
**Global Invasive Species Programme**

**Ministry of Tourism, Environment and Natural Resources**
**Republic of Zambia**

**United States Government**

# *Invasive Alien Species in Southern Africa*

## *National Reports & Directory of Resources*

*Edited by Ian A.W. Macdonald, Jamie K. Reaser, Chris Bright, Laurie E. Neville, Geoffrey W. Howard, Sean J. Murphy, and Guy Preston*

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## *Preface*

This report is one of three products of a workshop entitled *Prevention and Management of Invasive Alien Species: Forging Cooperation throughout Southern Africa*. This meeting was held by the Global Invasive Species Programme (GISP) in Lusaka, Zambia on 10-12 June, 2002. The other products are a workshop report and a regional statement on IAS, available at www.gisp.org. This document is the first country-driven effort to assess the status of invasive alien species (IAS) and share information on IAS national programmes in the Southern African region.

Each country that participated in the regional workshop was invited to submit a chapter that included information on known IAS, existing strategies for preventing and managing IAS, objectives and contact information for departments/ministeries concerned with IAS, priorities for future work on IAS, list of in-country IAS experts, and a list of relevant references and websites. Participants were asked to provide information relevant to both agriculture and environmental sectors and to work across multiple ministeries when possible. The ability of each country to provide this information varied considerably, and depended upon the amount of information already available on IAS problems in their country, existence of in-country technical expertise, and the priority attached to IAS issues by the current government. A few delegations were unable to contribute to this document and are in the process of assessing IAS status in their countries.

The data provided within this document reflects the most up-to-date information available to the authors of each country report at the time of writing. These authors and the GISP make no claims that this information is complete or scientifically accurate (e.g. scientific names may not always have been correctly assigned to alien species), although the authors and GISP have attempted to ensure as useful and reliable a document as possible.

GISP hopes that this document will be seen as a foundation for future work on IAS within the Southern African region. Readers who wish to provide additional information or updates to specific chapters are encouraged to contact the authors, as well as GISP. A web-based version of this report is downloadable from www.gisp.org and, if new information warrants, will be updated as appropriate.

Reports arising from GISP's workshops in other regions of the world will also be made available at www.gisp.org.

***Map of Africa, showing the southern African region from Angola, Zambia and Tanzania southwards***. Credits: U.S. Central Intelligence Agency map database © 2003

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# *Botswana*

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## *Introduction and summary of existing programmes*

Invasive alien species (IAS) have not been the subject of detailed investigations in Botswana, such that their potential threat to the country can be estimated. The Department of Water Affairs, in the Ministry of Energy and Water Affairs, has established an Aquatic Weeds Unit which investigates the management of aquatic alien plants. This unit is the only activity in Botswana specifically aimed at controlling invasive alien species. Another related activity is research conducted by the Department of Crop Production and Forestry under the Ministry of Agriculture on tree species that are being produced and used by government departments. This research will reveal the extent to which the government is utilising potentially invasive alien species.

The Department of Crop Production and Forestry is also involved in monitoring fish populations in inland dams and in the transboundary water systems; however, this monitoring is concerned with fish production, and not with fish as IAS. The Department of Wildlife and National Parks does not consider invasive alien birds to be a problem in Botswana. However, there is a generally low level of awareness about the IAS issue in Botswana, and some information could not be accessed for this national profile report.

Botswana has not yet developed national strategies for IAS management. Currently, monitoring of IAS, with the exception of that carried out by the Aquatic Weeds Unit, only occurs incidentally during other activities. The government must be sensitized to the issue of IAS and their impacts before any development of national policies and strategies to prevent and manage IAS can be developed.

### *Aquatic plants*

Several integrated control programmes are in progress, employing the following methods:

- Monthly manual removal of invasive alien aquatic plant mats.
- Yearly burning of dried mats to contain their spread before seasonal water flows into the system.
- Construction of bunds using sandbags, and barriers using chicken mesh and steel wires across streams to trap kariba weed *Salvinia molesta* mats floating downstream.

A host-specific weevil (*Cyrtobagous salviniae*) has been introduced onto kariba weed mats and is the best control measure for this IAS.

### *Fishes*

No research pertaining specifically to alien fishes in Botswana has been performed. A fish survey was conducted at Shashe Dam in 1978. A survey of Letsibogo Dam was undertaken in October/November 2000 and a follow-up survey is planned for July 2002. There are plans in place to invite a South African fisheries biologist to assist in the identification of alien species. A lack of resources has prevented these surveys from being conducted regularly.

***List and impacts of alien species that have been identified as harmful, invasive, or pests***

| **Common name** | **Scientific name** | **Impact** |
|---|---|---|
| ***Fishes*** | | |
| common carp | *Cyprinus carpio* | unknown |
| largemouth bass | *Micropterus salmoides* | unknown |
| Nile tilapia | *Oreochromis niloticus* | unknown |
| ***Aquatic plants*** | | |
| Kariba weed | *Salvinia molesta* | major invasive alien plant |
| water lettuce | *Pistia stratiotes* | impact not yet significant |
| water hyacinth | *Eichhornia crassipes* | impact not yet significant |
| ***Terrestrial plants*** | | |
| pepper tree | *Schinus* spp. | undetermined |
| gum trees | *Eucalyptus* spp. | undetermined |
| mesquite | *Propsopis* spp. | undetermined |
| leucaena | *Lucaena leucocephala* | undetermined |
| neem tree | *Melia azedarach* | undetermined |
| makunda grass | *Cenchrus biflorus* | high |

***Alien plant management - the way forward***

For a proper and full assessment of the status of invasive alien plants in a particular region, rigorously collected quantitative data on ecological as well as socio-economic parameters will be obtained. The assessment of the target invasive alien plant should be on a long-term basis.

***List of organizations involved in the management of invasive alien species***

Data on alien aquatic plants has mainly been collected during investigations conducted under the auspices of the National Biodiversity Programme in the country's various delta systems. These investigations are coordinated by the Harry Oppenheimer Okavango Research Centre, the University of Botswana, and the Department of Wildlife. Collaborative work is being conducted with the neighbouring countries of Namibia, Zambia, Zimbabwe, and South Africa. Safari companies along the water bodies also contribute to the surveys.

There are currently no active programmes on terrestrial IAS in Botswana. Previous research on the ecology and management of makunda grass (*Cenchrus biflorus*) has been conducted by Ms. Batugamile, Harry Oppenheimer Okavango Research Centre, University of Botswana.

***Priorities for future work*** - No future work priorities have yet been determined for Botswana.

***List of experts working in the field of biological invasions***

Fish: Mr. Mmopelwa, Dept. of Crop Production & Forestry, Ministry of Agriculture.

Aquatic plants: Dr. Naidu and Mr Innocent Tyolo, Aquatic Weeds Unit, Department of Water Affairs, Ministry of Energy and Water Affairs, Private Bag 07, Maun, Botswana. Tel: +267-660-452, fax: +267-660-372, e-mail: ityolo@gov.bw.

Terrestrial plants: Mr. C. Buss - Department of Forestry and Professor Lars Ramberg, Harry Oppenheimer Okavango Research Centre, University of Botswana.

***Bibliography***

No bibliography on IAS in Botswana is currently available.

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***Summary of existing programmes***

Invasive alien species identified in the country cover a wide range of sectors such as forestry, fisheries, water resources, and agriculture. No programmes have been implemented to control many of these species, as their impacts have not yet reached levels of economic importance. However, programmes to address IAS in both the fisheries and agricultural sectors are underway.

The control of water hyacinth *Eichhornia crassipes* started in the 1990s, when its impacts on the country's watercourses became serious. The Environmental Management Project, with funding from The World Bank, provided inputs into the control of water hyacinth in the Shire River, Lake Malawi, and Lake Malombe. The programme provided resources to acquire and raise biocontrol organisms, to train members of local communities in the release of these agents in infested areas, to manually remove the alien plant where it was abundant, and to conduct awareness campaigns through the production of posters. CAB International staff from Kenya provided technical support in the initial stage. This World Bank-supported project will be phased out in December 2002. While this initiative has succeeded in minimizing water hyacinth infestations in major watercourses, infestation of the alien plant in localized areas such as private dams is still prevalent. The control of the alien plant in such areas remains the responsibility of the dam owner.

The agricultural sector has several IAS control programmes. A programme to control *Prostephanus truncatus* was funded with resources from a Malawi/German project. This involved setting sex hormone traps to catch the alien pest in affected areas. The natural biocontrol agent, *Teretrius nigrescens*, was also released to minimize the alien pest species populations. This programme will be phased out in August 2002.

The control of *Aleurothrixus floccosus*, a pest in citrus fruit trees, is carried out through the release of the biocontrol agent *Cales noachi* in the affected areas. This programme is supported by the Malawian Government's recurrent budget.

*Mononychellus tanajoa*, a pest of cassava, is controlled by a programme initially supported by the International Institute for Tropical Agriculture. It employs a biocontrol agent, *Tryphlomaleus alipo*. Support from the IITA has been phased out, but the Malaŵi Government continues to fund this control programme from its recurrent budget.

*Tetranychus evancea* is controlled by spraying a concoction of ash, soap, and nicotine on the affected tomatoes or Irish potatoes. Farmers are trained to make the concoction and to apply it to the plants. This programme is funded by the Malaŵi Government's recurrent resources.

***List and impacts of alien species that have been identified as harmful, invasive, or pests***

**Impact codes:**
1 – Displaces indigenous plants/ serious invader of native ecosystems.
2 – Fruits, seeds, foliage or sap are poisonous to man or animals.
3 – Plant has thorns, spines, hairs or pollen dangerous, irritating, or allergenic to man.
4 -- Plant has thorns, spines, hairs or pollen dangerous, irritating, or allergenic to animals.
5 – Invades open water, cutting off light penetration and obstructing boat movement.
6 – Increases water loss through transpiration.
7 – Expands the range of disease-bearing organisms (e.g. water hyacinth for bilharzia vector snails).
8 – Can clog irrigation, power plant water intake pipes, etc.
9 – Competes with crop plants.
10 – Competes with garden plants.
11 – Invades plantations.
12 – Invades along watercourses, streambanks, and vleis/ponds.
13 – Invades along forest margins and/or in forest gaps.

| **Common name** | **Scientific name** | **Impact code** |
|---|---|---|
| ***Aquatic plants*** | | |
| Spanish reed | *Arundo donax* | 1 |
| red water fern | *Azolla filiculoides* | 8 |
| water fern | *Azolla nilotica* | 5,7,8 |
| water hyacinth | *Eichhornia crassipes* | 5,6,7,8 |
| parrot's feather | *Myriophyllum aquaticum* | 7 |
| water lettuce | *Pistia stratiotes* | 2,3,4,5,6,7,8 |
| Kariba weed | *Salvinia molesta* | 5,6,7,8 |
| ***Terrestrial shrubs, trees and climbers*** | | |
| agave | *Agave americana* | 1,2 |
| sisal | *Agave sisalana* | 1,3 |
| albizia | *Albizia lebbeck* | 1 |
| coral creeper | *Antigonon leptopus* | 1 |
| | *Aristolochia elegans* | 1,2,12 |
| | *Caesalpinia bonduc* | 3,9 |
| | *Caesalpinia decapetala* | 1,3,4,9 |
| balloon vine | *Cardiospermum grandiflorum* | 1,13 |
| beefwood | *Casuarina equisetifolia* | 1,3 |
| queen-of-the-night cactus | *Cereus jamacaru* | 1 |
| yellow cestrum | *Cestrum aurantiacum* | 1,2,13 |
| camphor tree | *Cinnamomum camphora* | 1 |
| | *Duranta erecta* | 1,2 |
| red river gum | *Eucalyptus camaldulensis* | 1 |
| | *Eugenia uniflora* | 1,13 |
| Australian silky oak | *Grevillea robusta* | 1 |
| | *Ipomea alba* | 1,13 |
| jacaranda | *Jacaranda mimosifolia* | 1 |
| lantana | *Lantana camara* | 1,2,3,4 |
| leucaena | *Leucaena leucocephala* | 1 |
| syringa berry | *Melia azedarach* | 1,2,3 |
| | *Mimosa pigra* | 1 |

| | | |
|---|---|---|
| | *Mimosa pudica* | 9 |
| | *Mirabilis jalapa* | 1,2 |
| mulberry | *Morus alba* | 1 |
| oleander | *Nerium oleander* | 1,2 |
| | *Opuntia aurantiaca* | 1 |
| | *Opuntia ficus-indica* | 1,2,3 |
| | *Opuntia humifusa* | 1,3 |
| Jerusalem thorn | *Parkinsonia aculeata* | 1 |
| | *Pinus patula* | 1 |
| mesquite | *Prosopis glandulosa* | 1,3,4,9 |
| granadilla | *Passiflora edulis* | 1,11,13 |
| castor-oil plant | *Ricinus communis* | 1,2 |
| | *Rubus ellipticus* | 1,12,13 |
| | *Rubus exsuccus* | 1,13 |
| | *Rubus fruticosus* | 1,3,4 |
| | *Rubus rigidus* | 1,13 |
| | *Senna didymobotrya* | 1 |
| | *Senna hirsuta* | 1,9 |
| | *Senna occidentalis* | 1,2 |
| | *Senna septemtrionalis* | 1 |
| | *Tecoma stans* | 1 |
| yellow oleander | *Thevetia peruviana* | 2,10 |
| | *Tipuana tipu* | 1,13 |
| | *Tithonia diversifolia* | 1,9 |
| | *Tithonia rotundifolia* | 9 |
| | *Toona ciliata* | 1,13 |
| ***Herbaceous plants*** | | |
| | *Ageratum conyzoides* | 9 |
| Mexican poppy | *Argemone mexicana* | 1,2,3,9 |
| canna | *Canna indica* | 1,9,11,12 |
| rosy periwinkle | *Catharanthus roseus* | 1,12 |
| common thorn apple | *Datura stramonium* | 1,2,3,12 |
| | *Kalanchoe* spp. | 1,2,3,10 |
| | *Spilanthes mauritiana* | 1,9 |
| large cocklebur | *Xanthium strumarium* | 1,2,3,9 |
| | *Zantedeschia aethiopica* | 1,12 |
| ***Ferns*** | | |
| | *Nephrolepis undulata* | 1 |

The only **invasive alien animals** thought to be having significant impacts in Malaŵi are several insect pests of cultivated crops, e.g.:

- *Aleurothrixus floccosus* which attacks citrus fruit trees;
- *Mononychellus tanajoa* which attacks cassava;
- *Prostephanus truncatus* which attacks stored grain;
- *Tetranychus evancea* which attacks tomatoes and Irish potatoes.

***List of organizations involved in IAS management***

- The **Environmental Affairs Department** participates in IAS control and coordinates environmental issues in government, NGOs and the private sector.
- The **National Herbarium and Botanical Gardens** currently chairs the National Biodiversity Committee in the country and provides taxonomic information on indigenous and alien plants, including both invasive and non-invasive species.

- The **Fisheries Department** and the **Ministry of Water Development** are both responsible for control of invasive alien aquatic plants, such as water hyacinth.
- The **Electricity Supply Commission of Malaŵi** participates in the control of invasive alien aquatic plants to minimize their impact on hydropower stations on the country's major rivers.
- The **water boards** also contribute, such as the Water Resources Board, Northern Region Water Board, Central Region Water Board, Southern Region Water Board, Blantyre Water Board and Lilongwe Water Board.
- The **Forestry Department** is responsible for IAS used in forestry, some of which were deliberately introduced into the country.
- The **Ministry of Agriculture and Irrigation** is responsible for alien pests, plant and animal.
- The **University of Malaŵi** participates in research studies on IAS that pose serious threats to the various ecosystems.

***Priorities for future work***

The priorities for future work are being elaborated in the National Biodiversity Strategy and Action Plan, which is under preparation.

***List of experts working in the field of biological invasions***

*Water hyacinth*

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***List and impacts of alien species that have been identified as harmful, invasive or pests***

*Vertebrates*

An estimated 40 species of introduced vertebrates are currently naturalised in Mauritius and 17 in Rodrigues. Some of those affect native terrestrial biodiversity in Mauritius (Table 1).

*Insects*

It is not known with any degree of accuracy how many species of insects have been introduced to Mauritius. The effect of introduced insects on native biodiversity has not been assessed. Many of those identified are pests of agricultural significance. A list of 24 of the most serious introduced insect pests is given in Appendix 1.

**Table 1. Introduced vertebrates and invertebrates thought to have a significant impact on native biodiversity in Mauritius.**

| IAS in Mauritius | Invasive in Rodrigues? | Interaction with native and alien biota |
|---|---|---|
| deer *Cervus timorensis* | no | consumes native plants |
| pig *Sus scrofa* | no | consumes native plants and animals, disturbs soils and disperses fruit |
| rats *Rattus rattus* and *R. norvegicus* | yes | consume eggs and young of native birds and reptiles and native plant seed predator |
| cat *Felis catus* | no | consumes native birds |
| mongoose *Herpestes javanicus* | no | consumes native birds and reptiles |
| mouse *Mus musculus* | yes | native seed predator, feeds on native invertebrates and eggs of reptiles |
| hare *Lepus nigricollis* | no | consumes native vegetation |
| tenrec *Tenrec ecaudatus* | no | consumes native invertebrates, disperses alien plants |
| toad *Bufo gutturalis* | no | consumes native invertebrates |
| monkey *Macaca fascicularis* | no | consumes eggs and young of native birds, native plants and disperses alien plants |
| Indian house shrew *Suncus murinus* | yes | consumes native invertebrates, reptile eggs and young |
| giant African land snails *Achatina fulica* and *A. panthera* | yes | compete with native snails and consume native vegetation |
| Indian wolf snake *Lycodon aulicus* | no | competes with native reptiles and consumes native reptiles |
| Indian agamid *Calotes versicolor* | yes | competes with native geckos and consumes native invertebrates |
| house geckos (5 species) | yes, 4 spp. | compete with native geckos and consume native invertebrates |
| alien birds (19 species) | yes, 7 spp. | compete with native birds and disperse alien plants |

*Snails*

The giant African land snails *Achatina panthera* and *Achatina fulica* are browsers which negatively impact on crops and probably also native plants. The rosy wolf snail *Euglandina rosea*, introduced in an unsuccessful attempt to control *Achatina* spp., has negative effects on native snails (Griffiths et al., 1993). The other introduced carnivorous snail *Eustreptaxis* (*Gonaxis quadrilateralis*) has a minimal impact on native biota, as it successfully invaded very few native forests, doing well mainly in residential and agricultural areas. At least 25 species of alien snails are invasive in Mauritius. Some of these are found in native forest and may displace native ecological equivalents, possibly after weeding, which is undertaken as part of an effort to restore native forest (Florens et al., 1998).

*Invasive plant species affecting native terrestrial biodiversity & agriculture*

Between 1700 and 2000 introduced plant species have been recorded in Mauritius (list currently under compilation). Of these, an as-yet-unquantified number are invasive, and many of these have become serious pests. A list of the 18 invasive alien plants with the most serious impacts on biodiversity is given in Table 2. In addition, 64 introduced plants have been identified as being serious pests in sugar cane (McIntyre, 1991). These are listed in Table 3.

*Plant diseases*

Introduced diseases affecting 16 crops of economic importance have been detected in Mauritius since 1974 (Table 4). *Colocasia* blight has been particularly devastating, wiping out 90% of *Colocasia*

varieties and considerably reducing exports. Most of the other diseases are sporadic, but some, such as bacterial leafspot of tomato and mango and banana septoria leafspot, also cause problems when climatic conditions are suitable.

*Freshwater and marine introductions*

Lists of freshwater and marine introductions have been compiled from information from the Ministry of Fisheries Albion Fisheries Research Centre. Records were found of 23 freshwater and 12 marine introductions (Tables 5 and 6). It is not known if all these species are still present in Mauritian waters.

