National Botanical Gardens:
havens of biodiversity

Supplement to *Veld & Flora*, Vol. 93(4) December 2007

Compiled by
Christopher Willis** & **Augustine Morkel
A collaboration between SANBI and BotSoc

FOREWORD

Dr Bruce McKenzie
Executive Director, BotSoc

The Botanical Society of South Africa (BotSoc) has been a partner and supporter of the South African National Biodiversity Institute (SANBI) and its forerunners for over 90 years. This supplement to *Veld & Flora* focuses on other "biodiversity" (birds, mammals, insects, etc.) rather than just our core interest, which is "plant diversity". It is an example of BotSoc embracing the change which has come about since SANBI replaced its predecessor the National Botanical Institute (NBI) and also supports one of the principles contained in BotSoc's Centenary Charter (see *Veld & Flora*, March 2006) which outlines our commitment to supporting SANBI and its mandate.

In this regard the BotSoc warmly welcomes the first CEO of SANBI, Dr Tanya Abrahamse, and looks forward to working with her and her team in tackling new challenges, some of which she has spelt out in her foreword to the supplement.

Dr Bruce McKenzie
EXECUTIVE DIRECTOR, BotSoc

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MESSAGE FROM SANBI'S CEO

It was indeed a pleasure to meet many Botanical Society (BotSoc) members, as well as your Executive Director, Dr Bruce McKenzie, during my tour of the National Botanical Gardens and facilities in my first month as CEO of SANBI.

Clearly BotSoc's support and partnership is invaluable to SANBI's success and I sincerely hope it will continue and strengthen into the future.

Our partnership arrangement seems to be a best-practice model to engage with civil society, NGOs, community-based organisations and specialist associations as we move from a focus on all things 'botanical' to everything 'biodiversity'.

As we begin to engage with organisations and associations on the faunal side of biodiversity we will no doubt be taking the valuable lessons from our very long and close relationship with yourselves. Therefore, it is heartening to see that BotSoc is producing a supplement to your quarterly journal, *Veld & Flora*, focusing on animal biodiversity – an opportunity to widen our engagement with interest groups and associations.

The challenges for 'Biodiversity South Africa' are many but not insurmountable, given the level of skill, experience and passion, both within SANBI and amongst our partners and network. The NBI, under Prof Huntley's leadership, is indeed a great foundation. But our job will not be done until we introduce a much wider range of South Africans to the interesting and exciting arena of biodiversity. I am sure that BotSoc will continue to be our partner in this challenge.

I am honoured and privileged to have been appointed as SANBI's first CEO and feel sure that together we can build a highly successful organisation. Thank you again for your welcome and support.

Dr Tanya Abrahamse
CHIEF EXECUTIVE OFFICER, SANBI

Dr Tanya Abrahamse
CEO, SANBI

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*The **Pied Kingfisher** (**Ceryle rudis**) with its distinctive black and white plumage is commonly found on water bodies with small fish. These monogamous birds hunt from perches or by hovering. They hover more than any other kingfisher and usually plunge underwater to catch fish. Breeding birds are killed in their burrows by water mongooses and snakes.*

Photo: Mark Anderson

Animals form an integral part of South Africa's National Botanical Gardens

by ***Christopher K. Willis*** *and* ***Augustine T. Morkel,***
South African National Biodiversity Institute

Christopher Willis

Augustine Morkel

South Africa's national botanical gardens mean different things to different people. Traditionally, botanical gardens, as their name implies, have been viewed primarily through a botanical filter. Indeed, Botanic Gardens Conservation International has defined botanical gardens as 'institutions holding documented collections of living plants for the purposes of scientific research, conservation, display and education'. There is, however, much more to botanical gardens, particularly in South Africa, where all national botanical gardens include an area of natural indigenous vegetation with its associated wealth of biodiversity and biological interactions.

South Africa's national botanical gardens are currently spread across five provinces, and include over 1 300 ha of natural vegetation, ranging from savanna bushveld, highveld grassland to subtropical forest, mountain and coastal fynbos to arid karroid vegetation. Efforts are currently under way to establish a new national botanical garden, comprising over 6 000 ha of renosterveld fynbos and succulent karoo vegetation, at Nieuwoudtville in the Northern Cape.

The formation of the South African National Biodiversity Institute (SANBI) in September 2004 through the proclamation of the National Environmental Management: Biodiversity Act (NEMBA) provided the ideal opportunity to showcase the biological diversity held within South Africa's eight national botanical gardens. With the organisation's main focus having been on documenting, studying and conserving South Africa's indigenous plants since Kirstenbosch was established in 1913, there are inevitably many gaps in our knowledge and understanding of the faunal diversity conserved in our gardens. In most cases there is a fairly comprehensive understanding of the avian diversity in the national botanical gardens. However, our knowledge of the lesser known, and very often less visible, groups such as insects, reptiles, amphibians and even mammals is in several cases still very restricted. Clearly, there are still many opportunities for individuals to study and document the faunal diversity associated with South Africa's national botanical gardens.

Red-winged Starlings *occur in all South Africa's national botanical gardens.*

Photo: Alice Notten



*South Africa's national botanical gardens are home to all three South African lapwings (previously called plovers) – **Blacksmith**, **Crowned**, and the **African Wattled Lapwing**. All three lapwings (**Vanellus spp.**) have been recorded in each of the Lowveld, Pretoria and Walter Sisulu NBGs.*

Photos: Mark Anderson

Although our knowledge of the gardens' faunal diversity is still at an embryonic stage, South Africa's national botanical gardens have, for many years, been describing the interactions and dependencies between plants, people and animals through interpretive signage displayed in the gardens. This has been extended to general visitors through guided tours and to learners through formal educational programmes held in the gardens. Several gardens offer weekend talks and specialised natural history courses, and visitors are encouraged to make use of the opportunities that are provided to learn more about biological diversity present in and outside our national botanical gardens.

Most of the available information on the biodiversity conserved in South Africa's national botanical gardens (NBGs) has come from observations and ad hoc surveys completed by university staff and students, museums, and natural history societies and clubs.

Free State NBG, Bloemfontein

Natural vegetation types present in the Free State NBG include Winburg Grassy Shrubland (dominated by the wild olive, guarris, spikethorns, star-apple and karees) and Bloemfontein Karroid Shrubland (dominated by dwarf small-leaved karroid and succulent shrubs).

Over 140 birds have so far been recorded in the Free State NBG. The most common birds ringed in the Garden by staff of the National Museum in Bloemfontein include the African Red-eyed Bulbul, Malachite Sunbird, Olive Thrush, Cape White-eye and White-bellied Sunbird. The dam in the Garden provides an important habitat for aquatic birds such as the Little Grebe, African Darter, cormorants, herons and ducks. Insect surveys have been conducted in the Garden by both the University of the Free State and the National Museum. The butterfly and dragonfly/damselfly fauna of the Garden is largely unknown, as is the amphibian, mammalian and reptilian fauna. The Yellow Mongoose with its white-tipped tail is frequently seen moving around the Garden.

*Scorpions, such as this **Opistophthalmus carinatus** photographed in the Free State NBG, are a seldom seen element of the arachnofauna of South Africa's national botanical gardens.*

Photo: David Rambuwani

Harold Porter NBG, Betty's Bay

Surveys of butterflies are required in several national botanical gardens. ***Citrus Swallowtails*** *(**Papilio demodocus**), shown here, are common and widespread throughout South Africa, particularly in wooded areas and gardens. They are generally absent from extremely arid areas.*

Photo: Christopher Willis

Baboons *are regular visitors to the Harold Porter NBG.*

Photo: Mark Skinner, courtesy of www.capepoint.co.za

Natural vegetation types present in the Harold Porter NBG include Kogelberg Sandstone Fynbos, Western Cape Talus Forest and Western Cape Afrotemperate Forest – both subgroupings of Southern Afrotemperate Forest, Fynbos Riparian Vegetation, Hangklip Sand Fynbos, and Overberg Dune Strandveld. The Kogelberg Sandstone Fynbos, considered the heart of the Cape flora with a high level of species endemism, covers the largest area within the Garden boundaries and falls within the core area of the Kogelberg Biosphere Reserve. Western Cape Talus Forest and Western Cape Afrotemperate Forest both comprise tall forest within the Garden boundaries, and contain *Podocarpus latifolius*, *Rapanea melanophloeos*, *Curtisia dentata*, *Cunonia capensis*, *Ilex mitis*, *Platylophus trifoliatus*, *Pterocelastrus rostratus*, *Olea capensis* subsp. *capensis* and *Olinia ventosa*. The understorey is poorly developed, with relatively few species. A southwestern Cape Fynbos endemic, *Aloe succotrina*, grows on the scree slopes in the gorge habitats. Fynbos Riparian Vegetation is evident along the lower reaches of the Disa River and along the braided Dawidskraal River as far as its mouth. Thick stands of palmiet (*Prionium serratum*) are interspersed with

thickets of *Brachylaena neriifolia* and *Metrosideros angustifolia*. Hangklip Sand Fynbos occurs on sand dunes and sandy areas supporting moderately tall, dense ericoid shrubland. Proteoid, ericaceous and restioid fynbos elements are dominant, including *Leucadendron coniferum* and *Erica plukenetii*, with some asteraceous fynbos such as *Metalasia muricata* also present. Overberg Dune Strandveld comprises flat or slightly undulating dunefields supporting tall, closed, evergreen, hard-leaved shrublands in moist dune slacks and wind-protected valleys and shorter coastal thicket that is wind-shorn along exposed seaside edges.

