



DURBAN: STATE OF  
**BIODIVERSITY**  
REPORT: 2016/2017

# BIO DIVER SITY

Biodiversity is the term used to describe the variety of life on earth and all natural processes. This includes ecosystem, genetic and cultural diversity, and the connections between these and all species, including humans. Ecosystem services are the benefits provided by healthy biodiversity to all living things. There is growing recognition of the value of ecosystem services to human well-being in terms of health, social, cultural and economic needs. Read more about ecosystem services on page 2 of this report.

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## INTRODUCTION

The intention of State of Biodiversity reporting is to present qualitative and quantitative data that describes the status of biodiversity and ecosystem services in Durban, to highlight key threats to this biodiversity and to record actions aimed at protecting and managing biodiversity. These reports are produced annually and this is the eThekweni Municipality's ninth State of Biodiversity Report. This report collates data relevant to the 2016/2017 municipal financial year<sup>1</sup>.



“ Humans are a part of nature. Not apart from nature. ”

– Marc Bekoff (Co-founder, together with Jane Goodall, of Ethologists for the Ethical Treatment of Animals).

*1. A municipal year starts on 1 July and ends on 30 June.*





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# 1 ECOSYSTEM SERVICES PROVIDED BY DURBAN'S NATURAL ENVIRONMENT

Biodiversity, short for biological diversity, is the term used to describe the variety of life found on earth and all of the natural processes that underpin this biodiversity. This includes all species (including humans), habitats and ecosystems and the connections between these.

- **Food production:**  
e.g. fish, crops and fruit
- **Waste treatment:**  
removal and breakdown of excess nutrients in wetlands, detoxification of air pollution by vegetation
- **Water supply:**  
supply and storage of water by rivers
- **Disturbance regulation:**  
flood control, drought recovery
- **Cultural:**  
aesthetic, educational, spiritual and scientific use
- **Recreation:**  
eco-tourism, sports, fishing, swimming
- **Raw materials:**  
fuel, craft work and building materials
- **Pollination:**  
movement of pollen by certain species (e.g. bees) to enable plant reproduction
- **Biological control:**  
e.g. rodent and insect control (spiders controlling mosquito populations)

It is known that biodiversity provides us with essential ecosystem services. These are the benefits provided by healthy ecosystems to all living organisms. There is growing recognition of the value of ecosystem services to human well-being in terms of health, social, cultural and economic needs (Figure 1).

- **Refugia:**  
habitat for resident or migrant populations, e.g. nurseries for fish
- **Nutrient cycling:**  
capture, storage and processing of nutrients, e.g. nitrogen fixation
- **Soil formation:**  
e.g. weathering of rock by water
- **Climate regulation:**  
control of temperatures, e.g. wind reduction
- **Gas regulation:**  
control of the chemical composition of the atmosphere
- **Genetic resources:**  
unique biological materials and products, e.g. plant and animal medicines
- **Erosion control:**  
storage of soil within an ecosystem, e.g. wetlands
- **Water regulation:**  
control of water flow, e.g. capture and release of water by vegetated landscapes for urban use



FIGURE 1. ECOSYSTEM SERVICES PROVIDED BY DURBAN'S BIODIVERSITY



## 2 PROFILE OF DURBAN

TABLE I: KEY STATISTICS DESCRIBING DURBAN IN 2016/2017<sup>2</sup>

Municipal area	2 556 km <sup>2</sup> (an increase in area from the previous year due to the incorporation of Wards from the disestablished Vulamehlo Municipality on the south coast of Durban)
Population	3,82 million
Population growth (1996-2010/2011)	1.4%
Percentage of people in poverty	38.0%
Total exports	R71.8 billion
Total imports	R104.7 billion
GVA <sup>3</sup>	R265.9 billion
GDP <sup>3</sup>	R292.1 billion
Unemployment rate	14.69%
Human Development Index <sup>4</sup>	0.63

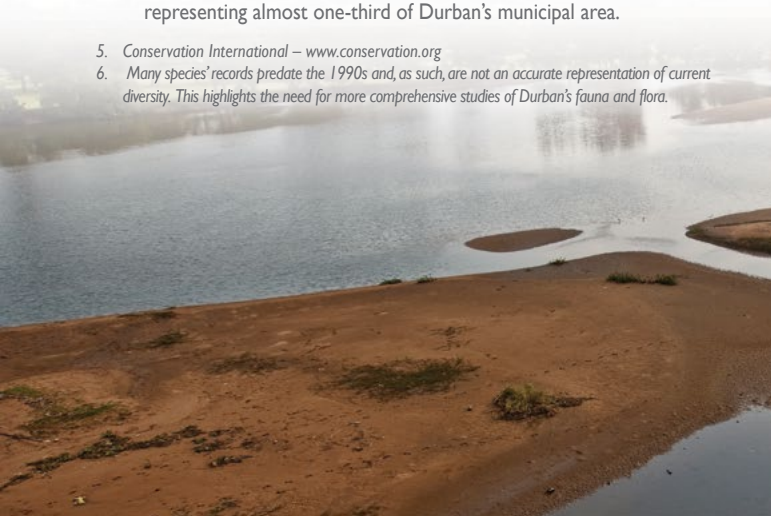
2. Source: Denny Thaver, *Global Insight/Economic Development & Investment Promotion Unit/Procurement & Infrastructure: Development Engineering, eThekweni Municipality*.
3. The Gross Domestic Product (GDP) is the total value of all goods and services produced within the economy in a given period. Gross Value Added (GVA) is the value of all goods and services produced in an area or sector of an economy, including taxes and less subsidies, and is used in the estimation of Gross Domestic Product (GDP).
4. The Human Development Index measures the well-being and human development of a country. It is a comparative measure of life expectancy, literacy, education and standards of living for countries throughout the world. The range of this index is valued from 0 to 1. Countries that rank over 0.8 are part of the high HDI group, countries that rank between 0.5 and 0.8 are part of the medium HDI group and countries with an HDI below 0.5 are ranked as low HDI countries.



### 3 THE NATURAL ENVIRONMENT

South Africa is the third most biodiverse country in the world<sup>5</sup>, and Durban contains:

- Three of the country's nine terrestrial biomes, namely Savanna, Forest and Indian Ocean Coastal Belt;
  - Eleven broad nationally recognised vegetation types. These include: Eastern Valley Bushveld, KwaZulu-Natal Coastal Belt, KwaZulu-Natal Hinterland Thornveld, KwaZulu-Natal Sandstone Sourveld, Ngongoni Veld, Scarp Forest, Northern Coastal Forest, Sub-tropical Dune Thicket, Sub-tropical Seashore Vegetation, Swamp Forest, and Mangroves;
  - Over 2 200 plant species, 520 species of birds, 37 species of amphibians, 69 species of reptiles, 80 terrestrial mammal species, and 25 invertebrate species endemic to KZN<sup>6</sup>;
  - 97 kilometres of coastline with a diversity of beach types and productive rocky shores;
  - 17 river catchments and 16 estuaries;
  - 4 000 kilometres of rivers; and
  - An open space system of 78 000 ha (approved December 2016), representing almost one-third of Durban's municipal area.
5. Conservation International – [www.conservation.org](http://www.conservation.org)
6. Many species records predate the 1990s and, as such, are not an accurate representation of current diversity. This highlights the need for more comprehensive studies of Durban's fauna and flora.



## 4 INDICATORS

### 4.1. Total area of D'MOSS

The Durban Metropolitan Open Space System (D'MOSS) is a system of open spaces incorporating areas of high biodiversity value (private- and public-owned) composed of a variety of habitat types linked together in an ecologically viable network.

In 2016/2017, D'MOSS comprised **78 000 ha** of open spaces, representing one third of the eThekweni Municipal Area. This represents the D'MOSS that was adopted by the eThekweni Council in December 2016.

D'MOSS is incorporated into the city's Integrated Development Plan, associated Strategic Development Framework, regional Spatial Development plans, and into the municipal Town Planning schemes as a controlled development layer.



