frog	LC
Kassina maculata	Red-legged Kassina	LC
Kassina senegalensis	Bubbling Kassina	LC
Leptopelis mossambicus	Brown-backed Tree Frog	LC
Leptopelis natalensis	Natal Tree Frog	LC
Phyrynobatrachus acridcides	East African Puddle Frog	LC
Phyrynobatrachus mababiensis	Mababe Puddle Frog	LC
Phyrynobatrachus natalensis	Snoring Puddle Frog	LC
Phrynomantis bifasciatus	Banded Rubber Frog	LC
Ptychadena anchietae	Plain Grass Frog	LC
Ptychadena mascareniensis	Mascarene Grass Frog	LC
Ptychadena mossambicus	Broad-banded Grass Frog	LC
Ptychadena oxyrhynchus	Sharp-nosed Grass Frog	LC
Ptychadena porosissima	Striped Grass Frog	LC
Pyxicephalus adispersus	Giant Bull Frog	LC
Pyxicephalus edulis	African Bull Frog	LC
Schismaderma carens	Red Toad	LC
Strongylopus fasciatus	Striped Stream Frog	LC
Tomopterna cryptotis	Tremelo Sand Frog	LC
Tomopterna krugerensis	Knocking Sand Frog	LC
Tomopterna marmorata	Russet-backed Sand Frog	LC
Tomopterna natalensis	Natal Sand Frog	LC
Xenopus laevis	Common Platanna	LC

Table 9: Recorded reptile species associated with the IOCB within the extended Eastern EGI corridor.

Species	Common Name	Redlist Category
Bitis gabonica	Gaboon Adder	NT
Bradypodion caeruleogula	uMlalazi Dwarf Chameleon	EN
Bradypodion melanocephalum	KwaZulu Dwarf Chameleon	VU
Caretta	Loggerhead Turtle	VU
Chamaesaura macrolepis	Large-scaled Grass Lizard	NT
Chelonia mydas	Green Turtle	NT
Crocodylus niloticus	Nile Crocodile	VU
Cryptoblepharus boutonii	African Coral Rag Skink	EN
Dendroaspis angusticeps	Green Mamba	VU
Dermochelys coriacea	Leatherback Turtle	EN
Eretmochelys imbricata	Hawksbill Turtle	NT
Leptotyphlops sylvicolus	Forest Thread Snake	DD
Lycophidion pygmaeum	Pygmy Wolf Snake	NT
Macrelaps microlepidotus	Natal Black Snake	NT
Natriciteres olivacea	Olive Marsh Snake	NA
Pelusios rhodesianus	Variable Hinged Terrapin	VU
Scelotes inornatus	Durban Dwarf Burrowing Skink	CR

With reference to Figure 15, The Futululu and Dukuduku Forest areas as well as the Umfolozi floodplain between St Lucia and Mtubatuba indicate a concentration of reptile records, indicating a potential “hot spot” that should be avoided. In this instance the majority of records were *Bitis gabonica* (Gaboon adder). This species is found within the intact moist grasslands and forest margins that are present in this area. Another potential “hot spot” is Ongoye Forest inland of Mtunzini. This scarp forest and reserve is shown to support butterfly, amphibian and reptile species as per the SANBI Data.

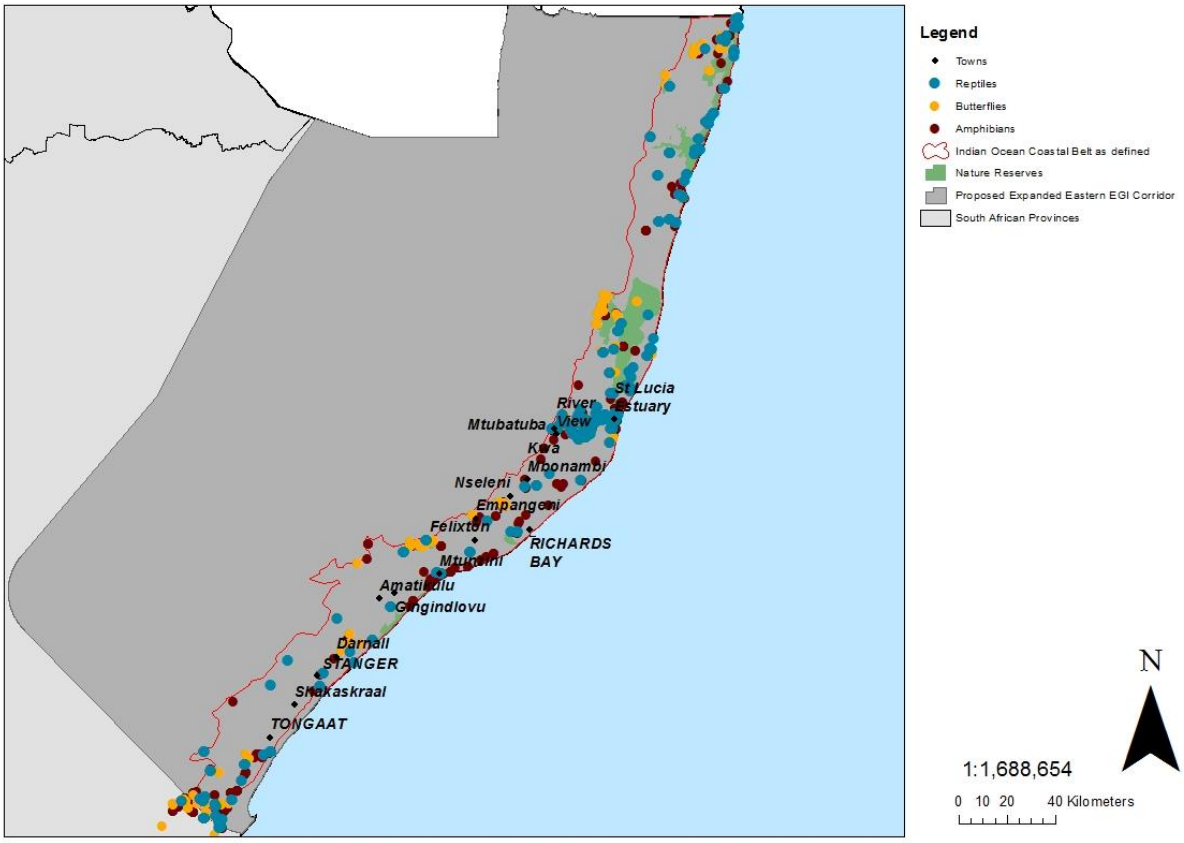

Figure 15: Distribution of recorded reptiles, amphibians and butterflies within the IOCB and expanded Eastern EGI corridor.

6.5 Transformation within the IOCB

The extent of the IOCB is as mentioned, limited, extending to a maximum of 50 km inland from the coast, at its widest point. As such, the expanded Eastern EGI corridor intersects with the IOCB only in its most eastern extent of the corridor (refer to Figure 1) and the IOCB accounts for about a third of the affected habitat within this corridor. The balance of the corridor, located to the west, falls within the Savanna biome.

Much of the IOCB has been subject to human settlement, initially in a highly dispersive manner with the advent of the Nguni tribes some 500 years ago, followed by more recent and rapid transformation arising from European settlement, which commenced approximately 150 years ago. Since that time, the land use within the IOCB has undergone significant change. Land uses have varied primarily according to economic impetuses, with agricultural practices evolving from initially livestock farming, through to crops as varied as coffee, cotton, timber and sugar cane (Figure 16). In the early 21st Century, land use within the IOCB can be considered to comprise primarily of the following:

- **Urban sprawl** – the expansion of existing urban nodes on account of inward migration of people to these areas has meant that towns and cities within the IOCB are rapidly extending. Attempts to contain urban expansion are not easy to implement as informal settlements arise on town peripheries and economic factors determine the levels of services that can be provided and afforded by residents. Generally, the so-called "ribbon effect" has arisen within the IOCB, which has seen urban settlement "creep" along the coastline of the east coast, effectively removing most of the more eastern extent of this biome.