The Garden forms part of the Kogelberg Biosphere Reserve, the first internationally recognised biosphere reserve in South Africa. Some 95 bird species have been recorded in the Garden, including the Cape Spurfowl (Cape Francolin), Water Thick-knee (Water Dikkop), African Olive-Pigeon (Rameron Pigeon), Olive Woodpecker, Cape Rock-jumper, Protea Seedeater (Protea Canary) and endemic Orange-breasted Sunbird. Because of the comparable flora and topography, it is not surprising that the birdlife is very similar to that recorded in Kirstenbosch NBG. Frogs recorded in the Garden include the Arum Lily Frog, Cape Mountain Rain Frog and Cape River Frog. Only 14 butterfly species have been recorded in the Garden, with 11 species of dragonfly (five) and damselfly (six) so far observed in the Garden (by staff and students attached to Stellenbosch University), mostly in Leopard's Kloof and Disa Kloof. Of the six damselflies observed in the Garden, five are considered South African endemics (restricted in their distribution to South Africa). Mammals recorded include the Chacma Baboon, Cape Porcupine (South Africa's largest rodent), Cape Clawless Otter and Water Mongoose. Leopards, although seldom seen, will undoubtedly move around the upper mountainous areas of the Garden that border on the Kogelberg Nature Reserve. Reptiles recorded include the Berg Adder, Boomslang, Puff Adder, Common Brown Water Snake and Herald or Red-Lipped Snake. The reptilian fauna has not been well studied and dedicated surveys will certainly reveal a much greater diversity than currently known. An annual occurrence of spectacular fireflies can be observed in the forested areas of the Garden on warm evenings in early

*The **Cape Sugarbird** (**Promerops cafer**) is largely sedentary and endemic to fynbos. It is dependent on Proteaceae for almost all resources, occurring mainly in mixed stands of Protea and Erica. The Cape Sugarbird is strongly dependent on protea nectar and visits up to 300 flowers per day to meet its energy requirements, making it an effective pollinator.*

Photo: Mark Anderson

*The **Cape Porcupine** (**Hystrix africaeaustralis**) is the largest rodent in southern Africa, weighing up to 19 kg. With their distinctive white and black quills, these nocturnal mammals are predominantly vegetarian, their food including bulbs, tubers and roots which they dig up. They normally live in extended family groups, comprising an adult male, adult female and variable numbers of offspring from consecutive litters.*

*Illustration by Dick Findlay. Reproduced with kind permission from **The mammals of the southern African subregion** (third edition), revised by John D. Skinner & Christian T. Chimimba and published in 2005 by Cambridge University Press.*

*The **Klipspringer** (**Oreotragus oreotragus**) has been recorded in the mountainous areas of the Harold Porter NBG. Klipspringers walk on the tips of their hooves, which are adapted to their life among rocks. These mammals are predominantly browsers and are found most commonly in pairs, as solitary individuals or in small family groups of a male, female and her offspring.*

Photo: Mark Anderson

November. Fireflies are in fact not flies at all, but beetles. Very little is currently known about the arachnids (spiders and scorpions) present in the Garden.

An interesting recent discovery in the Garden has been that of a velvet worm (*Peripatopsis species*). Velvet worms, looking very much like slugs with legs, represent a life form with features of both annelids (which include the familiar earthworms and leeches) and arthropods (which include the insects, spiders, scorpions, millipedes, centipedes and crustaceans). Recent genetic studies suggest that they are a specialised group, related to but not part of the arthropods. They had marine ancestors and were once more abundant, but the few surviving members are all restricted to moist habitats, generally in the litter and dead wood of forest floors. South Africa has 12 described species, but recent genetic work has shown that there are considerably more species. The species found in the Garden is probably another of the many new species from the Western Cape Province that have been revealed by DNA sequencing. An albino species inhabits a sandstone cave on Table Mountain, and one other species from Signal Hill in Cape Town is thought to be extinct. Although appearing defenceless, velvet worms defend themselves and attack prey (other arthropods) by squirting out very sticky glue from a pair of nozzles (oral papillae) under the head. Most give birth to live young. They are seldom seen as they are nocturnal, and spend much of their time squashed into small cavities in rotten logs.

Karoo Desert NBG, Worcester

*Egg sac of the **Rain Spider** (**Palystes sp.**) in the Karoo Desert NBG. Females lay 70–300 eggs in a greyish, cushion-like egg sac. The sac, covered with leaves and held together with silk, is hung in vegetation and guarded by the mother. These nocturnal spiders usually cause quite a stir because of their size.*

Photo: Christopher Willis

Natural vegetation types present in the Karoo Desert NBG include remnants of Breede Shale Fynbos, Breede Shale Renosterveld and mainly Robertson Karoo. Breede Shale Fynbos comprises moderately tall and dense shrubland – mostly restioid, proteoid and asteraceous fynbos. Breede Shale Renosterveld is dominated by renosterbos. This grades into Robertson Karoo, with karoo shrublands usually occurring on the northern aspects and renosterveld found on the southern aspects. Heuweltjies are very prominent, with succulent shrubs in drier habitats. Robertson Karoo comprises undulating flats and adjacent hills supporting dwarf succulent shrubland to succulent thicket dominated by succulent species of *Euphorbia*, *Crassula* and vygies. *Euphorbia mauritanica* is usually dominant on heuweltjies, which are an important element of the Robertson Karoo.

Relatively little is known of the faunal diversity in the Karoo Desert NBG, with most of the available information based on observations made by garden staff over many years. As many as 95 bird species have been recorded in the Garden, including the endemic Ground Woodpecker and Cape Rock-Thrush (both also found in Kirstenbosch and Harold Porter NBGs), the endemic Large-billed Lark, Grey Tit, Mountain Wheatear (Mountain Chat), Long-billed Pipit, Dusky Sunbird, Southern Tchagra, the near-endemic White-throated Canary and a breeding pair of Spotted Eagle-Owls.

Tortoises are often seen in the Garden, and include the Parrot-beaked Tortoise, Leopard Tortoise and Angulate Tortoise. A warning sign saying 'Give way to tortoises' has been erected at several sites along the ring road established inside the developed part of the Garden. Toads recorded include the Raucous Toad and Rose's Mountain Toad.

The Garden is also home to the Little Karoo Dwarf Chameleon (or Robertson Dwarf Chameleon), a widely distributed chameleon found in the Little Karoo and surrounding mountain ranges. Snakes found in the Garden but seldom seen include the Cape Cobra, Puff Adder, Common or Rhombic Egg Eater, Spotted or Rhombic Skaapsteker and the nocturnal Coral Snake. The colourful Coral Snake is fond of rocky outcrops and has been described as a 'bad-tempered clown'. When cornered, it will strike repeatedly, hissing and lunging forward at the same time.

Mammals that can be seen in the Garden include the Scrub Hare, Rock Dassie, Caracal, Small Grey Mongoose and Grysbok. Nocturnal visitors and inhabitants include a range of different bats and the Cape Porcupine. Several butterflies have been recorded in the Garden but further invertebrate surveys are required.

*The nocturnal and solitary **Scrub Hare** or 'Kolhaas' (**Lepus saxatilis**) occurs widely in the southern African subregion, emerging to feed at sundown. Their diet comprises leaves, stems and rhizomes of dry and green grass, with a preference for green grass.*

*Illustration by Dick Findlay. Reproduced with kind permission from **The mammals of the southern African subregion** (third edition), revised by John D. Skinner & Christian T. Chimimba and published in 2005 by Cambridge University Press.*

Kirstenbosch NBG, Cape Town

Natural vegetation types present in the Kirstenbosch NBG include Peninsula Granite Fynbos, Cape Winelands Shale Fynbos, Peninsula Sandstone Fynbos and Southern Afrotemperate Forest. Smaller reserves that are managed by Kirstenbosch include the Edith Stephens Wetland Park on the Cape Flats and the Tinie Versfeld Flower Reserve near Darling. Edith Stephens includes areas of Cape Flats Sand Fynbos and Cape Flats Dune Strandveld whereas the Tinie Versfeld Flower Reserve contains patches of Swartland Granite Renosterveld. The Peninsular Sandstone Fynbos is

***Striped Mouse** (**Rhabdomys pumilio**) in Kirstenbosch. It is an omnivorous rodent that is crepuscular, with peaks of activity in the early morning and late afternoon. In feeding on flowers of Proteaceae, it plays an important part in the pollination of flowers.*

Photo: Alice Notten

Orange-breasted Sunbird *feeding on the flowers of Erica verticillata in Kirstenbosch NBG. It is endemic to fynbos and found mostly in dense stands of Protea and Erica species. While not threatened, it is adversely affected by invasion of alien woody plants.*

Photo: Mark Anderson

Chick of a ***Spotted Eagle Owl*** *(**Bubo africanus**) in Kirstenbosch NBG. It is the most widespread owl in southern Africa, and a common breeding resident in Kirstenbosch.*

Photo: SANBI Collection

confined to the Cape Peninsula and comprises tall proteoid shrubland over a dense ericoid-leaved shrubland – mainly proteoid, ericaceous and restioid fynbos, with some asteraceous fynbos. It is probably the best explored and described vegetation type in the Fynbos Biome due to its locality in the Cape Town metropolitan area and near the University of Cape Town as a major research institution. Swartland Granite Renosterveld is the wettest renosterveld unit. The bulb-rich veld is dominated by *Lachenalia pustulata* in the Tinie Versfeld Flower Reserve. It is a critically endangered vegetation unit that has largely been transformed due to the prime quality of the land for agriculture and because of urban sprawl. Alien grasses include *Lolium multiflorum*, *Avena fatua* and *Bromus diandrus*.

During the decade of the 1920s, a series of articles on the biodiversity in Kirstenbosch were published in the *Journal of the Botanical Society of South Africa*, forerunner to *Veld & Flora*. Subjects included birds (1919), spiders (1920), mammals (1921), caterpillars (1922), reptiles (1923) and bees and wasps (1924). Copies of these early articles are available in the archival section of the Kirstenbosch website (www.sanbi.org/kirstenbosch). Since this period, apart from an article on the birds of Kirstenbosch by Broekhuysen in 1958, very little has been published on the biodiversity of Kirstenbosch. Argent & Loedolff's (1997) guide to the indigenous forests at Kirstenbosch provides an excellent insight into

the ecological processes and community dynamics within the afromontane forests at Kirstenbosch. Preliminary results of a study on the endemic invertebrate fauna of the Cape Peninsula currently being conducted by the Department of Conservation Ecology and Entomology of Stellenbosch University have indicated that young forests and Kirstenbosch's cultivated gardens show the highest ground-living and flying invertebrate diversity on Table Mountain. Kirstenbosch also appears to serve as an important refuge for many of Table Mountain's invertebrates.