**Table 2. List of 18 of Mauritius' worst invasive alien plants of biodiversity importance** (adapted from Strahm 1999). In Mauritius some of the species are aggressive invaders mainly of the upland (UF) or lowland (LF) forest types.

| Species | Common name | Habitat | Comments |
|---|---|---|---|
| Agavaceae<br>*Furcraea foetida* | aloes | LF | very invasive in dry areas |
| Anacardiaceae<br>*Schinus terebinthifolius* | poivre marron | LF | invasive in low and mid altitudes in Mauritius, introduced to Rodrigues but not yet invading there. |
| Bignoniaceae<br>*Tabebuia pallida* | tecoma | LF | invasive in Mauritius and Rodrigues, not introduced to La Réunion |
| Euphorbiaceae<br>*Homalanthus populifolius* | | UF | very invasive in Mauritius, not found in Rodrigues |
| Flacourtiaceae<br>*Flacourtia indica* | prune malgache | LF | very invasive in Mauritius, less invasive in Rodrigues |
| Lauraceae<br>*Litsea glutinosa* | bois d'oiseau | UF | very invasive on both islands |
| *Litsea monopetala* | yatis | UF | very invasive in Mauritius, not found in Rodrigues |
| Malpighiaceae<br>*Hiptage benghalensis* | liane cerf | LF | very invasive in Mauritius, not found in Rodrigues |
| Melastomataceae<br>*Ossaea marginata* | | UF | very invasive in Mauritius, not found in Rodrigues |
| Mimosoideae<br>*Leucaena leucocephala*<br>*Acacia nilotica* | l'acacie<br>piquant loulou | LF<br>LF | very invasive on both islands<br>very invasive on both islands |
| Myrsinaceae<br>*Ardisia crenata* | arbre de noel | UF | very invasive in Mauritius, not found in Rodrigues |
| Myrtaceae<br>*Psidium cattleianum* | Chinese guava | UF | very invasive in Mauritius and invasive in Rodrigues |
| *Syzigium jambos* | jamrosa | LF | very invasive on both islands |
| Oleaceae<br>*Ligustrum robustum* | privet | UF | very invasive in Mauritius, not found in Rodrigues |
| Rosaceae<br>*Rubus alceifolius* | vigne marron | UF | very invasive in Mauritius, not found in Rodrigues |
| Strelitziaceae<br>*Ravenala madagascariensis* | ravenal | UF | very invasive in Mauritius, invasive in Rodrigues |
| Thymeliaceae<br>*Wikstroemia indica* | l'herbe tourterelle | UF | very invasive on both islands |
| Verbenaceae<br>*Lantana camara* | vielle fille | LF | invasive in Mauritius, very invasive in Rodrigues |

**Table 3. List of introduced plants identified as serious pests in sugarcane (McIntyre 1991).**

| Species | Common name | Species | Common name |
|---|---|---|---|
| *Acalypha indica* | herbe chatte | *Kyllinga elata* | gros mota |
| *Ageratum conyzoides* | herbe de bouc | *Lobellia cliffortiana* | brede mamzelle |
| *Alternanthera sessilis* | brede emballage | *Mimosa pudica* | sensitive plant |
| *Amaranthus dubius* | brede malabar | *Nothoscordum inodorum* | ail sauvage |
| *Ambrosia psilostachya* | herbe solférino | *Oxalis corniculata* | petit trefle, petite oseille |
| *Anagallis arvensis* | mouron | *Oxalis debilis* | oseille, trefle |
| *Apium leptophyllum* | anis sauvage | *Oxalis latifolia* | oseille, trefle |
| *Argemone mexicana* | chardon | *Paederia foetida* | liane lingue |
| *Artemisia vulgaris* | brede chinois | *Panicum maximum* | fataque |
| *Bidens pilosa* | villebague | *Panicum subalbidum* | fataque rouge |
| *Bothriospermum tenellum* | botrice | *Paspalidium geminatum* | herbe sifflette |
| *Brachiaria eruciformis* | herbe carapatte | *Paspalum commersonii* | herbe a epée |
| *Cardiospermum halicacabum* | bonnet de pretre, liane poc-poc | *Paspalum conjugatum* | herbe créole |
| *Cenchrus echinatus* | herbe a cateaux | *Paspalum dilatatum* | herbe codaya |
| *Chloris barbata* | | *Paspalum paniculatum* | herbe duvet |
| *Cleome viscosa* | brede caya | *Paspalum urvillei* | herbe cheval |
| *Colocasia esculenta* | songe, songe blanc songe sauvage | *Phalaris arundinacea* | herbe mackaye |
| *Commelina benghalensis* | herbe aux cochons | *Phyllanthus tenellus* | petit tamarin |
| *Cynodon dactylon* | chiendent | *Plantago lanceolata* | plantain, herbe caroline |
| *Cyperus distans* | | *Portulaca oleracea* | pourpier |
| *Cyperus esculentus* | souchet comestible | *Pycreus polystachyos* | |
| *Cyperus rotundus* | herbe a l'ognons | *Setaria barbata* | herbe bambou, herbe bassine |
| *Digitaria horizontalis* | gros meinki | *Setaria pallide-fusca* | millet sauvage |
| *Digitaria timorensis* | meinki | *Sida acuta* | herbe panier |
| *Eleusine indica* | chiendent patte de poule, gros chiendent | *Siegesbeckia orientalis* | herbe de flacq |
| *Euphorbia hirta* | Jean Robert | *Sisyrinchium micranthum* | |
| *Euphorbia peplus* | herbe de lait | *Solanum nigrum* | brede martin |
| *Euphorbia thymifolia* | petite rougette | *Sonchus asper* | lastron piquant |
| *Gnaphalium indicum* | | *Sorghum verticilliflorum* | sorgho |
| *Heliotropium amplexicaule* | herbe bleue, verveigne sauvage | *Stachytarpheta jamaicensis* | queue de rat |
| *Hydrocotyle bonariensis* | herbe bol, herbe tam-tam | *Verbena officinalis* | verveine |
| *Kyllinga bulbosa* | petit mota | *Youngia japonica* | |

**Table 4. Crop diseases of economic importance detected since 1974.**

| Crop | Disease | Pathogen |
|---|---|---|
| crucifers | black rot<br>leaf spot | *Xanthomonas campestris* cv *campestris*<br>*Alternaria brassicicola* |
| watercress | virus | turnip mosaic virus |
| turmeric (*Cucurma domestica*) | leaf spot | *Pyricularia* sp. |
| ginger (*Zingiber officinale*) | leaf spot<br>soft spot | *Pyricularia zinziberi*<br>*Pythium myriotylum* |
| chilli (*Capsicum anuum*) | anthracnose on fruits | *Colletotrichum capsici* PVY, CMV, TMV |
| *Citrus* spp. | twig gall | *Sphaeropsis tumefaciens* |
| mango (*Mangifera indica*) | bacterial black spot | *Xanthomonas axonopodis mangifera indicae* |
| tomato (*Lycopersicum esculentum*) | bacterial scab<br>bacterial speck<br>viruses<br>phytoplasma | *Xanthomonas axonopodis* pv *vesicatoria*<br>*Pseudomonas syringae* pv tomato<br>ToMV, PVY, CMV<br>Tomato bushy stunt phytoplasma |
| onion (*Allium cepa*) | bacterial blight<br>virus | *Xanthomonas campestris*<br>OYDV |
| garlic (*Allium sativum*) | bacterial blight<br>viruses | *Xanthomonas campestris*<br>OYDV, SLV, GLCV, MbFV |
| carrot (*Daucus carota*) | bacterial blight | *Xanthomonas axonopodis* pv *carotae* |
| cucurbits | bacterial blight<br>viruses | *Xanthomonas axonopodis* pv *cucurbitae*<br>CMV,CABYV,PRSV,WMV-2,ZYMV |
| *Begonia* sp. | bacterial leaf blight | *Xanthomonas axonopodis* pv *begoniae* |
| banana (*Musa* spp.) | septoria leaf spot | *Mycosphaerella eumusae* |
| pineapple | fruitlet core rot | *Pennicillium funiculosum, Fusarium monoliforme* |
| strawberry | anthracnose<br>powdery mildew | *Colletotrichum* spp.<br>*Odium fragariae* |
| *Colocasia* spp. | leaf blight | *Phytophora colocasiae* |
| potato (*Solanum tuberosum*) | soft rot | *Erwinia chrysanthemi* |
| litchi | anthracnose (fruits) | *Colletotrichum gloeosporioides* |
| *Anthurium andreanum* | anthracnose<br>phytopthora blight<br>bacterial wilt | *Colletotrichum* spp.<br>*Phytopthora* spp.<br>*Rallstonia solanacearum* |
| sugarcane (*Saccharum officinarum)* | virus | Sugarcane bacilliform virus<br>Sugarcane mild mosaic virus<br>Sugarcane yellow leaf virus<br>Sugarcane yellows phytoplasma |

**Table 5. List of freshwater species known to be introduced into Mauritian waters.** Compiled from records of the Ministry of Fisheries Research Centre Albion.

| Group | Scientific name | Common name | Introduced in, from | Purpose of introduction |
|---|---|---|---|---|
| crustacea | *Macrobrachium rosenbergii* | rosenbergii | | aquaculture |
| fish | *Carassius auratus* var *auratus* | goldfish | 1953, Madagascar | ornamental aquaculture |
| fish | *Carassius auratus* var *gibelio* | prussian carp | 1953, Madagascar | ornamental aquaculture |
| fish | *Catla catla* | hamilton | 1960, India | polyculture with freshwater lobster |
| fish | *Cirrhinus mrigala* | mrigal | India | polyculture with freshwater lobster |
| fish | *Ctenopharyngodon idella* | valenciennes | China | polyculture with freshwater lobster |
| fish | *Cyprinus carpio* | carp | 1976, India | aquaculture |
| fish | *Etroplus suratensis* | tropical cichlid | Sri Lanka | unknown |
| fish | *Hyphophthalmichthys molitrix* | silver carp | 1975, China | polyculture with freshwater lobster |
| fish | *Labeo rohita* | rohu | India | polyculture with freshwater lobster |
| fish | *Lepomis cyanellus* | green sunfish | 1950, USA | sport |
| fish | *Lepomis macrochirus* | bluegill sunfish | 1950, USA | sport |
| fish | *Lepomis microlophus* | redear sunfish | 1944, USA | unknown |
| fish | *Lepomis micropterus* | largemouth bass (black bass) | 1949, USA | sport |
| fish | *Oreochromis macrochir* | tilapia | 1959, Madagascar | aquaculture |
| fish | *Oreochromis niloticus* | tilapia | 1950, Madagascar | aquaculture |
| fish | *Osphronemus gouramy* | gourami | 1951, Indonesia | aquaculture |
| fish | *Salmo gairdneri* | rainbow trout | 1934, South Africa | aquaculture |
| fish | *Tilapia rendalli* | tilapia | 1957, Madagascar | aquaculture |
| fish | *Tilapia zillii* | tilapia | 1956, Madagascar | aquaculture |
| fish | Triple cross hybrid (*Oreochromis niloticus* **x** *O. mossambicus* **x** *O. aureus*) | | Malaysia | introduced for culture |
| eel | *Channa stiata* (Ophiocephalus) | snake head murrel | SE Asia | sport |
| reptile | *Trionyx steindachneri* | soft-shelled Chinese terrapin, tortue de riviere Baptiste | China & Vietnam | as a pet |

**Table 6. List of marine species known to be introduced into Mauritian waters** (compiled from records of the Ministry of Fisheries Research Centre Albion).

| Group | Scientific name | Common name | Introduced in/from | Purpose of introduction |
|---|---|---|---|---|
| oyster | *Crassostrea commercialis* | | 1967, Australia | Introduced for mariculture |
| oyster | *Crassostrea gigas* | Japanese oyster | 1971 & 1972, Pacific mariculture pescadeo California | Introduced for mariculture |
| oyster | *Crassostrea virginica* | American oyster | 1972, Pacific mariculture pescadeo California | Introduced for mariculture |
| oyster | *Ostrea edulis* | European oyster | 1972, Pacific mariculture pescadeo California | Introduced for mariculture |
| shrimp | *Metapenaeus monoceros* | | | Introduced for mariculture |
| shrimp | *Penaeus latisulcatus** | | | Introduced for mariculture |
| shrimp | *Penaeus monodon** | | | Introduced for mariculture |
| plankton | *Chlorella* spp. | green plankton | Japan | Cultures to feed larvae and shrimps |
| plankton | *Treselmis* spp. | green plankton | Japan | Cultures to feed larvae and shrimps |
| rotifer | *Brachionus plicatilis* | | Japan | Cultures to feed larvae and shrimps |
| fish | *Rhabdosargus sarba* | gueule pavé | | Introduced for mariculture |
| fish | *Siganus sutar*** | | | Introduced for mariculture |

*Many *Penaeus* species are found from the Western Indian Ocean to the Pacific, so these species may not be introductions.
**This species is found in Mauritian waters.

***Current and completed programmes on invasive species***

⇒ *Quarantine efforts*

Dates: Ongoing.
Principal funding agencies: Mauritian Government: Quarantine Services, Ministry of Agriculture.
Implementing agencies: Ministry of Agriculture, Quarantine Services, Veterinary Service, NPCS.
Project contact: M. Chinappen.
Programme aims and measures in place:

- Importation of plant and animal material was unrestricted until 1882 when the first legislation was enacted. Currently the Plants Act of 1976 regulates all introductions of plant material. It is currently being revised to deal with plant breeders' rights and GMOs.

- Animal imports are regulated under CITES. Import permits are required for all live animal imports and exports. Animal health is inspected by the veterinary service. There are no restrictions (other than health requirements) on the importation of species not covered in CITES Appendices I and II.

- Quarantine services are based at the two ports of entry (Plaisance Airport and Port Louis Harbour) on a 24-hour basis. Quarantine measures carried out include the following:

    - insecticide spraying of aircraft cabins and luggage holds when travelling between "high risk" countries - including flights between Mauritius and Rodrigues;
    - fumigation at export and import of consignments containing plant produce;

- the use of 'blue cards' to be completed by incoming passengers. Questions such as 'are you carrying any plant or animal produce' and 'have you visited a farm during your visit' are asked;
- *ad hoc* measures include the use of foot dips for incoming passengers during the 2001 foot and mouth outbreak in UK;
- posters at airport detailing the importance of not bringing in food items, etc.;
- 'declare it or dump it' bins at the airport for prohibited produce;
- incineration of aircraft refuse and material confiscated or surrendered;
- ship and aircraft inspection and the inspection of consignments of all agricultural produce on arrival;
- the operation of a containment facility for elite germplasm varieties, e.g. for the cut-flower industry. Material is kept in a quarantined greenhouse for several months until judged free of infection.

➢ The Ministry has also set up a Pest and Surveillance Unit to report on plant health policy issues and ensure the following biosecurity measures are carried out:

- enforcement of quarantine regulations based on risk assessment;
- reinforce surveillance throughout the country;
- proposal of strategic measures for containment of alien invasive pests;
- formulation of future management measures for the control and/or eradication of alien invasive pests;
- regular monitoring and reporting;
- there is the mandatory requirement of a Plant Importation Permit and Phytosanitary Certificate for importation of plant material;
- very strict measures are enforced to control the white grub *Hoplochelus marginalis*, a devastating pest of sugarcane found in neighbouring La Réunion but not yet in Mauritius.

⇒ *Strategy for the control of alien insect pests in Mauritius*

Dates: Ongoing.
Principal funding agencies: Mauritian Government, European Union (through the IOC).
Implementing agency: Ministry of Agriculture, Entomology Division.
Project contact: S. Seewooruthun.
Programme aims:

➢ Publication of a 'black list' or regulated list of species deemed to be a risk to Mauritius. A regional database to facilitate this is currently being developed.
➢ Introduction of an integrated pest management programme for agriculture.
➢ Adoption of biological control measures for some of the most serious agricultural pests in Mauritius.

⇒ *Eradication of the fruit fly, Batrocera dorsalis*

Dates: 1996-1997.
Principal funding agencies: European Union (through the I.O.C.), Mauritian Government
Implementing agency: Ministry of Agriculture, Regional Fruit Fly Control Programme
Project contact: S. Seewooruthun.
Project outcome: Successful eradication of a potentially very harmful invasive alien species.

⇒ *Restoration of highly degraded and threatened native forests in Mauritius*

Dates: 1996–1999.
Principal funding agencies: UNDP/GEF.
Implementing agencies: MWF and NPCS.
Project contacts: MWF - John Mauremootoo, NPCS - Yousoof Mungroo.
Project outcomes:

- The testing of herbicides for controlling alien plants in Mauritian native forest.
- Training of staff of the NPCS, the Forestry Service, members of relevant NGOs and students of the University of Mauritius in techniques of biodiversity assessment and monitoring and in methods of creating awareness within the youth community of the importance and significance of biodiversity conservation and habitat restoration.
- A study of the biodiversity at the project site in order to document the different components of the biota and the effects of management practices on its diversity.
- The restoration of a key forest site to enhance regeneration of native plant species and to provide improved habitat conditions for native animals.
- The production of a series of recommendations for the management of Mauritian upland forest ecosystems to enhance biodiversity, as agreed at an international workshop in 1997.

⇒ *Development of predator-exclusion areas for the conservation of upland forest*

Dates: 2001 – 2003.
Principal funding agencies: UNDP/GEF, SGP.
Implementing agencies: MWF and NPCS.
Project contacts: J. Mauremootoo (MWF), Y. Mungroo (NPCS)
Project aims:

- To test the effectiveness of a 'total exclusion' fence design as pioneered in Australia and New Zealand under Mauritian conditions. If successful the fence design will be used to establish one or more predator-free refuges in upland Mauritian native forest (contract has been put out to tender).
- To establish a 'field genebank,' a secure area in which geographically specific (local) populations of critically endangered Mauritian endemic plants can be grown and then provide propagation material for bulk production of these rare plant species, for reintroduction into fenced and weeded Conservation Management Areas (CMAs) and proposed predator-free refuges (this genebank is being established).
- To train future conservationists, from NGOs, CBOs and the University of Mauritius, in the techniques of biodiversity conservation management techniques (one of two training workshops has been conducted).
- To raise awareness about CMAs and biodiversity conservation, including this project's exclusion-fence trials and to advocate the integrated use of intensive and extensive management in the management of native forest reserves.

⇒ *The Mauritius biodiversity restoration project*

Dates: 1996-2001.
Principal funding agencies: World Bank/GEF.
Implementing agencies: MWF, Forestry Service and NPCS.

Project contacts: J. Mauremootoo (MWF), Y. Mungroo (NPCS), H. Paupiah (Forestry Service)
Project outcomes:

- The restoration of most of the offshore islet of Ile aux Aigrettes.
- The restoration of significant amounts of two nature reserves in Rodrigues leading to the production of the largest contiguous areas of native forest in Rodrigues.
- The propagation of 44000 individuals of 63 species including 17000 individuals of 21 species of endangered plants on Ile aux Aigrettes.
- The propagation of 100000 individuals of 53 species of native plants on Rodrigues, including about 70000 individuals of 39 endangered species.
- The training of a large number of Mauritians in plant restoration, monitoring and data analysis techniques, project management and project report writing.
- The attraction of 23 volunteers, mostly Rodriguan, who have worked full-time and seven volunteer groups who have managed restoration areas in Rodrigues. Additional volunteers have worked from time to time and during school holidays.
- The testing of restoration techniques on Round Island.

⇒ *The restoration of Round Island*

Dates: 2001–2004.
Principal funding agencies: UNDP/GEF, SGP.
Implementing agencies: MWF and NPCS.
Project contacts: As above.
Project aims:

- To build a semi-permanent field station on Round Island in order to facilitate longer-term work that had not been possible to date (major construction completed in 2002).
- To restore as much as possible of the island by planting native species appropriate to the island in suitable locations (planting work has begun).
- To manage the impact of alien species on the Round Island ecosystem by containment of targeted species, development of strict quarantine facilities and localised management of invasive alien plants in restoration areas.
- To translocate reptile species found only on Round Island onto other rat-free islands to establish additional populations.
- To monitor populations of the rare Round Island petrel and to enhance their nesting success.
- To use Ile aux Aigrettes, which has been open to the general public, as an education resource aimed at informing the general public about the value of Round Island.

⇒ *The Rodrigues community education project*

Dates: started in 1998 and ongoing.
Principal funding agency: Philadelphia Zoo.
Implementing agency: MWF.
Project contact: Pierre Baissac.
Project outcome: Increased awareness in the Rodrigues public on all environmental issues, e.g. IAS.

⇒ *Island management prioritisation project*

Dates: 1993.
Principal funding agency: ODA.

Implementing agencies: NPCS, MWF and WMIL.
Project contact: Yousoof Mungroo.
Project outcomes:

- Assessment of biodiversity conservation value of the islets of Mauritius and Rodrigues.
- A report prioritising these islets for conservation.

⇒ *Islets mammalian pest eradication project*

Dates: 1996.
Principal funding agency: ODA.
Implementing agencies: NPCS, MWF and WMIL.
Project contact: Yousoof Mungroo.
Project outcomes:

- Eradication of rats from the offshore islets of Flat Island, Ilot Gabriel and Gunner's Coin
- Eradication of hares from Gunners Coin.
- Eradication of mice from Ile aux Cocos (off Rodrigues).

⇒ *Attempted eradication of shrews from Ile aux Aigrettes*

Dates: 1999.
Principal funding agency: MWF.
Implementing agencies: MWF and University of Bristol (UK).
Project contact: Richard Gibson.
Project outcome: Shrews temporarily reduced to a low level on Ile aux Aigrettes, not eradicated.

⇒ *Creation of weeded and fenced conservation management areas in the Black River Gorges National Park*

Dates: Begun in 1986 and ongoing.
Principal funding agencies: Government of Mauritius, UNDP GEF, World Bank, WWF.
Project contact: Yousoof Mungroo.
Project outcomes:

- Eight plots covering a total of about 40 ha fenced and weeded of alien plants.
- One plot of 5.6 ha fenced but not yet weeded of alien plants.
- Four plots covering a total area of about 8 ha weeded of alien plants but not fenced.
- Plots contributing positively to the regeneration of many native plant species.
- Native plant species reintroduced into CMAs (to December 2000, 8722 individuals of 48 species had been propagated in the NPCS nursery at Curepipe).
- Plots effective for native butterflies.
- Plots attracting many of the rarest endemic bird species of Mauritius.
- Some concern over the effect of weeding alien plants on certain groups of native snails.

⇒ *Creation of weeded and fenced conservation management areas in Mauritius outside the Black River Gorges National Park*

Dates: Begun in 1969 and ongoing.

Principal funding agencies: Government of Mauritius, Mauritius Private Sector, MWF, Royal Society of Arts and Sciences of Mauritius.
Project contacts: John Mauremootoo, Gabriel D'Argent, Hans Paupiah.
Project outcomes:

- Three plots covering a total area of approximately 15 ha fenced and weeded.
- Other outcomes as above, except that these plots are not currently of major importance for endemic birds.

⇒ *The Mauritius kestrel (Falco punctatus) species recovery programme*

Dates: Begun in the early 1970s and ongoing.
Principal funding agencies: DWCT, the Peregrine Fund, Government of Mauritius.
Project contacts: Richard Gibson, Yousoof Mungroo.
IAS components: The control of introduced mammals (mainly rats, cats and mongooses) around kestrel nesting sites; the construction of nest boxes designed to prevent entry of alien monkeys, which prey on eggs and young birds.
Project outcomes:

- Mauritius kestrel populations increased from one known pair and two additional males in 1973 to over 600 free-living birds today.
- Management of populations now minimal.
- Kestrel downlisted from Critically Endangered to Vulnerable by IUCN.

⇒ *The Mauritius pink pigeon (Columba mayeri) species recovery programme*

Dates: Begun in the early 1970s and ongoing.
Principal funding agencies: DWCT, Deutsche Bank, Government of Mauritius.
Project Contacts: Richard Gibson, Yousoof Mungroo.
IAS component: The control of introduced mammals (mainly rats, cats and mongooses) around pigeon nesting sites and in areas of forest that are heavily used by pink pigeons.
Project outcomes:

- Pink pigeon populations increased from 10 known birds in the wild in 1990 to between 350 – 450 birds living in intensively managed areas in April 2002.
- In 2000, IUCN downlisted the pink pigeon from critically endangered to endangered.

⇒ *The Mauritius echo parakeet (Psittacula eques) species recovery programme*

Dates: Begun in the early 1970s and ongoing.
Principal funding agencies: DWCT, Loro Parque, Chester Zoo, Paradise Park, World Parrot Trust, Government of Mauritius.
Project Contacts: Richard Gibson, Yousoof Mungroo.
IAS component: The control of introduced mammals (mainly rats, cats and mongooses) around parrot nesting sites and in areas of forest that are heavily used by parrots.
Project outcome: echo parakeet populations increased from 12 known birds in the wild in 1986 to between 150 and 170 wild birds in February 2002.

⇒ *The Mauritius passerine species recovery programme*

Dates: Begun in the early 1970s and ongoing.
Principal funding agencies: Iris Darnton Foundation, Wildlife Trust, Government of Mauritius.
Project Contacts: Richard Gibson, Yousoof Mungroo.
IAS component: The control of introduced mammals (mainly rats, cats and mongooses) around passerine nesting sites.
Project outcomes:

- Most of the work to date has been monitoring populations.
- Development of management techniques only began in 2001.