- **Sugar cane cultivation**. Contributing to the loss of habitat within the IOCB, sugar cane cultivation is perhaps the most expansive agricultural activity in the region. Cane cultivation followed in the

footprints of earlier farming practices and became more expansive following the end of the First World War.

- **Other agricultural practices**. As the global price of sugar and its demand has varied so too have agricultural practices, as producers look to maintain their farming enterprises. Contemporary commercial farming practices have seen investment in crops such as macadamia nut, moringa and pineapple, as well as silvicultural practices. The impact of these crops on the habitats within the IOCB remains to be seen.

- **Major infrastructure**. Significant infrastructure within the IOCB includes major highways and road infrastructure, which serve to dissect habitats, while projects such as dams, harbours and pipelines alter the eco-morphological drivers of various components of the IOCB.

Figure 16: An example of the extent to which transformation has occurred within the IOCB. This particular area is between Tinley Manor and Blythedale north of Durban. The only natural vegetation that remains occurs along the coastline with pockets of Northern Coastal Forest and Swamp Forest extending inland (Photo: SDP)

A description of the nature of the expanded Eastern EGI Corridor, is provided below in Table 10. The expanded Eastern EGI corridor intersects with the northern-most extent of the IOCB, which makes up a narrow band along the eastern extent of the corridor. Table 10 provides a brief overview of this habitat form.

Table 10: Summary of the nature and characteristics of the expanded Eastern EGI corridor.

Site	Brief description
Expanded Eastern EGI Corridor	The expanded Eastern EGI corridor extends from Durban to the Mozambique border. The IOCB within this corridor comprises of Maputaland Coastal Belt (CB 1), Maputaland Wooded Grassland (CB 2) and KwaZulu-Natal Coastal Belt. Subtropical Freshwater Wetlands, Swamp Forest and Lowveld Riverine Forest are three significant azonal vegetation types found within this section of the IOCB. A prominent protected area and land use feature is the Isimangaliso Wetland Park, a Ramsar Site of significance and World Heritage Site. Isimangaliso Wetland Park extends from Maphelane, just north of Richards Bay to Kosi Bay and extends inland to the Mkuze Nature Reserve. iSimangaliso includes significant areas of swamp forest and riverine habitat as well as CB1 and CB2. To the south, the IOCB, between Durban and Richards Bay the IOCB is largely transformed, with the exception of a few outliers of undisturbed and protected habitat, such as the Amatikulu Nature Reserve (Dokodweni/Nyoni area) and the Ongoye Forest, near Mtunzini. Apart from the abovementioned outliers of natural habitat, urban sprawl, the N2 freeway, extensive sugar cane farming and silviculture, as well as dune mining near Mtunzini are major disturbance factors within this section of the IOCB.

7 FEATURE SENSITIVITY MAPPING

In compiling a spatial representation of the interface between habitat forms within the IOCB a set of protocols based on the presence of certain features, including protected areas, as well as other land use management protocols was developed. Comment on these features and the development of "sensitivity criteria" is presented below.

7.1 Identification of feature sensitivity criteria

7.1.1 Protected areas

A number of statutory protected areas occur within the affected section of the IOCB. These include the following:

- Isimangaliso Wetland Park (Including Mapelane);
- Nseleni Nature Reserve;
- Richards Bay Game Reserve;
- Umlalazi Nature Reserve and Siyaya Coastal Park;
- Ongoye Nature Reserve;
- Amatikulu Nature Reserve;
- Harold Johnson Nature Reserve;
- Umhlanga Nature Reserve; and
- Beachwood Nature Reserve.

These protected areas are of *very high* conservation importance as many of them protect the last remaining primary habitats within sections of the IOCB. The inclusion of these features is deemed essential in identifying their spatial relationship with the corridor. These areas have been allocated a designation of *high level feature*.

In addition to and in recognition of the ecological value of the conservation authorities, municipalities and other statutory organs of state have sought to further enhance and improve the management of the above protected areas through the establishment of a network of important habitats and environments. These areas are discussed below, but can be considered to generally lie outside of the formally established protected areas, but are to be seen as providing specific and important benefits, both from an ecological perspective and a management perspective to protected areas. These areas are considered to have a high level of conservation value.

7.1.2 Protected area expansion focus areas

The National Protected Areas Expansion Strategy (NPAES) (South African Government, 2010) details the need for considering areas where land may be incorporated into the existing protected area network in order to improve ecological sustainability and representation, encompass conservation-worthy habitat and in so doing, increase resilience to climate change. The aim of the strategy is to identify priority areas for protected area expansion and to set in place the requisite administrative and legal mechanisms that would allow for such land to be gazetted as protected areas. The most recent version of this spatial data (2017) was utilised and treated as being a feature of high conservation importance.

7.1.3 Critical Biodiversity Areas

Critical Biodiversity Area data uses the occurrence of numerous "features" and "factors" (faunal or floral species; or vegetation types and habitats) to determine the biodiversity importance or *irreplaceability* of an area (Escott, 2012). The concept of critical biodiversity area mapping is that the higher the biodiversity value, the higher the irreplaceability. The updated 2016 version of the KZN CBA (EKZN Wildlife 2010) uses three categories:

- Irreplaceable – designated in this assessment as high level features;
- Optimal – designated in this assessment as medium level features; and
- ESA – designated in this area as low level features.

7.1.4 Private Nature reserves and game farms

Private Nature Reserves and game farms include formally protected areas that are not managed by a conservation or governmental authority, but rather private landowners and companies. According to the data base, only one private nature reserve occurs in the IOCB, this being the Palmiet Nature Reserve, which was proclaimed in 2006, which is located within the Westville/Pinetown region of eThekwini.

7.1.5 Stewardship areas

In addition to managing numerous protected areas, Ezemvelo KZN Wildlife are engaged in a number of stewardship agreements aimed at improving the integrity and conservation status of private land, through the co-operation of private landowners. The only example within the EGI Expansion Corridor is the Roosfontein Nature Reserve (Westville).

7.1.6 Forest Reserve

A forest reserve layer was provided by the CSIR/SANBI which contained one forest reserve in the IOCB, Mapelane. Mapelane Forest Reserve is part of the Isimangaliso Wetland Park and marks the most southern portion of this broad protected area. The Mapelane Forest Reserve is managed by the Isimangaliso Wetland Park Authority.

7.1.7 Ramsar Sites

A Ramsar Sites data layer was provided by the CSIR. Ramsar sites are wetlands designated as being of international importance under the UNESCO Convention on Wetlands or Ramsar Convention of 1971. Four Ramsar sites occur within the IOCB, in particular the following:

- Turtle Beaches/Coral Reefs of Tongaland;
- The St Lucia estuarine system;
- Kosi Bay estuarine system; and
- Lake Sibaya freshwater lake system.

All of the above wetlands fall within the Isimangaliso Wetland Park, a World Heritage Site.

7.1.8 World Heritage Sites

One World Heritage site falls within the IOCB, this being the Isimangaliso Wetland Park. Isimangaliso Wetland Park was designated as a World Heritage Site in 1999 and comprised of existing protected areas, as well as plantations and farmlands.