More than 125 birds have been recorded in Kirstenbosch, including some not seen in other national botanical gardens. These include the endemic Forest Buzzard, Osprey, Striped Flufftail, Kelp Gull, Hartlaub's Gull, Knysna Warbler and Common Chaffinch. The Common Chaffinch is an alien species introduced to the Cape Town area from Europe by Cecil John Rhodes in 1898, but has never become invasive and remains in a small population. The Orange-breasted Sunbird and Protea Seedeater are found in both Kirstenbosch and the Harold Porter NBG. Birds that occur in all three of the Western Cape NBGs include, amongst others, the Ground Woodpecker, Cape Bulbul, Cape Rock-Thrush, Familiar Chat, Karoo Prinia, Common Starling, Cape Sugarbird, Swee Waxbill and Cape Siskin. The resident Spotted Eagle-Owl is often seen in trees along the Camphor Avenue.

Kirstenbosch is home to several amphibians such as the endemic and Critically Endangered Table Mountain Ghost Frog (*Heleophryne rosei*), found only along forest streams on Table Mountain. Annual monitoring surveys on the habitat and tadpole populations are conducted by CapeNature in late summer when stream levels are at their lowest. The frog is threatened by reservoirs (affecting stream flow), water abstraction, invasive alien vegetation and erosion. The rotund Cape Rain Frog (*Breviceps gibbosus*) that burrows near bushes or logs in fynbos has also been recorded in Kirstenbosch. The butterfly and dragonfly/damselfly fauna of Kirstenbosch is not well known and has to be surveyed. The Table Mountain Beauty or Mountain Pride (*Aeropetes tulbaghia*) has been recorded in Kirstenbosch and is the only

Statue of a ***Cape Clawless Otter*** *(****Aonyx capensis****) in the Otter Pond, Kirstenbosch. Cape Clawless Otters are found in all our national botanical gardens where there is suitable aquatic habitat. Crabs and frogs are the preferred food items, followed by fish, insects, birds, reptiles, mammals and molluscs. As the common name suggests, the front feet are without claws.*

Photo: Christopher Willis

Cape Rain Frog *(****Breviceps gibbosus****) found in Kirstenbosch and classified as Vulnerable in the South African Red Data List. It is a Western Cape endemic and was apparently the first African frog to be described by Western science in 1550.*

Photo: SANBI Collection

*The **Table Mountain Beauty** or **Mountain Pride** (**Aeropetes tulbaghia**) is the only known pollinator of the Red Disa (Disa uniflora), but it also visits other flowers as seen here. It occurs along mountain ranges from the Western Cape to the Soutpansberg in the Limpopo Province.*

Photo: Alice Notten

*The **Banded Garden Spider** (**Argiope australis**) is a large, colourful spider often seen hanging upside down on its orb web. Once the web is spun, it remains in position and the spider will make running repairs to it as it is damaged.*

Photo: Petra de Abreu

*The **Table Mountain Ghost Frog** (**Heleophryne rosei**), previously known as the Thumbed Ghost Frog, is a Critically Endangered frog known only from forested gorges with perennial streams on the slopes of Table Mountain.*

Photo: Atherton de Villiers

known pollinator of the Red Disa (*Disa uniflora*) and is very fond of red or orange flowers. Despite its common name, the butterfly is not restricted to Table Mountain and in fact occurs on mountain ranges as far north as the Soutpansberg in the Limpopo Province.

Since dogs were banned from Kirstenbosch, both the Grysbok and Caracal have become more visible in the Garden. Grysbok are small antelope endemic to the southwestern portion of South Africa that are predominantly browsers, relatively more active at night than during the day and independent of a water supply. They are associated predominantly with thick scrub bush and dense cover.

Other mammals visible to visitors include the naturalised Grey Squirrel, Large Grey Mongoose and Small Grey Mongoose. While rats and mice form their principal diet, puff adders form a favoured prey item of the Large Grey Mongoose in the southwestern Cape. The Small Grey Mongoose is predominantly insectivorous, with rats and mice, carrion and birds also ranking high in their diet. The Grey Squirrel, also known as the American Grey Squirrel or Northeastern Grey Squirrel, was introduced to Groote Schuur Estate by Cecil John Rhodes around the turn of the 19th century. Within southern Africa, their habitat requirements include the presence in sufficient numbers of one or more of their staple food-trees, which include the oak (*Quercus robur*) and three species of pines (*Pinus pinea, P. pinaster* and *P. canariensis*). Several other mammals have been recorded in Kirstenbosch but are generally not seen by visitors due to their nocturnal habits. These include various bats, the Striped Polecat, Cape Porcupine and Small-spotted Genet.

While several snakes have been recorded in Kirstenbosch, little is known about its lizards, skinks, chameleons and geckos. Snakes recorded in Kirstenbosch include, amongst others, the Cape Cobra, Mole Snake, Berg Adder, Rinkhals, Aurora House Snake and the Boomslang.

Fifteen molluscs (snails and slugs) have been recorded by staff of the Natal Museum (Pietermaritzburg) in Kirstenbosch (mainly from the base of Skeleton Gorge and from Nursery Ravine), of which nine are exotic, including the Hedgehog Slug, Field Slug, Brown Garden Snail (*Helix aspersa*) and Banded Garden Slug. All introduced slugs in South Africa are thought to have originated from Europe, almost certainly arriving amongst imported plants.

KwaZulu-Natal NBG, Pietermaritzburg

The natural vegetation type present in the KwaZulu-Natal NBG is Ngongoni Veld. The natural grassland area on the hill slopes above the cultivated part of the Garden is dominated by the unpalatable, wiry Ngongoni grass (*Aristida junciformis*). Up to now 182 bird species have been recorded in the KwaZulu-Natal NBG. Specials include the Red-fronted Tinkerbird (Redfronted Tinker Barbet), Bush Blackcap, Chorister Robin-Chat, White-starred Robin, Barratt's Warbler, Broad-tailed Warbler, Croaking Cisticola, Black-bellied Starling, Grey Sunbird, Olive Sunbird, and the Dark-backed Weaver. Birds found in both the KZN NBG and Lowveld NBG include the Long-Crested Eagle, African Crowned Eagle, Buff-spotted Flufftail, Tambourine Dove, Purple-crested Turaco (Purplecrested Lourie), African Emerald Cuckoo, Narina Trogon, Grey Cuckooshrike, Terrestrial Brownbul, Groundscraper Thrush, Red-capped Robin-Chat, Dark-capped Yellow Warbler, Green-backed Camaroptera, Mountain Wagtail, Yellow-throated Longclaw, Olive Bush-Shrike, Collared Sunbird, Spectacled Weaver, Green Twinspot, Lesser Masked-Weaver and Red-backed Mannikin.

The KwaZulu-Natal NBG is home to the ***KwaZulu Dwarf Chameleon*** *(****Bradypodion melanocephalum****).*

Photo: Marius Burger

The KwaZulu-Natal NBG is the national botanical garden with the most comprehensive lists of butterflies, dragonflies and damselflies, thanks largely to previous studies and inventories conducted in the Garden by staff and students of the University of KwaZulu-Natal and amateur naturalists. To date, 117 butterfly species have been recorded in the Garden as a result of intensive surveys conducted by Nicki Feltham as part of her MSc thesis (1994) through the University of Natal, Pietermaritzburg, and Lawrence *et al.* (1998) who collected intensively in the Garden between February 1995 and October 1998. The latter authors have indicated that the KwaZulu-Natal NBG is important not only for introducing butterfly conservation to the general public, but to act as a valuable refuge for many butterfly species in the urbanised area of Pietermaritzburg.

Bird-dropping Spider *in the KwaZulu-Natal NBG. The spider has a smooth, glistening abdomen and rests on leaves where it resembles the wet excrement of a bird. This mimicry serves two purposes, attracting prey (certain butterflies and flies are attracted to bird droppings for the salts they contain) and repelling predators.*

Photo: John Roff

Equally comprehensive is the list of dragonflies and damselflies for the KwaZulu-Natal NBG. Surveys completed

A dragonfly and damselfly trail was established in the KwaZulu-Natal NBG in close collaboration with the University of KwaZulu-Natal in 2000.

Photo: Christopher Willis

When damselflies (Zygoptera), such as the female ***Salisbury Sprite*** *(**Pseudagrion salisburyense**) shown here in the KwaZulu-Natal NBG, settle on a perch they fold their wings close against their bodies, whereas all dragonflies (Anisoptera) settle with wings held stiffly at right angles to the body. Dragonflies have eyes that join together on top of the head, while the eyes of damselflies are widely separated on the head.*

Photo: John Roff

The ***Dorsal Dropwing*** *(**Trithemis dorsalis**) is one of the 'Core resident species' of dragonflies found in the KwaZulu-Natal NBG. This species is common along rivers and streams and its distribution extends from the southwestern Cape northwards across the eastern half of South Africa to central Africa.*

Photo: Christopher Willis

in the Garden by staff and students of the University of KwaZulu-Natal culminated in a dedicated Damselfly and Dragonfly Trail being developed inside the Garden in 2000. Repeated surveys conducted along the trail over a three-year period have indicated that from a list of 36 species (21 dragonflies and 15 damselflies) there are 24 'core resident species' of dragonflies and damselflies that can be seen along the trail in the various habitats from January to May. It is possible therefore, on occasion, to account for all 24 'core resident species' during a single visit during this peak period. The 24 species include three damselfly species that are South African endemics (Forest Malachite, Goldtail and White-masked Whisp) and are overall a suite of species 'typical' of other pools and streams in the Pietermaritzburg region at the same elevation. Generally, peak species richness was recorded in the summer months from December to February, characterised by high ambient and water temperatures, high light intensity, high water levels, and abundant vegetation. Troughs in species richness and abundance were recorded during the winter months (July to August). Niba & Samways (2006) state that 'botanical gardens are inherently valuable for drawing public attention to invertebrates, especially dragonflies which, like butterflies, have iconic value….to provide optimal conditions for a wide range of observable species, it is essential to maintain the natural heterogeneity of vegetation along reservoir and stream margins….removal of marginal vegetation for aesthetics or a sense of tidiness, can reduce local species diversity and abundance.'