⇒ *The development of a management plan for outer islets off Mauritius and Rodrigues*

Dates: From late 2002.
Principal funding agency: Government of Mauritius through Ministry of Environment.
Project Contacts: Yousoof Mungroo.
Overall aim: To prepare a strategic plan for the conservation of 16 islets which will fall under a National Park that has still to be proclaimed.
IAS component: The production of plans for the eradication and/or management of problem invasive alien species on the islets and the preparation of response plans to deal with the introduction or reintroduction of such species (both plants and animals).

⇒ *The control of Javan deer (Cervus timorensis) in the Black River Gorges*

Dates: From 2002.
Principal funding agencies: Government of Mauritius through the Ministry of Environment (under the Environmental Investment II [EIP II] programme).
Project contacts: Yousoof Mungroo and Manichand Puttoo.
Aims of project: To test out the paddock system for the control of deer. If successful, these efforts will be scaled up.

⇒ *The control and eradication of Indian house crows (Corvus splendens) from Mauritius*

Dates: To begin in late 2002.
Principal funding agency: Government of Mauritius through the NPCS.
Project contacts: Yousoof Mungroo and Angela Mellor.
Aim of project: The control of introduced crows at their nesting sites through the application of poison baits.

***Priorities for future work***

The Mauritian National Biodiversity Strategy and Action Plan (NBSAP), currently in preparation, states that its overall aim is to "ensure that native Mauritian biodiversity survives, flourishes and retains its genetic diversity and its components are optimally utilised for the continued progress and socio-economic growth of the country."

In terms of IAS management, the NBSAP states that gaps in the strategy to successfully conserve Mauritius' biodiversity include the following:

- The absence of biodiversity emergency response plan.
- Absence of a pest control strategy to tackle IAS.
- Absence of biosecurity planning and controls for Rodrigues.
- Inadequate information about marine alien invasive species in Mauritius.
- Inadequate information on and absence of control measures for marine IAS.

NBSAP objectives include:

- Continuation and expansion of existing species recovery and ecosystem restoration projects.
- Promotion of restoration measures for degraded ecosystems, including the control of invasive alien species and the recovery of threatened species.
- Research into management methods to control and eradicate IAS in areas of high native biodiversity value.
- Development of a pest control strategy and techniques including the training of relevant personnel, e.g. customs officers, park wardens.
- Development of a comprehensive database for sustainable management of biodiversity resources, including surveys and documentation of IAS that threaten biological diversity.
- IAS eradication and/or management on offshore islets and the introduction of appropriate native species.
- The development of national biodiversity emergency response plans for major threats to biological diversity including IAS
- The setting up of a biosecurity committee to look into the management of IAS for Mauritius, Rodrigues, the outer islands and small islets off Mauritius and Rodrigues.
- The development of a National Pest Control Strategy.
- The promotion of national, regional and international technical cooperation to enhance biodiversity activities.[1]
- The preparation of a comprehensive database of biodiversity resources in freshwater, lagoons high seas, coastal wetlands and estuaries.
- Completion of a national inventory of marine alien species.
- Development of a national policy for the control of marine IAS.

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**Appendix 1. List of people with expertise in the field of biological invasions in Mauritius**

| Name and contact details | Area of expertise |
|---|---|
| Mr. D. Abeeluck<br>Principal Research Scientist, Entomology Division, Agricultural Research and Extension Unit, Réduit, Mauritius<br>Tel: +230 466 0057<br>Fax: +230 464 8809<br>E-mail: areuento@intnet.mu | invasive insects/ agricultural pests |
| Mr. Gabriel D'Argent<br>Botanical Consultant, Mauritian Wildlife Foundation, Avenue Bois des Billes, La Preneuse, Mauritius<br>Tel: + 230 483 5038 or 8933 or 8340<br>Fax: + 230 483 5038<br>e-mail (c/o): cjmaure@intnet.mu | invasive plants |
| Mr. Vishnu Bachraz<br>Research and Development Officer, National Parks and Conservation Service, Ministry of Agriculture, Food Technology and Natural Resources Réduit, Mauritius<br>Tel: + 230 464 2993<br>Fax: + 230 465 1184<br>E-mail: npscagr@intnet.mu | invasive plants |
| Mr. Pierre Baissac<br>Public Relations Manager, Mauritian Wildlife Foundation<br>Port Louis Office, Ken Lee Building, Port Louis, Mauritius<br>Tel: + 230 211 2228/1749<br>Fax: + 230 211 1789<br>E-mail: pbaissac@intnet.mu | ecotourism for conservation funding and conservation education |
| Mr. Brian Bell<br>Wildlife Management International Ltd,<br>P.O. Box 14492, Wellington, New Zealand<br>Tel: +64 04 388 90551<br>Fax: +64 04 388 9051<br>E-mail: wmil@clear.net.nz | invasive animals, eradication of introduced vertebrates from islands |
| Mr. S.P. Beni Madhu<br>Principle Research Scientist, Plant Pathology Division<br>Agricultural Research and Extension Unit, Réduit, Mauritius<br>Tel: +230 466 3970<br>Fax: +230 466 3970<br>E-mail: areu@intnet.mu | introduced plant pathogens |
| Mr. M. Chinappen<br>Principal Research and Development Officer, Plant Quarantine Services<br>Ministry of Agriculture, Réduit, Mauritius<br>Tel: + 230 464 4872<br>Fax: + 230 465 9591<br>E-mail: plpath@intnet.mu | quarantine |
| Dr. Eshan Dulloo<br>Scientist, Conservation and Management of Germplasm Collection<br>Genetic Resources Science and Technology Group<br>International Plant Genetic Resources Institute<br>Via dei Tre Denari, 472/a, 00057 Maccarese, Rome, Italy<br>Tel: +39 66 118206, Fax: +39 66 1979661<br>E-mail: e.dulloo@cgiar.org | invasive alien plants |
| Mr. Vincent Florens<br>Lecturer, Department of Biological Sciences<br>University of Mauritius, Réduit, Mauritius<br>Tel: + 230 454 1041<br>Fax: + 230 465 6928<br>E-mail: v.florens@uom.ac.mu | invasive alien plants, vertebrates and snails |

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|---|---|
| Ms Danielle Florens<br>Manager, The Mauritius Herbarium, Mauritius Sugar Industry Research Institute, Réduit, Mauritius<br>Tel: +230 454 1061<br>Fax: +230 454 1971<br>E-mail: dflorens@msiri.intnet.mu | invasive alien plants |
| Mr. Seelavarn Ganeshan<br>Head, Entomology Department, Mauritius Sugar Research Industry Institute, Réduit, Mauritius<br>Tel: +230 454 1061<br>Fax: +230 454 1971<br>E-mail: sganeshan@msiri.intnet.mu | invasive alien insects/ agricultural pests |
| Mr. Richard Gibson<br>Fauna Conservation Manager, Mauritian Wildlife Foundation<br>Avenue Bois des Billes, La Preneuse, Mauritius<br>Tel: + 230 483 5038 or 8933 or 8340<br>Fax: + 230 483 5038<br>e-mail: spinnerdolphin@intnet.mu | invasive alien animals |
| Mr. David Hall<br>Mammal Research Group, School of Biological Sciences, University of Bristol, Woodland Road, Bristol, BS8 1UG, United Kingdom<br>Tel: +44 117 928 7593<br>Fax: +44 117 928 7374<br>E-mail: dg_hall@hotmail.com | invasive alien animals particularly the black rat (*Rattus rattus)* |
| Mr. Tom Hooper<br>Shoals Rodrigues, Pointe Monier, Rodrigues, Mauritius<br>Tel: +230 831 1225<br>Fax: +230 831 0287<br>E-mail: shoals.rod@intnet.mu | marine biodiversity |
| Dr. Carl Jones<br>Scientific Director, Mauritian Wildlife Foundation, Avenue Bois des Billes, La Preneuse, Mauritius<br>Tel: + 230 483 5038 or 8933 or 8340<br>Fax: + 230 483 5038<br>e-mail: carljones@intnet.mu | invasive alien animals |
| Dr. Christophe Lavergne<br>Service Scientifique, Conservatoire Botanique National de Mascarin, 2 rue du Père Georges, F-97436 Saint-Leu, Ile de La Reunion, France<br>Tel : + 262 24 92 27<br>Fax : + 262 24 85 63<br>E-mail: clavergne@cbnm.org | invasive plants |
| Mrs Neeta Leckraz<br>Senior Research and Development Officer, Plant Pathology Division<br>Ministry of Agriculture, Food Technology and Natural Resources<br>Réduit, Mauritius<br>Tel: + 230 464 5307<br>Fax: + 230 465 9591<br>e-mail: plpath@intnet.mu | quarantine |
| Ms. Tara Lynch<br>Shoals Rodrigues, Pointe Monier, Rodrigues, Mauritius<br>Tel: +230 831 1225<br>Fax: +230 831 0287<br>E-mail: shoals.rod@intnet.mu | marine biodiversity |

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|---|---|
| Dr. Mike Maunder<br>Director of Conservation and Curator of Living Collections<br>The National Tropical Botanical Garden, 3530 Papalina Road<br>Kalaheo, Kauai, Hawaii 96741, USA<br>Tel: +1 808 742 1011 x110<br>Fax: +1 808 332 9765<br>E-mail: m.maunder@ntbg.org | invasive alien plants |
| Dr John Mauremootoo<br>Plant Conservation Manager, Mauritian Wildlife Foundation<br>Avenue Bois des Billes, La Preneuse, Mauritius<br>Tel: ++ 230 483 5038 or 8933 or 8340<br>Fax: ++ 230 483 5038<br>e-mail: cjmaure@intnet.mu | invasive alien plants and vertebrates |
| Mrs A. Mellor<br>Director, Eradicators Ltd,<br>267 Royal Road, Rose Hill, Mauritius<br>Tel: +230 467 7056<br>Fax: +230 467 7055<br>E-mail: eradicators@intnet.mu | invasive alien animals, eradication and control of introduced vertebrates |
| Mr. Don Merton<br>Senior Technical Officer, Biodiversity Recovery Unit,<br>Department of Conservation, PO Box 10 420,<br>Wellington, New Zealand<br>Tel: +64 4 471 3291, Mobile: +64 25 367 366<br>Fax: +64 4 471 3279<br>Email: dmerton@doc.govt.nz | invasive alien animals, eradication of introduced vertebrates from islands |
| Mr. Yousoof Mungroo<br>Director, National Parks and Conservation Service, Ministry of Agriculture, Food Technology and Natural Resources, Réduit, Mauritius<br>Tel: + 230 464 2993<br>Fax: + 230 465 1184<br>e-mail: npcsagr@intnet.mu | invasive alien animals |
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|---|---|
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## Appendix 2. Major insect pests of agriculture that have been introduced naturally, accidentally or deliberately into Mauritius from 1900, with details of their introduction and management strategies.

*Phyllophaga smithi* (Arr.) [Col., Melolonthid.]
This sugarcane white grub is known only from Barbados and Mauritius. It was an undescribed species when it made its appearance in Mauritius, where it became for many years a major pest of sugarcane and familiar to all cane growers as the notorious 'moutouc' or 'Phytalus'. It was first detected in Mauritius at Réduit in 1907 and it is believed to have been imported from Barbados in soil containing rooted sugarcane, although its exact date of introduction is uncertain. The first outbreak to cause severe damage to sugarcane was at Mon Rocher in 1911 on lands adjacent to Pamplemousses Botanic Gardens, which appeared to be the focus of the infestation. The subsequent very slow spread of the insect over the island and the various measures taken to control it, which included a lengthy biocontrol campaign involving importation of various parasites and predators, are well documented. It declined in importance from about the mid-1930s, when it had spread over most of the island, for reasons that are not clear. Today it is of little significance as a cane pest, although it is still very common, and sometimes locally abundant.

*Procontarinia matteiana* Kieff. & Cecc. [Dip., Cecidomyiid.]
The mango leaf gall midge is undoubtedly the cecidomyiid, then unidentified, reported to have spread throughout the island early in the 20th century and which was thought to have been introduced in 1909 with mango plants imported from India. It occurs also in Réunion, where it was first recorded only in 1953.

*Aspidiotus destructor* Sign. (Homopt., Diaspidid.]
The coconut scale insect is widespread in the tropics and the warm temperate zone. Although originally described from Réunion, it was first found in Mauritius on guava in 1922, and by 1927 it was causing considerable damage to coconut palms. Its importance declined from 1937 onwards following the importation of the coccinellid predators *Chilocorus politus* Muls. in 1937 and *C. nigritus* (F.) in 1939. Apart from coconut, on which it is now rare, it has been recorded on 17 other plant species in Mauritius.

*Gonipterus scutellatus* Gyll. [Col. Curculionid.]
The eucalyptus weevil, native to Australia, has spread to many countries and was first recorded in Mauritius in 1940. By 1944, extensive attacks were occurring in eucalypt plantations. Its biocontrol was achieved by the introduction of the egg parasite *Patasson nitens* Gir. (q.v.) in 1946.

*Ceratitis* (*Pterandrus*) *rosa* Karsch [Dip., Tephritid.]
The Natal fruit fly, a notorious pest which is widespread in Africa, is believed to have been introduced accidentally into Mauritius with fruit imported from South Africa, probably in 1953. By 1962, it had become by far the most important fruit fly in the island and is rated as a major pest. It has been recorded from the fruits of 18 plant species in Mauritius.

*Neoceraritis cyanescens* (Bezzi) [Dip., Tephritid.]
The tomato fruit fly, which comes from Madagascar, was seen severely damaging tomato plantations in Réunion in 1951 and immediate measures were taken to try to prevent its entry into Mauritius. These included banning the importation of tomatoes into Mauritius from Réunion and Madagascar (Government Proclamations No. 18 of 1951 and No. 22 of 1953). The measures were not successful and in 1958 the pest was discovered in Mauritius in the vicinity of Port Louis. Severe crop loss resulted in fields of tomato in subsequent years but the insect is currently of relatively little importance. Apart from tomato fruits, the insect also attacks those of various *Solanum* spp., and has been recorded from *S. macrocarpum* L. (grosse anghive) and *S. melongena* L. (bringelle) in Mauritius.

*Oryctes rhinoceros* (L.) [Col., Dynastid.]
The rhinoceros beetle has a wide distribution in southeast Asia and the Pacific, and was first found in Mauritius in July-August 1962 attacking coconut trees at Tombeau Bay and Roche Bois. The proximity of these two localities to the Port Louis Harbour indicated that the beetle had arrived by ship, possibly from Diego Garcia. By 1969, the insect had spread throughout the island, causing considerable damage to both coconut and ornamental palms. Attempts at biocontrol using parasitic and predatory insects were unsuccessful, but a virus, *Rhabdionvirus oryctes*, introduced in 1970, was highly effective, reducing the status of the beetle to that of a minor pest.

*Erionota thrax* (L.) [Lep., Hesperiid.]
The larva of the banana leaf-roller or 'banana skipper', which occurs throughout southeast Asia, forms a tubular shelter for itself by rolling up a segment of a banana leaf. It was first found in Mauritius in 1970 and the severe damage it caused to banana leaves led to the introduction of hymenopterous parasites from Sabah in an attempt to achieve biocontrol. It is currently not considered an important pest.

*Cerneura delonixia* Ghauri (Homopt., Cicadellid.]
The tiny flamboyant leafhopper was unknown to science until it was found in Réunion and Mauritius, in 1975 and 1977 respectively, causing the bronzing and premature shedding of the foliage of flamboyant trees (*Delonix regia)*. It was subsequently found in Madagascar, where it is considered to be indigenous like the flamboyant tree itself, and where it causes similar damage. The insect does not seem to have any adverse effect on flamboyant trees other than hastening the annual shedding of its leaves.

*Liriomyza trifolii* (Burgess) [Dip., Agromyzid.]
This leaf miner of American origin has spread to many parts of the world in recent decades through the agency of air-freighted flowers. It was first detected in Mauritius in October 1979 at Médine, where it was infesting tomato plants. There is little doubt that it arrived in Mauritius from Réunion, where it had been reported in the previous year as having entered that island probably with flowers imported by air from France. The insect caused very severe damage to potato crops in Mauritius in 1980 and remains a significant pest of several crop plants. More than 30 host-plants have been recorded in Mauritius.

*Anonaepestis bengalella* Rag. [Lep., Pyralid.]
The larva of this moth attacks the fruits of custard apple (*Annona squamosa* L.). It was first reported in Mauritius in 1980. It occurs throughout southeast Asia and in Indonesia and Australia.

*Thrips* sp. prob. *nigropilosus* Uzel [Thysanopt., Thripid.]
The chrysanthemum thrips has a world-wide distribution, and is a pest of *Pyrethrum* in East Africa but also has other food plants. Although recorded in 1980, it is considered to have been present in Mauritius since at least 1969, when thrips attack on lettuce was observed for the first time, and is attributed, almost certainly erroneously, to *Thrips tabaci*.

*Aleurothrixus floccosus* (Mask.) [Homopt., Aleyrodid.]
An aleyrodid of wide distribution and with many host plants, *A. floccosus* was first found in Mauritius in December 1981, having probably been introduced from Réunion. It is thought to have arrived in the latter with citrus plants imported from France. The importance of the insect on citrus led to the implementation of measures for its biocontrol on both islands

*Erosomyia mangiferae* Felt [Dip., Cecidomyiid.]
A midge that attacks the inflorescences of mango, it was first recorded in Réunion and Mauritius in 1974 and 1982 respectively. Severe attacks on mango were reported in Mauritius in 1985.

*Thrips palmi* Karny [Thysanopt., Thripid.]
This insect is of wide distribution in South and East Asia, the Pacific, Africa and the West Indies and has many host plants. It was first recorded in Mauritius in September 1985 on eggplant and was subsequently found on various other crop plants, including potato. It sometimes causes appreciable crop damage. Its presence in Réunion was confirmed in 1986, although it is thought to have been present there for about 12 years beforehand.

*Carpomya vesuviana* Costa [Dip., Tephritid.]
A fruit fly which attacks jujube (*Ziziphus mauritiana* Lam.), it was first recorded on Maritius in 1986, when it was found to be already widespread in the island. Since it was not recorded from jujube in 1960, it was presumably introduced after that date. The insect is of wide distribution from southern Europe across central and South Asia, including the Indian subcontinent.

*Pseudaspidoproctus fulleri* (CkII.) [Homopt., Margarodid.]
An intense infestation of this little-known mealybug, which has been recorded on grasses in Natal, Zimbabwe and Kenya, appeared at Gros Cailloux in February 1990 on *Cynodon dactylon* (L.) Pers. (chiendent). Other grasses in the immediate vicinity, including sugarcane, were also infested, but to a lesser extent. Evidently a recent introduction into Mauritius, the presence of the insect on sugarcane was initially a cause for concern but it soon became apparent that sugarcane is not a favoured host plant and fears that a new cane pest of consequence had appeared were thus allayed. The coccinellid *Rodolia chermesina* Muls., a predator of *Icerya seychellarum* (Westw.), the only other foliage-infesting margarodid mealybug in Mauritius, readily attacks *P. fulleri*.

*Heteropsylla cubana* Craw. [Homopt., Psyllid.]
The leucaena psyllid, a native of Central America and now a major pest throughout the tropics and subtropics of the introduced fodder tree Leucaena (*Leucaena leucocephala)*, spread dramatically across the Pacific in the 1980s, possibly in aircraft, to reach southeast Asia and Australia, and then across the Indian Ocean to the Mascarenes and Africa. It was first recorded from Mauritius in 1991.

*Liriomyza huidobrensis* (Blanch.) [Dip., Agromyzid.]
This is a leaf-miner of South American origin which has been spread to many parts of the world, including several European countries, by means of infested plant material. It was recorded in Réunion in 1990, probably having been imported from France and was detected in Mauritius in August 1992 infesting potato. Once recognised, it was found to be widespread, not only on potato but also on other crops including tomato and bean. In appearance and habits it is similar to *L. trifolii* (q.v.), which it has largely displaced as a pest of field crops.

*Phyllocnistis citrella* Stainton [Lep., Gracillariidae]
The citrus leaf miner, a native of southeast Asia, has spread to Australia, the Middle East, Africa, southern Europe, southern USA and Central America. First found in Mauritius in 1995 at Labourdonnais, it has become an important citrus pest throughout the island. It was also recorded in 1995 from Réunion Island.

*Bemisia argentifolii* Bellows & Perrin [Homopt., Aleyrodid.]
The silverleaf whitefly is also known as *Bemisia tabaci* (Gennadius) biotype B. Its common name is derived from a characteristic silvering it causes to the foliage of cucurbitaceous plants. First detected in May 1998 at Bel Ombre on eggplant, tomato and *Brassica*, it was subsequently found on other plants. It has a wide distribution and is polyphagous. Apart from its phytotoxicity, it is capable of transmitting plant viral diseases.

*Cinara cupressivora* Wats. & Vorg. [Homopt., Apidid.]
This aphid, formerly assigned to the species *C. cupressi* (Buckton), feeds on the twigs of cypress and juniper trees (Cupressaceae), and is capable of causing severe damage to such trees. It was recorded from sub-Saharan Africa only after 1985 and was first identified from Mauritius in January 1999 on *Juniperus bedfordiana* and *J. bermudiana*. Widespread and severe damage to the latter, causing the death of many trees, occurred in 1999.

*Aleurodicus dispersus* Russell
The spiralling whitefly was first recorded in 2000 on Poinsettia. It has been recorded on 38 genera of plants belonging to 27 plant families and more than 100 species including *Annona*, avocado, banana, bird-of-paradise flower, breadfruit, citrus, coconut, eggplant, guava, mango, palm, papaya, pepper, poinsettia and rose. Its feeding causes premature dropping of leaves. Direct feeding damage, even during heavy infestations, is usually insufficient to kill plants. Indirect damage is due to the accumulation of honeydew and white, waxy flocculent material produced by the whiteflies. The honeydew also serves as a substrate on which sooty mould grows. A small population of whiteflies is sufficient to cause considerable damage. Due to its wide host range, controlling the insect by applying insecticides would not be of great help. Biological control by the use of parasitoids and predators is being investigated. The present status of the pest and its existing natural enemies are being investigated.

*Chilades pandava*
A lycaenid butterfly, the plains cupid was first recorded in December 2000. The larvae feed on young leaves of the sago palm *Cycas thouarsii,* causing severe damage to this plant. Death of many plants has been noted. Insecticides, which were previously never applied to these plants, currently have to be applied for the control of this pest.