### Ex-situ conservation of endemic KZN species

The eThekweni Municipality (EM) and KZN Wildlife have embarked on a threatened plant species ex-situ conservation initiative. The project aims to propagate two Endangered (*Gymnosporia woodii* and *Dahlgrenodendron natalense*) and one Critically Endangered (*Brachystelma natalense*) plant species, ex-situ, with a view towards reintroduction into the wild. *Gymnosporia woodii* is a geoxyllic suffrutex with a known distribution entirely within the boundary of the eThekweni Municipal area (EMA) and a male-dominated population. *Dahlgrenodendron natalense* is a paleoendemic, with a few adult specimens confined to the Pondoland and KZN coastal and coastal-escarpment forests. *Brachystelma natalense* is a grassland forb known from only two small populations in the Assagay/Kloof area of EMA.

The project aims to contribute towards the conservation of these threatened species while improving understanding of propagation methods, growth and reproductive attributes, and reintroduction planning and implementation processes. The project is currently in the propagation stage, having recently reached a number of promising milestones. These include (1) nodal budding on *Brachystelma natalense* material subjected to tissue culture techniques, (2) persistence and rooting of *Dahlgrenodendron natalense* cuttings in sand beds, and (3) germination of the viable seed collected from one of the few known female *Gymnosporia woodii*. The inter-organisational nature of the core team is one of the key contributing factors to these initial successes, with a range of skills contributing to a common objective. The next key step is to develop a focused model, based on current and historical locality data, to determine potential reintroduction sites. The feasibility of bulking up existing populations will also be assessed. Long-term monitoring of reintroduced populations will be critical in determining the overall success of the project. It is hoped that the lessons learnt will be applicable to other threatened plant species.

**Information supplied by:** Lyle Ground (Senior Specialist Ecologist, EPCPD) and Trafford Peterson (Biodiversity Protection Officer, EPCPD).

## 4.2. Percentage of D'MOSS that is protected

Only 8.2% of the area of D'MOSS enjoys some form of protection (Table 2). This includes various categories of protection: proclaimed and unproclaimed private or public nature reserves; properties that have been bought through the EM environmental land acquisition programme; sites where sensitive portions have been protected by non-user conservation servitudes during the development approval process; and sites that have been rezoned for conservation.

Furthermore, less than 3% of the entire area of the EM is protected (Table 2). This is well below the Convention of Biological Diversity's requirement for all governments to protect a minimum of 17% of terrestrial and inland water areas and 10% of coastal and marine areas.<sup>7</sup> In addition, it has been noted that these flat targets may be too small to adequately ensure the preservation of habitat types in perpetuity as it may not have a compelling ecological rationale. As a consequence, South Africa has adopted a more scientific-based approach to setting conservation targets.

**TABLE 2: AREA OF D'MOSS WITH SOME SORT OF PROTECTION AND CATEGORIES OF PROTECTION**

The hierarchical classification was defined to categorise the various levels of protection from least protected (a private conservation area that may not have legislated protection) to a formally Proclaimed Nature Reserve (protected in terms of the National Environmental Management Protected Areas Act, Act No. 57 of 2003). Such a classification prevents double counting when areas fall within more than one category.

Conservation area type	Total area in the EM (ha)	Hierarchical classification (ha)	Total per category – clipped to D'MOSS (ha)	Hierarchical classification areas – clipped to D'MOSS (ha)	% D'MOSS
Private Conservation Area	375.5	373.1	369.8	367.4	0.47
Special Rating Area	228.0	205.5	228.0	205.5	0.26
Conservation Servitude	295.3	295.3	237.4	237.3	0.30
Private Conservation Area/ Municipal Nature Reserve	64.4	64.4	63.7	63.7	0.08
State Nature Reserve	1 951.5	1 951.5	1 937.1	1 937.1	2.46
Acquisition	641.2	22.6	632.6	17.8	0.02
Municipal Conservation Area	825.3	681.8	794.1	650.9	0.83
Council-owned Nature Reserve	967.8	316.7	955.6	312.5	0.40
Conservation Zone	3.5	3.5	3.5	3.5	0.00
Environmental Conservation Reserve	2 144.5	1 313.0	2 127.3	1 298.0	1.65
Proclaimed Nature Reserve	1 373.1	1 373.1	1 365.4	1 365.4	1.73
<b>Total Protected</b>		<b>6 600.5</b>		<b>6 459.2</b>	<b>8.20</b>

7. Convention on Biological Diversity; <https://www.cbd.int/sp/targets/rationale/target-111>

#### 4.2.1. Land Acquisition

The Municipal Land Acquisition Programme prioritises the acquisition of critical biodiversity areas where other means of protection are ineffective. Properties containing critical biodiversity assets, as determined through a systematic conservation assessment, are acquired through purchasing the property from the private landowner or by landowners donating the land to eThekweni Municipality for biodiversity conservation purposes.

In the 2016/2017 financial year, the EPCPD acquired just over 23 ha of prime conservation land through both purchase and donations to the value of R3.8 million. Some of these properties are located in the Treasure Beach Nature Reserve and were previously owned by the KZN Department of Human Settlements. Through the Land Acquisition Programme, eThekweni Municipality now owns the biggest portion of Critically Endangered KZN Sandstone Sourveld grassland (a critically endangered vegetation type) within the KwaZulu-Natal Province, a testament to the importance of local level conservation action.

EPCPD has acquired over 646.2 ha of land since 2002 for biodiversity protection, thus increasing the municipal- owned conservation estate.

#### 4.2.2. Nature Reserve proclamation

eThekweni Municipality is currently collaborating with Ezemvelo KZN Wildlife to proclaim 11 municipal nature reserves in terms of the National Environmental Management: Protected Areas Act (Act No. 57 of 2003) (Table 3). The areas to be proclaimed currently have varying levels of legal protection ranging from none to zoned Public Open Space, while there are a small number of sites 'zoned' Environmental Conservation Reserve. The formal protection afforded by the proclamation of these reserves will ensure the conservation of the sites, will allow their areas to be included in calculating national and provincial statistics for the conservation status of vegetation types, and should assist with attracting more resources for the management of the protected areas.



TABLE 3: PROGRESS MADE WITH THE PROCLAMATION OF 11 MUNICIPAL NATURE RESERVES IN 2016/2017

Nature reserve	Survey diagrams complete (yes/no)	Management and zonation plan	Approval by EM Heads	Approval of proclamation by EM Executive Committee	Approval by EKZNW's Executive Committee	Proclamation approved by the EKZNW's Board	Proclamation endorsed by the EM City Manager	Proclamation documents submitted to MEC (CoGTA) & MEC (EDTEA)	Public participation process approved and completed	Proclamation/ Gazette declaration
Burman Bush	Yes	1st draft complete	Yes	Yes	Yes	Yes	Yes	No	Yes	No
Empisini	No	2nd draft complete	Yes	Yes	Yes	Yes	No	No	Yes	No
Marian Wood	N/A	2nd draft complete	Yes	Yes	Yes	Yes	Yes	No	Yes	No
New Germany	Yes	1st draft complete	Yes	Yes	Yes	Yes	Yes	No	Yes	No
Paradise Valley	N/A	3rd draft complete	Yes	Yes	Yes	Yes	Yes	No	Yes	No
Pigeon Valley	N/A	2nd draft complete	Yes	Yes	Yes	Yes	Yes	No	Yes	No
Silverglen	Yes	1st draft complete	Yes	Yes	Yes	Yes	Yes	No	Yes	No
Springside	N/A	2nd draft complete	Yes	Yes	Yes	Yes	Yes	No	Yes	No
Virginia Bush	Yes	1st draft complete	Yes	Yes	Yes	Yes	Yes	No	Yes	No
Giba Gorge	N/A	1st draft complete	Yes	Yes	Yes	Yes	Yes	No	Yes	No
Roosfontein	Yes	Complete	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

### 4.3. Percentage of D'MOSS that is managed

Rapid urbanisation of cities increases the fragmentation of landscapes, making management interventions in natural areas even more important. This management may take the form of the removal of invasive alien species, periodic burning of grassland habitats, removal of litter from streams, prevention of illegal harvesting of species, etc. The management of D'MOSS in the eThekweni Municipal area is undertaken by various departments and agencies and overall, **7.7% of D'MOSS is formally managed** (Figure 2). In future iterations of the State of Biodiversity Report, as our databases become more refined, we will report on categories of management and management agencies.