The mammalian, reptilian and amphibian fauna of the KwaZulu-Natal NBG is poorly documented, with only a handful of species listed for each group. Further surveys of these groups are required. Frogs known to occur in the Garden include the Bronze Caco, Common River Frog and Painted Reed Frog. Snakes include the Herald or Red-lipped Snake, Dusky-bellied Water Snake and the Common Night Adder.

One of the special reptiles occurring in the KwaZulu-Natal NBG is the KwaZulu Dwarf Chameleon (*Bradypodion melanocephalum*), also known as the Black-headed Dwarf Chameleon and Durban Dwarf Chameleon. The original common name of this species, the Black-headed Dwarf Chameleon, is inappropriate as this chameleon does not have a black head. The name was given based on a museum

specimen in which the head had turned black due to the process of preservation. In the KwaZulu-Natal NBG the chameleon, not more than 11 cm long, is usually found along the forest margin and occasionally in grassland. It occurs singly and tends to sit at branch ends at night, turning a pale colour.

Several collections of molluscs have also been made from the Garden by staff of the Natal Museum in Pietermaritzburg. Some 27 mollusc species have been recorded in the Garden, of which only the Brown Garden Snail is exotic. Most of the mollusc specimens collected from the KwaZulu-Natal NBG were collected by Henry Burnup (1852–1928), with a few collected by W.G. Rump – caretaker and carpenter at the Natal Museum for 45 years in the first half of the 1900s. The earliest mollusc specimen collected from the Garden was the Ribbed Awl Snail collected by Burnup in January 1906. In Burnup's lifetime, his own collection of molluscs was to become the most important ever assembled in this country by any one person, particularly in the field of land snails. He was responsible for the discovery of more species of South African land snails and slugs than any other person – 11 of which were named in his honour. It is reported that in the last few weeks before his death he insisted on being taken to the museum on a stretcher in an attempt to complete the integration of his personal collection with that of the mollusc collection of the Natal Museum.

With both natural and artificial water bodies, the KwaZulu-Natal NBG is home to various frog species, such as the ***Forest Tree Frog*** *(****Leptopelis natalensis****).*

Photo: John Roff

Lowveld NBG, Nelspruit

Natural vegetation types present in the Lowveld NBG include Legogote Sour Bushveld and Pretoriuskop Sour Bushveld.

In terms of visible biodiversity, the Lowveld NBG must surely rank as one of the most rewarding of South Africa's national botanical gardens. The unique setting of the Garden in the Lowveld region of South Africa, straddling the Crocodile River and Nels Rivers with the spectacular Nelspruit Cascades, makes this Garden a true urban haven for biodiversity.

The Lowveld NBG has the highest avian diversity of all national botanical gardens, with 242 birds having been recorded in the Garden so far. Many birds are shared with other NBGs, but birds that have been spotted in the Lowveld NBG and not in any of the others include the White-backed Night-Heron, Bat Hawk, European Honey-Buzzard, Ayres's Hawk-Eagle, Steppe Eagle, Lizard Buzzard, Crested Francolin, Shelley's Francolin, African Finfoot, Emerald-spotted Wood-

Female ***Black-tailed Skimmer*** *(****Nesciothemis farinosa****) in the Lowveld NBG. They frequent reed-, sedge- and grass-lined margins of still and running water. Adult dragonflies are visible mainly in the summer months.*

Photo: Christopher Willis

*Striking larvae of the **Common Emperor** or **Cabbage Tree Emperor Moth** (**Bunaea alcinoë**) defoliate the Common Cabbage Tree (Cussonia spicata) outside the offices of the Lowveld NBG every year. Other host plants include Bauhinia, Croton, Ekebergia and Harpephyllum.*

Photo: Rudi Britz

*Apart from the Walter Sisulu NBG where a limited millipede and centipede survey was conducted on 24 January 2000, the diversity of millipedes and centipedes in South Africa's national botanical gardens is largely unknown. **Doratogonus flavifilis**, shown here in the Lowveld NBG, is the only millipede that is differently coloured – all others are black, although the colour of the legs does vary between species.*

Photo: Christopher Willis

*With patience and some luck one can experience dramatic biological interactions in our national botanical gardens. Here a **Flower Assassin** preys on a honey bee in the Lowveld NBG. (right)*

Photo: Christopher Willis

Dove, African Pygmy-Kingfisher, Yellow-rumped Tinkerbird, Scaly-throated Honeyguide and the Eastern Nicator (Yellowspotted Nicator). Nocturnal birds include, among others, the Southern White-faced Scops-Owl, Square-tailed Nightjar and Spotted Eagle-Owl.

Almost 75 species of reptile (55) and amphibians (18) combined have been recorded in the Garden (see *Veld & Flora* 64(4), pp. 104–107, December 1979), and visitors are bound to come across a range of reptiles during their walks through the Garden. More than half of the reptiles are snakes, ranging from the commonly recorded Mozambique Spitting Cobra and Black Mamba to the Spotted Bush Snake and Twig Snake. The Mozambique Spitting Cobra is considered one of the most dangerous snakes in Africa, second to the Mamba. Like the mambas and other cobras, the Mozambique Spitting Cobra is a front-fanged snake. Its fangs are especially modified for 'spitting' venom which, when sprayed, can cover a distance of 2 m. The venom, for which an antidote is available, is cytotoxic (cell-destroying). Without prompt attention, serious tissue loss occurs, resulting in the necessity for skin grafts. If there is venom in the eyes, they must immediately be washed with clean water or milk.

Some 27 species of freshwater fishes have been recorded in the Crocodile and Nels Rivers, and over 40 species of mammals have been recorded in the Garden. Since dogs

were banned from the Garden, the number and visibility of various mammals has increased significantly. Mammals that are commonly seen include the Vervet Monkey, Dwarf Mongoose, Slender Mongoose, Tree Squirrel and Chacma Baboon. Many of the mammals are nocturnal and not visible during the day, including the Hippopotamus, various bats, and the Thick-tailed Bushbaby. Hippos are selective nocturnal grazers, and are known to consume about 40 kg of grass per night. They are regular nocturnal visitors to the Garden and move through the Garden at night bypassing the Nelspruit Cascades en route to their grazing fields. For such large creatures (weighing in at just under 1 500 kg) they do relatively little damage to plants in the cultivated part of the Lowveld NBG, but in the past have done serious damage to the wooden walkways close to the Crocodile River. Sponsorship was received from Sappi in 2005 to construct an aerial boardwalk in the African Rainforest section of the Garden, which now allows the hippos to walk under, rather than directly on, the walkway en route from the Crocodile River to their feeding places.

Juvenile Boomslang *in the Lowveld NBG, characterised by its very large emerald eyes. The Boomslang is a shy diurnal snake that spends most of its time in trees and shrubs. Though deadly venomous, this timid snake very seldom bites. Like the Twig Snake, it actively hunts chameleons and other tree-living lizards, birds and frogs.*

Photo: Christopher Willis

The Garden's main interpretive walking trail is the Riverside Trail (originally known as the 'Mamba Trail') that allows visitors access to the natural riverine bush along the Crocodile River. The trail, which descends down to the banks of the Crocodile River and back up into the Garden again, includes over 140 plant species, including huge fig trees and lichens that grow flat against the rocks. The 1-km trail, which takes about an hour to walk, challenges one to spot the seldom seen African Finfoot. Other birds visible along the trail are the African Black Duck, Reed Cormorant, Pied Wagtail, Sombre Bulbul, Malachite Kingfisher, Blackeyed Bulbul, Crested Barbet and Blackcollared Barbet, to mention a few.

With a perennial river running through the Garden, the butterfly, dragonfly and damselfly fauna is spectacular and visitors are almost guaranteed of seeing several different species on a visit to the Garden. Surprisingly, however, the dragonfly and damselfly fauna has not been well studied and comprehensive surveys of the butterflies, dragonflies and damselflies in the Garden are required. Almost 90 different

Darting Cruiser *(**Phyllomacromia picta**) in the Lowveld NBG. It is widespread in South Africa where it is the commonest macromid. Its range extends from the southwestern Cape northwards to East and West Africa. Like all Cruisers, this species is a typical flyer that usually rests in a hanging position in branches of trees. It can also be seen perching in a horizontal position on twigs.*

Photo: Christopher Willis

***White-ringed Atlas Moth** (**Epiphora mythimnia**) in the Lowveld NBG. Larvae of this moth feed on Croton gratissimus and Ziziphus mucronata. It is a relative of the world's largest (Asian) moths.*

Photo: Lou-Nita le Roux

species of spiders have been recorded in the Lowveld NBG by spider experts John and Astri Leroy, illustrating the biodiversity value of the Garden amidst rapidly expanding urban development on the Garden's northern and western boundaries. Other groups that still need to be adequately surveyed include the scorpions, molluscs and other invertebrates. Cursory observations indicate that the Lowveld NBG has a significant collection of grasshoppers and locusts.

Nieuwoudtville NBG

***Blue Cranes** (**Anthropoides paradiseus**), South Africa's national bird, are frequently seen in the Nieuwoudtville NBG. Our endemic blue cranes are the world's most range-restricted crane, with their conservation status classified as Vulnerable. Blue cranes usually occur in large flocks and roost in shallow water bodies at night.*

Photo: Mark Anderson

SANBI has acquired the Farm Glenlyon outside Nieuwoudtville where it plans to establish South Africa's ninth national botanical garden. Comprising an area of over 6 000 ha, the new Nieuwoudtville National Botanical Garden is located just outside the town of Nieuwoudtville (marketed as the 'bulb capital of the world') in the Northern Cape. The new Garden includes representative patches of Nieuwoudtville Shale Renosterveld, Nieuwoudtville-Roggeveld Dolerite Renosterveld and Hantam Karoo, a vegetation type typical of the Succulent Karoo Biome. The Hantam Karoo comprises dwarf karoo shrubland with nearly equal proportions of succulent elements (*Aloe, Antimima, Euphorbia, Ruschia*) and low small-leaved karroid shrubs, particularly of the family Asteraceae (*Eriocephalus, Pentzia, Pteronia*).