## Appendix 3. List of acronyms used in this document

| | |
|---|---|
| CMA | Conservation Management Area |
| DWCT | Durrell Wildlife Conservation Trust (Jersey) |
| GEF | Global Environment Facility |
| IOC | Indian Ocean Commission |
| IUCN | International Union for the Conservation of Nature or World Conservation Union |
| MWF | Mauritian Wildlife Foundation |
| NBSAP | National Biodiversity Strategy and Action Plan |
| NPCS | National Parks and Conservation Service |
| ODA | Overseas Development Association (UK)' |
| SGP | Small Grants Programme |
| UNDP | United Nations Development Programme |
| WMIL | Wildlife Management International (New Zealand) |
| WWF | World Wide Fund for Nature |

# *Mozambique*

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***Provisional list and impacts of alien species identified as harmful, invasive or pests***

Invasive alien species are one of the main causes of a wide variety of adverse environmental impacts in Mozambique, both as agricultural pests, and as species affecting the country's natural ecosystems. Their introduction into the country has occurred for many different reasons, including their inadvertent introduction during the importation of goods, animals, planting material and plant tissues that were not properly checked at quarantine.

*Birds:* Indian crow (*Corvus splendens*) at Inhaca Island

*Insects:* spotted maize stem borer (*Chilo partellus*), larger grain borer (*Prostephanus truncates*), cassava mealy bug (*Phenacoccus manihoti*), sugarcane borer (*Chilo sacchariphagus*), peanut leaf miner (*Aproaerena modicella*)

*Mites:* cassava green mite (*Mononychellus tanajoa*)

*Plants:* There are over 150 species recorded throughout the country, mainly during 1982/3 by J. Compton. Some of the most well-known are: *Eichornia crassipes*, *Pistia stratiotes, Salvinia molesta, Striga amontica, Ocimum canum* Sims, *Albizia adianthifolia, Amaranthus viridis* L., *A. viridis, A. graecisans, Vernonia rogerii, V. glabra*, *V. acuminatissima*, *V. petersii, Imperata cilindrica, Panicum maximum, P. trichocladum, Penissetum unisetum* Nees, *Eragrostis aspera* Jacq, *Commelia benghalensis, Corchorus trilocularis* L., *Echinochloa frumentaceu, Mucuna pruriens, Solanum incanum, Hibiscus* sp., *Vigna* sp., *Boerhavia erecta.*

*Pathogens:* lethal yellowing disease (LYD) of coconut, *Oidium anacaridi* of cashew nut, cassava brown streak disease (CBSD) of cassava.

***Summary list of existing programs***

A number of programs have been carried out with a view to containing and/or controlling most of these introduced species. Examples are:

- The containment and control program at Inhaca Island for the Indian crow, which entered the country on ships from India during the 1970s, employing mechanical means or poisoning. This has not been successful.
- The cassava mealy bug biological control programme using the parasitic wasp *Epidinocarsis lopezi* from 1988 to 1995, which was extremely successful.
- The ongoing biological control program of the spotted maize stem borer *Chilo partellus* which is undertaken in collaboration with international organisations ICIPE and PPRI.
- A pilot biocontrol program of the sugarcane borer in the central region of the country.
- A containment and control program is being investigated for the larger grain borer, a new pest of stored crops which is becoming devastating in some identified hotspots.

- A survey of water hyacinth (*Eichornia crassipes*) has been conducted in order to evaluate its impact on the country's main rivers, lakes and dams. Major control activities were carried out at the Cahora Bassa Dam in the central Tete Province, where, although mainly under control, it remains a threat and as such must be kept under surveillance.
- A case study and research survey on marine invasive species has been conducted jointly by the Biodiversity Department of the Ministry for the Environment and the University.

***List of organizations that could potentially be involved with IAS management***

- The Ministry for the Coordination of Environmental Affairs
- The National Directorate of Agriculture, Plant Protection Department
- The National Agricultural Research Institute (INIA), Botany Department
- Universidade Eduardo Mondlane
- World Vision Mozambique

***Priorities for future work***

The priorities that are being set in order to tackle this issue are a policy of prevention and containment of all invasive species (prevention mainly through improved quarantine measures), especially those species with a high detrimental impact. Also a programme aimed at compiling an updated inventory of IAS in Mozambique is to be carried out.

***Some experts working in the field of biological invasions***

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***Bibliography***

A list of publications on IAS in Mozambique is not yet available. There is, however, a new programme that is soon to be initiated which will encompass a broad study of IAS in the country. This study will generate such a bibliography.

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## *List of invasive alien species in Namibia*

Invasive alien species seem to be considered a comparatively modest problem in Namibia. In comparison to other countries, Namibia appears to be less impacted by IAS in terms of numbers and spatial extent. Until recently, Namibia had no list of IAS; the significance of the ecological threat posed by IAS in Namibia has yet to be addressed.

Knowledge about invasive alien species in Namibia depends largely on *ad hoc* observations and a few structured investigations. Until recently, the only comprehensive published data available were collected at a workshop held in 1984. Problem alien plant and animal species were identified and qualitative estimates of distribution, severity, and ecological threat were discussed. In addition, the National Herbarium composed a list of naturalized alien species without categorizing or prioritizing species. The only exception is kariba weed, *Salvinia molesta,* on which extensive information exists resulting from a control program active since the 1980s.

It is against this background that the Namibian National Biodiversity Task Force realized the need for more objective scientific information about IAS in Namibia and initiated the Working Group for Invasive Alien Species. As a first step, existing information about invasive alien plant species was collected and reviewed. Eventually all IAS in Namibia need to be identified and categorized, estimates of their spatial distribution need to be quantified and their severity and impacts need to be calculated. Initial emphasis has been placed on invasive alien plants because their impacts on ecosystem structure and function seem to be the most obvious. Criteria such as commonness, abundance, and detrimental ability were applied to the "Top Ten" list of invasive alien plants of 1984 in order to prioritize the current "Nasty Nine," or the"worst" IA plants in Namibia. These nine species were illustrated for an awareness poster which has been widely distributed in Namibia since March 2002 (Table 1).

**Table 1. The "Nasty Nine" worst invasive alien plant species occurring in Namibia, illustrated on a public awareness poster recently distributed nationally.**

| **Scientific name** | |
|---|---|
| *Argemone ochroleuca ochroleuca* | *Opuntia* spp. |
| *Datura innoxia* | *Pennisetum setaceum* |
| *Leucaena leucocephala* | *Prosopis* spp. |
| *Melia azedarach* | *Salvinia molesta* |
| *Nicotiana glauca* | |

***List of existing management and awareness programs***

The Working Group for Invasive Alien Species in collaboration with the National Herbarium of Namibia is currently reviewing, collating, and synthesizing current databases and literature in order to identify gaps and prioritize research projects on (1) indicator species, (2) identification of sources of invasive aliens, and (3) appropriate means of management and prevention.

Broad public awareness and involvement in the invasive alien species issue in Namibia is being encouraged. An atlas program for invasive alien species will be established during 2002. Building on the experience of Namibia's Tree Atlas Program, an interactive database has been proposed to provide information on the distribution and abundance of invasive alien species in Namibia.

In the past, little effort was made to control alien invasive species in a concerted way. At present, local initiatives to control certain species operate in isolation. On a national level, there have been problems with phytosanitary measures due to inadequate facilities, enforcement powers, and staff numbers. Improved management and effective enforcement through phytosanitary, customs, and field control units depends on the revision of existing policies and regulations, and the development of new ones. Law enforcement should be a national effort involving all line ministries and more should be done to implement existing regulations. For example, 1) title deeds should include regulations relevant to alien invasive species, 2) urban developments under the auspices of local authorities need to discourage the introduction and spread of alien invasive species, and 3) the planting of indigenous species should be promoted. Enforcement is especially needed to prohibit the introduction, sale or propagation of undesirable alien species, to oblige landowners to eradicate declared unwanted species on their property, and to synchronize national efforts with those of neighbouring countries.

The Namibian public is largely unaware of IAS, which impedes efforts to limit their introduction and spread. Building on the early success of the "Nasty Nine" Poster, the potential impacts of IAS will be a recurring theme in display materials such as Namibia's annual "Art for the Earth" competition for young schoolchildren, and will be the subject of continuous awareness campaigns. Curricula need to include this issue and short courses must be offered at Namibia's tertiary education institutions.

***List of organizations involved with IAS management in Namibia***

Current collaborators with the Working Group for IAS of the National Biodiversity Task Force include the University of Namibia; Polytechnic of Namibia; Ministry of Environment & Tourism (Forestry, Environmental Affairs, and Parks & Wildlife Management); and Ministry of Agriculture, Water & Rural Development (Water Affairs, Research & Training, including the National Herbarium).

*Ad hoc* involvement of officials from the Ministry of Fisheries & Marine Resources (Policy Planning and Economics), Ministry of Finance (Customs and Excise), Ministry of Home Affairs (Immigration and Border Posts and the Namibian Police); Ministry of Works, Transport & Communication (Transportation, Infrastructure Maintenance and Construction); Ministry of Justice (Legal Drafting); Ministry of Regional & Local Government (Regional Councils; Local Authorities); Roads Constractor Company; TransNamib; Telecom Namibia, Namwater, and Nampower is desirable in future.

It is also proposed to involve personnel from non-governmental organizations such as the Desert Research Foundation of Namibia (DRFN), Centre for Research Information Africa Action (CRIAA), Namibia Environmental Education Network (NEEN), Namibian Association of CBNRM (Community Based Natural Resource Management) Support Organisations (NACSO), and other similar organisations in the future.

***Priorities for future work***

All activities of the Working Group for Invasive Alien Species of the National Biodiversity Task Force can be grouped under four major on-going tasks:

- Quantitative surveys of invasive alien species in Namibia (their distribution, sources of introduction, methods of infestation, and impacts) and implementation of an atlas program, resulting in an interactive database.
- Case study research on selected invasive alien species.
- Appropriate control programs, enforcement of national legislation, phytosanitary control, and trans-boundary cooperation.
- Promotion of public awareness about the potential threats of invasive alien species and the involvement of the public in the control and prevention of invasions.

The initiation of a National Invasive Alien Control Program is proposed. This strategy invites financial, political, and scientific support on a national level and includes objectives such as poverty alleviation and rural development. Ideas include national educational "alien-buster" days and the forming of cooperatives. Eradication efforts promise to be profit-driven in terms of secondary products, job creation, small industry creation, and improved productivity from reclaimed habitats.

The ecological and economic implications of invasive alien species in Namibia are not well quantified to date. Currently, use of *Prosopis* species as indicators is being studied. Detrimental impacts of *Prosopis* species include 1) displacement, out-competition, and elimination of native species, 2) consumption of limited resources such as water, 3) loss of ecosystem productivity, 4) changes in ecosystem structure and function, and 5) degradation of landscape aesthetics. So far, none of these impacts have been quantified in terms of ecological or economic costs. The consequences of *Prosopis* invasions went unnoticed until their effects became almost irreversible and their eradication virtually impossible. Control and rehabilitation efforts are expensive and may themselves pose adverse effects for the environment. On the other hand, *Prosopis* management may lead to job creation, manufacturing of secondary products, and sustainable local economies in some of Namibia's most resource-poor regions. These issues will be analyzed and addressed in the present research project.

A list of unwanted species (including species that are unwanted elsewhere and indigenous invasive species, e.g. *Acacia mellifera* and *Dichrostachys cinerea*) must be compiled for Namibia. Close cooperation with other programs is proposed in order to provide platforms for raising awareness and stronger links with the activities of national days like Water Day, Earth Day, and Arbor Day. Stronger trans-boundary control and sub-continental cooperation on IAS is needed, especially in the fields of information-sharing and training. Close cooperation with local nurseries will be encouraged to provide more information on gardening with indigenous species and to promote water-wise gardening. The selling of IAS by nurseries should also be discouraged.

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**Appendix 1. Extract from Namibia's National Biodiversity Strategy and Action Plan (in press).**

***Strategic Aim 3.8 Reduce the threat to biological diversity from invasive alien species.***

***a Review and categorise information on invasive alien species known in Namibia***

Current databases and literature in Namibia and the region need review, collation and synthesis in order to identify gaps and prioritise projects. This will assist in the selection of indicator species, the identification of sources of invasive aliens, and appropriate means of control.

***Target:*** *Detailed country study on invasive alien species in Namibia, including prioritised lists of problem plants, insects, mammals and other taxa, is published by 2003*

***b Establish an ongoing database and atlas on plant and animal invasive aliens***

An atlas project for invasive alien species is needed, focusing on distribution and abundance and filling gaps through the use of volunteer atlassers. The project would develop an interactive database to generate feedback to farmers, land managers, planners and others.

***Targets:*** *A comprehensive database framework with existing data is established by 2002, with at least 1500 new atlas records per year from across the country until 2008*

***c Research the invasiveness of selected species, the impact on livelihood security and potential mitigation strategies***

Focused research from Namibia and elsewhere is needed on selected invasive alien species, including their spread, sources, invasiveness, and environmental impacts.

***Target:*** *Research recommendations on control of the top 50% priority plant, insect and mammal species are taken up by implementing agencies by 2008*

***d Establish policy, legislation and control measures for invasive aliens, and strengthen regulatory capacity***

Policies and regulations need development or revision, implementation, enforcement, and harmonisation through the Southern African Development Community in order to promote improved management. Phytosanitary, customs and field control units need considerable strengthening.

***Targets:*** *Namibian policies and regulations strengthened and harmonised with other SADC countries by 2006; Namibian phytosanitary, extension and customs units fully equipped to control IAS by 2007*

***e Promote public awareness of the ecological and economic threat posed by invasive alien species***

The threat posed by invasive aliens to biodiversity and water supply should be a recurring theme in display material such as Namibia's annual "Art for the Earth" competition for young schoolchildren, and the subject of posters and brochures at schools, border posts and police stations. Tertiary curricula need updating to include the issue, with short courses for horticulturalists and customs officials.

***Targets:*** *The publication of yearly "Update" briefing sheets and display materials including school competitions is established by 2002; effective annual courses designed and offered to priority target audiences starting in 2004*

***f Initiate and test appropriate, low-impact control projects for problem invasive aliens***

The cost-effective control of invasives must not be more harmful to the environment than the species themselves. Control measures used in other areas need careful assessment of impacts and effectiveness in local conditions.

***Target:*** *Pilot experimental control projects for top-priority IAS are established by 2004*

Invasive alien species do not occur naturally in an area, and when introduced either intentionally or by accident by humans, they start spreading, often to the detriment of local species. They may have serious economic and ecological impacts, by displacing local species, attacking crops or native plants, consuming precious groundwater, or choking our rivers. In neighbouring South Africa, the impact on water supply of infestation by alien trees costs that country many millions of rands per year. Control of most invasive species is extremely expensive, if not impossible, once the species is well established. Control should thus start well before the problem becomes significant or widespread. Namibia can often still do this.

# *South Africa*

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***Contents***



## *List of alien species that have been identified as harmful*

*Alien plants*

**Table 1. Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983), Regulation 15**

| Kind of plant | | Type* | Category** | Special conditions |
|---|---|---|---|---|
| **Botanical name** | **Common name** | | | |
| **Column 1** | | **Column 2** | **Column 3** | **Column 4** |
| *Acacia baileyana* F.Muell. | Bailey's wattle | invader | 3 | |
| *Acacia cyclops* A.Cunn. ex G.Don | red eye | invader | 2 | |
| *Acacia dealbata* Link | silver wattle | weed | 1 in Western Cape, 2 rest of S. Africa | |
| *Acacia decurrens* (Wendl.) Willd. | green wattle | invader | 2 | |
| *Acacia elata* A.Cunn. ex Benth. (*A. terminalis* misapplied in South Africa) | pepper tree wattle | invader | 3 | |
| *Acacia implexa* Benth. | screw-pod wattle | weed | 1 | |
| *Acacia longifolia* (Andr.) Willd. | long-leaved wattle | weed | 1 | |
| *Acacia mearnsii* De Wild. | black wattle | invader | 2 | |
| *Acacia melanoxylon* R.Br. | Australian blackwood | invader | 2 | |
| *Acacia paradoxa* DC. (= *A. armata* R.Br.) | kangaroo wattle | weed | 1 | |
| *Acacia podalyriifolia* A.Cunn. ex G.Don | pearl acacia | invader | 3 | |
| *Acacia pycnantha* Benth. | golden wattle | weed | 1 | |
| *Acacia saligna* (Labill.) H.L.Wendl. | Port Jackson willow | invader | 2 | |
| *Achyranthes aspera* L. | burweed | weed | 1 | |
| *Agave sisalana* Perrine | sisal hemp, sisal | invader | 2 | |

| Kind of plant | | Type* | Category** | Special conditions |
|---|---|---|---|---|
| **Botanical name** | **Common name** | | | |
| **Column 1** | | **Column 2** | **Column 3** | **Column 4** |
| *Ageratina adenophora* (Spreng.) R.M.King & H.Rob.(= *Eupatorium adenophorum* Spreng.) | Crofton weed | weed | 1 | |
| *Ageratina riparia* (Regel) R.M.King & H.Rob. (= *Eupatorium riparium* Regel) | mistflower | weed | 1 | |
| *Ageratum conyzoides* L. | invading ageratum | weed | 1 | |
| *Ageratum houstonianum* Mill excluding cultivars | Mexican ageratum | weed | 1 | |
| *Ailanthus altissima* (Mill.) Swingle | tree-of-heaven | invader | 3 | |
| *Albizia lebbeck* (L.) Benth. | lebbeck tree | weed | 1 | |
| *Albizia procera* (Roxb.) Benth. | false lebbeck | weed | 1 | |
| *Alhagi maurorum* Medik. (= *A. camelorum* Fisch.) | camelthorn bush | weed | 1 | |
| *Anredera cordifolia* (Ten.) Steenis (*A. baselloides* (Kunth) Baill. misapplied in South Africa) | madeira vine, bridal wreath | weed | 1 | |
| *Araujia sericifera* Brot. | moth catcher | weed | 1 | |
| *Ardisia crenata* Sims (*A. crispa* misapplied in South Africa) | coralberry tree, coral bush | weed | 1 in Northern Prov, KwaZulu-Natal, Mpuma-langa only | |
| *Argemone mexicana* L. | yellow-flowered Mexican poppy | weed | 1 | |
| *Argemone ochroleuca* Sweet subsp. o*chroleuca* (= *A. subfusiformis* G.B.Ownbey) | white-flowered Mexican poppy | weed | 1 | |
| *Arundo donax L.* | giant or Spanish reed | weed | 1 | |
| *Atriplex lindleyi* Moq. subsp. *inflata* (F.Müll.) P.G.Wilson | sponge-fruit saltbush | invader | 3 | |
| *Atriplex nummularia* Lindl. subsp. *nummularia* | old man saltbush | invader | 2 | |
| *Azolla filiculoides* Lam. | azolla, red water fern | weed | 1 | |
| *Bauhinia purpurea L.* | butterfly orchid tree | invader | 3 | |
| *Bauhinia variegata L.* | orchid tree | invader | 3 | |
| *Bryophyllum delagoense* (Eckl. & Zeyh.) Schinz (= *B. tubiflorum* Harv.; *Kalanchoe tubiflora* Raym.-Hamet; *K. delagoensis* Eckl. & Zeyh.) | chandelier plant | weed | 1 | |
| *Caesalpinia decapetala* (Roth) Alston (= *C. sepiaria* Roxb.) | Mauritius thorn | weed | 1 | |
| *Campuloclinium macrocephalum* (Less.) DC. (= *Eupatorium macrocephalum* Less.) | pompom weed | weed | 1 | |
| *Canna indica* L. Excluding hybrid cultivars | Indian shot | weed | 1 | |
| *Cardiospermum grandiflorum* Sw. | balloon vine | weed | 1 | |
| *Casuarina cunninghamiana* Miq. | beefwood | invader | 2 | Not for use in dune stabilisatn. |
| *Casuarina equisetifolia* L. | horsetail tree | invader | 2 | Not for use in dune stabilisatn. |
| *Cereus jamacaru* DC. (*C. peruvianus* misapplied in S. Africa) | queen of the night | weed | 1 | |

| Kind of plant | | Type* | Category** | Special conditions |
|---|---|---|---|---|
| **Botanical name** | **Common name** | | | |
| **Column 1** | | **Column 2** | **Column 3** | **Column 4** |
| *Cestrum aurantiacum* Lindl. | yellow or orange cestrum | weed | 1 | |
| *Cestrum elegans* (Brongn.) Schtdl. (= *C. purpureum* (Lindl.) Standl.) | crimson cestrum | weed | 1 | |
| *Cestrum laevigatum* Schtdl. | inkberry | weed | 1 | |
| *Cestrum parqui* L'Hér. | Chilean cestrum | weed | 1 | |
| *Chromolaena odorata* (L.) R.M.King & H.Rob. (= *Eupatorium odoratum* L.) | triffid weed, chromolaena | weed | 1 | |
| *Cinnamomum camphora* (L.) J.Presl | camphor tree | weed | 1 in Northern Prov., Mpuma-langa, KwaZulu-Natal only | |
| *Cirsium vulgare* (Savi) Ten. (= *C. lanceolatum* Scop.) | spear or Scotch thistle | weed | 1 | |
| *Convolvulus arvensis* L. | field bindweed, wild morning-glory | weed | 1 | |
| *Cortaderia jubata* (Lem.) Stapf | pampas grass | weed | 1 | |
| *Cortaderia selloana* (Schult.) Asch. & Graebn. (excluding sterile cultivars) | pampas grass | weed | 1 | |
| *Cotoneaster franchetii* Boiss. | cotoneaster | invader | 3 | |
| *Cotoneaster pannosus* Franch. | silver-leaf cotoneaster | invader | 3 | |
| *Cuscuta campestris* Yunck. | common dodder | weed | 1 | |
| *Cuscuta suaveolens* Ser. | lucerne dodder | weed | 1 | |
| *Cytisus monspessulanus* L. (= *C. candicans* (L.) DC., *Genista monspessulana* (L.) L. Johnson) | Montpellier broom | weed | 1 | |
| *Cytisus scoparius* (L.) Link (= *Genista scoparia* (L.) Lam.) | Scotch broom | weed | 1 | |
| *Datura ferox* L. | large thorn apple | weed | 1 | |
| *Datura innoxia Mill.* | downy thorn apple | weed | 1 | |
| *Datura stramonium* L. | common thorn apple | weed | 1 | |
| *Echinopsis spachiana* (Lem.) Fiedrich & Rowley (= *Trichocereus spachianus* (Lem.) Riccob.) | torch cactus | weed | 1 | |
| *Echium plantagineum* L. (= *E. lycopsis* L.) | Patterson's curse | weed | 1 | |
| *Echium vulgare* L. | blue echium | weed | 1 | |
| *Egeria densa* Planch. (= *Elodea densa* (Planch.) Casp. | dense water weed | weed | 1 | |
| *Eichhornia crassipes* (C.Mart.) Solms | water hyacinth | weed | 1 | |
| *Elodea canadensis* Michx. | Canadian water weed | weed | 1 | |
| *Eriobotrya japonica* (Thunb.) Lindl. | loquat | invader | 3 | |
| *Eucalyptus camaldulensis* Dehnh. | red river gum | invader | 2 | |
| *Eucalyptus cladocalyx* F.Muell. | sugar gum | invader | 2 | |
| *Eucalyptus diversicolor* F.Muell. | karri | invader | 2 | |
| *Eucalyptus grandis* W.Hill ex Maiden (*E. saligna* Sm. (p.p.) | saligna or rose gum | invader | 2 | |