7.1.9 Vegetation

The updated SANBI Vegetation Map (2012) was utilised as the primary spatial data source for the compilation of a vegetation map of the IOCB and associated areas including azonal and intrazonal vegetation. Ezemvelo KZN Wildlife (Scott-Shaw and Escott 2011) compiled an updated vegetation conservation status map for KwaZulu-Natal and this layer classifies the conservation status of the various vegetation types within KwaZulu-Natal in terms of:

- Least Threatened;
- Vulnerable;
- Endangered; and
- Critically endangered.

The update process was detailed and a full description is provided within the metadata. Essentially the conservation status was assigned, based on the conservation targets for vegetation types (Jewitt, 2016).

7.1.10 Landcover

The National Land Cover, modified layer, was utilised (SANBI, 2017) to determine areas of transformation as well as field crop boundary data (DAFF 2017) which identified current and old agricultural fields and land uses. Disturbance and habitat modification is an ubiquitous characteristic of the IOCB and this layer is essential for indicating the *status quo*. The other broad layers for KwaZulu-Natal, with the possible exception of the updated CBA data does not take full consideration of the status quo and are based on theoretical boundaries. Commercial agriculture has been a dominant land use for over 100 years in KZN and parts of the Eastern Cape and this land use has been a significant factor in influencing the nature of the IOCB in its current form and the concomitant changes brought about as a result of this needs to be considered.

7.1.11 Ecoregions

The ecoregion layer, provided by SANBI/CSIR (undated based on Burgess (2004)) was included at a broad scale. This layer forms a base layer behind the other data, to capture any areas not included in other feature/sensitivity layers. The eco-region layer is the least deterministic of the habitat information.

7.1.12 National Forests

The National Forest Inventory data (2016) indicates natural forest types and declared natural forests. The following forest types are found with the IOCB:

- Northern Coastal Forest;
- Scarp Forest;
- Swamp Forest;
- Mangrove Forest; and
- Lowveld Riverine Forest.

Forest ecosystems are generally highly threatened in the IOCB with large areas having been lost to agriculture and development. Examples of significant natural forests within the IOCB include Ongoye, Futulu and Dukuduku (large area recently lost to peri-urban settlement and subsistence agriculture). As noted above, swamp forest and mangrove forest are considered under other specialist investigations.

7.1.13 Buffer zones

Default buffer zones were provided with the SANBI/CSIR data pack. The following buffers were provided:

- A 5 km buffer layer from all Nature Reserves/Protected Areas;
- A 10 km coastal setback;
- A 2500 m buffer around Game Farms;
- A 5000 m buffer around Game Farms; and
- A 10 000 m buffer around Game Farms.

Due to the diverse land uses within the IOCB, there are very few examples where an unprotected natural area lies adjacent to a protected area or threatened habitat. Extensive agriculture and peri-urban sprawl has resulted in protected areas and remaining natural habitats being generally isolated. Therefore, the assignment of buffers is unlikely to facilitate protection or prevent habitat loss as most areas that will be included in the buffer zone would already be transformed. Although useful planning tools, in the IOCB, buffers should rather be assigned on a site by site basis during a detailed review of the power line routing within the corridor. Buffer widths are expected to be highly variable – even for the same feature – based on the setting.

Table 11 summarises the sensitive environmental features identified for this assessment.

Table 11: A summary of the relevant features assessed within the extended Eastern EGI corridor.

Sensitivity Feature Class	Data Source + Date of Publications	Data Description, Preparation and Processing
Protected Areas	• National DEA SAPAD, 2017. • SANBI Protected Areas Database, 2011. • Ezemvelo KZN Wildlife Protected Areas updated 2015	DEA protected areas database was compared against the SANBI protected areas database discrepancies were resolved. This data was provided by the CSIR. Provincial data was added for KwaZulu-Natal and the Eastern Cape.
Protected Area Expansion Areas	• DEA Priority areas for protected area expansion 2017	This data was provided by the CSIR and used without modification.
Critical Biodiversity Areas	• Ezemvelo KZN Wildlife CBA 2016	A CBA layer was provided by the CSIR, which included national CBA data. This layer was given a default sensitivity rating of "Very High." This was retained however the KZN CBA data was added separately and specific sensitivity ratings assigned to each CBA category within KZN. The National data aligned with the "irreplaceable" layer of the KZN CBA. The "Optimal" and "ESA" layers provided additional sensitivity contrast.
Private NR and game farms	• Ezemvelo KZN Wildlife Private Nature Reserves 2016 • Provincial Game Farm Data	The game reserve data was provided by the CSIR. Additional private nature reserves were added to include any areas not considered to be game farms.
Stewardship sites	• Ezemvelo KZN Wildlife Stewardship areas (draft) 2016	This layer was added un-modified and reflects the areas actively being pursued by the Ezemvelo KZN Wildlife Stewardship Programme. Although not protected areas, these areas are of conservation importance and are being actively managed as such.

Sensitivity Feature Class	Data Source + Date of Publications	Data Description, Preparation and Processing
Forest Nature Reserve	• National Department of Environmental Affairs SAPAD, 2017.	Provided by SANBI/DEA
Ramsar Sites	• National Department of Environmental Affairs SAPAD, 2017.	Provided by SANBI/DEA
World Heritage sites	• National Department of Environmental Affairs SAPAD, 2017.	Provided by SANBI/DEA
Vegetation	• SANBI Vegetation Map 2012. • Ezemvelo KZN Wildlife Vegetation conservation Status 2011	The thicket layer was obtained from the SANBI Vegetation Map while the vegetation type conservation status data was included. This data set provides the conservation status of the specific vegetation types within KZN based on various attributes, such as percentage statutorily conserved. This layer was used to derive the vegetation sensitivity ratings.
Landcover	• National Land Cover 2013/2014/DEA and Habitat Modification Layer SANBI 2017 • Field Crop Boundaries, Department of Agriculture, Forestry and Fisheries 2017	The modified land use and agricultural layers (field crop boundaries) were retained and applied. These indicate the transformed areas that characterise much of the KZN coastal hinterland – sugar cane farms and plantations.
Ecoregions	• SANBI undated (based on Burgess 2004)	Basic ecoregion layer, applied unmodified.
National Forests	• National Forest Inventory, Department of Agriculture, forestry and Fisheries, 2016.	The extent of the National Forests. This layer complements the vegetation layers above and due to their protected status allow for a higher sensitivity to be applied to relevant areas.
Buffer zones	• Assigned by SANBI/CSIR. Date unknown.	Simple buffer extents for Nature Reserves/Protected Areas, Game Farms and a coastal setback.

The various ratings have been provided in Table 12 below. In addition, buffer zones and comments regarding the assignment of buffer zones have been provided. Also see Appendix 1 for a summary of all GIS data utilised.

Table 12: Sensitivity ratings of the relevant environmental features of the IOCB in the expanded Eastern EGI corridor.