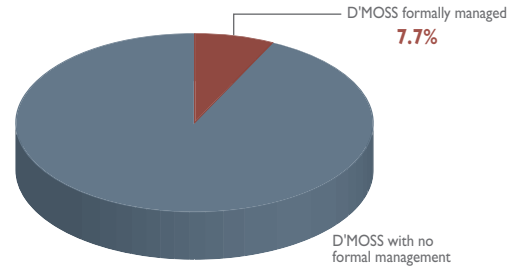


FIGURE 2. AREA OF D'MOSS THAT IS MANAGED

#### High Altitude Team (HAT) managing key D'MOSS areas

HAT is recruited from the Fire and Invasive Control (FISC) Programme managed by the EPCPD's Restoration Ecology branch. HAT assists the Municipality (and other government agencies) with the control of invasive alien species in areas that are difficult or dangerous to access, e.g. cliff faces or steep slopes. During the course of 2016/2017, HAT undertook invasive alien plant management in a number of important D'MOSS areas.

Site	Species Cleared
Crestholme	<i>Lantana camara</i> , <i>Solanum mauritianum</i> , <i>Melia azedarach</i> , <i>Chromolaena odorata</i> , <i>Tecoma stans</i>
Edgecliff	<i>Solanum mauritianum</i> , <i>Chromolaena odorata</i> , <i>Cinnamomum camphora</i> , <i>Ricinus communis</i> , <i>Eucalyptus grandis</i> , <i>Lantana camara</i> , <i>Hedychium coccineum</i> , <i>Canna indica</i>
Giba Gorge	<i>Eucalyptus grandis</i> , <i>Lantana camara</i> , <i>Acacia mearnsii</i> , <i>Melia azedarach</i> , <i>Chromolaena odorata</i> , <i>Solanum mauritianum</i>
Marianhill	<i>Eucalyptus grandis</i> , <i>Lantana camara</i> , <i>Melia azedarach</i> , <i>Chromolaena odorata</i> , <i>Hedychium coccineum</i> , <i>Solanum mauritianum</i>
Monteseel	<i>Solanum mauritianum</i> , <i>Eucalyptus grandis</i> , <i>Lantana camara</i> , <i>Melia azedarach</i> , <i>Acacia mearnsii</i> , <i>Chromolaena odorata</i>
New Germany	<i>Bidens pilosa</i> L., <i>Ricinus communis</i> , <i>Lantana camara</i> , <i>Tithonia diversifolia</i> , <i>Chromolaena odorata</i> , <i>Solanum mauritianum</i> , <i>Melia azedarach</i> , <i>Senna didymobotrya</i> , <i>Acacia podalyriifolia</i> , <i>Bambusoideae</i>

## 4.4. Species abundance

In terms of representing urban biodiversity, three taxonomic groups are commonly surveyed, i.e., plants, birds and butterflies. In Durban, reliable, quantitative data sets for most groups of organisms are difficult to obtain because of the lack of long-term monitoring initiatives. For the purposes of this report, only data that is collected consistently and quantitatively is utilised.

### 4.4.1. KwaZulu Dwarf Chameleon

*Bradypodion melanocephalum* is a regionally endemic chameleon and its range is restricted to the coastal belt of KZN. The two vegetation types most frequently inhabited by this chameleon are North Coast Grassland and South Coast Grassland, both of which are classified as Critically Endangered. These vegetation types have been largely transformed by sugarcane cultivation, urbanisation and timber farming. The population of the KwaZulu Dwarf Chameleon is therefore threatened with extinction, and is listed as Vulnerable by the IUCN.

In 2002, Ezemvelo KZN Wildlife initiated the monitoring of this species at two localities in Durban, i.e. Chameleon Park and a plot of land within D'MOSS next to the Edwin Swales Business Park on Bellair Road. Since 2009, the monitoring of the abundance of chameleons at Chameleon Park has been reported on in the State of Biodiversity Report (Figure 3).

#### Biodiversity targets

To conserve three viable free-living sub-populations of the population of the KwaZulu Dwarf Chameleon in perpetuity, the following are required:

1. At least three viable sub-populations of 7 000 adults each conserved across the range of the coastal population.
2. A viable sub-population conserved at Chameleon Park and connected D'MOSS areas.

3. A total of 100 adults conserved at Chameleon Park and the D'MOSS area adjacent to Edwin Swales Business Park.

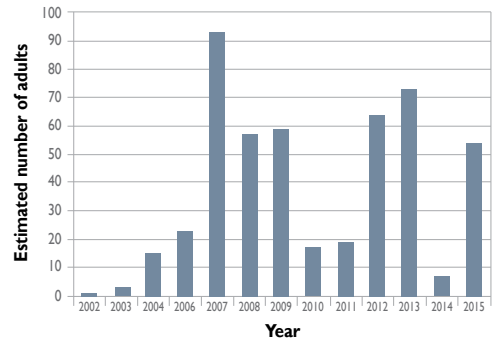


FIGURE 3. ESTIMATED NUMBER OF KWAZULU DWARF CHAMELEONS AT CHAMELEON PARK. COUNTS AT THE D'MOSS STRIP WERE SUSPENDED IN 2007 DUE TO THE CONTINUAL DECLINE OF THE SPECIES

#### Status

The sub-population size of Chameleon Park is below the target of 100 adults – this target has not been achieved.

#### Key management actions for 2016/17

It is critical that Chameleon Park is managed consistently and appropriately to increase the amount of suitable habitat for the KwaZulu Dwarf Chameleon. Management actions required include: regular, frequent and light alien plant control; mosaic defoliation of moribund grass and removal of moribund material off the site; securely fencing or hedging of the area with an impenetrable barrier plant (e.g. *Acacia ataxacantha*); and fitment of litter traps at storm water pipe outflows.



#### 4.4.2. Waterbirds of Durban Bay

One of the most comprehensive biodiversity data sets available for Durban is that of the waterbird species in Durban Bay. The waterbird populations of Durban Bay are well-known, both historically and in recent times in terms of their species richness and abundance. Bird species counts started in July 1999 and are ongoing. What started out as birdwatchers enjoying the diversity of avifauna in Durban Bay has become a key dataset for the eThekweni Municipal area, demonstrating trends in waterbird species diversity and abundance. The eighteen-year dataset demonstrates the decline in the overall abundance of water birds in Durban Bay over the study period. A key driver of the changes observed is the ongoing attrition and infilling of the Bay's natural

habitats. In a special edition of the journal *Novitates*<sup>8</sup> a synthesis of waterbird counts in Durban Bay was compiled. This is an excerpt from the publication: "Between 1902 and 1999 infilling for harbour and industrial development reduced the overall size of the Bay from about 1968 ha to 853 ha, a reduction of 57% in total aquatic habitat. Intertidal mud- and sand-flats, the primary habitat in Durban Bay for Palearctic waders, has been reduced by about 86%, from 1166 ha to 165 ha. Mangrove swamps have been even harder hit and have been reduced by about 97% from 438 ha to 15 ha. By contrast and concomitant with dredging to allow the passage of large commercial ships, the extent of permanently inundated open-water has increased by about 1.85 times from 364 ha to 673 ha.