Over 150 bird species have been recorded in the Garden, including the Secretarybird, threatened Blue Crane and a range of larks that have not been recorded in any of the other national botanical gardens. These include the Cape Clapper Lark, Karoo Long-billed Lark, Karoo Lark, Spike-heeled Lark, Red-capped Lark, Large-billed Lark, Grey-backed Sparrowlark and Black-eared Sparrowlark. Other birds not seen in other national botanical gardens include the Capped Wheatear, Sickle-winged Chat, Karoo Chat, Ludwig's Bustard, Southern Black Korhaan, Kittlitz's Plover, Burchell's Courser, Double-banded Courser, Cape Eagle-Owl and the Karoo Eremomela.

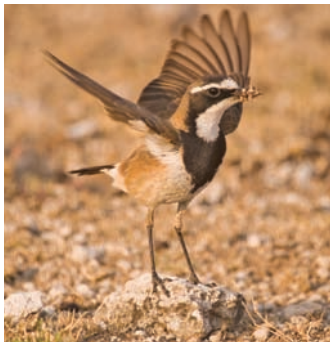
Mammals known to occur in the Garden include, amongst others, Cape Porcupine, Black-backed Jackal, Chacma Baboon, Aardvark, Steenbok, Bat-eared Fox, Cape Fox and Caracal. A PhD study on porcupines is currently being conducted in the Garden by Ms Christy Bragg, a postgraduate student attached to the University of Cape Town. Small mammals include the Cape Rock Elephant-Shrew, Cape Gerbil, Namaqua Rock Mouse, Short-tailed Gerbil, Krebs's Fat Mouse and the Hairy-footed Gerbil.

Surveys of ants as well as wasps and bees were conducted in the Nieuwoudtville area by staff of the Iziko: South African Museum as part of SANBI's Conservation Farming Project in October 2000. For ants, the greatest species richness (35 species) was recorded in renosterveld followed closely by succulent karoo (29) and fynbos (28). The high number of ant species in renosterveld was coupled with a high incidence of rare species, indicating that further sampling would have yielded many more species. Ant species richness was low on doleritic soils away from dolerite koppies, probably because of their unstable nature that makes soil nesting difficult. Species richness of bees across various land uses was similar (highest in the renosterveld) except for fynbos and succulent karoo where it was lower.

A reptile survey was conducted in the Nieuwoudtville area by staff attached to Stellenbosch University in September 2002. A total of only seven reptiles were recorded on the farms Glenlyon and Charlie's Hoek that form part of the Nieuwoudtville NBG. These included the Angulate Tortoise, Karoo Sand Snake, Karoo Girdled Lizard, Southern Rock Agama, Spotted Sand Lizard, Bibron's Thick-toed Gecko and the Striped Dwarf Leaf-toed Gecko. Bibron's Thick-toed Gecko (*Pachydactylus bibronii*) is one of the most common Karoo geckos that live on rocky outcrops, under loose tree bark and in buildings. They are gregarious and often live in dense colonies. The Karoo Sand Snake or Whip Snake

*The **Cape Rock Elephant-shrew** (**Elephantulus edwardii**) has been recorded in the Nieuwoudtville NBG. The first specimen of the elephant-shrew was collected by Edward Verreaux and named after him by Andrew Smith. Verreaux was a well-known collector after whom a number of mammals and birds are named, including the Verreaux's Eagle (Black Eagle). Elephant-shrews are predominantly diurnal mammals that feed mainly on insects, especially ants and termites.*

*Illustration by Dick Findlay. Reproduced with kind permission from **The mammals of the southern African subregion** (third edition), revised by John D. Skinner & Christian T. Chimimba and published in 2005 by Cambridge University Press.*



***Capped Wheatears** (**Oenanthe pileata**) are found in the Nieuwoudtville NBG and forage mainly on the ground, after flying down from a perch (bushes, termite mounds, fence posts, or stones), using the dash-and-jab technique. Their prey comprises insects (especially ants) and arachnids, including spiders and solifuges.*

Photo: Mark Anderson

***Caracals** (**Felis caracal**) are generally nocturnal, solitary and secretive mammals. The species became officially known from a specimen illustrated and described from Table Mountain in 1776 by Johann Christian Daniel von Schreber (1739–1810), a German naturalist. Their diet comprises mammals, birds and reptiles, including the young of larger antelopes.*

*Illustration by Dick Findlay. Reproduced with kind permission from **The mammals of the southern African subregion** (third edition), revised by John D. Skinner & Christian T. Chimimba and published in 2005 by Cambridge University Press.*

(*Psammophis notostictus*) is one of the main predators of terrestrial lizards, such as the Spotted Sand Lizard (*Pedioplanis lineoocellata*), and serves as an indicator for the presence of terrestrial lizards. The reptile survey showed that around Nieuwoudtville, those areas most suitable for cultivation and where rocks are limited, support the lowest number of species. Examples are renosterveld and dolerite vertisols (clay-rich soils that shrink and swell with changes in moisture content; during dry periods the soil volume shrinks and deep wide cracks form). Those areas that are less suitable for cultivation, such as excessively rocky areas and the arid karroid areas, support the highest number of species. Reptile species present in the renosterveld and other arable land also occur in Table Mountain Sandstone/fynbos and karroid areas. The latter areas can therefore serve as reservoirs of species for the recolonisation of those parts formerly affected by agricultural activities. With the exception of one species, all endemic and threatened lizard species occurring in the Nieuwoudtville area are rock-dwelling.

Pretoria NBG

***Mud Dauber wasp** (cf. **Sceliphron spirifex**) in the Pretoria NBG. Females build large multi-celled mud nests attached to cliffs, rocks, tree trunks and buildings. Cells are mass-provisioned with several spiders and sealed with mud.*

Photo: Lambert Smith
See also www.insecta.co.za

The natural vegetation type present in the Pretoria NBG is Marikana Thornveld. It comprises open *Acacia karroo* woodland. Shrubs are denser along drainage lines, on termitaria and rocky outcrops. Important tree taxa in this vegetation type include *Acacia caffra, A. tortilis* subsp. *heteracantha, Combretum molle, Rhus lancea, Ziziphus mucronata, Celtis africana, Peltophorum africanum* and *Dombeya rotundifolia*. The Garden includes representative samples of grassland and Bankenveld vegetation along the Silverton Ridge. Over 230 species of flowering plants, including over 40 different grass species, have so far been recorded by SANBI's plant taxonomists in the natural grassland, making it an invaluable area for both plant conservation and environmental education.

Over 220 bird species have been listed for the Pretoria NBG, including various hawks, falcons and kestrels. Some of the more colourful birds include the Pied Kingfisher, Giant Kingfisher, Malachite Kingfisher, Green Wood-hoopoe (Redbilled Woodhoopoe), Crested Barbet, Black-headed Oriole, African Paradise-Flycatcher, Bokmakierie and Violet-backed Starling (Plumcoloured Starling). Verreaux's Eagles (or African Black Eagles), that have dassies as one of their preferred food items (dassies are known to comprise 70–90% of the diet), are sometimes observed flying over the

ridge in search of prey. Their presence is often announced by the screeching alarm calls of disturbed Crowned Lapwings. With no perennial water in the Garden, artificial water bodies such as the waterfall and the wetland placed north of the Mokha Restaurant provide important habitats for some aquatic birds such as the White-breasted Cormorant, Reed Cormorant, Red-knobbed Coot, Common Moorhen, Fulvous Duck and African Darter. The indigenous Banded Tilapia (*Tilapia sparrmanii*) has been introduced to the wetland adjacent to the Garden's Restaurant. Interestingly, the Grey Go-away-bird (or Grey Lourie) occurs in only two of SANBI's national botanical gardens – Pretoria NBG and the Walter Sisulu NBG. The Department of Zoology & Entomology of the University of Pretoria has been conducting surveys of birds in the Pretoria NBG for several years. Surrounded by urban development, the Pretoria NBG and the Silverton Ridge form an important green area and corridor in the eastern suburbs of Pretoria. Most of the ridge is still natural, and an interpretive Dassie Trail has been established to showcase some of the unique fauna and flora that inhabit the ridge. Dassies are abundant on the ridge and visitors are almost guaranteed of seeing these animals along the trail.

The grasslands and lawned areas, both south and north of the ridge, are inhabited by a variety of bird species, including the Crowned Lapwing, Swainson's Spurfowl (Swainson's Francolin), cisticolas, Cape Longclaw, Spotted Thick-knee (or Spotted Dikkop), Blacksmith Lapwing and Helmeted Guineafowl. Mammals that use the grassland for either food or shelter include the Slender Mongoose, Yellow Mongoose and the predominantly nocturnal Scrub Hare, South African Hedgehog and Common Duiker. Common Duikers are very hardy, elusive and adaptable and have a relatively wide habitat tolerance. They are usually solitary animals that browse on leaves, twigs, flowers, fruits and seeds of a wide variety of trees and shrubs, only very rarely eating grass. Duikers are also avid diggers in search of succulent bulbs and tubers, required for satisfying metabolic water requirements. They require very little water, and even when it is freely available, they rarely drink. Common Duikers are active mainly in the late afternoon, extending well into the hours of darkness, and in the early morning.