Feature Class	Feature Class Sensitivity	Prescribed Buffer Distance
1 km Coastline Buffer	Very High	Not applicable. Predetermined 1 km setback.
Protected Areas	Very High	May vary from 0 to 5 km (To be determined based on site specific evaluation) See generic 5 km Nature Reserve Buffer in "Buffer zones" Feature Class.
World Heritage Site	Very High	None (The identified WHS falls within a protected area)
Ramsar Sites	High	None. (as per World Heritage Site above)
Forest Nature Reserve	Very High	None (The only Forest Nature Reserve falls within a protected Area)
Protected Area Expansion Areas	Medium	None
National Forests	Very High	Up to 100m (To be determined based on site specific evaluation)
KZN CBA	CBA Irreplaceable - High	None
	CBA Optimal - Medium	
	ESA - Low	
Landcover	Modified: Low	Not applicable
	FCB: Low	
	FCB other: Low	
Vegetation	KZN Veg. Cons. Status "Least Threatened" – Low	None
	KZN Veg. Cons. Status "Vulnerable" - Medium	None
	KZN Veg. Cons. Status "Endangered" - High	None
	KZN Veg. Cons. Status "Critical" – Very High	None
Ecoregion	Medium	None
Private Nature Reserves and Game farms	Private Nature Reserves – Very High	None
	Game Farms Title Deeds - Medium	None
Buffer zones	5 km buffer layer from all Nature Reserves/Protected Areas - Medium	Not applicable
	2500 m buffer around Game Farms - Medium	
	5000 m buffer around Game Farms - Medium	
	10 000 m buffer around Game Farms - Low	

7.2 Feature maps

Figure 17 provides a visual representation of the features assessed in the review of the IOCB portion of the extended Eastern EGI corridor (as per Table 12 above). The order of the features displayed in the image is arbitrary with the exception of the National Forest Inventory and Protected Area data which has been prioritised and the more expansive vegetation and biome layers displayed lower so that as many features as possible are visible.

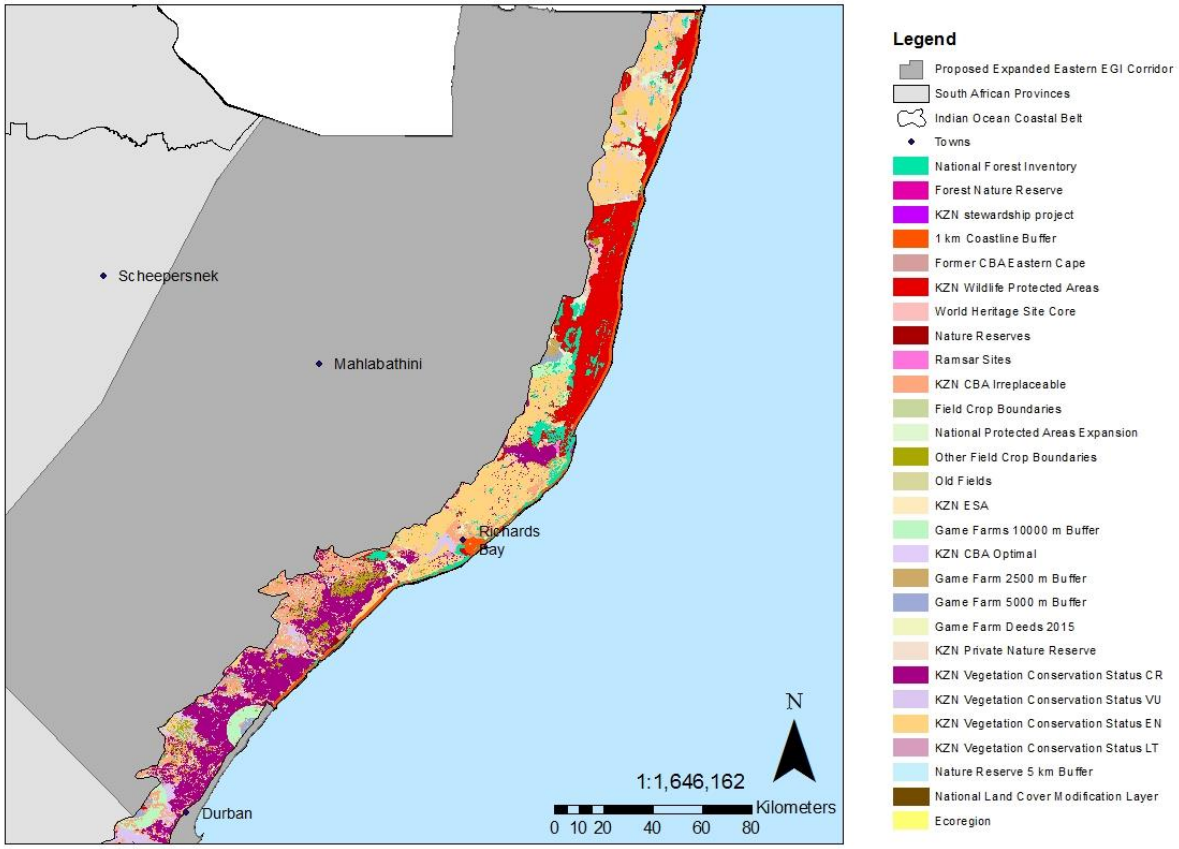

Figure 17: Features within the section of the IOCB affected by the expanded Eastern EGI corridor.

8 FOUR- TIER SENSITIVITY MAPPING

8.1 Default Sensitivity Map

The "default sensitivity map" displays the highest sensitivity category as the upper most map layer (Figure 18). This shows the most sensitive layers but is not necessarily a reflection of the *status quo*. This issue was discussed above with the inclusion of the *National Land Cover modified areas* layer as a fair representation of the *status quo*. Being representative of a disturbed environment, this layer is rated as having a low sensitivity and indicates transformed areas. This layer should also be viewed as the upper most layer as many of the other layers do not consider the *status quo* but are applied based on probabilities, assumptions and theoretical knowledge. Site specific knowledge and observations support the extent of transformation that is illustrated by the modified habitat layer. An example is the KwaZulu-Natal Coastal Belt, which is highlighted as being "critical" equating to a "very high" sensitivity rating. This and other extensive vegetation types of "very high" and "high" sensitivity result in the blanket of maroon and red that covers most of the IOCB. The majority of the KwaZulu-Natal Coastal Belt has however been transformed to sugar cane or urban settlement with a distinct north – south corridor of disturbance associated with the N2 up to Hluhluwe. Very little truly representative primary habitat remains and thus it is

not accurate to consider such disturbed areas as of “very high” sensitivity as the drivers and primary attributes of this habitat have been removed.

8.2 Land Use (Priority) Map

Figure 19 below provides a contrast to Figure 18 as a result of the prioritisation of the National Land Cover (modified and agricultural areas) layer. As noted above, this layer, because it consists of areas that are transformed, is rated as “low sensitivity”. This layer provides a more realistic representation of the transformation that has taken place within the IOCB, particularly between Richards Bay and Durban, which has been extensively transformed for the cultivation of sugar cane. The extent of transformed land decreases slightly north of Richards Bay, primarily due to the presence of the Isimangaliso Wetland Park. Areas which have not been transformed or allowed to “recover” to discernible and representative habitats, while other portions of the IOCB relevant to the expanded Eastern EGI corridor, are either protected, inaccessible or cannot be cultivated.