| Kind of plant | | Type* | Category** | Special conditions |
|---|---|---|---|---|
| **Botanical name** | **Common name** | | | |
| **Column 1** | | **Column 2** | **Column 3** | **Column 4** |
| *Eucalyptus lehmannii* (Schauer) Benth. | spider gum | weed | 1 Western Cape, 2 rest of South Africa | |
| *Eucalyptus paniculata* Sm. | grey ironbark | invader | 2 | |
| *Eucalyptus sideroxylon* A.Cunn. ex Woolls | black or red ironbark | invader | 2 | |
| *Eugenia uniflora* L. | pitanga, Surinam cherry | weed | 1 Northern Prov, KwaZulu-Natal, Mpuma-langa, 3 rest of SA | |
| *Gleditsia triacanthos* L. Excluding sterile cultivars | honey or sweet locust | invader | 2 | |
| *Grevillea robusta* A.Cunn. ex R.Br. | Australian silky oak | invader | 3 | |
| *Hakea drupacea* (C.F.Gaertn.) Roem. & Schult. (= *H. suaveolens* R.Br.) | sweet hakea | weed | 1 | |
| *Hakea gibbosa* (Sm.) Cav. | rock hakea | weed | 1 | |
| *Hakea sericea* Schrad. & J.C.Wendl. | silky hakea | weed | 1 | |
| *Harrisia martinii* (Labour.) Britton & Rose (= *Eriocereus martinii* (Labour.) Riccob. | moon or harrisia cactus | weed | 1 | |
| *Hedychium coccineum* Sm. | red ginger lily | weed | 1 | |
| *Hedychium coronarium* J. König | white ginger lily | weed | 1 | |
| *Hedychium flavescens* Roscoe | yellow ginger lily | weed | 1 | |
| *Hedychium gardnerianum* Ker Gawl. | kahili ginger lily | weed | 1 | |
| *Hypericum perforatum* L. | St. John's wort, Tipton weed | invader | 2 | controlled cultivatn. |
| *Ipomoea alba* L. | moonflower | weed | 1 Northern Prov, Mpumalanga, KwaZulu-Natal, 3 rest of SA | |
| *Ipomoea indica (*Burm.f.) Merr. (= *I. Congesta* R.Br.) | morning glory | weed | 1 Northern Prov, Mpumalanga, KwaZulu-Natal, 3 rest of SA | |
| *Ipomoea purpurea* (L.) Roth | morning glory | invader | 3 | |
| *Jacaranda mimosifolia* D.Don Excluding sterile cultivar 'Alba' | jacaranda | invader | 3 | |
| All seed producing species or seed producing hybrids of *Lantana* that are non-indigenous to Africa | lantana, tickberry, cherry pie | weed | 1 | |
| *Lepidium draba* L. (= *Cardaria draba* (L.) Desv.) | pepper-cress, hoary cardaria, white top | weed | 1 | |
| *Leptospermum laevigatum* (Gaertn.) F.Muell. | Australian myrtle | weed | 1 | |
| *Leucaena leucocephala* (Lam.) de Wit (= *L. glauca* Benth.) | leucaena | weed | 1 Western Cape, 2 rest of SA | |
| *Ligustrum japonicum* Thunb. | Japanese wax-leaved privet | invader | 3 | |
| *Ligustrum lucidum* Aiton | Chinese wax-leaved privet | invader | 3 | Only for use as root stock if autho-rised by |

| Kind of plant | | Type* | Category** | Special conditions |
|---|---|---|---|---|
| **Botanical name** | **Common name** | | | |
| **Column 1** | | **Column 2** | **Column 3** | **Column 4** |
| | | | | Exec. Official i.t.o. reg. 15C(5) |
| *Ligustrum ovalifolium* Hassk. | Californian privet | invader | 3 | |
| *Ligustrum sinense* Lour. | Chinese privet | invader | 3 | |
| *Ligustrum vulgare* L. | common privet | invader | 3 | |
| *Lilium formosanum* A. Wallace (= *L. longiflorum* Thunb. var. *formosanum* Baker) (*L. longiflorum* has sometimes been misapplied to this species in South Africa) | St Joseph's or trumpet or formosa lily | invader | 3 | |
| *Litsea glutinosa* (Lour.) C.B.Rob. (= *L. sebifera* Pers.) | Indian laurel | weed | 1 | |
| *Lythrum salicaria L.* | purple loosestrife | weed | 1 | |
| *Macfadyena unguis-cati* (L.) A.H.Gentry | cat's claw creeper | weed | 1 | |
| *Melia azedarach* L. | syringa, Persian lilac | invader | 3 | |
| *Metrosideros excelsa* Sol. ex Gaertn. (= *M. tomentosa* A.Rich.) | New Zealand christmas tree | invader | 3 | |
| *Mimosa pigra* L. | giant sensitive plant | invader | 3 | |
| *Montanoa hibiscifolia* Benth. | tree daisy | weed | 1 | |
| *Morus alba* L. excluding cultivar 'Pendula' | white or common mulberry | invader | 3 | Only for use as root stock if autho-rised by the Exec. Official i.t.o reg. 15C(5) |
| *Myoporum tenuifolium* G.Forst. subsp. *Montanum* (R.Br.) Chinnock (= *M. montanum* R.Br.) (*M. acuminatum* misapplied in South Africa) | manatoka | invader | 3 | |
| *Myriophyllum aquaticum* (Vell.) Verdc. | parrot's feather | weed | 1 | |
| *Myriophyllum spicatum* L. | spiked water-milfoil | weed | 1 | |
| *Nassella tenuissima* (Trin.) Barkworth (= *Stipa tenuissima* Trin.) | white tussock | weed | 1 | |
| Nassella trichotoma *(Nees) Arech.* (= *Stipa trichotoma* Nees) | nassella polgras/tussock | weed | 1 | |
| *Nephrolepis exaltata* (L.) Schott (= *Polypodium exaltatum* L.) (excluding cultivars) | sword fern | invader | 3 | |
| *Nerium oleander* L., excluding sterile, double-flowered cultivars | oleander | weed | 1 | |
| *Nicotiana glauca* Graham | wild tobacco | weed | 1 | |
| *Opuntia aurantiaca* Lindl. | jointed cactus | weed | 1 | |
| *Opuntia exaltata* A.Berger (= *Austrocylindropuntia exaltata* (A.Berger) Backeb.) | long spine cactus | weed | 1 | |

| Kind of plant | | Type* | Category** | Special conditions |
|---|---|---|---|---|
| **Botanical name** | **Common name** | | | |
| **Column 1** | | **Column 2** | **Column 3** | **Column 4** |
| *Opuntia ficus-indica* (L.) Mill. (= *O. megacantha* Salm-Dyck) excluding all spineless cactus pear cultivars and selections | mission or sweet prickly pear | weed | 1 | |
| *Opuntia fulgida* Engelm. (*O. rosea* misapplied in South Africa) | rosea cactus | weed | 1 | |
| *Opuntia humifusa* (Raf.) Raf. (*O. compressa* (Salisb.) J.Macbr. illegitimate) | large-flowered or creeping prickly pear | weed | 1 | |
| *Opuntia imbricata* (Haw.) DC. (= *Cylindro-puntia imbricata* (Haw.) (Knuth) | imbricate cactus or prickly pear | weed | 1 | |
| *Opuntia lindheimeri* Engelm. (= *O. tardospina* Griffiths) | small round-leaved prickly pear | weed | 1 | |
| *Opuntia monacantha* Haw. (*O. vulgaris* Mill. misapplied) | cochineal or drooping prickly pear | weed | 1 | |
| *Opuntia spinulifera* Salm-Dyck | saucepan cactus, large roundleaved prickly pear | weed | 1 | |
| *Opuntia stricta* (Haw.) Haw. (= *O. dillennii* (Ker Gawl.) Haw.) | pest pear of Australia | weed | 1 | |
| *Orobanche minor* Sm. | lesser or clover broomrape | weed | 1 | |
| *Paraserianthes lophantha* (Willd.) Nielsen (= *Albizia lophantha* (Willd.) Benth.) | Australian albizia, stink bean | weed | 1 | |
| *Parthenium hysterophorus* L. | parthenium | weed | 1 | |
| *Passiflora caerulea* L. | blue passion flower | weed | 1 | |
| *Passiflora mollissima* (Kunth) L.H.Bailey | banana poka, bananadilla | weed | 1 | |
| *Passiflora suberosa* L. | devil's pumpkin, indigo berry | weed | 1 | |
| *Passiflora subpeltata* Ortega | granadina | weed | 1 | |
| *Pennisetum setaceum* (Forssk.) Chiov. excluding sterile cultivar 'Rubrum' | pronkgras/fountain grass | weed | 1 | |
| *Pennisetum villosum* R.Br. ex Fresen. | feathertop | weed | 1 | |
| *Pereskia aculeata* Mill. | Barbados gooseberry | weed | 1 | |
| *Phytolacca dioica* L. | belhambra | invader | 3 | |
| *Pinus canariensis* C.Sm. | canary den | invader | 2 | |
| *Pinus elliottii* Engelm. | slash pine | invader | 2 | |
| *Pinus halepensis* Mill. | aleppo pine | invader | 2 | |
| *Pinus patula* Schltdl. & Cham. | patula pine | invader | 2 | |
| *Pinus pinaster* Aiton | cluster pine | invader | 2 | |
| *Pinus radiata* D.Don | radiata or Monterey pine | invader | 2 | |
| *Pinus roxburghii* Sarg. (= *P. longifolia* Roxb.) | chir or longifolia pine | invader | 2 | |
| *Pinus taeda* L. | loblolly pine | invader | 2 | |
| *Pistia stratiotes* L. | water lettuce | weed | 1 | |
| *Pittosporum undulatum* Vent. | Australian cheesewood, sweet pittospormum | weed | 1 | |
| *Plectranthus comosus* Sims (= *Coleus grandis* Cramer) | Abyssinian coleus, woolly plectranthus | invader | 3 | |

| Kind of plant | | Type* | Category** | Special conditions |
|---|---|---|---|---|
| **Botanical name** | **Common name** | | | |
| **Column 1** | | **Column 2** | **Column 3** | **Column 4** |
| (*Plectranthus barbatus* Andr. misapplied in South Africa) | | | | |
| *Pontederia cordata* L. | pickerel weed | invader | 3 | |
| *Populus alba* L. | white poplar | invader | 2 | |
| *Populus* X *canescens* (Aiton) Sm. | grey or matchwood poplar | invader | 2 | |
| *Prosopis glandulosa* Torr. var. *torreyana* (Benson) Johnst. and hybrids | honey mesquite | invader | 2 | |
| *Prosopis velutina* Wooton and hybrids | velvet mesquite | invader | 2 | |
| *Psidium cattleianum* Sabine (= *P. littorale* Raddi var. *longipes* (O.Berg) Fosb.) | strawberry guava | invader | 3 | |
| *Psidium guajava* L. and hybrids | guava | invader | 2 | |
| *Psidium guineense* Sw. | Brazilian guava | invader | 3 | |
| *Psidium* X *durbanensis* Baijnath ined. | Durban guava | weed | 1 | |
| *Pueraria lobata* (Willd.) Ohwi | kudzu vine | weed | 1 | |
| *Pyracantha angustifolia* (Franch.) C.K.Schneid. (excluding cultivars) | yellow firethorn | invader | 3 | |
| *Pyracantha crenulata* (D.Don) M.Roem. | Himalayan firethorn | invader | 3 | |
| *Rhus succedanea* L. (= *Toxicodendron succedaneum* (L.) Kuntze | wax tree | weed | 1 | |
| *Ricinus communis* L | castor-oil plant | invader | 2 | |
| *Rivina humilis* L. | rivina, bloodberry | weed | 1 | |
| *Robinia pseudoacacia* L. | black locust | invader | 2 | Only for use as root stock if authorised by the Exec. Official ito reg. 15B(10) |
| *Rorippa nasturtium – aquaticum* (L.) Hayek (= *Nasturtium officinale* R.Br.) | watercress | invader | 2 | |
| *Rosa rubiginosa* L. (= *R. eglanteria* L.) | eglantine, sweetbriar | weed | 1 | |
| *Rubus cuneifolius* Pursh and hybrid *R.* X *proteus* C.H.Stirt. | American bramble | weed | 1 | |
| *Rubus fruticosus L. agg.* | European blackberry | invader | 2 | |
| *Salix babylonica* L. (not to be confused with the indigenous *S. mucronata* Thunb. (= *S. capensis, S. subserrata, S. woodii*) | weeping willow | invader | 2 | |
| *Salix fragilis* L. (not to be confused with the indigenous *S. mucronata* Thunb. (= *S. capensis, S. subserrata, S. woodii*) | crack or brittle willow | invader | 2 | |
| *Salvinia molesta* D.S.Mitch. and other species of the Family Salviniaceae | Kariba weed | weed | 1 | |
| *Schinus terebinthifolius* Raddi | Brazilian pepper tree | weed | 1 KwaZulu-Natal, 3 rest of South Africa | |
| *Senna bicapsularis* (L.) Roxb. (= *Cassia bicapsularis* L.) | rambling cassia | invader | 3 | |
| *Senna didymobotrya* (Fresen.) Irwin & | peanut butter cassia | invader | 3 | |

| Kind of plant | | Type* | Category** | Special conditions |
|---|---|---|---|---|
| **Botanical name** | **Common name** | | | |
| **Column 1** | | **Column 2** | **Column 3** | **Column 4** |
| Barneby (= *Cassia didymobotrya* Fresen.) | | | | |
| *Senna pendula* (Willd.) Irwin & Barneby var. *glabrata* (Vogel) Irwin & Barneby (= *Cassia coluteoides* Collad.) | | invader | 3 | |
| *Sesbania punicea* (Cav.) Benth. | red sesbania | weed | 1 | |
| *Solanum elaeagnifolium* Cav. | silver-leaf bitter apple | weed | 1 | |
| *Solanum mauritianum* Scop. | bugweed | weed | 1 | |
| *Solanum seaforthianum* Andr. | potato creeper | weed | 1 | |
| *Solanum sisymbriifolium* Lam. | wild tomato, dense-thorned bitter apple | weed | 1 | |
| *Sorghum halepense* (L.) Pers. | Johnson or aleppo grass | invader | 2 | |
| *Spartium junceum* L. | Spanish broom | weed | 1 | |
| *Syzygium cumini* (L.) Skeels | jambolan | invader | 3 | |
| *Syzygium jambos* (L.) Alston | rose apple | invader | 3 | |
| *Tamarix chinensis* Lour. | Chinese tamarisk | weed | 1 North., West., East. Cape, 3 rest of SA | |
| *Tamarix ramosissima* Ledeb. | pink tamarisk | weed | 1 North., West., East. Cape, 3 rest of SA | |
| *Tecoma stans* (L.) Kunth | yellow bells | weed | 1 | |
| *Thelechitonia trilobata* (L.) H.Rob. & Cuatrec. (= *Wedelia trilobata* (L.) A.Hitchc.) | Singapore daisy | weed | 1 KwaZulu-Natal, 3 rest of South Africa | |
| *Thevetia peruviana* (Pers.) K.Schum. (= *T. neriifolia* A.Juss. ex Steud.) | yellow oleander | weed | 1 | |
| *Tipuana tipu* (Benth.) Kuntze (= *T. speciosa* Benth.) | tipu tree | invader | 3 | |
| *Tithonia diversifolia* (Hemsl.) A.Gray | Mexican sunflower | weed | 1 | |
| *Tithonia rotundifolia* (Mill.) S.F.Blake | red sunflower | weed | 1 | |
| *Toona ciliata* M.Roem. (= *Cedrela toona* Rottler) | toonboom / toon tree | invader | 3 | |
| *Triplaris americana* L. | triplaris, ant tree | weed | 1 | |
| *Ulex europaeus* L. | European gorse | weed | 1 | |
| *Xanthium spinosum* L. | spiny cocklebur | weed | 1 | |
| *Xanthium strumarium* L. | large cocklebur | weed | 1 | |

****Category 1 plants** are prohibited and must be controlled; **Category 2 plants** (commercially used plants) may be grown in demarcated areas providing that there is a permit and that steps are taken to prevent their spread; **Category 3 plants** (ornamentally used plants) may no longer be planted; existing plants may remain, as long as all reasonable steps are taken to prevent the spreading thereof, except within the flood line of watercourses and wetlands.

### *Alien freshwater crayfish in South Africa*

Two species are naturalized and invasive: the red swamp crayfish *Procambarus clarkii* and redclaw *Cherax quadricarinatus.* Two other species are used in aquaculture: yabby *Cherax destructor* and marron *Cherax tenuimanus*.

### *Alien invasive molluscs in South Africa*

Twenty-five species in 11 families in subclass Gastropoda pulmonata are IAS. Ten species are slugs:

| | |
|---|---|
| *Arion hortensis* (1939) | *Milax gagates* (1848) |
| *Arion intermedius* (1898) | *Otala punctata* successfully eradicated (1980) |
| *Bradybeana similaris* (1860) | *Oxychilus alliarius* (1894) |
| *Cochlicella ventricosa* (1909) | *Oxychilus cellarius* (1846) |
| *Deroceras panormibanum ?* (1963) | *Oxychilus draparnaudi* (1908) |
| *Deroceras laevis* (before 1898) | *Physa* sp. (unidentified) |
| *Deroceras reticulatus* (before 1898) | *Physastra dispar* (1944) |
| *Eobania vermiculata* (possibly 1980) | *Subulina octona* (1905) |
| *Helix adspersa* (1854) | *Testacella maugei* (before 1893) |
| *Limax flavus* (before 1900) | *Theba pisana* (1881) |
| *Limax maximus* (unknown) | *Vallonia pulchella* (1846) |
| *Limax nyctelius* (before 1939) | *Vitrea cristallina* (1890) |
| *Limax valentianus* (1961) | *Zonitoides arboreus* (1912) |
| *Lymnaea columella* (introduced 1944) | |

*Source: This information was kindly supplied by Dr. W.F. Sirgel.*

### *Alien spiders in South Africa*

**Table 2. List of introduced spider species known to occur in South Africa** (frequency: o = occasionally; c = commonly; distribution records from published data and personal observations in Province of Gauteng)

| Family | Species | Frequency | Distribution records |
|---|---|---|---|
| Agelenidae | *Tegenaria domestica* | O | Cape Town, Gauteng |
| Dysderidae | *Dysdera crocata* | O | Cape Town |
| Gnaphosidae | *Urozelotus rusticus* | C | Gauteng |
| | *Scotophaeus blackwalii* | C | Gauteng |
| Heteropodidae | *Heteropoda venatoria* | O | Cape Town |
| Linyphiidae | *Ostearius melanopygius* | C | South Africa |
| | *Prinerigone vagans* | C | South Africa |
| Oecobiidae | *Oecobius navus* | C | South Africa |
| Pholcidae | *Pholcus phalangiodes* | C | South Africa |
| | *Smeringopus pallidus* | C | South Africa |
| Salticidae | *Hasarius adansoni* | C | Gauteng |
| | *Menemerus bivittatus* | C | Gauteng |
| | *Plexippus paykulli* | C | Gauteng |
| Scytodidae | *Scytodes fusca* | C | Gauteng |
| Tetragnathidae | *Tetragnatha boydi* | C | South Africa |
| | *T. vermiforus* | O | South Africa |
| | *T. nitens* | O | South Africa |
| Theridiidae | *Achaearaneae tepidariorum* | C | South Africa |
| | *Latrodectus geometricus* | C | South Africa |
| | *Steotoda grossa* | C | South Africa |
| | *Theridula opulenta* | O | Gauteng |
| | *Coleosoma blandum* | O | Gauteng |
| Uloboridae | *Uloborus plumipes* | C | South Africa |
| | *U. walckenaerius* | O | Gauteng |

References: Berland, L. 1932. Les Aragnées ubiquistes, ou à large répartition, et leurs moyens de dissémination. C.R. Soc. Biogeography III:65-67. Decae, A. 1986: Dispersal: ballooning and other mechanisms. Ecophysiology of spiders. pp. 346-356. Dippenaar-Schoeman, A. & R. Jocqué. 1997. African spiders: an identification manual.