***Rock Dassies** (**Procavia capensis**) occur in most of South Africa's national botanical gardens. Weighing up to 4.5 kg, dassies are predominantly diurnal, with litter sizes varying from one to six. Rock dassies are gregarious, living in colonies that vary in size according to the area of rock habitat and amount of food available.*

Photo: Hans Heilgendorff

*Many **wasps** paralyse caterpillars and drag or carry them to their nests. After laying a single egg on the caterpillar, the nest is sealed. Within two or three weeks, the egg hatches into a larva which feeds on the paralysed caterpillar.*

Photo: Lambert Smith
See also www.insecta.co.za

***Bark mantids** (**Tarachodes spp.**) are well camouflaged and move about on the trunks of trees in search of caterpillars and other prey items.*

Photo: Lambert Smith
See also www.insecta.co.za

*The **Brown-veined White** (**Belenois aurota**) butterfly is a rapid flier sometimes migrating in huge numbers in late summer (between December and February), usually in a southerly and easterly direction.*

Photo: Lambert Smith
See also www.insecta.co.za

Other nocturnal inhabitants of the Garden include the South African Lesser Bushbaby that frequents *Acacia*-dominated woodland areas of the Garden, and the Greater Canerat. The latter are vegetarians, living on the roots, shoots and stems of grasses and reeds that grow in damp places. Various bat species have been recorded in the Garden by the Gauteng & Northern Regions Bat Interest Group (GNORBIG) and include the Rusty Bat, Cape Serotine, Yellow House Bat and Egyptian Free-tailed Bat. During the day, the bats usually roost in crevices in rocks and trees, behind the bark of dead trees or in suitable crevices in the roofs of buildings. Being aerial feeders, their diets comprise mainly various combinations of beetles, moths, bugs, flies and lacewings. Cape Serotines are attracted to insects around lights, and are one of the most commonly seen bats flying at dusk at a height of some 10–15 m above the ground.

Snakes are not often seen in the Garden, although the following snakes are known to occur in the Pretoria NBG: Aurora House Snake, Brown House Snake, Herald or Red-lipped Snake, Mole Snake, Puff Adder (very rare), Green Water Snake, Common Egg-eater, Common Brown Water Snake, Spotted Bush Snake, Common Slug-eater and Spotted Skaapsteker. Other reptiles known to occur in the Pretoria NBG include the Flap-necked Chameleon, various skinks, the Yellow-throated Plated Lizard and the Rock or White-throated Monitor.

An interesting phenomenon that occurs on an annual basis is the mass migration of the Brown-veined White (*Belenois aurota aurota*) butterfly that moves across the country from the southwestern parts in a northeasterly direction towards Mozambique and the Indian Ocean. The migration takes place between December and February each year, with the migrating butterflies usually passing over the Pretoria and Walter Sisulu NBGs during this time.

Surveys currently in progress in the Garden include a survey of butterflies (through the Lepidopterists' Society of Africa) and spiders (through the South African National Survey of Arachnida or SANSA and the Spider Club of Southern Africa). Analysis of collections made during an insect survey conducted by entomologists in the Garden in 2005 is currently in progress. Natural history societies regularly offer courses on a range of faunal groups (bats, snakes, scorpions, spiders) in the Garden, and provide SANBI with the opportunity to share its facilities and biodiversity with interested members of the public. Natural history surveys still required in the Pretoria NBG include small mammals, reptiles, dragonflies and damselflies, molluscs and amphibians.

Walter Sisulu NBG, Roodepoort/Mogale City

The natural vegetation type present in the Walter Sisulu NBG is savanna known as Gold Reef Mountain Bushveld. Some 412 indigenous tree species can be found in the Walter Sisulu NBG, of which 69 (17%) occur naturally in the Garden's 275 ha area. Up to now, 240 bird species have been recorded in the Walter Sisulu NBG, with a world renowned resident pair of Verreaux's (Black) Eagles nesting on the cliffs of the Witpoortjie Waterfall on the perennial Crocodile River. The eagles breed every year and their movements are constantly monitored by volunteers attached to the Black Eagle Project Roodekrans, a nonprofit organisation dedicated to ensuring their survival. The eagles perform nest-building activities in March, lay their eggs in April and the chicks normally hatch in June each year. An artificial dam, the Sasol Dam, provides valuable habitat for many aquatic birds in the Garden. From the bird hide situated at the dam, visitors can view, among others, Reed Cormorants, the Pied Kingfisher, Giant Kingfisher, Half-collared Kingfisher, Red-knobbed Coot, Common Moorhen, Southern Masked-Weaver and the Southern Red Bishop. Garden specials include the Kurrichane Thrush, Grey-headed Bush-Shrike, Brown-crowned Tchagra, Bar-throated Apalis, Golden-tailed Woodpecker, Black Cuckooshrike and Lesser Honeyguide. Like the Lowveld and Pretoria NBGs, the Garden boasts all three of the Crowned Lapwing, Blacksmith Lapwing and the African Wattled Lapwing.

The mammalian fauna in the Garden comprises 25 species, ranging from the Mountain Reedbuck and Common Duiker to smaller mammals such as the Black-backed Jackal, Caracal, Rock Dassie (favoured prey item of the Verreaux's Eagle), Small-spotted Genet, Cape Clawless Otter, Scrub Hare, Vervet Monkey, Cape Porcupine and the South African Hedgehog. Mongooses recorded in the Garden include the Water Mongoose, Slender Mongoose and Yellow Mongoose. Bats recorded include the Cape Serotine and Common Slit-faced Bat. The latter is very widespread in southern Africa,

*Snakes, such as this **Rinkhals** photographed in the Walter Sisulu NBG, occur in all national botanical gardens but are seldom seen. The Rinkhals is a common venomous snake that frequents human dwellings, often entering houses. It spits its venom from a reared position and may also play dead. Despite its cobra-like appearance, the Rinkhals is not a true cobra. Unlike true cobras that lay eggs, the Rinkhals gives birth to live young.*

Photo: Andrew Hankey

*Resident **Verreaux's** (**Black**) **Eagles** are an important tourist attraction and play a valuable ecological role in the Walter Sisulu NBG.*

Photo: G. Heydenrych

***Green Milkweed Locusts** are found in large numbers in the Walter Sisulu NBG during September and October each year.*

Photo: Christopher Willis

has conspicuously long ears and its diet comprises predominantly insects (katydids, crickets and grasshoppers) as well as beetles, cockroaches, moths and lacewings. Cape Serotines are attracted to insects around lights and are one of the most commonly seen small bats flying at dusk, jinking and turning in flight at a height of 10–15 m above the ground.

More than 25 reptile species have been found in the Walter Sisulu NBG, including the Bell's Hinged Tortoise, Leopard Tortoise and the common Marsh or Helmeted Terrapin. The flat-shelled Marsh Terrapin is omnivorous and eats almost anything, including birds, insects and frogs. Leopard Tortoises are found throughout the savannas of Africa, from the southern Cape to Sudan. They normally emerge from their winter retreats in September to feed on new spring shoots.

A variety of snakes have been recorded in the Walter Sisulu NBG, including the Rinkhals, Berg Adder, Brown House Snake, Boomslang, Common or Rhombic Night Adder, Green Water Snake, the Herald or Red-lipped Snake and Puff Adder. Some of the more unusual snakes include the Bibron's Blind Snake, Cape Centipede Eater, the grey-black Distant's Thread Snake and Sundevall's Garter Snake. The endemic Bibron's Blind Snake searches underground for the brood chambers of ants and termites, where they are known to bloat themselves on vast quantities of eggs and larvae. Sundevall's Garter Snake is slow-moving and reluctant to bite, with a varied diet that includes snakes, lizards and their eggs, frogs, rodents and moles. The Common Flap-necked Chameleon is known to occur in the Garden. Other reptiles include the Cape Skink, Nile or Water Monitor, Red-sided Skink, Southern Rock Agama, Yellow-throated Plated Lizard and the Cape Dwarf Gecko.

A survey of butterflies in the Garden was conducted by members of the Lepidopterists' Society of Africa from January to December 2006. Altogether 73 butterflies have so far been recorded in the Walter Sisulu NBG, although further survey work over a longer period is bound to reveal an even greater diversity. Surveys of molluscs, dragonflies and damselflies, as well as other invertebrates are needed in the Walter Sisulu NBG. An invertebrate survey conducted

in a small section of the Garden on 24 January 2000, as part of a greater survey of invertebrates in the Gauteng Province, revealed eight centipedes, four millipedes, a mollusc (orchid snail; *Zonitoides arboreus*) and four earthworms. While the mollusc and earthworms were exotic, several of the centipedes and millipedes could not be identified to species level (even by taxonomic specialists) and could possibly be new species. The orchid snail, native to Canada and the United States (it was in fact the first North American land snail to be scientifically named), was introduced to South Africa prior to 1898 and is now quite widely distributed in the country. The modest survey highlighted just how poor our knowledge of the invertebrate fauna of South Africa is, especially cryptic invertebrates, due partly to lack of sampling and relevant taxonomic expertise. With a perennial river and other water bodies in the Garden, the diversity of dragonflies and damselflies, like that of the Lowveld NBG, is bound to be high.

*The **Common Flap-Neck Chameleon** (**Chamaeleo dilepis**), with a distinct white stripe along its flanks, is one of the larger chameleons in southern Africa. They are found in a variety of habitats, including coastal forest, woodlands, thicket and savanna.*

Photo: Christopher Willis

Scorpions that have been recorded in the Walter Sisulu NBG include *Opistophthalmus pugnax*, *Hadogenes gunningi*, *Pseudolychas pegleri* and *Uroplectes triangulifer*. *O. pugnax* and *H. gunningi* are typically found on rocky outcrops and ridges in Gauteng. *P. pegleri* is known to occur in highly urbanised and even industrial areas in Gauteng. Individuals have been found in houses – in sinks, bathtubs and showers. Its sting is very painful but not of medical importance. *U. triangulifer* is very widely distributed in grassland areas of South Africa, Lesotho and Swaziland, and has been known to enter houses in Gauteng. Like *Pseudolychas* species, it has a painful sting but, unlike the venomous *Parabuthus* species, it is not medically important (see www.scorpions.co.za).