8. Allan, D.G. (2012). The waterbirds of Durban Bay – Current and historical population trends. *Durban Natural Science Museum Novitates* 35: 1-74  
[http://www.durban.gov.za/City\\_Services/ParksRecreation/museums/nsm/Natural Science Museum Novitates/Novitates 35.pdf](http://www.durban.gov.za/City_Services/ParksRecreation/museums/nsm/Natural%20Science%20Museum%20Novitates/Novitates%2035.pdf)





## Curlew Sandpiper

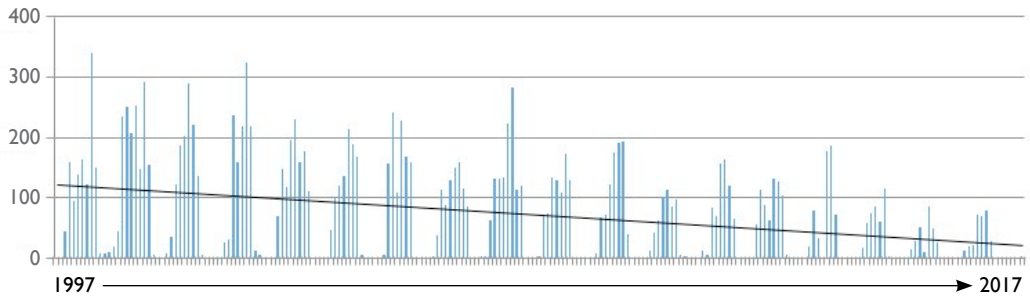


FIGURE 4. DECLINE OF CURLEW SANDPIPER ABUNDANCE AT DURBAN BAY FROM 1999 TO 2007

The original open-water areas, however, were shallow (likely mainly <2 m deep), whereas dredging now ensures that most of these regions now comprise deep water (up to 14 m deep). Concerning the shorelines fringing the outer extremities of the Bay, a key habitat for the majority of waterbird species, less than 5% of these are in a natural condition, the remainder largely comprising concrete quaysides and steep shorelines artificially reinforced with rubble. Only three small rivers feed into the Bay and all are channelised with concrete in their lower reaches. These provide relatively limited freshwater inflow into the Bay, which is essentially a seawater-dominated system subject to tidal influence throughout and which has been classified as an 'estuarine embayment.'

In 2016/2017, David Allan, Curator of Birds at the Durban Natural Science Museum, presented a talk entitled 'The

Beleaguered Waterbirds of Durban Bay: Facing Up To The Latest Threat'. Below are some of the key points from that talk:

- There has been a shocking ongoing decrease in Curlew Sandpipers in Durban Bay. Once the most abundant waterbird species in the Bay, the Curlew Sandpiper is likely to disappear entirely within a decade based on the current trend (Figure 4). This seems to be occurring across the range of this bird. Whimbrel, in contrast to this, has remained constant over time and Egyptian Geese numbers continue to grow.
- Grey-headed Gulls were decreasing but have had their abundance rebound in recent times.
- Lesser Crested Tern, a non-breeding migrant from the north Indian Ocean/Arabian coast, is a species showing a strong pattern of increase in the Bay.

## 4.5. Threats to biodiversity in Durban

Some of the major threats to biodiversity include:

- Transformation of natural areas (habitat destruction, degradation and fragmentation);
- Introductions of invasive alien species;
- Over-exploitation (e.g. harvesting and sandmining);
- Pollution and diseases; and
- Human-induced climate change.

Due to the lack of quantitative data relating to many of these threats, this report will only focus on transformation, invasive alien species and climate change. As more information becomes available, it will be included.

### 4.5.1. How much land has been transformed?

Transformed areas are those areas that have been altered dramatically from their natural state by human activities. This is one of the single greatest threats to biodiversity as it implies habitat loss, habitat degradation and fragmentation of natural areas. Transformation reduces the ability of natural areas to provide ecosystem services to the citizens of Durban. In Durban, scientifically-derived conservation targets for 13 of the city's vegetation types indicate that six of these are in all likelihood beyond the natural threshold required for long-term survival (Table 4) because they have been irrevocably altered from their natural state.

In 2015/2016, the EPCPD drafted detailed descriptions of the vegetation types and associated environmental determinants within the eThekweni Municipal Area (EMA)<sup>9</sup>. Fine scale environmental variables, 1937 aerial photography, historical accounts and expert knowledge were used in the production of a reference/historic vegetation map. The map aims to represent the vegetation types and their extent ca. 1850, after which sugar cane farming resulted in the mass transformation of areas in Durban (Figure 5).

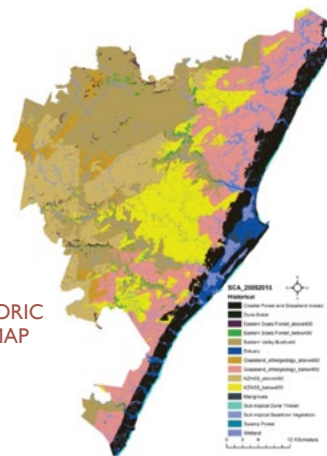


FIGURE 5. HISTORIC VEGETATION MAP CA. 1850

Figure 6 displays the remaining vegetation distributions of the EMA. A visual comparison between the historical and current vegetation distributions highlights the level of transformation and fragmentation that these systems have been subjected to.

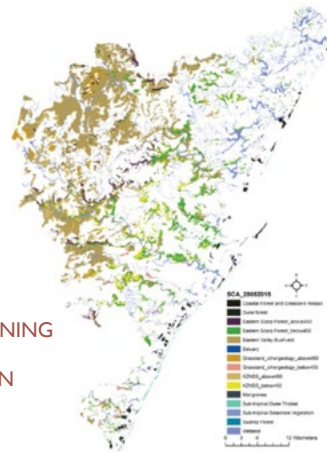


FIGURE 6. REMAINING VEGETATION DISTRIBUTION IN ETHEKWENI

9. Mclean, C.T., Ground, L.E., Boon, R.G.C., Roberts, D.C., Govender, N., & McInnes, A. 2016. Durban's Systematic Conservation Assessment. EThekweni Municipality, Environmental Planning and Climate Protection Department, Durban, South Africa.

TABLE 4: TARGET AND DEFICITS FOR ETHEKWINI VEGETATION TYPES

Vegetation type	Historical area (ha)	Area remaining (ha)	Target (%)	Target (ha)	Percent remaining (%)	Shortfall (ha)
Coastal Forest and Grassland mosaic	20 690	1 720	72	14 833	8	-13 113
Dune forest	2 039	590	69	1 411	29	-821
Eastern Scarp Forest – above 450	1 692	3 096	62	1 042	183	2 053
Eastern Scarp Forest – below 450	3 872	9 295	62	2 386	240	6 909
Eastern Valley Bushveld	76 340	40 377	25	19 085	53	21 292
Grassland – other geology – above 450	6 569	1 556	25	1 642	24	-86
Grassland – other geology – below 450	48 020	1 176	25	12 005	2	-10 829
KZNSS – above 450	35 730	7 043	25	8 933	20	-1 889
KZNSS – below 450	37 220	3 163	25	9 305	8	-6 142
Mangroves	492	82	100	492	17	-411
Sub-tropical Dune Thicket*	199	199	100	199	100	6
Sub-tropical Seashore Vegetation*	17	17	100	17	100	1
Swamp Forest*	55	55	100	55	100	0
Wetland	16 860	11 673	24	4 046	69	7 627

\* It was not possible to estimate the original extent of these vegetation types.

It is important to note that the area of vegetation remaining does not contribute to conservation targets unless habitat is formally conserved.

## Potential threat: Golden Trumpet Tree *Handroanthus chrysotrichus* (formerly known as *Tabebuia chrysotricha*) in eThekweni

The South African National Biodiversity Institute (SANBI) is mandated to conserve South Africa's rich biodiversity. Its Invasive Species Programme (ISP), funded by the Department of Environmental Affairs, aims to reduce the threat of biological invasions through detection, identification, assessment and management of invasive species that may be contained or eradicated. SANBI ISP thus targets alien invasive species that have not yet reached their full invasive potential, i.e. populations that are relatively small/localised compared with established invaders. The benefit of this 'nip-it-in-the-bud' approach is to aim for eradication and reduce the long-term management costs of invasive alien species.