**Table 3. Distribution records of alien aquatic animals in seven South African catchments and sub-catchments (A-G).** See distribution codes at bottom of Table 6.

| Species | Catchments | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | A1 | A2 | A3 | B1 | B2 | B3 | C1 | C2 | C3 | D1 | D2 | D3 | D4 | D5 | D6 | E | F | G |
| *Ichthyophthirius multifilis* | | | S | S* | S | | | | | | | | | | | | | |
| *Bothriocephalus acheilognathi* | | | | | S | | | S | | | | | | | | | | |
| *Trichodina acuta* | S | | S | | S | | | S | S | | | | | | | | | |
| *Craspedacusta sowerbyi* | | | | | | | | | | | | | | | | | | |
| *Argulus japonicus* | S | | | | | | | S | S | | | | | | | | | |
| *Cherax tenuimanus* | | | | | | | | | | | | | | | | | | |
| *Procambarus clarkii* | | | | | | | | | | | | | | | | | | |
| *Physa acuta* | S3 | | | S3 | S3 | | | S3 | | | | | | | | | | S |
| *Helisoma duryi* | | | | | | | | | | | | | | | | | | H |
| *Lymnaea columella* | S3 | | S3 | S3 | S3 | S | | S3 | S | | | S | | | | S | | S3 |
| *Oncorhynchus mykiss* | R | | M | S2 | R | S/R | S/R2 | M | M | $S3_U$ | $S3_U$ | | | | | S2 | | S2 |
| *Salmo trutta* | M | | M | S2 | M | S2 | | | | S2 | R | | | | | S2 | | S2 |
| *Carassius auratus* | | | | | | | | | | | | | S1 | S | | | | S |
| *Ctenopharyngodon idellus* | | | | | | | M | R | M | | | | | | | | | |
| *Cyprinus carpio* | S3 | P | S2 | P | S3 | S | P | S3 | S3 | | S | S | S | S | S | M | | S3 |
| *Hypophthalmichthys molitrix** | | | | | S* | | | | | | | | | | | | | |
| *Tinca tinca* | | | | | | | | | | | | | | | | | | S1 |
| *Gambusia affinis* | S* | | H | S* | | | | S | | | | | | | | | | S* |
| *Poecilia reticulata* | | | | | | | | | | | | | | S | | | | |
| *Xiphophorus helleri* | | | | | | | | | | | | | | | | | | |
| *Lepomis macrochirus* | | | S | | S | | S | P | P | | S | P | | | | S3 | | S3 |
| *Micropterus dolomieu* | S | | S | S | P | S | P | S | P | | P | P | | | | S3 | | S3 |
| *Micropterus punctulatus* | | | | | | | | | | | S*1 | | | | | | | H |
| *Micropterus salmoides* | S | P | S2 | S | S | S | S | S | S | | S | S | | | S | S3 | | S3 |
| *Perca fluviatilis* | | | | | | | | S | | | | | | | | | | S |
| *Oreochromis aureus* | | | | | | | | | | | | | | | | | | H |
| *Oreochromis niloticus* | | | | | | | | | | | | | | | | | | H |
| *Trachemys s. elegans* | S | | | | | | | | | | | | | | | | | |

**Table 4. Distribution records of translocated indigenous aquatic animals present in catchments and sub-catchments A-G.** Total numbers of alien species (including species listed in Table 3) in each catchment are also given.

| Species | Catchments | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | A1 | A2 | A3 | B1 | B2 | B3 | C1 | C2 | C3 | D1 | D2 | D3 | D4 | D5 | D6 | E | F | G |
| *Barbus aeneus* | | | | | | | | | | | | | | | | | | |
| *Barbus anoplus* | | | | | | | | | | | | | | | | | | |
| *Labeo capensis* | | | | | | | | | | | | | | | | | | |
| *Labeo umbratus* | | | | S | | | | | | | | | | | | | | |
| *Clarias gariepinus* | | | | | | | | | | | | | | | | | | S |
| *Chetia flaviventris* | | | | | | S* | | | | | | | | | | | | |
| *Oreochromis andersonii* | | H | | | | | | | | | | | | | | | | |
| *Oreochromis macrochir* | | S | | | | | | | | | | | | | | | | |
| *Oreochromis mossambicus* | S | | | | | | | | | | | | | | S $3_1$ | S | | S |
| *Sargochromis codringtoni* | | H | | | | | | | | | | | | | | | | |
| *Serranochromis thumbergi* | | H | | | | | | | | | | | | | | | | |
| *Serranochromis r. jallae* | | H | | | | | | | | | | | | | | | | H |
| *Serranochromis angusticeps* | | H | | | | | | | | | | | | | | | | |
| *Tilapia r. swierstrae* | | | | | | | | | | | | | | | | | | |
| *Tilapia sparrmanii* | | | | | | | | | | | | | | | | S | | S* 3 |
| *Sandelia capensis* | | | | | | | | | | | | | | | | S | | |
| No. alien species in sub-catchments | 11 | 1 + 5H | 7 + 1H | 9 | 10 | 7 | 3 | 11 | 5 | 2 | 6 | 3 | 2 | 3 | 3 | 9 | 0 | 15 + 5H |
| No. alien species in major catchments | 14 | | | 15 | | | 13 | | | 10 | | | | | | 9 | 0 | 15 |

s-c = sub-catchment
m-c = major catchment

**Table 5. Distribution records of alien aquatic animals present in catchments and sub-catchments H-Z. Total catchments (from A – Z) invaded by alien species are also given.**

| Species | Catchments | | | | | | | | | | | | | | | | | | | | | | Total catchmts invaded (A-Z) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | H | J | K | L | M | N | P | Q | R | S | T1 | T2 | T3 | U | V | W1 | W2 | X1 | X2 | X3 | Y1 | Y2 | Z | s-c | m-c |
| *Ichthyophthirius multifilis* | | | | | | | | | S | S | | | | | | | | | S | | | | | 6 | 5 |
| *Bothriocephalus acheilognathi* | | | | | | | | | | | | | | S* | | | | S* | | S | | | | 5 | 4 |
| *Trichodina acuta* | | | | | | | | | S | | | | | | | | | | | | | | | 6 | 4 |
| *Craspedacusta sowerbyi* | | | | | | | | | | | | | | S2 | | | | | | | | | | 1 | 1 |
| *Argulus japonicus* | | | | | | | | | | | | | | | | | | | S | | | | | 4 | 3 |
| *Cherax tenuimanus* | | | | | | | | | H1 | | | | | | | | | | | | | | | | 111 |
| *Procambarus clarkii* | | | | | | | | | | | | | | | | | | | S* | | | | | 1 | 1 |
| *Physa acuta* | | | | | S | | | | | | | | | S3 | | | S | | | | | | | 8 | 7 |
| *Helisoma duryi* | | | | | | | | | | | | | | | | | | | | | | | | | 111 |
| *Lymnaea columella* | S | | S | | S3 | S | | S | S | | S | | S | S3 | | S | S | S | S3 | S | | | | 24 | 16 |
| *Oncorhynchus mykiss* | S2 | R1 | S2 | M | | | M | M | S2 | S2 | S | S | S3 | S2 | S2 | S2 | M | S2 | S2 | R | | | | 23 | 16 |
| *Salmo trutta* | S | | S2 | | | | | | S2 | S2 | M | M | M | S2 | S2 | M | M | M | S2 | | | | | 13 | 11 |
| *Carassius auratus* | H | | | | S | | S* | | | S | | | S* | S* | | | | | | | | | | 8 | 7 |
| *Ctenopharyngodon idellus* | | | | | | | | | | | M | R* | R | R | R | M | R* | | | | | | | 6 | 5 |
| *Cyprinus carpio* | S | S | S | S3 | S | S3 | S | S3 | S | S | S | S | S | S3 | S3 | S | S* | M | S2 | M | | S3 | S3 | 32 | 22 |
| *Hypophthalmichthys molitrix** | | | | | | | | | | | | | | | | | | | | | | | | 1 | 1 |
| *Tinca tinca* | S1 | | | | | | S1 | | | | | | | | | | | | | | | | | 3 | 3 |
| *Gambusia affinis* | | | S2 | | | | | | | | | | | | | | | | | | | | | 5 | 5 |
| *Poecilia reticulata* | | | | | | | | | | | | | S* | S | | | S | | | | | SB | SB | s-c 5 | m-c 5 |
| *Xiphophorus helleri* | | | | | | | | | | | | | | S | | | | | S | | | SB | SB | 3 | 3 |
| *Lepomis macrochirus* | S3 | | S | S*3 | | | S* | H | S | S | | S* | S | S3 | S3 | H | | S* | S | S | | | | 19 | 16 |
| *Micropterus dolomieu* | S3 | S* | S | S3 | S | | | | S | S | S | | | S | S3 | | | | | | | | | 17 | 15 |

| | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Micropterus punctulatus* | | | | | | | S1 | S* | S* | S | | S* | | S2 | S2 | | | | | | | | | 8 | 8 |
| *Micropterus salmoides* | S3 | S3 | S3 | S | S | H | S | H | S3 | S | P | S | S | S3 | S | S | S* | S*2 | S | S | | S3 | S3 | 32 | 21 |
| *Perca fluviatilis* | | | | | | | | | S | | | S* | | | | | | | | | | | | 4 | 4 |
| *Oreochromis aureus* | | | | | | | | | | | | | | H | | | | | | | | | | | 2H |
| *Oreochromis niloticus* | | | | | | | | | | | | | | H | | | | | | | | | | | 2H |
| *Trachemys s. elegans* | | | | | | | | | | | | | | S | | | | | | | | | | 2 | 2 |

s-c = sub-catchment
m-c = major catchment

**Table 6. Distribution records of translocated indigenous aquatic animals present in catchment and sub-catchment H-Z. Total numbers of alien species (including species listed in Table 5) and total numbers of catchments (from A-Z) invaded by alien species are also given.**

| Species | Catchments | | | | | | | | | | | | | | | | | | | | | | Total catchmts invaded (A-Z) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | H | J | K | L | M | N | P | Q | R | S | T1 | T2 | T3 | U | V | W1 | W2 | X1 | X2 | X3 | Y1 | Y2 | Z | s-c | m-c |
| *Barbus aeneus* | | S | | | | | S | S | | S | | | | | S* | | | | | | | | | 5 | 5 |
| *Barbus anoplus* | | | | | | | | | | | | | S* | H | H | | | | | | | | S | 2 | 2 |
| *Labeo capensis* | | | | | | | | S | | | | | | | S* | | | | | | | | | 2 | 2 |
| *Labeo umbratus* | | | | | | | | | S | | | | | | H* 1 | | | | | | | | | 2 | 2 |
| *Clarias gariepinus* | | | | | | S | | S | S | S | | | | | | | | | | | | | | 5 | 5 |
| *Chetia flaviventris* | | | | | | | | | | | | | | | | | | | | | | | | 1 | 1 |
| *Oreochromis andersonii* | | | | | | | | | | | | | | | | | | | | | | | | | 1H |
| *Oreochromis macrochir* | | | | | | | | | | | | | | | | | | | | | | | | 1 | 1 |
| *Oreochromis mossambicus* | S | | | | S | S $3_l$ | | | | | | | | | | | | | | | | S 3 | S 3 | 9 | 9 |
| *Sargochromis codringtoni* | | | | | | | | | | | | | | | | | | | | | | | | | 1H |
| *Serranochromis thunbergi* | | | | | | | | | | | | | | | | | | | | | | | | | 1H |
| *Serranochromis r. jallae* | | | | | | | | | | | | | S 1 | | | H | S 1 | | | | | | | 2 | 2 |
| *Serranochromis angusticeps* | | | | | | | | | | | | | | | | | | | | | | | | | 1H |
| *Tilapia r. swierstrae* | | | | | | | | | | | | | S* | S* | | | | | | | | | | 2 | 2 |
| *Tilapia sparrmanii* | S | S 3 | S* | S 3 | S | S | S | S | S 3 | S* 3 | S* | P | P | S | | | | | | | | | S | 15 | 15 |
| *Sandelia capensis* | | | | | | | S | | | | | | | | | | | | | | | | | 2 | 2 |
| Total no. alien species in sub-catchments | 10 | 6 | 9 | 5 | 8 | 5 1H | 9 | 7 2H | 14 | 12 | 5 | 7 1H | 11 | 18 3H | 10 2H | 4 2H | 7 | 5 | 10 | 5 | 0 | 3 2B | 5 2B | | |
| Total no. in major catchments | 10 | 6 | 9 | 5 | 8 | 5 | 9 | 7 | 14 | 12 | 14 | | | 18 | 10 | 8 | | 11 | | | 3 | | 5 | | |

*Code for distribution*
S - Self-sustaining population
P - Self-sustaining population probable, but no definite records
R - Regular stocking, probably not self-sustainig
M - Maybe stocked somewhere in catchment, self-sustaining populations unlikely
H - Historical. May or may not still be present
U - Uncertain historical translocation

*Code for abundance*
1 - Very rare. Probably a single record
2 - Isolated population in small restricted region/s
3 - Widespread
$3_u$ - Widespread in upper catchment
$3_l$ - Widespread in lower catchment
B - Boundary: Close to watershed between two catchments, so exact catchment is uncertain

* - New distribution record since de Moor & Bruton (1996). Alien and translocated aquatic animals in southern Africa. *Ann. Cape Prov. Mus. (Nat. Hist.)* 19(6).

***Alien birds in southern Africa***

**Table 7. Alien bird species that have been deliberately introduced to or have invaded South Africa, excluding species known to have escaped from captivity**.

| Species | Date | Distribution |
|---|---|---|
| *Cygnus olor** | 1918 and 1941 | Kromme Rivier, Eastern Cape; Paardevlei, Somerset West, Western Cape |
| *Cygnus atratus** | 1926 | Humansdorp, Eastern Cape |
| *Anas platyrhynchos*** | ? | Scattered small populations in Western Cape, Eastern Cape and Gauteng |
| *Colinus virginianus** | ? | Drakensberg, KwaZulu-Natal |
| *Alectoris chukar*** | 1964 | Only on Robben Island |
| *Phasianus colchicus** | *c.* 1900 – 1950s | Ceres, Elgin, Knysna, Stellenbosch, Western Cape; Kimberley, Northern Cape; Dullstroom, Mpumalanga |
| *Lophura nycthemera** | ? | Ceres, Western Cape |
| *Pavo cristatus* | 1968 | Robben Island |
| *Columbia livia**** | 1652 | Throughout in all urban centres |
| *Psittacula krameri**** | 1850s | Cape Town area, coastal KwaZulu-Natal, west of Johannesburg, Gauteng |
| *Corvus splendens**** | early 1970s | Durban, East London, Cape Town |
| *Sturnus vulgaris**** | 1899 | Widespread in Western and Eastern Cape, incl. Karoo |
| *Acridotheres tristris**** | 1888, 1902, 1930s | Widespread in KwaZulu-Natal and central Guateng |
| *Passer domesticus**** | 1880 – 1890 | Throughout in all urban centres |
| *Fringilla coelebs*** | 1890s | Constantia-Plumstead area only |

*Source: Dean, W.R.J. 2000. South African Journal of Science 96:9-14.*

*= extinct, or may be extinct;

**= population and geographic range in southern Africa stable or decreasing, species usually with restricted range;

***= population and range increasing.

***Case studies on ecological and economic impacts of IAS: summary and selected references***

*Aquatic invaders*

- There are 58 alien aquatic species (mainly fish) naturalized in Southern Africa, 33 from outside South Africa and 25 internal transfers. Of the 58 species, 37 are considered detrimental. Of these, more than 22 species are alien fish (about 12% of total fish species) and about 36 are internal translocations causing reductions or local extinctions of severa; indigenous fish, mainly minnows and a *Kneria* sp.
- At least 8 fish parasites and diseases were introduced with alien fish species, which now have a major impact on native fish populations.
- Habitat alterations, extreme competition, hybridization and predation by aliens also contribute to extinctions.
- Two freshwater crayfish species have naturalized and two more species survive in captivity in artificial environments. It must be assumed that these will eventually become naturalized.
- Major impacts are caused by introduced water-borne diseases and parasites affecting mainly human and animal health, exacerbated by aquatic plant invaders.
- Aquatic plant invaders cause interrupted water flow, increase evapo-transpiration, provide vector breeding sites, affect recreational use, decrease oxygenation and transform food webs.

Ashton, P.J., C.C. Appleton & P.B.N. Jackson. 1986. Ecological impacts and economic consequences of alien organisms in southern African aquatic ecosystems. *In:* Macdonald, I.A.W., F.J. Kruger & A.A. Ferrar (eds.). The Ecology and Management of Biological Invasions in Southern Africa. Oxford University Press, Cape Town. pp. 247-257.

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*Mammals*

- Internal mammal translocations can result in hybrids and cause major ecological problems.

Brooke, R.K., P.H. Lloyd & A.L. de Villiers. 1986. Alien and translocated terrestrial vertebrates in South Africa. *In*: Macdonald, I.A.W., F.J. Kruger & A.A.Ferrar (eds.). The Ecology and Management of Biological Invasions in Southern Africa. Oxford University Press, Cape Town. pp. 63-74.

*Reptiles*

- One species of freshwater turtle, *Trachemys scripta*, has been naturalized in South Africa.

Branch, B. 1998. Field guide to snakes and other reptiles of southern Africa, 3rd edn. Struik, Cape Town.

*Molluscs*

- 25 alien species are naturalised in South Africa.

Herbert, D.G. & W.F. Sirgel. 2001. The recent introduction of two potentially pestiferous alien snails into South Africa and the outcomes of different pest management practices: an eradication and a colonization. South African Journal of Science 97:301-304.

*Insects and spiders*

- As is the case in several other countries, the aggressive European wasp has a high nuisance value and will have major implications for the Western Cape tourist industry. They can attack and destroy beehives and damage soft fruit. It also successfully outcompetes native pollinating species.
- The recently introduced varroa mite not only threatens honey production in South Africa but also seriously impedes the efficacy of the African and indigenous Cape bees and other bee species. This will have a major impact on pollination services in general and on plant species survival.

- The internal transfer of the indigenous Cape bee to areas outside their native range to the north has caused the extinction of millions of commercial hives and wild African bee colonies, also seriously affecting pollination services.
- About 225 exotic natural insect enemies (about 80% are parasitic Hymenoptera and 20% predators) have been introduced for the biological control of 50 insect pests. Many have established on native insect species resulting in unwanted, non-target effects.
- 24 spider species commonly found in and around the house are introduced. However, their impact on local endemic species is as yet unknown.

Prinsloo, G.L. & M.J. Samways. 2001. Host specificity among introduced chalcidoid biological control agents in South Africa. *In:* Lockwood, A.J., F.G. Howarth & M.F. Purcell. Balancing Nature: Assessing the Impact of Importing Non-Native Biological Control Agents. Proceedings: Thomas Say Publications in Entomology, Entomological Society of America, Maryland. pp. 31-40.

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*Plants*

- 180 species of invading alien plants cover 10 m ha (8% of South Africa's surface area).
- About 7% of the annual flows of South Africa's rivers is lost due to the excessive use of water of alien woody invaders, over and above the water used by the natural vegetation.
- Selected studies have shown that invasions have reduced the value of the fynbos ecosystems by over US$11.75 billion.
- The net present cost of invasion by black wattles (a widespread forestry and agroforestry species) amounts to US$1.4 billion.
- An approximate 750 000 ha must be cleared annually to win the battle over 20 years, excluding follow-up treatments, costing the country US$92 million/yr for the next 20 years.
- Alien plants have been implicated in the extinction of 58 plants species in the Cape Floral Kingdom and have also contributed to the endangered status of 3 435 other species of southern African plants.
- 750 fynbos plant species currently face extinction because of the spread of alien plant species.
- Changes in biomass and using fuel models showed that an increase of 60% and 50% in fuel load occurred in the cases of *Hakea sericea* and *Acacia saligna* invasions respectively, with disastrous consequences: increase in fire hazard (increased rate of ignition), faster burns and greater intensity resulting in greater damage to the ecosystem.
- Grazing was seriously impeded by rapid invasion by jointed cactus (*Opuntia aurantiaca,* a native cactus from Argentina), reaching about 870 000 ha in the Eastern Cape by 1980, increasing at a rate of 8 000 ha per year. Serious stock losses occurred because of injury to sheep, and contaminated wool was degraded. Intensive chemical control cost the State US$2.5 million/yr in 1981, with little hope of success. Environmental damage caused by continued use of non-selective chemical herbicides over a period of 40 years was alarming.

Versfeld, D.B., D.C. Le Maitre & R.A. Chapman. 1998. Alien invading plants and water resources in South Africa. Water Resource Commission No. TT99/98.

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***Successes***

- In 1975 the burrowing petrels on Marion and Edward islands were on the brink of extinction because of predation by feral cats, which were introduced in 1949. The common diving petrel is considered to have been exterminated by cats as early as 1965. An intensive campaign of biological control using viruses, trapping and hunting started in 1977, and resulted in the extermination of all cats by 1991.
- The Mediterranean snail, *Otala lactea,* was first discovered in the Cape Town docks and in Bellville during 1986 and 1987. A very intensive control programme was immediately launched and the pest is believed to have been eradicated successfully. Intensive surveys between 1989 and 1992 have yielded no trace of the pest.
- Eight alien invading plant species have been brought under complete biological control and 14 species are under substantial control. This represents an overall saving of R1.38 billion (US$ 276 m).
- The Working for Water Programme is a unique initiative in that it was able to leverage substantial funds (mainly through offering employment to the unemployed) for the control of many "thirsty" woody alien plant invaders. This increased the availability of water for many deprived communities.

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**Table 8. Key role players in alien invasive programmes (government agencies and other bodies)**

***Code:***
** = organisations currently working on (controlling) alien invasives*
*# = organisations involved by default (legislation, services or research) in alien invasives*
*@ = important organisations that should become more involved in control programmes*

**Department of Water Affairs and Forestry (DWAF)**

**a. * Working for Water Programme (WfW)**

Department of Water Affairs and Forestry (DWAF), Private Bag X4390, Cape Town 8000. Contact person: Dr. Guy Preston.

- Orchestrating a national programme for the control of alien plant invaders with emphasis on woody invaders and including water weeds.
- Capacity building programmes.
- Funders of various research programmes with emphasis on biological control
- Job creation and upliftment programmes
- Awareness campaigns
- Creating partnerships (governmentla and non-governmntal)

**b. #@ Directorate: Community Forestry**

Agroforestry programmes. Private Bag X93, Pretoria 0001. Mr. F von Krosigk.

- Utilization of weedy agroforestry species (*Prosopis*).
- Providing alternative non-invasive agroforestry species to landowners and communities.

**National Department of Agriculture (NDA)**

**a. *# Directorate: Agricultural Land and Resource Management**

Private Bag X 120. Pretoria 0001. Director: Mr. M. Msomi.

- Executive role by supporting control programmes of certain alien plant invaders of agricultural importance (cacti, nassella etc) and managing the Landcare Programme.
- Regulatory role as custodians of two Acts (CARA and Agric. Pest Act).
- Awareness programmes and land inspection services.

**b. #@ Directorate: Plant Health and Quality**

Private Bag X 258, Pretoria 0001. Mr. E Rademeyer.

- Inspection services at all ports of entry and quarantine services for all imports with emphasis on plant pests.
- Import permits and phytosanitary services. This includes some but inadequate risk assessment service.
- Regulatory role as custodians of the Agricultural Pest Act, which controls all imports and exports of living material.

**c. #@ Directorate: Genetic Resources**

Dr. S. Moephuli, National Department of Agricultural, Private Bag X 973, Pretoria 0001**.**

- Controlling all genetically modified organisms.

**#@ Department of Environmental Affairs and Tourism (DEAT)**

**a. Regulatory as custodians of Environmental Conservation Act and proposed Biodiversity Act.**

Private Bag X 447, Pretoria 0001.

- Controlling all import and release of all alien organisms at national and provincial levels.
- Permit system for collecting and export of all organisms, national and provincial.
- Controlling ballast waters.

**b. *# Marine and Coastal Management Branch**

Private Bag X2, Roggebaai 8012

- **Global Ballast Water Management Programme,** c/o Global Invasive Species Programme, Kirstenbosch Botanical Gardens, P/Bag X7, Claremont 7735

**#@ Department of Trade and Industry**

Private Bag X313, Pretoria 0001

- Links with WTO and IPPC on movement of alien organisms through trade.

**# Agricultural Research Council (ARC)**

**a. Plant Protection Research Institute**

Private bag X 134, Pretoria 0001

- Accredited quarantine services up to virus level.
- Biological control of alien organisms with emphasis on alien plant invaders.
- Identification services and inventories of alien plants (SAPIA), insects, nematodes, spiders, mites and fungi.
- Designing integrated management plans and rehabilitation programmes for alien plant control programmes.
- Course material for training programmes on the control of alien plant invaders.