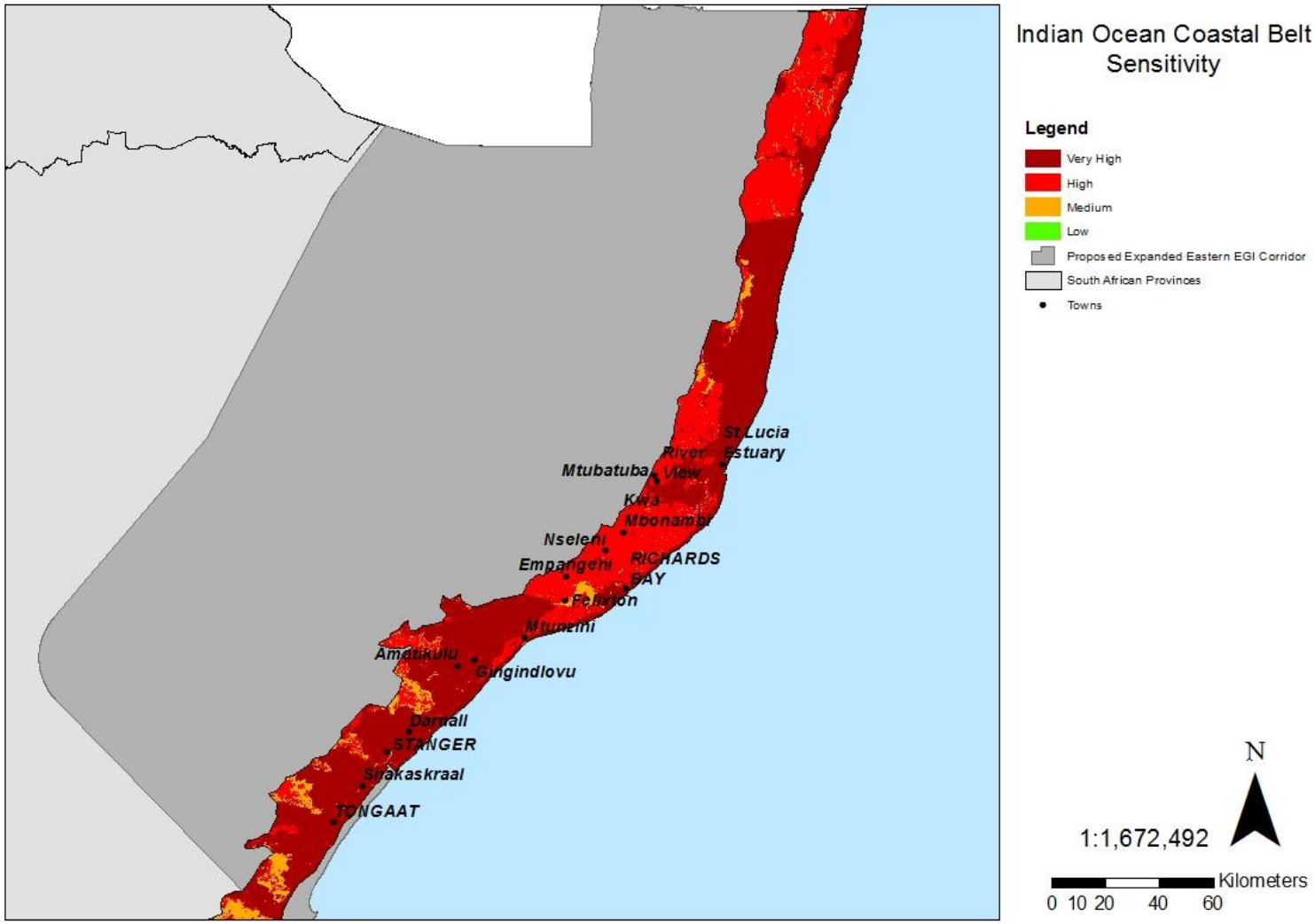

Figure 18: Sensitivity mapping for the portion of the IOCB affected by the expanded Eastern EGI corridor. Note that high and very high sensitivity areas are rated highest – compare it to Figure 19.

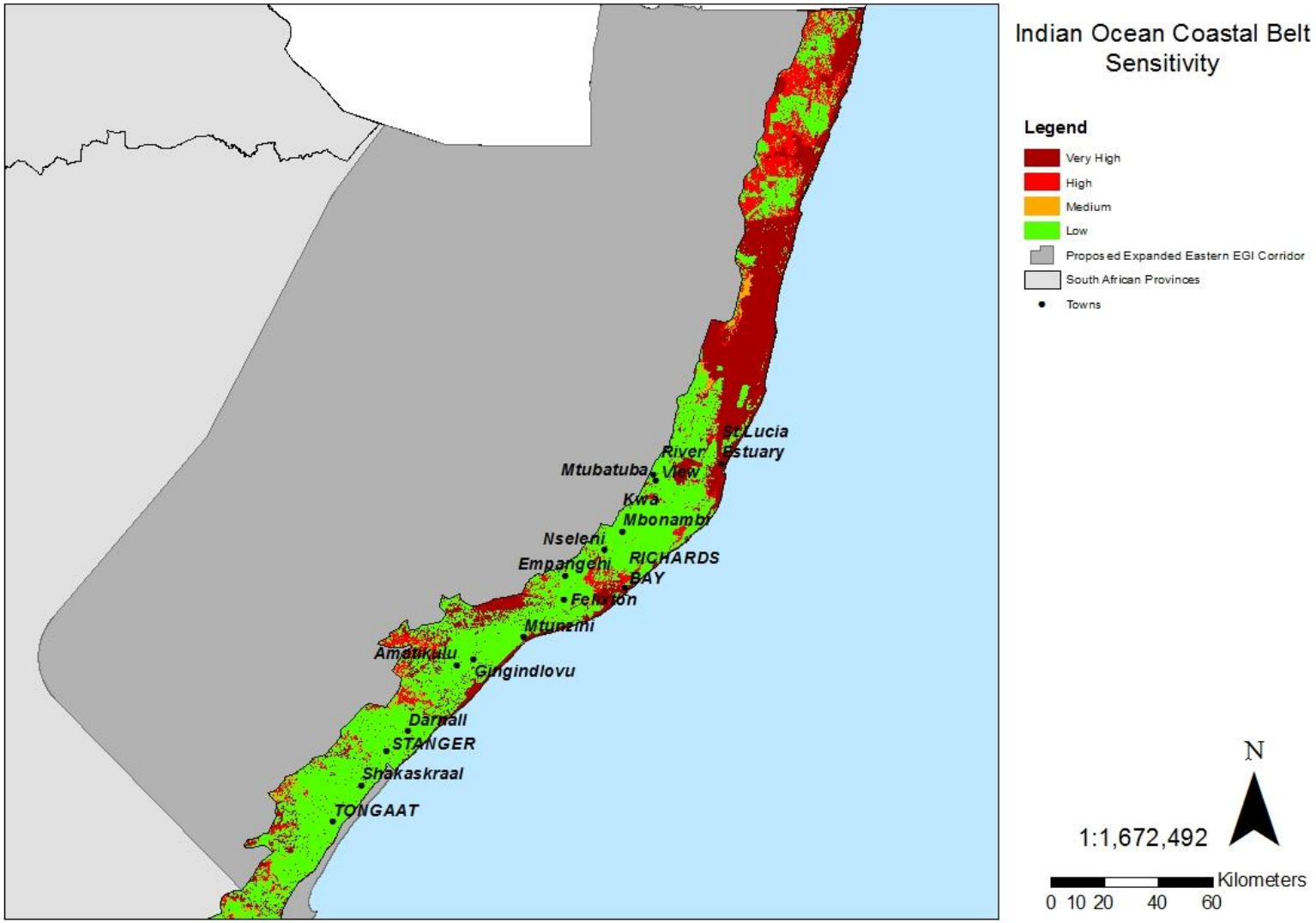

Figure 19: Sensitivity mapping for the portion of the IOCB affected by the expanded Eastern EGI corridor where the land use data – transformed areas have masked out/ filtered out. This is a more realistic representation of the status quo. Compare it to Figure 18.

9 KEY POTENTIAL IMPACTS AND MITIGATION

Table 13 provides the details of the key impacts likely to be associated with the extended Eastern EGI corridor.