*Handroanthus chrysotrichus* is also known as the Golden Trumpet Tree due to its golden yellow tubular flowers. It is a small spreading deciduous tree that has been widely used as an ornamental in parks and gardens, as well as for street trees. The species is native to Brazil and has naturalized in recent years in Queensland (Australia), with populations consisting of over 1 000 plants. It is a prolific seed producer as seeds can be dispersed over large distances by the wind. It is in the same family as *Tecoma stans* (Yellow Bells), which has increased rapidly in abundance and distribution over recent decades, serving as a warning that related trees may behave similarly.

Naturalised populations of this species have been detected in Durban (specially, in New Germany and SANBI's Directorate on Biological Invasions (DBI) is currently assessing its invasive risk. Sighting reports of naturalised populations would be appreciated. Diagnostic features are listed below to aid identification:

- Height: 4 to 10m tall with branchlets and leaves covered in reddish hairs when young (A)
- Yellow tubular flowers which are 40 to 75 mm long with 5 shallow petal lobes and reddish tracks in the centre (throat) (B)
- Leaves are palmately compound and oblong 20-110 mm long and 10-55 mm wide with shortly pointed tips
- The fruit are long, slender capsules (100-400 mm long and 80-120 mm wide) and are covered with golden or reddish hairs (C)

Localities may be reported to Reshnee Lalla ([r.lalla@sanbi.org.za](mailto:r.lalla@sanbi.org.za) or [invasivespecies@sanbi.org.za](mailto:invasivespecies@sanbi.org.za))

Article compiled by Reshnee Lalla and Michael Cheek of the ISP.



## 4.5.2. Invasive alien species (IAS)

Invasive alien species are plants, animals, pathogens and other organisms that are not indigenous to an ecosystem, and which are capable of spreading naturally (often rapidly) into natural or semi-natural habitats. They can cause economic or environmental harm or can adversely affect human health. In particular, they impact adversely upon biodiversity, causing the decline or elimination of indigenous species through competition, predation or transmission of pathogens, and the disruption of local ecosystems and ecosystem functions.

### 4.5.2.1. Durban Invasives Website

The Durban Invasives Website ([www.durbaninvasives.org.za](http://www.durbaninvasives.org.za)) was developed to help report, manage and track progress in the control of new infestations of invasive alien plant species that occur within the eThekweni Municipal Area, with the help of the general public. In the 2016/2017 financial year, the website received tremendous support in terms of public participation, with 62 emerging invasive species reported (Table 5). A total number of 45 of the reported emerging species have been successfully cleared. Together with other partners like the South African National Biodiversity Institute (SANBI), and through partnerships with other interested stakeholders such as Conservancies, the general public, the Duzi-Umngeni Conservation Trust (DUCT), Working for Water, etc. eThekweni Municipality continues to contribute meaningfully to controlling the spread of IAS.

TABLE 5: EMERGING WEEDS IDENTIFIED DURING THE COURSE OF 2016/2017 FINANCIAL YEAR

Species name	Common name	Total number of sightings reported
<i>Ageratina adenophora</i>	Crofton Weed	2
<i>Ageratina riparia</i>	Creeping Crofton Weed	2
<i>Ailanthus altissima</i>	Tree of Hell	1
<i>Albizia lebeck</i>	Lebeck Tree	3
<i>Clusia rosea</i>	Clusia, Pitch-apple	3
<i>Tibouchina mutabilis</i>	<i>Tibouchina mutabilis</i>	3
<i>Tibouchina urvilleana</i>	Glory Bush, Princess Flower	1
<i>Melastoma malabathricum</i>	Melastoma	4
<i>Sesbania punicea</i>	Red Sesbania	2
<i>Mirabilis jalapa</i>	Four-o'clock	1
<i>Coreopsis lanceolata</i>	Tickseed	3
<i>Sagittaria platyphylla</i>	Delta Arrowhead	0
<i>Diplocyclos palmatus</i>	Lollipop Climber	5
<i>Tradescantia spathacea</i>	Moses-in-the-Cradle	0
<i>Lilium formosanum</i>	Formosa Lily	13
<i>Furcraea foetida</i>	Mauritius Hemp	0
<i>Triplaris americana</i>	Ant Tree	4
<i>Campuloclinium macrocephalum</i>	Pompom Weed	12
<i>Parthenium hysterophorus</i>	Famine Weed	3

#### 4.5.2.2. An Audit of the eThekweni Parks and Nurseries

**TABLE 6: NUMBER OF NATIONAL ENVIRONMENTAL MANAGEMENT BIODIVERSITY ACT (NEMBA) LISTED SPECIES IN THE AUDITED NURSERIES (2005-2017)**

Dashes indicated that the nursery was not operating in a given financial year. Counts reflect species assessed on nursery grounds.

Nursery		Number of listed species observed (NEMBA)								
		2007	2009	2011	2012	2013	2014	2015	2016	2017
1	Botanic Gardens A (cultivation/storage)	-	15	11	19	5	3	7	4	4
2	Botanic Gardens B (production/display)	9	13	11	13	3	5	3	5	5
3	Botanic Gardens C (sales)	6	1	5	7	7	9	7	5	5
4	Bridgevale Nursery (production/display)	21	23	22	29	22	19	17	18	15
5a	Randles Nursery A (production/display)	-	-	6	7	9	4	4	4	2
5b	Randles Nursery B (decorative)	-	-	-	10	5	2	2	6	4
6	Farewell Nursery (cultivation/storage)	21	27	23	25	12	9	9	6	6
7	Hillary Nursery (production/display)	29	33	32	32	27	17	19	18	18
8	Amanzimtoti Nursery (cultivation/storage)	30	26	22	28	11	5	13	12	8
9	Silverglen Medicinal Plant Nursery (cultivation/storage)	14	20	9	21	19	8	9	8	8
10a	Buffesdraai Storage Nursery A (EPCPD reforestation programme)	-	-	12	18	18	12	12	10	7
10b	Buffesdraai Storage Nursery B (EPCPD reforestation programme)	-	-	-	-	-	8	10	7	7

TABLE 7: NUMBER OF NEMBA LISTED SPECIES OBSERVED IN THE AUDITED PARKS (2008-2015)

Park name		Number of listed species observed (NEMBA)						
		2008	2010	2013	2014	2015	2016	2017
1	Memorial Park	11	9	9	8	13	15	10
2	Town Park	12	15	8	7	3	5	5
3	Japanese Gardens (Sarnia)	20	25	26	16	12	35	26
4	Japanese Gardens (Durban North)	34	39	38	36	29	40	33
5	Sunningdale Ponds	19	17	23	23	20	30	30
6	Phoenix Plaza	5	14	14	10	11	12	15
7	How Long Park	10	16	19	13	11	23	19
8	Amazimtoti Bird Park	17	25	21	16	15	26	22
9	Havenside Park	19	23	22	21	18	26	28
10	Gugu Dlamini Park	3	1	2	2	2	3	3

## What are the NEMBA Invasive Alien Species categories and what do they mean?

**Category 1a:** Invasive species that may not be owned, imported into South Africa, grown, moved, sold, given as a gift or dumped in a waterway. These species need to be controlled on your property. Examples include *Campuloclinium macrocephalum* (Pom Pom Weed), and *Diplocyclos palmatus* (Lollipop Climber).

**Category 1b:** Invasive species that may not be owned, imported into South Africa, grown, moved, sold, given as a gift or dumped in a waterway. Category 1b species are major invaders that may need government assistance to remove. All Category 1b species must be contained, and in many cases they already fall under a government sponsored management programme. Examples include *Ageratina riparia* (Creeping Crofton Weed) and *Ipomoea indica* (Purple Morning Glory).