Seven amphibians have been recorded in the Walter Sisulu NBG, including the Common Caco, Bubbling Kassina, Common Platanna, Common River Frog, Guttoral Toad, Natal Sand Frog and Red Toad.

More than 70 species of spiders have been recorded by John and Astri Leroy in the Walter Sisulu NBG, including banded garden spiders, hairy field spiders, ant-like spiders, mouse spiders, wolf spiders, crab spiders, jumping spiders, both the black- and brown button spiders, and baboon spiders.

While no fish have been recorded in the Crocodile River that runs through the Walter Sisulu NBG, biannual

*The **Leopard Tortoise** (**Geochelone pardalis**), photographed in the Walter Sisulu NBG, is the largest tortoise in South Africa, generally weighing between 10 and 20 kg. It is one of the hardiest species and is widespread in central and southern Africa, from Ethiopia and Sudan to the southern Cape. They eat a wide variety of plants, including grasses, annuals and succulents. During cold, rainy weather and in winter they shelter deep in thick bush.*

Photo: Christopher Willis

Many of the animals that occur in South Africa's national botanical gardens, such as the ***South African Hedgehog****, are nocturnal and normally not seen by visitors.*

Photo: Sharon Willcock

The ***Goliath Beetle*** *(****Goliathus albosignatus****) is a massive beetle (body length 55 mm) and the largest fruit chafer in the region. Adults feed on various fruits as well as sap flows and gum oozing from Acacia trees.*

Photo: Alice Aubrey

biomonitoring of the river is conducted. Results from surveys conducted in 2006 have shown that the quality of the water improves as it flows though the Walter Sisulu NBG, with the Garden having a positive effect on the biological integrity of the river reach under SANBI's management. Some 21 family representatives of aquatic macro-invertebrate taxa were recorded in the section of river that flows through the Garden. These included dragonflies, damselflies, caddisflies, whirligig beetles, riffle beetles, crabs, pond skaters, water boatmen and stout crawlers. Recommendations have been made for a historically occurring fish restocking programme to be considered and fish bypass facilities (fishways) to be designed and constructed in the section of river flowing through the Garden. This would allow fish downstream of the Walter Sisulu NBG to naturally recolonise this section of the river. By allowing this natural recolonisation of fish, the natural balance of biota within the river would be restored, with the consequential increase of the ecological integrity of the river. Naturally occurring indigenous fish that might be expected to occur in the Crocodile River include the Chubbyhead Barb (*Barbus anoplus*), Straightfin Barb (*Barbus paludinosus*), Banded Tilapia (*Tilapia sparrmanii*), South African Mouthbrooder (*Pseudocrenilabrus philander*) and Sharptooth Catfish (*Clarias gariepinus*). The Kitso-Ecocentre at the entrance of the Garden has an interesting live display of some of South Africa's indigenous fishes.

A noteworthy phenomenon that occurs annually during September/October in the Walter Sisulu NBG is the occurrence of huge numbers of the Milkweed Locust (*Phymateus viridipes*) found mainly in the area below the Witpoortjie Waterfall. The plants that seem to attract the locusts the most are the Smooth Tinderwood (*Clerodendrum glabrum*) which they completely defoliate. Thereafter the locusts feed on a range of other trees, including the African Olive (*Olea europaea*).

Natural history courses, arranged by the Bankenveld Branch of the Botanical Society of South Africa, are held throughout the year, and have proved very popular with members of the public.

Managing wildlife

National botanical gardens are managed with the aim of maximising their display, conservation, education and research functions. While the natural areas of the gardens perform important roles as refuges for many different animals and plant species, these areas are relatively small compared with many other nature reserves and national parks. There are also, in most cases, no large natural predators (e.g. large cats, pythons, raptors) to control populations of some species. This requires management intervention to keep some kind of balance. For example, the population of Rock Dassies in the Pretoria NBG has grown significantly over the past few years because of the absence of their natural predators, Verreaux's Eagles, from the eastern suburbs of Pretoria. In collaboration with Tshwane Nature Conservation, a relocation programme was initiated by which dassies were trapped in cages and then released in other nature reserves in and around Pretoria. Since the project started, 82 dassies have been captured and relocated to the Groenkloof and Wonderboom Nature Reserves. Another example: because of the relatively small area that some mammals have available to them in some national botanical gardens, salt licks have been provided to supplement the nutrients and vitamins available to these animals, particularly during the harsh winter months on the highveld.

Other challenges include the introduction of feral animals (such as cats and dogs) or the introduction of rabbits by some members of the public who may unfortunately mistakenly perceive national botanical gardens as places of refuge for their unwanted pets and associated litters. Domination by certain naturalised birds, such as Common (Indian) Mynas, can also cause disturbance to the natural populations of birds in certain gardens. Common Mynas have now become a pest in many urban areas in South Africa, particularly in Gauteng and KwaZulu-Natal. They are now considered one of the world's 100 worst alien invasive species and do not warrant protection. Mynas compete aggressively with many indigenous species, and tend to replace them in areas where Myna populations are well established. Other alien species that are a potential threat to South Africa because of their aggression towards indigenous species include the House Crow and the Common (European) Starling.

Maintaining a cultivated garden in association with wildlife can also be frustrating, particularly when certain mammals take a preference to plants that horticulturists are attempting to cultivate and display for visitors. This includes the activities

***Twig Snake** (**Thelotornis capensis**; also known as the **Vine Snake** or **Bird Snake**) preying on an agama in the Lowveld NBG. Twig snakes are usually found in trees and shrubs, feed mainly on chameleons and other tree-dwelling lizards and are well camouflaged. Although considered very dangerous, Twig Snakes are extremely shy and the chance of being bitten by one of them is very slight.*

Photo: Lou-Nita le Roux

*Our understanding of aquatic invertebrates, such as this **common water scorpion** (**Family Nepidae**), in our national botanical gardens is limited. The respiratory tube can be seen at the tip of the abdomen. Water scorpions usually sit quietly amongst vegetation with their forelegs in a striking position.*

Photo: Christopher Willis

***Dwarf mongooses** (**Helogale parvula**) are frequently seen in the Lowveld NBG. These small mammals are diurnal and live in packs of up to 30 in permanent holes, usually in termitaria. They live mostly on insects and insect larvae but will take other invertebrates, reptiles and small mice.*

Photo: Mark Anderson

***Greater canerats** have so far been recorded in the Pretoria, Lowveld and Walter Sisulu NBGs. They are predominantly nocturnal vegetarians living on the roots, shoots and stems of grasses and reeds. They also show some crepuscular activity, being active up to about 07:00 and from 17:00 until about sunset. They are known to have poor eyesight but acute hearing. Litters of up to three young are born in the summer months.*

*Illustration by Dick Findlay. Reproduced with kind permission from **The mammals of the southern African subregion** (third edition), revised by John D. Skinner & Christian T. Chimimba and published in 2005 by Cambridge University Press.*

of canerats, moles, baboons and porcupines in several gardens, as well as the effect of alien invasive grey squirrels on strelitzias cultivated for their seed in Kirstenbosch.

With the promulgation of the National Environmental Management: Biodiversity Act in 2004, SANBI has renewed its focus on the conservation of all forms of life in the national botanical gardens, with the ultimate aim that biodiversity and ecological processes in the boundaries of the Gardens will be protected and conserved for both present and future generations. The effective management of the biodiversity housed within South Africa's national botanical gardens requires the development of biodiversity information management systems that include databases, threatened status categorisation, annual indicator surveys, preparation of GIS maps and significant research projects. A need exists to consolidate and standardise a dynamic biodiversity information system, linked to horticultural databases, for South Africa's national botanical gardens.

South Africa's national botanical gardens house an impressive diversity of plants and animals, and it is only through regular monitoring of biodiversity and habitats in the gardens that we can evaluate the effectiveness of management interventions that are put in place. Probably the most challenging part of managing national botanical gardens is balancing human values and needs with ecosystem processes. The value of collaboration and partnerships in the management of South Africa's NBGs cannot be underestimated, and if we are to be successful in our management of the biodiversity within our gardens, there has to be close co-operation, facilitated by Garden Curators and their management teams, with local and provincial conservation agencies, universities, museums, natural history societies and volunteers. By sharing resources between agencies through partnerships and collaborative projects, funds and resources can be leveraged to achieve mutual conservation objectives.

SANBI's ultimate aim is to conserve and celebrate biodiversity and educate members of the public about its value and importance, both inside and outside the boundaries of our precious national botanical gardens, or, as they have also been described, national biodiversity facilities. The underlying assumption is that people with more exposure to nature are more interested in conserving it. It has been shown that direct experience with the natural world, especially during childhood, appears to be the most important source of environmental sensitivity. As human populations shift to cities, people will experience nature primarily through contact with urban nature. If it is true that conservation will increasingly depend

on the ability of people in cities to maintain a connection with nature, then South Africa's national botanical gardens as urban havens of biodiversity, and places that allow people to connect with natural habitats and ecosystems, will become increasingly more valuable for future generations.

South Africa's biodiversity conservation assessments: *how can you get involved?*

In association with various partners, SANBI is currently engaged in nationwide biodiversity conservation assessments involving reptiles, butterflies and arachnids (spiders, scorpions and other arachnids) as well as an update of the southern African bird atlas. Apart from the revised bird atlas project, each of the projects has a web-based virtual museum of digital photographs that are linked to an accurate set of co-ordinates, a date, an observer's name and reliable species identification. Digital photographs submitted (with associated basic information required by each specific project) by individuals interested in the different groups are identified by experts and added to the project's virtual museum, which can be accessed online by anyone with access to the internet. All the projects also involve field collecting trips in which interested members of the public can participate.