From a broad perspective, it is to be understood that the sensitivity maps over emphasise certain habitat groups on account of the levels of importance presented in the CBA map and other datasets. However, it is clear that the proposed corridor is substantially wider than the actual power line servitude and therefore there is significant opportunity to avoid site specific and narrow or spatially constrained habitat forms, such as areas of Scarp Forest. Other areas will be impacted upon by the line servitude and the final alignment of such route within the EGI corridor will be evaluated on a site specific level to either avoid vegetation units or align with a servitude route that is of least impact from an ecological perspective. Where sensitive habitats cannot be avoided, mitigation measures have been proposed. At this strategic level, these are broad recommendations requiring further evaluation and refinement. Some may not be applicable to sections of the EGI route or be effective in mitigating certain impacts. The mitigation measures mentioned include the following:

- **Plant rescue** – Prior to the construction of the power line or clearance of the servitude, specific species of plant are to be removed from the servitude and relocated to a suitable area outside of the servitude. This approach is a more suitable method of rescue applicable to small plants or immature specimens.
- **Rehabilitation** – Where clearance or disturbance is temporary i.e. a site camp or access road, this area can be rehabilitated/revegetated. The aim of the rehabilitation/revegetation plan will need to match the receiving environment. If within an area of high sensitivity or low level disturbance, return of the affected land to a state approximating the pre-construction condition would be preferable. If within an area of low sensitivity and high disturbance, basic revegetation can be undertaken to establish ground cover and limit further degradation.
- **Offset** – This is a controversial form of mitigation that should only be considered as a last resort and only if absolutely necessary. Standard ideology dictates a *like for like* biodiversity offset at a set ratio (i.e. 1:2 ratio, 1Ha disturbed requires 2Ha of new habitat of the same type to be established or rehabilitated). This can be difficult to achieve due to environmental variables, feasibility (obtaining land, costs of management etc.) and a complete lack of guarantee/certainty of whether the offset habitat will a) be successful and b) if successful, will be representative of the transformed habitat. Other "means" of biodiversity offsets can also be applied, such as replacing the loss of protected trees, by planting the same species in the adjacent area (similar to plant rescue, but the specimens are sourced from off site and often in large numbers). The goals of this simpler form of offset are easier to achieve, monitor and assess. Any form of offset must be carefully selected in accordance with the receiving environment. Detailed site specific information is essential.
- **Site specific setbacks or buffers** – Setbacks or buffers assigned on a case by case basis where detailed information for the receiving environment and subject habitat is available. Such setbacks must be recommended and supported by ecologically sound reasoning.
- **Alien invasive plant control** – The control of alien invasive plant species within the power line servitude using suitable methods and resources may be deemed to be a form of "mitigation", particularly where this reinforces seral traits within the identified habitat.

Table 13: A description of key impacts likely to be associated with the establishment of the power lines within the Extended Eastern EGI corridor.

Key Impacts		Site Specific Descriptions	Possible Effect	Mitigations
Habitat Loss	Impact on protected and keystone species associated with vegetation clearance. Project Phase – Construction Phase.	There are some parts of the IOCB which have a high abundance of protected tree species such as *Sclerocarya birrea* and *Mimusops caffra* which are ecologically significant in their own right due to the variety of species associated with large tree specimens.	Loss of ecologically significant habitats associated with these species. Such loss is likely to be permanent and of high intensity – i.e. no pruning or trimming, simply total removal.	Areas with a high abundance of protected tree species should be avoided. Plant rescue of small specimens may be undertaken and transferred to outside of the servitude.
	Impact on natural forest areas associated with vegetation clearance Project Phase – Construction Phase	The northern portion of the IOCB supports a number of isolated forest habitats associated, the most common being Northern Coastal Forest. Other forest types such as Scarp Forest and azonal forests such as Swamp Forest and Lowveld Riverine Forest occur in places. The isolated nature of these forest areas make them important islands of natural habitat within an area that has been largely transformed by agriculture and other land uses. These forest habitats often support unique fauna and flora.	Loss of ecologically important habitat and unique flora and fauna associated with the specific conditions that occur within these forests. Such loss is likely to be permanent and of high intensity.	Areas of natural forest are to be avoided. Rehabilitation of the servitude area is not possible as the mature trees will impact on the servicing and maintenance of the power lines. Offset and plant rescue options may be considered following further onsite and detailed investigations.
	Impact on azonal vegetation types associated with vegetation clearance. Project Phase – Construction Phase	A number of azonal vegetation types occur within the IOCB. Most are isolated or restricted in extent. Most azonal habitats support unique species adapted to the prevailing conditions, which are unique.	Loss of azonal habitat and associated species. Loss of specialised and unique species. Such loss is likely to be permanent and of high intensity.	All azonal vegetation types are to be avoided within the IOCB. Rehabilitation and offset are not considered viable options due to the unique setting and drivers governing these vegetation types.
	Impact on conservation status due to vegetation clearance. Project Phase – Construction Phase	Land surrounding protected areas has conservation potential due to the possibility of protect area expansion and improved land management. Numerous extensive protected areas occur in the northern portion of the IOCB.	Establishing a major servitude through such areas can result in habitat degradation, reducing the significance of the habitat being protected. Establishing a servitude adjacent to an existing protected area may limit opportunities for expansion. Any loss that may occur is likely to be permanent but the intensity of the impact is likely to be low as the affected land will not be lost to conservation.	Avoid protected areas and so far as possible consider setbacks and potential expansion corridors at a site specific level.

Key Impacts		Site Specific Descriptions	Possible Effect	Mitigations
Faunal Disturbance	Impact on fauna associated with habitat loss. Project Phase – Construction Phase	Due to habitat loss as a result of agriculture and human settlement, the remaining fauna is restricted to limited natural and semi natural habitat.	Displacement of fauna is likely to occur following the loss of habitat. In some instances, range restricted species or populations may be lost. Any loss that may occur is likely to be permanent but the intensity of the impact is likely to only be medium to low due to the opportunity and ability of fauna to move.	Avoid remaining natural habitat and areas highlighted as important from a faunal diversity (CBA irreplaceable areas for example).
Alien Invasive Plants	Exotic invasion primarily by alien invasive plant species. Project Phase – Operational Phase	Power line servitudes are susceptible to invasion by a number of common and virulent alien invasive plant species within the IOCB. Some examples include *Chromolaena odorata, Tithonia diversifolia, Ricinus communis* and *Lantana camara.*	Increased spread in invasion footprint. Such servitudes act as vectors for alien invasive plant species. Invasion may encroach into neighbouring areas where invasion has been absent or low.	Implementation of a long term servitude management programme that includes a dedicated alien invasive plant control initiative. This may include: - regular monitoring and auditing of exotic species. - Identification of new species, - Cover and treatment application - Spatial rendition of above information

10 BEST PRACTICE GUIDELINES AND MONITORING REQUIREMENTS

10.1 Planning phase

This SEA should be considered as the initial planning phase of the EGI. Within the Expanded Eastern EGI corridor and the eastern seaboard of South Africa, it is clear that much of the natural habitat within this area has been subject to transformation through anthropogenic interventions. To this end, the alignment of the servitudes within the corridor should use the following criteria to establish the most appropriate route for the power line:

- The outer extent of existing settlement – both formal and informal should be identified i.e. the peri-urban environment.
- Key infrastructure should be identified that traverses in a north-south direction, within the identified corridor. In particular the R61/N2 or the R102 roadways north of Durban should be considered as important routes with which to align directly, or in parallel, the final servitude, thereby consolidating impacts associated with a linear development.
- Disturbed agricultural or related lands under cultivation.