**Category 2:** These are invasive species that can remain in your garden, but only with a permit, which is granted under very few circumstances. Examples include *Morus alba* (Common Mulberry), *Pinus elliottii* (Slash Pine).

**Category 3:** These are invasive species that can remain in your garden. However, you cannot propagate or sell these species and must control them in your garden. In riparian zones or wetlands, all Category 3 plants become Category 1b plants. Examples include *Syzygium jambos* (Rose Apple), *Duranta erecta* (Pigeon Berry).

For more resources on invasive species in Durban, please visit the EPCPD publications website page ([http://www.durban.gov.za/City\\_Services/development\\_planning\\_management/environmental\\_planning\\_climate\\_protection/Publications](http://www.durban.gov.za/City_Services/development_planning_management/environmental_planning_climate_protection/Publications)) or the EPCPD offices (Room 200, City Engineers Building, 166 K.E. Masinga Road, Durban).

**TABLE 8: LISTED IAPS COMMONLY OBSERVED ACROSS NURSERIES**

Botanical name	Common name(s)	NEMBA category	Number of nurseries observed in 2013	Number of nurseries observed in 2014	Number of nurseries observed in 2015	Number of nurseries observed in 2016	Number of nurseries observed in 2017
<i>Ageratum conyzoides</i>	Invading Ageratum	1b	7	11	9	8	7
<i>Melia azedarach</i>	Syringa	1b (KZN)	4	6	5	7	4
<i>Syngonium podophyllum</i>	Arrow-head Vines/ Goose Foot	1b (KZN)	5	6	6	5	6
<i>Solanum mauritanium</i>	Bugweed	1b	6	5	5	3	1
<i>Aristolochia elegans</i>	Dutchman's Pipe Vine	1b	4	4	4	2	2
<i>Cardiospermum grandiflorum</i>	Balloon Vine	1b	4	4	4	4	4



**TABLE 9: IAPS (INCLUDING EMERGING SPECIES) COMMONLY OBSERVED ACROSS PARKS**

Botanical name	Common name	NEMBA category	Number of parks observed in				
			2013	2014	2015	2016	2017
<i>Ageratum conyzoides</i>	Invading Ageratum	1b	8	8	5	7	8
<i>Melia azedarach</i>	Syringa	1b	6	7	6	6	7
<i>Morus alba</i>	White Mulberry	2	7	7	5	6	6
<i>Syngonium podophyllum</i>	Arrow-head Vines/Goose Foot	1b	7	7	8	7	6
<i>Callistemon rigidus</i>	Stiff-leaved Bottlebrush	1b	6	6	4	6	6
<i>Canna indica</i>	Indian Shot	1b	7	6	6	6	7
<i>Ipomoea purpurea</i>	Common Morning Glory	1b	6	6	3	3	3
<i>Ricinus communis</i>	Castor-oil Plant	1b	7	6	4	3	4
<i>Chromolaena odorata</i>	Triffid Weed	1b	6	5	5	6	7

### 4.5.3. Climate change

In Durban, the following changes have been projected to occur:

- Increases in temperature of 1.5-2.5°C by 2045-2065 and 3-5°C by 2081-2100. Rainfall in Durban is projected to increase in the future (up to an additional 500mm by 2081-2100). The distribution and variability of this rainfall will change; with rainfall events becoming more erratic.
- The sea level along the Durban coastline is rising at present by 2.7cm every decade. Projections indicate that this rate is likely to accelerate in the future.
- Due to these changes in temperature and rainfall, the climatic conditions in which the fauna and flora of Durban exist could change or shift. This will place additional pressure on Durban's biodiversity as species may only be adapted to a narrow climatic range or may have limited ability to disperse to new areas where climatic conditions are suitable.





## Global Environmental Change Research Programme Annual Report <sup>10</sup>

The Global Environmental Change (GEC) Research Programme falls under the umbrella of the Durban Research Action Partnership (D'RAP), which has been established as a broad-based partnership between the University of KwaZulu-Natal and eThekweni Municipality. The GEC is the third research programme within D'RAP, following on the KwaZulu-Natal Sandstone Sourveld programme and the Community Reforestation Research Programme. For the GEC, the lead Principal Investigator (PI) from UKZN is SARCHI Chair Prof. Colleen Downs, with Dr Sean O'Donoghue leading from the Municipality.

The GEC currently supports four PhD, three MSc students and one Post-Doctoral fellowship, as well as a research administrator and coordinator, and data manager position. Fields of study supported by the GEC include, among others, human-wildlife conflict in the City, forest-dependent mammals and bird diversity, biodiversity in eco-estates, and nitrogen enrichment and remote sensing. Funding was also made available for a short-term contract position for a scientist to rework biodiversity information from D'RAP into relevant and accessible information. Thus far, the programme has also supported activities such as a formal launch and visioning workshop, and workshops relating to the co-development of products like a biodiversity monitoring programme. During the past year, the GEC hosted a writing workshop for students and staff from both UKZN and the eThekweni Municipality, and an 'Open Day' for UKZN students to meet staff from the Municipality and learn about municipal managed D'MOSS areas.

D'RAP follows a transdisciplinary research approach, where research problems are explored and projects are designed collaboratively by both researchers and practitioners. Another novel approach towards closing the research-action gap commonly experienced between learning and decision-making institutions is through the so-called 'Embedded Researcher (ER)' approach. The GEC's Post-doc Fellow is designed to be an 'ER', where the candidate is embedded fully into both UKZN and the EPCPD, in order to investigate and streamline the integration of climate information into biodiversity planning and management. The ER approach is developed and supported by the Future Resilience for African CITIES and Lands (FRACTAL) project – a four-year transdisciplinary research project on advancing and integrating scientific knowledge about climate change into decision-making in southern African cities (hosted by the Climate System Analysis Group at the University of Cape Town).

Continuous evaluation, reflection, and learning are important components of the research partnership, as this allows an adaptive approach to research and management. Responses from continuous evaluation exercises has indicated positive perceptions and outcomes of the partnership and programme.

*10. Information provided by Dr Lulu Pretorius (Post-doctoral Researcher, Climate Protection Branch, EPCPD).*

## 4.6. Responses to threats

### 4.6.1. Greenhouse Gas Inventory

A Greenhouse Gas (GHG) Emissions Inventory for the eThekweni Municipality was compiled for the 2015 calendar year and made available in the 2016/2017 municipal financial year. The inventory identifies the sources of GHG emissions from both the government and community sectors within the eThekweni Municipal Area. The eThekweni Municipality has compiled the Emissions Inventory to help plan climate change mitigation strategies within the Municipality.

The total greenhouse gas emissions recorded for the entire eThekweni Municipal Area was **27 067 912 tCO<sub>2</sub>e** for 2015. This was lower than the previous years recording of **29 092 033 tCO<sub>2</sub>e**, representing a 7% decrease in emissions (Figure 7). This reduction appears to be due to less emissions from residential, commercial and industrial electricity usage. As with previous inventories, the largest contribution to the total footprint was the transportation sector (40% of the

total GHGs), followed closely by industrial emissions (34%). Local government emissions accounted for 6% of the total emissions for the eThekweni Municipal Area (Figure 8).