Southern African Bird Atlas Project 2 (SABAP2)

SABAP2 is an update and refinement of the first Southern African Bird Atlas Project which ran from 1987–1991 and culminated in the publication of two volumes on the distribution and relative abundance of southern African birds in 1997. Since the first bird atlas project was conducted more than 15 years ago, large-scale landscape changes, habitat transformation and fragmentation, coupled with climate change and invasion have contributed to changing bird distributions. Monitoring these distributional changes is crucial if we are to put in place proper and effective management plans to conserve bird populations and diversity in southern Africa into the future. Apart from tracking through time and space the impacts of environmental change on southern African birds, SABAP2 also aims to promote increased public participation in biodiversity data collection and public awareness of birds, through large-scale mobilisation of 'citizen scientists'. The four-year project that includes the countries of South Africa, Lesotho and Swaziland, was officially launched at the Pretoria NBG on 26 June 2007 and at Kirstenbosch on 28 June 2007. SABAP2 is funded through SANBI and BirdLife South Africa and is managed and run by the Avian Demography Unit of the University of Cape Town and BirdLife South Africa. Information on how to participate in this worthwhile project can be gathered from SABAP2's web address: www.sabap2.org.

Southern Double-collared Sunbird *on a strelitzia in Kirstenbosch. These common resident or sedentary birds are endemic to southern Africa, with a diet comprising mainly of nectar.*

Photo: Alice Notten

***Berg Adders** (**Bitis atropos**) are bad-tempered snakes common to all three national botanical gardens located in the Western Cape. The venom of berg adders differs from that of most adders (which is cytotoxic) in that it is mildly neurotoxic, affecting the optic and facial nerves. Unlike cobra venom, it does not cause difficulty in breathing. Antivenom is ineffective but no fatalities are known.*

Photo: Warren McCleland

*Scorpions, such as **Opistacanthus laevipes** shown here, are included with spiders, whipscorpions and sunspiders in the South African National Survey of Arachnida. It is well known that scorpions fluoresce under ultraviolet light.*

Photo: Lou-Nita le Roux

Southern African Reptile Conservation Assessment (SARCA)

SARCA is a four-year project launched on 10 May 2005. SANBI is the lead institution while the Avian Demography Unit (ADU) of the University of Cape Town is the institution principally responsible for carrying out the work. SARCA depends heavily on the collaboration of all herpetologists and herpetological institutions in the region, as well as the participation of members of the public. The aim of the project is to improve our understanding of the diversity and distribution of reptiles in South Africa, Lesotho and Swaziland, thereby making it possible to improve the conservation status of these animals. The project area has an exceptional diversity of reptiles: 363 species (5% of the global total), or approximately five times what one would expect, based on land area alone. Levels of endemism are extremely high, with 130 (36%) species being endemic to the three-country region. Web address: www.saherps.net/sarca/

South African National Survey of Arachnida (SANSA)

South Africa has a rich arachnid fauna with about 4 950 known species, representing 6% of the global arachnid diversity. Currently, 75% of the arachnids are endemic to South Africa. Our knowledge of the arachnids is, however, still sketchy in terms of their taxonomy, ecology and distribution. Large areas are still not sampled. SANSA is an umbrella project initiated in 1997 and dedicated to unify and strengthen biodiversity research on arachnology (spiders, scorpions and other arachnids) in South Africa and to make an inventory of the arachnofauna. It runs on a national basis in collaboration with other researchers and institutions with an interest in the arachnid fauna of South Africa. The second phase of this project (2006–2010) is co-ordinated by the Agricultural Research Council (ARC) in association with SANBI, and plans to provide a detailed database of arachnids within South Africa. Farmers or reserve managers who would like to know the diversity of the arachnid fauna on their farm or reserve are welcome to contact the ARC for support. ARC web address: www.arc.agric.za.

Southern African Butterfly Conservation Assessment (SABCA)

SABCA is a four-year conservation assessment launched on 14 May 2007 in the Pretoria NBG, made possible through a partnership between SANBI, the Lepidopterists' Society of Africa (LepSoc) and the Avian Demography Unit (ADU) of the University of Cape Town. The project is aimed at determining the distribution of and conservation priorities for all butterfly species in southern Africa (South Africa, Lesotho and Swaziland),

especially those threatened with extinction. The project is funded by the Norwegian Ministry for the Environment and co-ordinated by the ADU, which is experienced in running atlassing projects such as those for birds and frogs already successfully completed. LepSoc is an amateur society that will be responsible for the collection of butterflies in the field and for providing expertise in the identification of butterflies. South Africa has 671 butterfly species of which 40 (6%) are considered threatened with extinction. Web address: http://butterflies.adu.org.za or http://sabca.adu.org.za.

People interested in participating in these projects should consult the respective project websites for more details. If you have a digital camera, global positioning system (GPS) and access to email and the internet, SANBI would welcome you to photograph and submit photos of reptiles, butterflies and arachnids to these projects, wherever you are in the country, but especially when visiting South Africa's national botanical gardens. In this way the biodiversity checklists for the various gardens can be expanded and at the same time contributions will be made to the national conservation assessments of the particular groups. To facilitate locality information, the latitude/longitude co-ordinates for all South Africa's national botanical gardens are included below.

Free State NBG: 29° 03′ 05.9″S 26° 12′ 48.5″E
Harold Porter NBG: 34° 21′ 01.6″S 18° 55′ 37.4″E
Karoo Desert NBG: 33° 36′ 48.5″S 19° 27′ 01.9″E
Kirstenbosch NBG: 33° 59′ 19.3″S 18° 25′ 52.3″E
KwaZulu-Natal NBG: 29° 36′ 20.5″S 30° 20′ 44.2″E
Lowveld NBG: 25° 26′ 29.8″S 30° 57′ 40.3″E
Nieuwoudtville NBG: 31° 23′ 50.8″S 19° 08′ 24.4″E
Pretoria NBG: 25° 44′ 10.8″S 28° 16′ 34.6″E
Walter Sisulu NBG: 26° 05′ 16″S 27° 50′ 36.4″E

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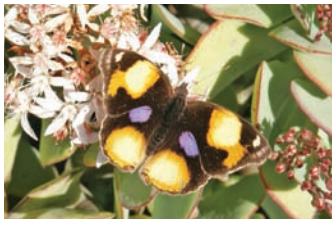
*The **Garden Acraea** (**Acraea horta**) is found mainly in parks, gardens and forest edges. Larval food includes the Wild-peach (Kiggelaria africana).*

Photo: Alice Notten



*The **Yellow Pansy** (**Junonia hierta cebrene**) is a common and widespread butterfly found in most of the eastern parts of South Africa. It has a year-round flight period with peaks in October and November as well as February to May.*

Photo: Alice Aubrey

***Vervet monkeys**, photographed here in the Lowveld NBG, occur in several national botanical gardens.*

Photo: Johan Hurter

Birds common to all South Africa's National Botanical Gardens

Egyptian Geese *are one of the 23 birds common to all our national botanical gardens.*

Photo: Alice Notten

Hadeda Ibis

Photo: Alice Notten

African Hoopoe (Hoopoe)
Alpine Swift
Barn Swallow (European Swallow)
Black-shouldered Kite
Cape Robin-Chat (Cape Robin)
Cape Turtle-Dove
Cape Wagtail
Cape Weaver
Cape White-eye
Common Fiscal (Fiscal Shrike)
Common Waxbill
Diderick Cuckoo (Diederik Cuckoo)
Egyptian Goose
Fiscal Flycatcher
Hadeda Ibis
Helmeted Guineafowl
House Sparrow
Laughing Dove
Little Swift
Red-winged Starling
Rock Martin
Speckled Mousebird
White-rumped Swift

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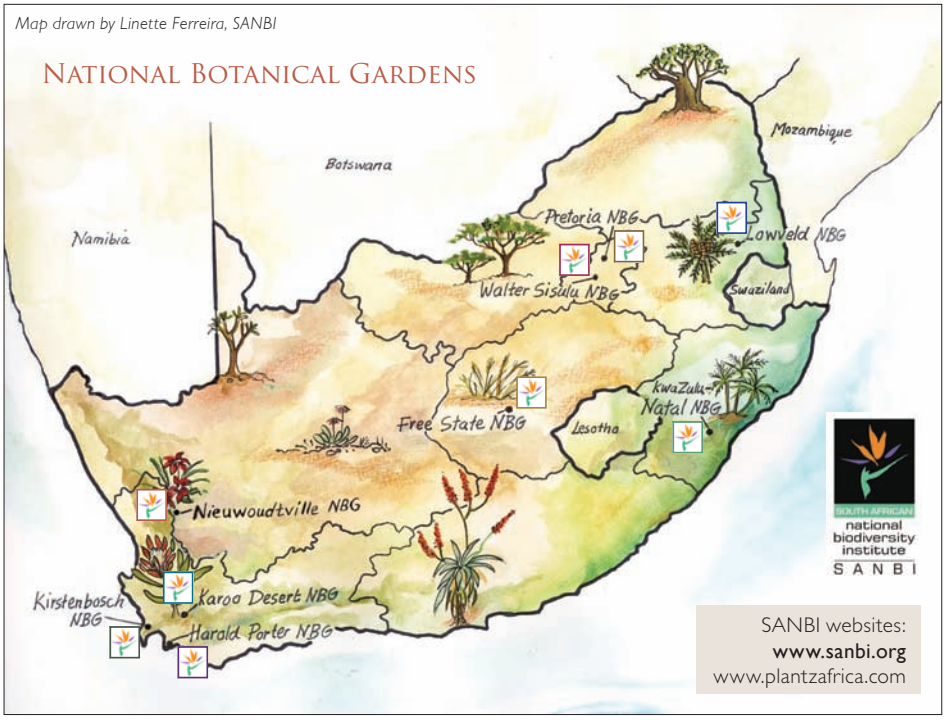

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KwaZulu-Natal NBG Mayor's Walk Pietermaritzburg	P.O. Box 21667 Mayor's Walk 3208	Tel: (033) 344 3585 Fax: (033) 344 1284 e-mail: tarr@sanbi.org	Curator: Brian Tarr
Lowveld NBG Off White River Road Opposite Value Mart Intersection, Nelspruit	P.O. Box 1024 Nelspruit 1200	Tel: (013) 752 5531 or (013) 755 1494 Fax: (013) 752 6216 e-mail: britz@sanbi.org	Curator: Rudi Britz
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