Given that the alignment of selected servitudes follows the above criteria, particular consideration should be given to the avoidance of the following:

- areas of distinct, closed canopy, natural forest;
- open, primary grassland environments;
- protected areas;
- areas considered to be CBAs or ESAs (not affected by transformation); and
- areas which may be considered to hold ecological significance under a secondary habitat regime (e.g. abandoned agricultural lands that lie within critically endangered, endangered or vulnerable vegetation units).

As indicated above, the IOCB biome has been and will continue to be subject to rapid transformation. While it is deemed appropriate to identify and utilise transformed lands to establish servitudes such as that envisaged in the EGI as opposed to utilising important natural habitats, it is important to recognise that secondary habitats offer important ecological services and opportunities to maintain faunal diversity, even under a rapidly changing land cover. Discernment and recognition of the growing importance of secondary habitat in KZN must accompany decision making on the final routing of power lines.

Further to, and in support of the above, consideration should be given to the impact of climate change on habitat within the IOCB. Figure 20 indicates the climate projections to 2100 provided through the Koppen-Geiger classification system and the expected warming trends in southern Africa. A significant warming trend is predicted along the eastern seaboard that will establish a climate similar to that of Maputo (*equatorial, winter dry*) spreading as far south as Port Elizabeth (Rubel & Kottek, 2010). Such change is likely to be driven by variation in the Inter Tropical Convergence Zone and the Limpopo high pressure and will result in an initially latent, but becoming more significant, change in floral communities and faunal populations. The impact of climate change must be considered in the detailed planning associated with the line routes, particularly where it is likely that vegetation units presently identified as endangered or critically endangered may be placed under increasing pressures.

a) b)

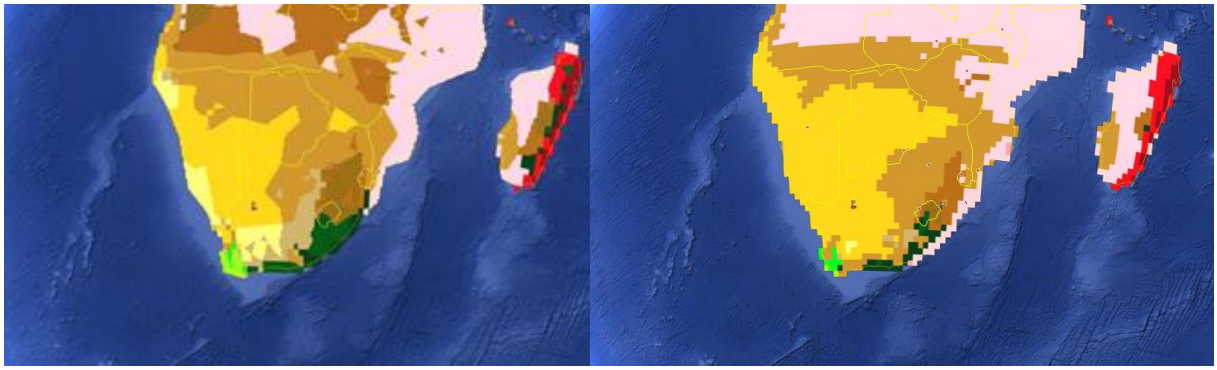

Figure 20: Koppen-Geiger modelling overlain on Google Earth imagery, indicating the expansion of Aw climate class (depicted in pink) which has its southern limit in and around Maputo during the period 2001 to 2025 (a) to a point approximately aligned with Port Elizabeth during the period 2076 to 2100 (b). (Source: Rubel & Kottek, 2010; http://koeppen-geiger.vu-wien.ac.at/)

10.2 Construction phase

It is difficult to provide management and best practice measures to be instituted broadly within a terrain as diverse as the coastal IOCB; however the following construction related measures should be implemented, where possible:

- Construction related servitudes must be limited, particularly where such activities are being undertaken in or close to areas of "high ecological sensitivity".
- Points of instability or of steep grade should be identified and stabilised, where required.
- Tower footprints should be cordoned off during the construction phase.
- The use of helicopters during the stringing of the lines should be used, particularly where lines traverse forest environments or steep inclines.
- Vegetation control and management around tower footings should be undertaken during and immediately after the construction of towers to prevent exotic weed invasion at these points.

10.3 Operations phase

General vegetation management procedures, including alien invasive plant management within the major power line routes should encompass the following;

- The monitoring of "sensitive habitats" where towers have been established either within or adjacent to such vegetation units, should be undertaken. Monitoring should include evaluation of change in adjacent habitat form and structure, as well as other more evident factors such as erosion and collapse related to the structures.
- Weed control using appropriate techniques in terms of an Alien Invasive Plant Management Plan.
- The application of the Eskom code of conduct relating to staff management on sites.

10.4 Rehabilitation and post closure

Specific rehabilitation measures will be applicable to the specific sites under consideration as well as the nature of such sites (e.g. forest or grassland habitat). In general two approaches may be taken at these sites, these being:

- **Revegetation and restoration**. This method may be considered to be a horticultural intervention, where the active planting of selected plant species is undertaken. Such interventions are often

supported by environmental groupings and authorities, but are in themselves a means of driving seral process, often contrary to that which would be followed under a natural regime. It therefore follows that horticulturally driven interventions should be used prudently and judiciously within selected environments. Such actions are perhaps more applicable to areas of secondary vegetation.

- **Reinstatement** of habitat may be considered to follow a "managed seral process", where the natural succession process is allowed to proceed without the introduction of significant external elements, such as plant specimens. In this regard management is primarily restricted to the stabilisation of the area through minimal earth sculpting and the use of inert materials to stabilise slopes (geofabrics), while exotic weed control forms a key component of such action. This form of rehabilitation is applicable to climax forest environments and primary grasslands.

10.5 Monitoring requirements

Monitoring of habitat change in and around the selected line route within the corridor is considered the most applicable ecological management tool within the IOCB region. Such monitoring will be site specific but may include the following:

10.5.1 Pre-Construction

Where "sensitive habitats" are affected by construction activities, suitable baseline information should be gathered prior to the commencement of construction. Baseline information should include *inter alia:*

- Species composition on affected sites;
- Species composition within buffer zones; and
- Species composition over at least two transects that are aligned to other variables (slope, elevation etc.).

Such data would allow for the long term monitoring of change in habitats, as well as inform the appropriate rehabilitation methods and expected outcomes.

10.5.2 Construction phase

- The accurate delimiting of construction sites, particularly towers, in and around areas of ecological sensitivity. Such habitats should be afforded suitable buffers that do not impede construction but maintain the integrity of affected habitats.
- The monitoring of exotic weed invasion within natural habitats. Exotic weeds within the construction site and immediately adjacent to the site should be recorded.
- Construction phase monitoring must be undertaken according to an appropriate but regular time basis.

10.5.3 Rehabilitation

- Following the selection of appropriate rehabilitation methods monitoring of the following should be undertaken for a designated period:
    - Identification of exotic weed invasion and success of selected weed control measures.
    - Identification of recruitment of new species to site where the seral management process is adopted.
    - Identification of the "success" of repatriated or established plants, where horticultural intervention is selected.

10.5.4 Post-construction and operations

It would be useful to select a few sites within the EGI servitude that lie within sensitive environments and monitor the status of vegetation and habitat within these areas over an extended period. This may be undertaken through the establishment of a number of permanent transects in selected grasslands, scrub and forest environments. Other factors should also be monitored including rainfall etc. in order to correlate data. The objective of this monitoring would be to identify any severe change arising to adjacent habitat, or perhaps improvement in disturbed habitat over time, following the establishment of the EGI. Any negative outcomes from such evaluation should be met with a review of the operations undertaken in and around such habitats and consideration of other management interventions. Annual audits of the servitude need to be undertaken and management measures adjusted according to the observations.