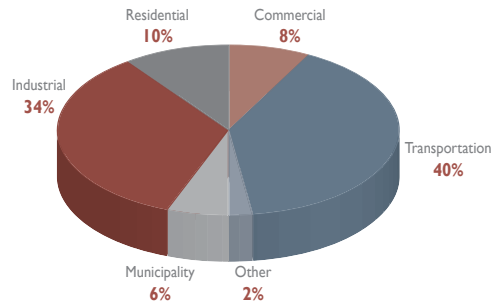


FIGURE 8. GHG EMISSIONS BY SECTOR

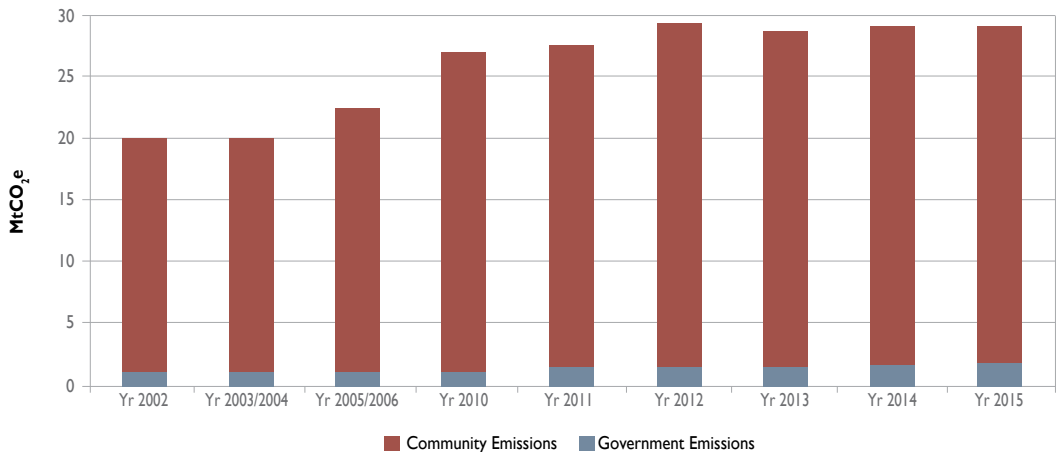


FIGURE 7. HISTORIC EMISSIONS DATA FOR THE ETHEKWINI MUNICIPALITY (tCO<sub>2</sub>e)

## 4.6.2. Restoration ecology

Restoration ecology, a science that emerged as a separate field in ecology in the 1980s, looks at renewing and restoring ecosystems that have been degraded or destroyed by human activities to a stable, healthy and sustainable state. It is the practice of employing human intervention and action for conserving biodiversity and ecological integrity. Examples of ecological restoration include the active management of habitat for species, e.g. burning of grasslands or removal of invasive alien species, and creation of new habitats in areas that may have been historically transformed for farming and other human activities, e.g. replanting forests or recreating wetlands.

In the 2016/2017 municipal financial year, the Restoration Ecology Branch of the EPCPD had a budget of **R18,012,460** allocated to invasive alien species control and a further **R10,422,244** for reforestation. The management of natural areas allows for a unique opportunity to address one of the biggest threats to biodiversity, i.e. poverty. Two programmes, Fire and Invasive Species Control (FISC) and Working for Ecosystems (WfE), have been appointed to tackle the problem of invasive alien species in Durban. Both FISC and WfE are sustainable development programmes that aim to alleviate poverty and develop skills by employing people to manage aspects of the environment such as burning of grasslands and invasive alien species. Both programmes also have a strong education and training component.

### Work begins in the iLanda Wilds Nature Reserve

The iLanda Wilds Nature Reserve, situated alongside the Amanzimtoti River on Durban's south coast, has been suffering from poor management for a number of years. This has led to a decline in the quality of the natural environment and, consequently, a decline in visitors to the reserve. Through a request received from the Toti Conservancy and the Parks, Leisure & Cemetery Department of eThekweni Municipality, the WfE Programme extended its Invasive Alien Plant (IAP) control operations into this municipal-owned reserve. Prior to this, very limited work on IAP control had been done in the area and infestation levels were high. iLanda Wilds has now become one of WfE's core sites and work will continue into the foreseeable future. In the weeks and months following the clearing, locals were able to make use of the nature reserve for its trails and other aesthetic qualities, thus demonstrating the importance of natural resource management.



TABLE 10: BREAKDOWN OF EPCPD INVASIVE ALIEN PLANT CONTROL (IAP) FOR THE 2016/2017 MUNICIPAL FINANCIAL YEAR

Programme	Fire and Invasive Species Control	Working for Ecosystems
Total area of invasive alien plant (IAP) control	515 ha	2 453 ha
- Initial	182 ha	49.5 ha
- Follow-up	202 ha	2 403.5 ha
- Maintenance	131 ha	n/a
Burning	411.4 ha (block burns); 06.9 ha (firebreaks); 12 9990 m (tracer belts)	n/a
Training courses	20	10 (and 185 toolbox talks)
Training person days	496	4231
Total jobs created	53	416
Total person days	12 754	25 529
<b>Budget</b>	<b>R10,313,876</b>	<b>R8,876,056.44</b>



## TOOLBOX TALK

A Toolbox Talk is a specialised and focused training kit designed for WfE staff members. The objectives are to reinforce safety in the workplace, to refresh staff on handling work mechanisms, to increase the compliance to work ethics, and to stress the importance of hygiene in the workplace. It is an effective way to get employees involved in matters relating to their own safety, finding solutions to problems, as well as building a committed and productive team.



There are currently 15 SMMEs developed and contracted to Working for Ecosystems, demonstrating how biodiversity conservation and management can contribute positively to socio-economic upliftment.

TABLE 11: SMALL, MEDIUM AND MICRO-SIZED ENTERPRISES (SMME) DEVELOPMENT WITHIN THE WORKING FOR ECOSYSTEMS PROGRAMME

Company name	Service provided	BEE information	Area contracted to
Umhlabakva Enterprises	IAP Control	Black-owned	Ntshongweni
Thinking iMvelo Pty Ltd	IAP Control	Black-owned	Paradise Valley Nature Reserve/Ntshongweni
Umoyomuhle Environmental Services	IAP Control	Black-owned	Huletts Bush/Roosefontein Nature Reserve
Vikelimvelo Environmental Services	IAP Control	Black-owned	Paradise Valley Nature Reserve
Mthini Environmental Projects	IAP Control	Black-owned	Ngonweni
Msenge Clearing Services	IAP Control	Black-owned	Drummond Erf 2/ Ringwood/KwaXimba
Lihlithemba Multi Services	IAP Control	Black-owned	Ngonweni
KBT Creation and Construction	IAP Control	Black-owned	Roosefontein Nature Reserve/Amanzimtoti
Indabengapheli Trading	IAP Control	Black-owned	Ntshongweni/EDRR
Taambe Nzimande Environmental Services	IAP Control	Black-owned	Roosefontein Nature Reserve
Sindy Holdings (Pty) Ltd	IAP Control	Black-owned	Roosefontein Nature Reserve/Huletts Bush
Sbani Sethu Environmental Services	IAP Control	Black-owned	Roosefontein Nature Reserve
Sibonelo Environmental Services	IAP Control	Black-owned	Redcliffe
Skheshe Environmental Services	IAP Control	Black-owned	Ntshongweni
Siyangqoba Environmental Services	IAP Control	Black-owned	Roosefontein Nature Reserve

### 4.6.3. Community Reforestation Project (CRP)

The EPCPD has partnered with the Wildlands Conservation Trust in order to restore selected indigenous forest areas in the EMA. The reforestation programme has adopted the Community Ecosystem Based Adaption (CEBA) model, which demonstrates the strong and vital link between socio-economic upliftment and biodiversity conservation, enhanced ecosystem functioning and carbon sequestration. ‘Treepreneurs’ propagate trees at their homesteads, through the Indigenous Trees for Life Programme developed by the Wildlands Conservation Trust. Treepreneurs then trade their trees for basic food items, clothes, building materials and even school fees. Ninety percent of people who now benefit from this project were earning wages below the poverty line, and are, therefore, from some of the most vulnerable communities in the country. Many of these Treepreneurs are women and children, unemployed adults and pensioners.

In 2016/2017, the CRP was focused on secondary reforestation activities within the buffer zone of the Buffelsdraai Landfill Site. The Buffelsdraai Landfill is the largest regional landfill in the eThekweni Municipality area and is situated north of Durban, near Verulam. As at the end of June 2017, a total of 709 124 trees comprising 72 species were planted in 602.15 ha of land in and around the landfill’s buffer zone since the project’s inception in 2008. A total of 30 000 plants to the value of R225 000 were traded by 142 of the 168 registered and active treepreneurs.