**b. Institute for Soil, Climate and Water**

Private Bag X 79, Pretoria 0001

- Remote sensing and vegetation mapping.

**# Council for Scientific and Industrial Research (CSIR)**

**a. Environmentek**

Private Bag X 320, Stellenbosch 7600.

- Vegetation mapping, impact assessments, cost/benefit analyses.
- Strategy development and capacity building.
- EIA services.

**# Rhodes University, Grahamstown**

**a. South African Institute of Aquatic Biodiversity- formerly JLB Smith Institute for Ichthyology**

Private Bag 1015, Rhodes University, Grahamstown 6140.

- Alien invasive aquatic organisms with emphasis on fish.

**b. Dept. Zoology and Entomology, Rhodes University**

Grahamstown 6140

- Biological control of alien invasive plants.

**# University of Cape Town**

Rondebosch 7700

**a. Institute for Plant Conservation**

UCT, Rondebosch 7700

- Ecological research on plant invasions and risk assessments.

**b. Dept. of Zoology**

UCT, Rondebosch 7700

- Biological control of alien plant invaders.

**c. Freshwater Research Unit**

UCT, Rondebosch 7700

- Alien invasive fish, other aquatic vertebrates and invertebrates.

**d. Percy Fitzpatrick Institute for African Ornithology**

UCT, Rondebosch 7700

- Research on alien invasive birds.

**# University of Pretoria**

**a. Mammal Research Institute**

Univ. of Pretoria, Hatfield 0028

- Impact of internal transfers of mammals and introduced species.

**# University of Stellenbosch**

**a. Department of Zoology**

Private Bag X1, Matieland, Stellenbosch 7602

- Identification and research on alien invasive slugs and snails.

**@ Provincial Conservation Agencies**

**a. Departments of Environmental Affairs, Tourism and Agriculture of all nine Provinces**

- Various activities in alien invasive control programmes in association with central authorities.

*** Key conservation organisations**

**a. * National Parks Board**

Alien Plant Control Officer, Private Bag X402, Skukuza 1350

- Control of alien invasive plants in national parks.

**b. * KwaZulu-Natal Wildlife**

P.O. Box 662, Pietermaritzburg 3200

- Control of alien invasive plants in KZN.

**c. * Cape Nature Conservation**

Private Bag X5014, Stellenbosch 7599

- Control of alien invasive plants in Western Cape and various related research programmes.

**d. * Botanical Society of South Africa**

Private Bag X10, Claremont 7735

- Regional branches have organised hacking groups that remove alien invasive plants.

**Forests South Africa (Forest Owners Association)**

P.O. Box 1553, Rivonia 2128

**a. *@ SAPPI Forests**

Mr Wayne Lotter, P.O. Box 13124, Cascades 3202

**b. *@ MONDI**

Box 69, Sabie 1260

**c. *@ SAFCOL Timber Growers**

Stamvrug Str., Val de Grace 0184

***Future priorities and strategies to identify management and policy priorities***

*Legislation*

- Continue to improve CARA (Conservation of Agricultural Resources Act) by updating and redefining lists of problem plant invaders under the various categories. Add new category of emerging problem plants.
- Harmonize existing legislation, including within the SADC region. Conflicting legislation:
  - Agricultural Pest Act no. 36 of 1983
  - Conservation of Agricultural Resources Act No. 43 of 1983
  - Environmental Conservation Act, 1989
  - The Mountain Catchment Areas Act no. 63 of 1970
  - The National Water Act no. 36 of 1998
  - The draft National Biodiversity Act (to be promulgated circa 2004).
- Harmonize international conventions dealing with alien invaders.

*Risk assessments*

- Create a local risk assessment centre (RAC) employing experts to determine risks and advise NDA (National Department of Agriculture) and DEAT (Department of Environmental Affairs and Tourism) on applications for introductions. This would include cost/benefit studies.
- Improve on international links and participation. Establish all possible links with global expertise, data banks, and websites etc. on problem organisms, also managed by the RAC.

*Polluter-pays concept*

- Responsibilities for invasions after introductions must rest with industries (e.g. nursery association, FOA, DWAF) benefiting from introductions and not with individual importers. Importers have to belong to a recognized association.
- Early detection of invasions and speedy action by means of existing and improved legislation.

*Awareness*

- Embark on intensive awareness campaigns involving the three relevant government departments (all custodians of legislation dealing with alien invaders) and targeting ports of entry, vehicles (ships, airlines, trucks), nursery industry, forestry and agroforestry, aquarium industry, aquaculture, agriculture, butterfly houses and others.
- Share information and improve interdepartmental communication. Improve communication links with overseas organizations involved with alien invaders, e.g. ISSG.

*Regional coordination*

- Negotiate regional agreements (SADC) to deal with above matters and to share capacity (harmonize legislation).
- Compile protocols for all introductions including for state-supported research programs.

*Research and capacity building*

- Compile inventories, identification services, prioritize targets species, compile tailor-made management plans, biological/integrated control methods, establish rehabilitation programs, impact studies, etc.
- Design alien plant control courses for several levels. Encourage capacity sharing and in-house training opportunities within SADC.
- Invest in state-of-the-art quarantine facilities for all introductions including quarantine facilities for research into biological control to service all SADC countries. Share research/technical capacity within SADC.

*Resource economics*

- Utilization of invasions (mainly plants) as part of broader integrated management plans.

***Bibliography – see annex 1 to this volume.***

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***Background***

Swaziland has a very high biological diversity, containing 14% of southern Africa's plant species. The livelihoods of more than 50% of the people are directly dependent on indigenous biological resources which are rapidly dwindling because of over-utilization, degradation of habitats, and importantly, infestation by alien plants which eventually out-compete the indigenous ones.

***List and impacts of alien species that have been identified as harmful, invasive, or pests***

Like other countries in southern Africa, Swaziland is facing the problem of invasive alien species (IAS). This problem threatens the economy of the country in terms of biodiversity loss, decreasing livestock grazing capacities and reduction of water availability. IAS worsen the problems associated with poverty, decreasing land productivity and ultimately negatively impact the welfare of the people.

More than ninety alien plant species, some of which are invasive, have been identified (Annex 1). These are grouped into economic plants, weeds, and IAS. The most problematic IAS are *Chromolaena odorata, Lantana camara, Acacia mearnsii, Solanum mauritianum, Eucalyptus grandis* and *Parthenium hysterophorus,* with *Chromolaena odorata* considered to pose the greatest threat.

Another group of introduced organisms which has proven problematic are pathogens of agricultural crop species, e.g. the grey leaf spot (*Cercospora zeae-maydis)*, a serious disease of maize.

***Summary of existing programmes***

The Swaziland National Trust Commission (SNTC) is an umbrella organization for the national nature reserves, selected private nature and game reserves, and commercial farms, and is the only organization to initiate alien plant control programmes. So far these control programmes have focused on alien *Acacia* species in the highveld and *Lantana camara* and *Parthenium hysterophorus* in the middleveld and lowveld.

The Ministry of Agriculture and Cooperatives (MOAC) has addressed the problem of *Lantana camara* invasions at a small scale through manual weeding on government farms.

The *Chromolaena odorata* campaign

Soon after the 2000 floods there was an outcry from the general public regarding the invasion of their agricultural lands by *Chromolaena odorata.* The Swaziland Environment Authority (SEA) convened a national workshop for all interested and affected parties so that they could join forces to fight the plague.

Currently Swaziland has no clear strategy to control the spread of invasive alien plant species. There are no realistic and fundable programmes to deal with the problem. Only a few clauses in a variety of different pieces of legislation administered by a range of different ministries address such invasions. An important question which requires quick resolution is: which ministry or organization should take the lead in controlling invasive alien species in Swaziland?

During the national workshop, a task force through the Biodiversity Programme Implementation Committee was formed. Its major functions are to:

- Formulate an action plan and strategy that would effectively control the weed.
- Create awareness of the serious implications of this weed's invasion on people's livelihoods.
- Identify appropriate legislation to manage invasive alien species.
- Prevent reproduction of alien species.
- Address the currently unsatisfactory institutional setup.
- Categorise the plants in terms of nature, characteristics, and their impacts using the stakeholder departments.
- Partner, in particular, with South Africa's 'Working for Water' Programme to tap into their expertise, adopt their successful approaches and, thus avoid initiating unworkable strategies.

The outcomes of this campaign were:

- The task force drew up terms of reference for preparing the strategy.
- Awareness has been raised through the media:
  - Radio programmes were used to inform the public on *Chromolaena*, its nature, impacts, and long-term implications of its invasion. Farmers and experts were interviewed.
  - Articles on *Chromolaena* were published in local newspapers.
  - Posters have been distributed to strategic places around the country.
- Through the Southern Africa Biodiversity Support Programme (SABSP), in which invasive alien species have been accorded a high priority, funds have been solicited to carry out a rapid assessment to evaluate the situation.

*Other initiatives*

Senior officials from MOAC undertook a tour to the Lubombo Conservancy. This revealed the scale of devastation caused by *Chromolaena odorata*.

- Following the tour, the Principal Secretaries from MOAC and the Ministry of Tourism, Environment and Communication (MTEC) formed an emergency team to draw up a proposal for the management of invasive alien species (biased towards *Chromolaena*).

***List of organizations that could be involved in IAS management***

Ministry of Agriculture and Cooperatives, MOAC

- Forestry
- Livestock Unit
- Research Division
- Land Use and Mechanisation
- Veterinary Services

Ministry of Tourism, Environment and Communication

- Swaziland Environment Authority
- National Biodiversity Implementation Committee (BPIC)
- Swaziland National Trust Commission

Ministry of Natural Resources

- Water Resources Branch
- Swaziland Water Services Corporation

University of Swaziland

- Faculty of Agriculture
- Biological Sciences
- Game reserves

Private farmers

- rangeland farmers
- commercial crop farmers

Non-governmental organisations

- Yonge Nawe
- Swaziland Environment Justice Agenda
- and several others

***Priorities***

*Short term interventions*

- Aggressive awareness campaigns will occur at all levels.
- A national disaster task force will be formed.
- A Cabinet Paper is being written to inform Cabinet members.

*Medium term (within next six months)*

- Conduct a rapid inventory of invasive alien species and prioritize the species.
- Prepare a strategy and action plan – centering on Integrated Pest Management approaches.
- Develop draft legislation that will holistically deal with the IAS problem.
- Enforce legislation regarding import and export of alien species.

*Long term strategies*

- Monitor and evaluate all established and ongoing IAS projects.
- Develop pilot projects with direct and tangible benefits to the people, e.g. income generating projects.
- Prevent introductions of new alien species that might become problematic in the future.

***Provisional list and contacts of experts***

| **Expert** | **Contact** |
|---|---|
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| Ngwane Dlamini (plants and animals)<br>Dr. Morris Mtsambiwa (ditto)<br>Kim Roques | Swaziland National Trust Commission, Box 100 Lobamba, Swaziland<br>Tel: +268 416 1481/9<br>Staff@Swazimus.org.sz |
| Linda Dobson (biodiversity aspects) | P.O. Box 764, Mbabane, Swaziland<br>Tel: +268 416 3255<br>linda@realnet.co.sz |
| Stephen Zuke<br>Lungile Magagula<br>(both environmental and biodiversity aspects) | SEA<br>P. O. Box 2652, Mbabane, Swaziland<br>Tel: +268 404 6420/1<br>seabiodiv@realnet.co.sz |
| Kate Braun | kbraun@iafrica.sz |
| Kenneth Msibi (aquatic)<br>Solami Mavimbela (aquatic) | Water Resources Branch, Mbabane<br>P.O. Box 6201, Mbabane, Swaziland<br>Tel: +268 404 6244 |
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# *Tanzania*

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***List of alien species that have been identified as harmful, invasive, or pests***

*Birds*

Indian house crow *Corvus splendens*

*Insects*

cassava mealybug *Phenacocus manihot*
cassava green mite *Monorychelus tanajoa*
larger grain borer *Prostephanus tanscatus*
citrus woolly whitefly *Aleurothrixus floccosus*
stem borer *Chilo partellus*
banana weevil *Cosmopolite* sp.
sugarcane white grub *Phyllophaga smithi*
leucaena psyllid *Heteropsylla cubana*
cypress aphid *Cinara cupressivora*
diamond back moth (presumed to be *Plutella maculipennis* – ed.)

*Plants*

water hyacinth *Eichhornia crassipes*
water lettuce *Pistia stratiotes*
Mexican poppy *Argemone mexicana*
leucaena *Leucaena leucocephala*
maesopsis *Maesopsis emimi*

*Plant diseases*

gray leaf spot *Cercospora zeae-maydis*
cassava mosaic virus (CMD – UgV)
coffee wilt *Colletotrichum coffeanum*
black sigatoka *Mycosphaerella figiensis*
coffee berry disease *Colletotrichum* sp.

***Summary of existing programmes***

Manual removal of water hyacinth, *Eichhornia crassipes,* from Lake Victoria and other waterbodies in the lake basin has involved communities along the lake as well as community-based organisations and NGOs. Local communities are also involved in the mass rearing and release of biocontrol agents. Water hyacinth control is one component of the Lake Victoria Environment Management Project (P.O. Box 78089, Dar-es Salaam, Tanzania).

A programme for the control of *Leucaena leucocephala* has been implemented by the Tanzania Forestry Research Institute (TAFORI). A programme exists for control of sugarcane white grub at Kibaha Sugarcane Research. The Ministry of Agriculture and Food Security – Plant Health Service (National Biological Control Centre) -- is working on a cassava green mite control programme. Finally, the Ministry of Agriculture and Food Security, Plant Health Services is working on biological control of the larger grain borer.

***List of organizations not covered above which should be involved in IAS management***

- Vice-President's Office, Department of the Environment
- Ministry of Agriculture and Food Security: Plant Health Services, Crop Research, Tropical Pesticides Research Institute (TPRI), Herbarium
- Ministry of Natural Resources & Tourism: Fisheries Department, Tanzania Fisheries Research Institute (TAFIRI), Tanzania Forestry Research Institute (TAFORI), Forestry Department
- Ministry of Higher Education, Sokoine University of Agriculture, University of Dar-es-Salaam (Zoology and Botany Departments_
- National Environment Management Council (NEMC)
- LANESCO (an NGO)
- Ministry of Water and Livestock Development
- Ministry of Lands and Human Settlement
- Tanzania Electric Supply Company (TANESCO)

***Priorities for future work***

- Control of water hyacinth in infested water bodies
- Development of a regional strategy for control of water hyacinth and other invasive alien plants (this should also involve other countries in East Africa)
- Capacity building for the enforcement of quarantine regulations

***List of experts working in the field of biological invasions***

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Mrs. Beatrice Mnari
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Dr. Katundu
ARI, Kibaha, Tanzania

***Bibliography -*** No bibliography on invasive alien species in Tanzania is currently available.

# *Zambia*

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When a lake or reservoir is deep and covers a large area, plant growth will be minimal. This is because deep water eliminates those plants, which have to root on the bottom. Floating plants, which are not hampered by deep water, are subjected to damage by wind and wave action. Where the climate is cold species of vigorous water-weeds are unable to flourish. Flooding river valley systems has, of necessity, formed many of the man-made impoundments in the warmer regions of the world. Thus, many of the lakes are relatively shallow, allowing bottom-growing plants to flourish. These impoundments often have complex shapes and hence long margins.

An added complication is that sometimes trees are only partially submerged, thereby increasing the complexity of the border of the lake. The recently submerged soil is moreover, rich in plant nutrients to which is added the breakdown products from the decay of large amounts of vegetation killed by the rising water. All of these conditions create a situation, which is ideally suited to both water plants, which root beneath the water and those which float. Many times shortly after and during the formation of new tropical lakes, there is a sharp increase in aquatic plant growth to such an extent that large areas of the lake are taken over with the following results:

- Navigation by boat becomes difficult or impossible.
- Hydroelectric installations and harbors (e.g. Kafue Gorge Dam) can be blocked by large floating mats of weeds.
- This exerts mechanical pressure on dam and bridge walls.
- Feeder streams and irrigation outlets can become choked by weeds, which in turn hampers collection and utilization of the water causing flooding.
- A dense cover can be formed over the surface of the water so that fishing can become very difficult, or the plants may cause so much deoxygenation of the water that it becomes impossible for fish to live. Both of these situations will adversely affect communities that depend on fishing for their livelihood.
- Water plants, by evapotranspiration, may greatly increase water loss from the lake to the atmosphere.
- Aquatic weeds may substantially reduce the effective storage capacity of the reservoir by occupying large volumes of the water storage region (Kafue Gorge Dam).
- Extensive weed growth can reduce or eliminate the use of the water body for recreation (Livingstone- Maramba River, Ndola boating club and Kafue Marina).
- Habitat may be reduced for aquatic flora and fauna, thus reducing biological diversity.

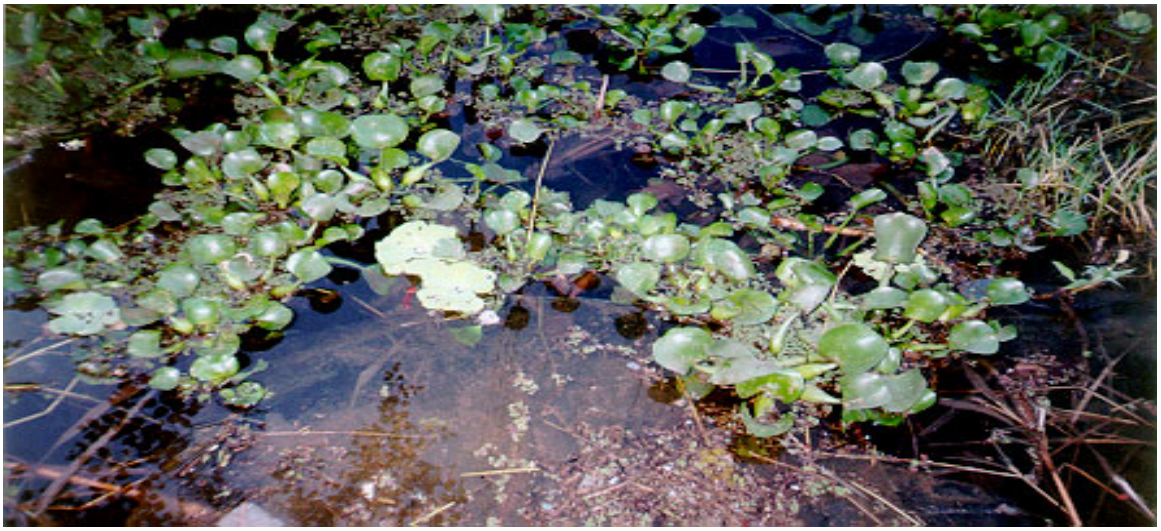
Waterweeds provide excellent breeding grounds for many disease-carrying insects, snails and worms. The main plants to guard against are those that float, especially water hyacinth (*Eichhornia crasspes*). This plant, because of its outstanding ornamental appearance, its powers of vegetative reproduction, its long-lived seeds, and its resistance to attack by pests and disease, has spread far and wide over the warmer regions of the globe.

Introduced weeds in any part of the world tend to have innate advantages, in that their introduction often tends to leave behind the natural pest, insects, fungi etc. which operate on their disadvantages in their natural homes. In addition they leave behind their most effective ecological competitors in the

form of other plant species, and enter an environment in which their new competitors are not specially adapted to compete against them. In the case of Central and South American weeds they have an additional advantage in that they come from an area such as the high plateau savannas of Brazil and the lower coastal tropical areas which can be more or less exactly matched in Africa. Immigrants from South and Central America are bound to find ecological niches in Africa on which they can thrive.

**Table 1. Different weeds that occur in Zambia**

| **Aquatic weed** | **Anchorage** | |
|---|---|---|
| *Eichhornia crassipes* (water hyacinth or Kafue weed) | Floating | Mat-forming |
| *Salvinia molesta* (Kariba weed) | Floating | Mat-forming |
| *Pistia stratiotes* (water lettuce) | Floating | Mat-forming |
| *Azolla filiculoides, A. pinnata* (red water fern) | Floating | Mat-forming |
| *Vossia cuspidata* (hippo grass) | Floating | Mat-forming |
| *Echinochloa stagnina* (hippo grass) | Rooted | |
| *Typha latifolia* (water reed) | Rooted | |
| *Limnophyton angolense* (kalasha) | Rooted | |
| *Polygonum senegalense* | | |
| *Aeschynomene elaphroxylon* | | |
| *Lagarosiphon* | | |
| *Utricularia* | Rooted | |
| *Aeschynomene* sp. | Rooted | |



***Morphology and reproductive characteristics of the problematic weeds in Zambia***

*Eichhornia crassipes*

Water hyacinth, also called Kafue weed in Zambia, is a monocotyledon of the Ponterderiaceae or pickerelweed family. The popular garden hyacinth belongs to the Liliaceae family. The plants vary in height from a few to 50 cm and form a bushy mass of fibrous roots 6-24 in. long. Perennial rhizomes 1-10 in. long are surmounted by a rosette of glossy leaves. In small plants or in loosely connected strands, the petioles, containing spongy tissue, serve as bladder-like floats; in larger plants or in densely packed masses, the base of the except the seeds have specific gravity of less than 1.0, hence the

plants are free floating. The plants will also root in mud on the margins of the lake and in swampy areas. The inflorescence, consisting from 2 to 38 flowers, is borne on a spike above the leaves. Individual flowers are about 50 mm in diameter, the lavender perianth having six lobes, with the banner petal displaying a chrome yellow spot surrounded by a purple-blue border. Some insect pollination has been observed, but self-pollination when the flowers wither, which takes place 24-48 hours after opening, is considered the most common means of producing ripe seeds. As the individual flowers wilt the spike twists, the seeds are cast into the surrounding mat of hyacinth or into the water, where they sink to the bottom. The seeds remain viable for at least 7 years.

Scarification (scratching the hard surface of the seed) by physical, chemical or biotic means, and exposure to air, appear to be prerequisites to germination. A stand of medium-size water hyacinths can produce as much as 45 million seeds per acre, but because relatively few of the seeds have the requisite conditions for germination only about 5% (> 2.5 million seeds per acre) normally produce seedlings. Most of the seeds that do germinate are those washed to the water's edge and subsequently exposed when water levels are lowered, or those left in muddy areas by receding floodwaters. Loosened from the soil by rising water and later floods, these seedlings can be carried into treated areas to renew infestations. The water hyacinth originates from South America.