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Appendix 1: Description of GIS Data

GIS ID	Feature Class	Feature Name/ Ecosystem Type (if available)	Feature Sensitivity Rating	Feature Sensitivity Score	Buffer Sensitivity Rating	Buffer Sensitivity Score	Buffer Distance	Notes/Comments/Changes compared with Draft Corridor Environmental Constraints Map
KZN_Wildlife_PAs_IOCB	Protected Areas	Various Protected Areas	Very High	10	Medium	5	0-5 km	A new layer included to augment the Nature_Reserves IOCB layer. Buffer width to be confirmed on a site by site basis.
Nature_ReservesIOCB	Protected Areas	Various Protected Areas	Very High	10	Medium	5	0-5 km	The original rating of Very High was retained. Buffer width to be confirmed on a site by site basis.
National_protected_areas_explOCB	Protected Area Expansion Areas	Priority Focus Areas, Areas under negotiation	Medium	4	NA	NA	NA	The original rating of Medium was retained.
KZN_CBA_irrepl_IOCB	Critical Biodiversity Areas	CBA Irreplaceable	High	7	NA	NA	NA	Downgraded from Very High. The original CBA layer was replaced by the latest KZN Wildlife CBA layers, which were assigned a separate sensitivity rating which aligned with their designation.
KZN_CBA_Optim_IOCB	Critical Biodiversity Areas	CBA Optimal	Medium	4	NA	NA	NA	Downgraded from Very High. The original CBA layer was replaced by the latest KZN Wildlife CBA layers, which were assigned a separate sensitivity rating which aligned with their designation.
KZN_ESA_IOCB	Critical Biodiversity Areas	Ecological Support Area	Low	2	NA	NA	NA	Downgraded from Very High. The original CBA layer was replaced by the latest KZN Wildlife CBA layers, which were assigned a separate sensitivity rating which aligned with their designation.

GIS ID	Feature Class	Feature Name/ Ecosystem Type (if available)	Feature Sensitivity Rating	Feature Sensitivity Score	Buffer Sensitivity Rating	Buffer Sensitivity Score	Buffer Distance	Notes/Comments/Changes compared with Draft Corridor Environmental Constraints Map
Gamefarm_deeds_2015IOCB	Private NR and game farms	Game Farms	Medium	5	Low Medium	1; 3	2.5 km to 10 km	The original Medium sensitivity rating was retained. Buffer zones as per Buffer Layer.
Forest_nature_reserve IOCB	Forest Nature Reserve	Mapelane Nature Reserve	Very High	10	NA	NA	NA	The original Very High sensitivity rating was retained. The only proclaimed Forest Nature Reserve in the IOCB.
Ramsar_sites_IOCB	Ramsar Sites	Turtle Beaches/Coral Reefs of Tongaland, St Lucia System, Kosi Bay, Lake Sibaya	High	8	NA	NA	NA	The original High sensitivity rating was retained. The Ramsar Site Is situated within the Isimangaliso Wetland Park.
WHS_coreIOCB	World Heritage sites	Isimangaliso Wetland Park	Very High	10	NA	NA	NA	The original Very High sensitivity rating was retained. The Protected Area buffer would be applicable.
KZN_VEG_CONS_ST_CR_IOCB	Vegetation	Various vegetation types within KZN	Very High	9	NA	NA	NA	The KZN Vegetation Conservation Status layers were new data, not originally included. A suitable sensitivity rating was assigned according to the designated conservation status.
KZN_VEG_CON_ST_VU_IOCB	Vegetation	Various vegetation types within KZN	High	7	NA	NA	NA	The KZN Vegetation Conservation Status layers were new data, not originally included. A suitable sensitivity rating was assigned according to the designated conservation status.
KZN_VEG_CONS_ST_EN_IOCB	Vegetation	Various vegetation types within KZN	Medium	4	NA	NA	NA	The KZN Vegetation Conservation Status layers were new data, not originally included. A suitable sensitivity rating was assigned according to the designated conservation status.
KZN_VEG_CON_ST_LT_IOCB	Vegetation	Various vegetation types within KZN	Low	2	NA	NA	NA	The KZN Vegetation Conservation Status layers were new data, not originally included. A suitable

GIS ID	Feature Class	Feature Name/ Ecosystem Type (if available)	Feature Sensitivity Rating	Feature Sensitivity Score	Buffer Sensitivity Rating	Buffer Sensitivity Score	Buffer Distance	Notes/Comments/Changes compared with Draft Corridor Environmental Constraints Map
								sensitivity rating was assigned according to the designated conservation status.
Thicket_veg_IOCB	Vegetation	Thicket vegetation	High	6	NA	NA	NA	The original High sensitivity rating was retained. Only a very slight portion of true thicket occurred within the revised IOCB boundary.
NLC_IOCB	Land cover	Built up, Cultivation, Natural (From plantation), Plantation, Plantation (Old fields), Secondary Natural, Mining	Low	0	NA	NA	NA	The original Low sensitivity rating was retained. This layer represents the modified and transformed pockets and is considered the layer most representative of the situation on the ground.
Old_fields_IOCB	Land cover	Old fields	Low	0	NA	NA	NA	The original Low sensitivity rating was retained.
OtherFCB_IOCB	Land cover	Old fields, Rain fed annual crop cultivation/planted pasture, Subsistence farming 1	Low	0	NA	NA	NA	The original sensitivity rating was High. The rating was downgraded to Low due to data representing disturbed areas.
FCB_IOCB	Land cover	Horticulture, shadenet	Low	0	NA	NA	NA	The original sensitivity rating was Very High. The rating was downgraded to Low due to data representing disturbed areas.
Ecoregions_IOCB	Eco region	Kwazulu-Cape coastal mosaic, Maputaland coastal forest mosaic, Maputaland-Pondoland bushveld and thickets	Medium	3	NA	NA	NA	The original Medium sensitivity rating was retained.
NFI_IOCB	National Forests	Declared Natural Forests	Very High	9	Medium	4	Up to 100 m	The original Very High rating was retained. Buffer width to be determined on a site by site basis.
Coastline_bufferIOCB	Buffer zones	Coastline buffer	Very High	9	NA	NA	NA	The original Very High rating was retained.
Gamefarm_2500m_IOCB	Buffer zones	Game farm 2500 m	Medium	3	NA	NA	NA	Originally rated as High sensitivity.

GIS ID	Feature Class	Feature Name/ Ecosystem Type (if available)	Feature Sensitivity Rating	Feature Sensitivity Score	Buffer Sensitivity Rating	Buffer Sensitivity Score	Buffer Distance	Notes/Comments/Changes compared with Draft Corridor Environmental Constraints Map
		buffer						This was downgraded to Medium to align with the downgrading of the Game Farm deeds layer.
game_farm_5000m_buff_IOCB	Buffer zones	Game farm 5000 m buffer	Medium	3	NA	NA	NA	The original Medium sensitivity was retained.
game_farms_10000mbuffer_IOCB	Buffer zones	Game farm 10000 m buffer	Low	1	NA	NA	NA	The original Low sensitivity was retained.
NatureReserve_buffer_IOCB	Buffer zones	Nature Reserve buffer	Medium	3	NA	NA	NA	The original Medium sensitivity was retained.