TABLE 12: REFORESTATION PROJECTS FOR THE 2016/2017 MUNICIPAL FINANCIAL YEAR

Combined statistics for Buffelsdraai and iNanda mountain	
Total permanent jobs	30
Total temporary jobs	61
Total part-time jobs	4
Active Treepreneurs	200
Area planted	13.68 ha
Trees planted	15 539
Total IAP maintenance	115.26 ha
Total initial IAP control	44.07 ha
Total follow-up IAP control	70.79 ha
<b>Budget</b>	<b>R12,151,650.00</b>





#### 4.6.3.1. D'RAP Reforestation Research Programme

The Community Reforestation Research Programme is a joint initiative between the EM and the University of KwaZulu-Natal (UKZN) under the Durban Research Action Partnership (D'RAP). The partnership was developed to advance knowledge in biodiversity conservation and management within the context of global environmental change. The programme not only aims to generate much needed knowledge to assist managers in the Municipality in making biodiversity and conservation decisions, but also to build capacity by employing interns and supporting student research activities at the university. Such novel institutional partnerships are important for generating knowledge and learning so as to address the gap between scientific research, policy development and management within a local government setting.



The programme is facilitated by the EM, in particular, the EPCPD, the Research Chair in Land Use Planning and Management at UKZN, along with researchers from various other disciplines at UKZN. The research programme focuses on all sites where community reforestation is taking place (Buffelsdraai, Inanda and Paradise Valley). This complex research programme uses the principles of transdisciplinary research. In essence, this involves identifying and framing a common research problem, integrating knowledge from various disciplines and developing products for decision-making and science.



Two students from the Reforestation Research programme, Mr Sizwe Hlatshwayo and Ms Ashrenee Govender, graduated *cum laude* in their individual research projects. On the following pages are brief descriptions of their projects and outcomes of their research.





## RESEARCH SPOTLIGHT

### Sizwe Hlatshwayo

Sizwe Hlatshwayo is an aspiring Geographic Information Systems (GIS) and remote sensing specialist. He graduated with a BSc degree majoring in Hydrology and Environmental Science (2013), BSc Honours in Environmental Science (2014) and an MSc degree in Environmental Science (2017) at the University of KwaZulu-Natal (UKZN). He participated in the UKZN-D'RAP partnership during his BSc Honours and MSc degrees. His research focus was on understanding ecological processes in forest environments. He has a strong background in GIS and remote sensing (spatial modelling) and statistical programming. The title of his MSc thesis was *Quantifying Live Forest Above Ground Biomass of a Randomly Mixed Natural Forest Plantation using GIS and Remote Sensing Models*. This study has potential to contribute to the importance of using spatial planning and design of naturally mixed forest plantations to improve their diversity and biomass productivity. The first part of the study focused on mapping the temporal and spatial distribution of forest biomass using spatially optimised three-band texture combinations computed from SPOT-6 imagery and a random forest regression algorithm. The second part of the thesis focused on assessing the effects of forest structural diversity and topographic variables on forest biomass productivity using GIS and remotely sensed data. The study showed that forest diversity and topographic variables have significant influences on forest biomass variability. He is currently working on his PhD, researching the impacts of droughts on forest environments. Sizwe was exposed to the UKZN-D'RAP partnership through his supervisor, Professor Onesimo Mutanga from UKZN's Geography department. Through the UKZN-D'RAP partnership, he has gained experience in multidisciplinary research and integrating remote sensing and GIS with other disciplines. Furthermore, he had the opportunity to work in a team and to work in an applied science project (linking academic science with community science).



## RESEARCH SPOTLIGHT

### Ashreee Govender

Ashreee Govender completed a Bachelor of Science degree majoring in Genetics and Microbiology in 2013 at the University of KwaZulu-Natal (UKZN). She then went on to complete her Honours degree in Conservation Genetics under the supervision of Dr Sandi Willows-Munro at UKZN. The research carried out during her Honours degree allowed her to understand the opportunities that were accessible through conservation genetics. Ashreee graduated *cum laude* for her MSc in Genetics at the beginning of 2017. Her MSc study focused on testing the utility of DNA barcoding in South African Hemiptera, using the species found in the eThekweni region as a case study.

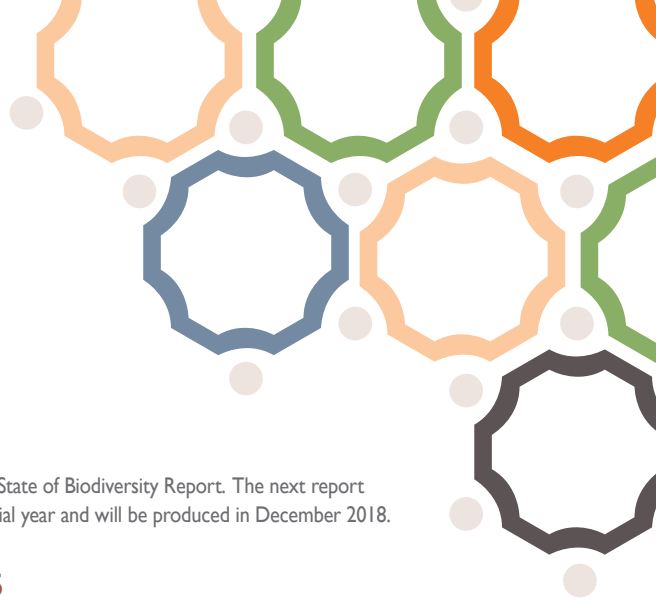
DNA barcoding has been suggested as a mechanism that enables biologists to 'label' or 'tag' species using nucleotide variations in short sequences known as DNA barcodes. Ashreee's MSc study investigated the utility of DNA barcoding and the use of the mitochondrial cytochrome oxidase c sub-unit I (COI) marker to identify species of Hemiptera efficiently and accurately. This study presented a preliminary DNA barcode reference library for Hemiptera collected from 18 different localities within and around the eThekweni municipal region. To test the success of DNA barcoding and the COI marker, matches between morphospecies and barcode clusters (BINs) were analysed and the presence of the DNA barcode gap in the data was examined. The DNA barcode gap is the gap between the intraspecific and interspecific genetic distances. The lack of the DNA barcode gap suggests that taxa cannot be reliably sorted into species based on the genetic data. Analyses revealed that DNA barcoding using the COI marker is a successful method of identifying Hemiptera species. Thereafter, a case study was selected within the Buffelsdraai Landfill Site Community

Reforestation Project to test whether DNA barcoding could be used to assess the potential of Hemiptera as an indicator of ecological restoration success. The Hemiptera species composition and assembly were assessed by analysing multiple diversity indices, ordination, UPGMA cluster analysis and phylogenetic analysis. Hemiptera was seen to be sensitive to changes in an ecosystem, which make this order an effective environmental and biological indicator. With the help of DNA barcoding, specific families of Hemiptera were identified as habitat-specific and good biological indicators for future studies of ecological restoration and reforestation.

Both Ashreee's BSc Honours and MSc study has contributed towards a larger project started through the collaboration between the UKZN and the eThekweni Municipality. She has been part of the UKZN-D'RAP partnership for three years and allowed Ashreee to interact with policy makers and other municipal staff from the EPCPD. This gave her the opportunity to better understand how the results from her research will be used in the future of conservation management within the eThekweni region.

At present, Ashreee is a private consultant in the field of DNA barcoding associated with the Willows Munro laboratory, however, she would like to pursue a PhD in the future. Ashreee is passionate about research and she intends following this passion through her involvement with the UKZN-D'RAP partnership.





## CONCLUSION

This is the eThekweni Municipality's ninth State of Biodiversity Report. The next report will be for the 2017/2018 municipal financial year and will be produced in December 2018.

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