Various ways of describing the water hyacinth's prolificacy has been proposed, but one expression of this is sufficient to make the point, plants can double in number in 10 days, in ideal conditions 100 plants will cover 1 $km^2$ in 8 months.

The Kafue weed has been declared a national disaster in Zambia. It is eminent in the stretch of the river between the Nakambala lagoon, in Mazabuka area and Kafue Gorge, in Namalundu. This is within the Kafue flats, which are important wetlands in Zambia. The weed has caused social, economic and biological problems.

*Biological control of water hyacinth and its constraints*

Biological control was started with the assistance of the Commonwealth Science Council in the mid-1990s. Weevils, which are natural enemies, were imported from South America. Weevils used for the control of the weed are *Neochetiniae eichhorniae* and *N. bruchi*. *N. eichhorniae* was released earlier than *N. bruchi*, which was only released in 1998. These weevils were reared and released by the Environmental Council of Zambia. Since 1998, the Zambia Sugar Company at Nakambala Sugar Estates is now rearing and releasing the weevils into the Kafue River.

There had been inconsistencies in the release of weevils and monitoring due to financial and logistical problems. This affected the efficiency of biological control. From 1996 to the year 2000, the impact of weevils as a means of biological control of water hyacinth had been almost zero as the weed kept on growing prolifically. Towards the end of 1999, other stakeholders were involved through the distribution of the weevils. These are communities along the banks of the Kafue River namely Kafue Fisheries, Chanyanya Fisheries and some individual farmers. It is hoped that involvement of other institutions, the private sector and local communities will contribute positively to control of the weed.

*Mechanical control of water hyacinth and its constraints*

Mechanical control method offers quick and efficient way of the weed removal without biological or economic damage to the water body. Just when the weed started colonizing the area around the Road Bridge in early 1990s, the Zambia army engaged in the removal of the weed. After some time, they stopped, as it was not the core responsibility of the army.

Under the auspices of the Kafue Weed Steering Committee being currently chaired by the Ministry of Transport and Communication, a strategy was mapped out to remove the weed mechanically. A machine called "The Water Master" from the maritime department was mobilized to remove the weed. The machine worked continuously for almost two months to remove the weed. The main areas of operation were around the main installations, i.e. the Road Bridge, Railway Bridge and the Kafue Gorge dam. The main problem with the operation of this machine was to remove the weed from the middle part of the river to the banks as the machine does not drag the harvest. Ways of improving this were devised.

The weed, which was harvested, was heaped on the riverbanks. With advice from the Environmental Council of Zambia (ECZ), the weed was disposed of at a licensed landfill in Kafue. Residents of Kafue town were very interested in utilizing the weed for manure in their gardens, but this was restricted to farmers who were less than two km from the Kafue River banks. The water hyacinth is a noxious weed therefore, its movement is restricted in the country. Only farmers along the riverbank were given permission by ECZ to utilize manure from the water hyacinth. This was done under strict permission and supervision of ECZ. Farmers who utilized manure reported high yields due to increased fertilization.

*Chemical control of water hyacinth*

Suggestions were made to use chemical control method and an Environmental Assessment (EA) was done. However, it lacked detailed information and was dismissed as an option. Chemical control is not preferred because chemicals for spraying may affect the drinking water source for the City of Lusaka, which is below the weed mass.

*Community participation in water hyacinth management*

The more recent approach is to encourage local communities, which are also greatly affected by the weed, to be involved in the release of the weevils. Several institutions have been identified along the river to be involved in the rearing and release of the weevils as explained under biological control. In addition, the Kafue Fisheries Association is willing to engage in mechanical control of the weed for areas further up the river. The association has requested working resources from government.

*Lantana camera*

*Lantana camara* is a common weed and has invaded many areas, including National Parks such as the Mosi-oa-tunya National Park area around the Victoria Falls. The weed also occurs in many open areas. In addition, the weed is used as a hedge by some households. However, this should now be declared illegal because it is clear that the weed is now difficult to contain.

*Mimosa pigra*

Along the Chunga lagoon in the Kafue Flats, Lochnivar National Park in particular has been invaded by *Mimosa pigra*. The mimosa is choking the water system and reducing the aesthetic quality of the National Park. This means that touristic attractions along the Chunga lagoon will be reduced. It is also reducing the transparency of water for birds of prey that feed on the fish, thereby reducing their food intake.

*Invasive alien animals*

It has been noted that some fish species are invasive. A few fish species have been noted in Zambia but the most prominent is the Nile perch, which is a threat to most fisheries.

The large grain borer is an IAS which has seriously affected stored grain in Zambia, especially maize. This poses a serious threat to national food security, as maize is a staple food in Zambia. The Ministry of Agriculture and Cooperatives (MACO) has made significant efforts in minimizing its spread.

***Conclusion***

The management of IAS needs concerted efforts and a combination of methods for control. The main other factor is the reduction in the nutrient load from industries, e.g. along the river. The ECZ is employing cleaner production techniques to improve the efficiency of production for industries and improve the quality of discharge.

The ECZ has carried out an inventory of aquatic weed species. There will be need to carry out a general IAS inventory, covering other sectors such as agriculture, wildlife, and fisheries.

Collaborating partners such as GISP have come at the right time, when there is a need to increase efforts in IAS management.

# *Zimbabwe*

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***Identified harmful invasive alien species***

*Floating aquatic alien plants*

- water hyacinth *Eichhornia crassipes*
- water lettuce *Pistia stratiotes*
- azolla weed *Azolla filiculoides*
- Kariba weed *Salvinia molestans*

*Terrestrial weeds (other than woody trees and shrubs)*

- cactus pear *Opuntia rosea*
- Australian pest pear *Opuntia stricta*
- prickly pears *Opuntia lindheimeri* and *O. ficus-indica*
- common thorn apple *Datura stramonium*
- wild oats *Avena fatua*

*Woody trees and shrubs*

- *Pinus patula, P. taeda, P. elliottii, P. kesiya, P. radiata, P. roxburghii*
- *Acacia mearnsii, A. melanoxylon, A. podalyriifolia, A. elata, A dealbata, A. decurrens*
- *Eucalyptus grandis, E. microcorys, E. camaldulensis, E. tereticornis, E. robusta, E. macarthurii, E. paniculata, E. globulus, E. citriodora*
- *Albizia procera*
- *Bauhinia* spp.
- *Caesalpinea decapetala*
- *Callistris calcarata*
- *Cotoneaster pannosa*
- *Cupressus lusitanica*
- *Grevillea robusta*
- *Homalanthus populifolius*
- *Jacaranda mimosifolia*

- *Lantana camara*
- *Melia azedarach*
- *Morus alba*
- *Populus canescens*
- *Prunus cerasoides*
- *Psidium guajava*
- *Psidium cattleianum*
- *Senna didymobotrya*
- *Toona ciliate*
- *Ziziphus mauritiana*

*Invasive invertebrates affecting crop plants*

There are several species, e.g. green spider mites and mealybugs identified from cassava (I. Mharapara, pers. comm.), but no attempt was made to compile a complete listing for this report.

***Summary of existing programmes***

Zimbabwe is currently focusing on the biological management of invasive alien aquatic plants which impact negatively on agricultural production. In addition, there is existing legislation which prohibits the growing of *Lantana camara* anywhere in the country, and therefore weeding out of this bush is compulsory for every Zimbabwean. As far as invasive woody trees and shrubs are concerned, the following programmes are currently in operation:

- The control of invasive alien tree species around timber plantations by individual forestry companies (Timber Producers Federation is the coordinator).
- The control of invasive alien trees in Vumba (Team Vumba, contact Dr Colin Saunders).
- The control of invasive alien tree species in Nyanga (Nyanga Rural District Council Intensive Conservation Committee, contact Mrs. Mary Clarke).
- The control of invasive exotic tree species in national parks estates (Department of National Parks and Wildlife, to be known in future as National Parks and Wildlife Authority).

***List of other stakeholders***

- Plant Protection Research Institute
- Agronomy Institute: Weed Research Team (Ministry of Lands, Agriculture and Rural Resettlement)
- Department of Natural Resources
- National Parks and Wildlife Authority within the Ministry of Environment and Tourism
- University of Zimbabwe (in particular its Institute of Environmental Studies)
- Africa University
- Zimbabwe Forestry Commission
- various non-governmental organizations.

***Priorities for future work***

- Management of all invasive alien aquatic plants using biocontrol agents and integrated pest control management approaches where possible.
- There is a need for a concerted effort to root out *Lantana camara* from the lands.
- Biological control strategies have been identified as appropriate for crop pest management.

- As far as invasive alien woody trees and shrubs are concerned, priority needs are as follows:
  - Determine the true extent of invasions so that success of control programmes is measurable from some benchmark.
  - Determine the environmental and economic impact of invasive alien tree species so as to be able to influence policy makers, funding, etc.
  - Develop policy guidelines and legislation to prevent future introduction of potential invasive tree species.
  - Enact legislation to enforce the control of currently known invasive tree species.
  - Collate IAS information (availability, impact, etc.) and inform/ educate communities.

***Experts working in the field of biological invasions***

| Name | Mailing address | Contact details |
|---|---|---|
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| **Woody plants** | | |
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| Mr S. van der Lingen | The Wattle Company, P. O.<br>Box 250, Mutare | Tel: +263-20-638 21, Fax: +263-20-645 64<br>Email: svdl@syscom.co.zw |
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| Mrs Mary Clark | 69 Demera Rd, Nyanga | Tel: +263-298-353 |
| **Other plants** | | |
| G.P. Chikwenhere<br>(*Opuntia rosea* and<br>*Lantana camara*) | Plant Protection Research Inst.<br>P.O. Box CY 550, Causeway,<br>Harare, Zimbabwe | Email: pestmgt@africaonline.co.zw |
| **Field crop weeds** | | |
| S. Mabasa (*Striga*)<br>A.O. Chivinge (*Striga*) | | |

| | | |
|---|---|---|
| **Insect pests** | | |
| G.P Chikwenhere, P. Chinwada, S.Z. Sithole and R. Masundire (migratory locusts, armyworm, larger grain borer, leaf miner, stemborers) | Plant Protection Research Inst. P.O. Box CY 550, Causeway, Harare, Zimbabwe | Email: pestmgt@africaonline.co.zw |
| E. Zitsanza (*Helicoverpa armigera*) | Crop Science Department<br>University of Zimbabwe<br>P.O. Box MP 167<br>Mount Pleasant<br>Harare, Zimbabwe | |
| **Mite pests** | | |
| I. Saunyama (*Teranychus evansi*) | Plant Protection Research Inst. P.O. Box CY 550, Causeway, Harare, Zimbabwe | Email: pestmgt@africaonline.co.zw |
| **Plant diseases** | | |
| E. Mtisi, T. Mutanda (grey leaf spot)<br>C.M. Mguni (black rot disease of cabbage)<br>P. Zvoutete (*Xanthomonas* disease in sugarcane) | Plant Protection Research Inst. P.O. Box CY 550, Causeway, Harare, Zimbabwe | E-mail: pestmgt@africaonline.co.zw |

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# *Introduced marine species across southern Africa*

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***Summary of existing programmes***

- **The Global Ballast Water Management Programme** (GloBallast) is a joint initiative between the United Nations Development Programme (UNDP) and International Maritime Organization (IMO), with funding provided by the Global Environment Facility (GEF). The GloBallast Programme is working to reduce new introductions through controls on ballast water management. This Programme is operating in six developing regions of the world. The southeast African Programme is based in Cape Town, South Africa. The programme aims to raise awareness of marine alien species issues throughout the region, to help develop surveillance and monitoring programmes, to develop and implement ballast water management policy, and to provide technical assistance for developing port-specific management regimes.

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- **The Benguela Current Large Marine Ecosystem** (BCLME) Programme is a GEF-funded programme involving the governments of South Africa, Namibia and Angola. The programme is aiming to streamline sustainable resource use, conservation of biodiversity and efforts to control pollution within the system of the Benguela Current. One of the objectives identified in the programme documents is to aid in the prevention and management of alien species introductions where possible. This programme provides an opportunity for links to be developed with parties or programmes interested in preventing, monitoring or controlling marine alien species introductions.

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***List of recorded marine alien species in southern Africa***

| **Country** | **Species** | **Organism type** | **Classification** |
|---|---|---|---|
| Angola | *Mytilus galloprovincialis* | mussel | invasive |
| Namibia | *Mytilus galloprovincialis* | mussel | invasive |
| | *Crassostrea gigas* | oyster | cultured |
| South Africa | *Ascidiella aspersa* | ascidian | naturalised |
| | *Ciona intestinalis* | ascidian | naturalised |
| | *Clavelina lapadiformis* | ascidian | naturalised |
| | *Diplosoma listerianum* | ascidian | naturalised |
| | *Botrylloides leachi* | ascidian | naturalised |
| | *Bedeva paivae* | snail | naturalised |
| | *Littorina saxatilis* | snail | naturalised |
| | *Aureococcus anophagefferens* | phytoplankton | harmful |
| | *Gymnodinium* cf. *mikimotoi* | phytoplankton | harmful |
| | *Carcinus maenas* | crab | invasive |
| | *Pilumnus hirsutus* | crab | naturalised |
| | *Crassostrea gigas* | oyster | naturalised |
| | *Metridium senile* | sea anemone | naturalised |
| | *Mytilus galloprovincialis* | mussel | invasive |
| | *Panaeus indicus* | prawn | cultured |
| | *Thais haemastoma* | whelk | naturalised |
| | *Bugula neritina* | bryozoan | naturalised |
| | *Membranipora membranacea* | bryozoan | naturalised |
| Mozambique | *Eucheuma striatu* | macro algae | cultured |
| | *Kapaphycus cottonii* | macro algae | cultured |
| Tanzania | *Eucheuma denticulatum* | macro algae | cultured |
| | *Kappaphycus alvarezii* | macro algae | cultured |
| | *Saccostrea cucullata* | oyster | cultured |
| Mauritius | *Crassostrea commercialis* | oyster | cultured |
| | *Crassostrea gigas* | oyster | cultured |
| | *Crassostrea virginica* | oyster | cultured |
| | *Ostrea edulis* | oyster | cultured |
| | *Metapenaeus monoceros* | prawn | cultured |
| | *Penaeus latisulcatus* | prawn | cultured |
| | *Penaeus monodon* | prawn | cultured |

| | | | |
|---|---|---|---|
| | *Chlorella* spp. | plankton | cultured |
| | *Treselmis* spp. | plankton | cultured |
| | *Brachionus plicatilis* | rotifer | cultured |
| | *Rhabdosargus sarba* | fish | cultured |
| | *Siganus sutar* | fish | naturalised |

***List of organizations not covered above which should be involved in IAS management***

*Government ministries:*

- **Environment** - One of the largest threats of invasive species is that posed to biodiversity. Ministries of Environment should be involved with the development of policies to protect biodiversity.
- **Fisheries -** In many parts of the world, invasive marine species have demonstrated high impacts on coastal shellfish industries as well as on natural populations of other commercially valuable organisms.
- **Health** - Bacteria and pathogens (such as cholera) have been shown to be transported in ballast water and introduced to new environments. Some phytoplankton species also present a threat to human health.
- **Transport** - The shipping industry represents the most significant vector of marine alien species introduction. The ministry responsible for transport should be involved with the development of regulations to help minimize such introductions.
- **Agriculture** - Mariculture industries are growing in southern Africa, and can be severely impacted by the introduction of alien organisms. This industry is also responsible for some introductions. Ministries of Agriculture are important role players in managing both sides of this problem.

*Non-governmental organizations:*

- IUCN - The World Conservation Union has an office in Nairobi, Kenya
  - Contact: Dr Melita Semoilys: MAS@iucnearo.org
- ICRAN - The International Coral Reef Action Network has an East African Region.
  - Contact: Jerker Tamelander: Jerker.Tamelander@unep.org
- WIOMSA - The Western Indian Ocean Marine Science Association
  - Contact: Dr. Julius Francis: julius@zims.udsm.ac.tz
- WWF - The World Wide Fund for Nature
  - Contact: Di Wilson: wilhop@iafrica.com Website: http://www.panda.org.za
- CI - Conservation International
  - See: http://www.conservation.org/xp/CIWEB/regions/africa/africa.xml

***Priorities for future work***

- **Biological baseline surveys** - Funding of projects to survey ports and coastlines for baseline data on existing species, to include detection of alien species. Standardisation of sampling and reporting protocols should be achieved across the region (see GloBallast Programme objectives).
- **Building taxonomic capacity** - Sponsorship of projects to increase capacity for identification and systematics of existing species, in order to increase data available for management.

- **Risk assessments** - Quantification of risks associated with shipping and fishing vessels at major ports of entry, and also with the development and/or expansion of mariculture facilities.
- **Research into community-based control programmes -** Initial research is underway at the University of Cape Town to address this need. With respect to *Mytilus galloprovincialis* Replicate initiatives may be necessary to address the spread of *Carcinus maenas* and *Crassostrea gigas.*
- **Standardisation of methodologies and protocols** - Applies to biological undertakings as well as regulatory regimes to be developed for port and coastal management.
- **Increased regional cooperation and data sharing** - Combining efforts for monitoring species introductions, and also monitoring and enforcing compliance with regulatory regimes.

**List of experts working in the field of marine biological invasions**

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# *Annex 1. The Southern African Plant Invaders Atlas (SAPIA) database and bibliography*

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## *Introduction*

The Southern African Plant Invaders Atlas (SAPIA) is a mapping project, launched in 1994, to collate information on the distribution, abundance and habitat types of alien invasive plants in southern Africa. SAPIA is a project of the ARC-PPRI's Weeds Division and is coordinated by Lesley Henderson. The SAPIA database is a computerised catalogue of some 49 000 locality records of 500 naturalised alien plant species. The database incorporates records from roadside surveys done by Lesley Henderson (1979–1993) and the SAPIA project (1994+).

***Explanation of the codes used in the table***

CARA legislation = The South African Conservation of Agricultural Resources Act, Act 43 of 1983, amended in 2001. An abbreviated interpretation of the regulations contained in CARA is given here. The full amendments were published in Government Gazette Vol. 429, No. 22166, of 30 March 2001.

Category 1 (Declared weed):
- Prohibited on any land or water surface in South Africa
- Must be controlled, or eradicated where possible (except in biological control reserves)

Category 2 (Declared invader):
- Allowed only in demarcated areas under controlled conditions
- Import of propagative material and trading allowed only by permit holders
- Outside demarcated areas must be controlled, or eradicated where possible (except in biological control reserves)
- Prohibited within 30 m of the 1:50 year floodline of watercourses or wetlands unless authorisation obtained

Category 3 (Declared invader):
- No further plantings allowed (except with special permission)
- No trade of propagative material
- Existing plants may remain but must be prevented from spreading
- Prohibited within 30 m of the 1:50 year floodline of watercourses or wetlands unless authorisation obtained

Proposed species:
These species were proposed as declared weeds or invaders but require further investigation before they can be included in CARA

**SPECIES LIST FOR SOUTHERN AFRICA FROM THE SAPIA DATABASE (JUNE 2002)**

LEGEND:
1, 2, 3 = categories of declared weeds and invaders according to CARA legislation in South Africa; Pr = proposed for listing; more information needed
SA = South Africa, A = Angola, B = Botswana, L = Lesotho, MA = Malawi, MO = Mozambique, N = Namibia, SW = Swaziland, ZA = Zambia, ZI = Zimbabwe

| Scientific name | Family | Common name | 1 | 2 | 3 | Pr | SA | A | B | L | MA | MO | N | SW | ZA | ZI |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Acacia baileyana* | Fabaceae | Bailey's wattle | | | 3 | | SA | | | | | | | | | ZI |
| *Acacia cultriformis* | Fabaceae | knife-leaved wattle | | | | | SA | | | | | | | | | |
| *Acacia cyclops* | Fabaceae | red eye/ rooikrans | | 2 | | | SA | | | | | | | | | |
| *Acacia dealbata* | Fabaceae | silver wattle | 1 | 2 | | | SA | | | L | | | | | | ZI |
| *Acacia decurrens* | Fabaceae | green wattle | | 2 | | | SA | | | | | | | | | |
| *Acacia elata* | Fabaceae | peppertree wattle | | | 3 | | SA | | | | | | | | | |
| *Acacia fimbriata* | Fabaceae | fringed wattle | | | | | SA | | | | | | | | | |
| *Acacia implexa* | Fabaceae | screw-pod wattle | 1 | | | | SA | | | | | | | | | |
| *Acacia longifolia* | Fabaceae | long-leaved wattle | 1 | | | | SA | | | | | | | SW | | |
| *Acacia mearnsii* | Fabaceae | black wattle | | 2 | | | SA | | | | | | | SW | | ZI |
| *Acacia melanoxylon* | Fabaceae | Australian blackwood | | 2 | | | SA | | | | | | | | | ZI |
| *Acacia paradoxa* | Fabaceae | kangaroo thorn | 1 | | | | SA | | | | | | | | | |
| *Acacia podalyriifolia* | Fabaceae | pearl acacia | | | 3 | | SA | | | | | | | SW | | ZI |
| *Acacia pycnantha* | Fabaceae | golden wattle | 1 | | | | SA | | | | | | | | | |
| *Acacia saligna* | Fabaceae | Port Jackson willow | | 2 | | | SA | | | | | | N | | | |
| *Acanthocereus* sp. | Cactaceae | | | | | | SA | | | | | | | | | |
| *Acanthospermum australe* | Asteraceae | eight-seeded prostrate | | | | | SA | | | L | | | | | | |
| *Acanthospermum hispidum* | Asteraceae | upright starbur | | | | | SA | | | | | | | | | |
| *Acanthus pubescens* | Acanthaceae | bear's breeches | | | | | SA | | | | | | | | | |
| *Acer negundo* | Aceraceae | ash-leaved maple | | | | Pr | SA | | | | | | | | | |
| *Acer* sp. ? | Aceraceae | red-leafed maple? | | | | | SA | | | | | | | | | |
| *Achyranthes aspera* | Amaranthaceae | burweed/ grootklits | 1 | | | | SA | | | L | | | | SW | | |
| *Acorus calamus* | Araceae | calamus | | | | | SA | | | | | | | | | |
| *Acrocarpus fraxinifolius* | Fabaceae | shingle tree | | | | | SA | | | | | | | | ZA | |
| *Adiantum raddianum* | Adiantaceae | maidenhair fern | | | | | SA | | | | | | | | | |

| Scientific name | Family | Common name | 1 | 2 | 3 | Pr | SA | A | B | L | MA | MO | N | SW | ZA | ZI |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Agave americana* | Agavaceae | American agave | | | | Pr | SA | | | L | MA | | | | | |
| *Agave decipiens* | Agavaceae | false sisal | | | | | SA | | | | MA | | | SW | | |
| *Agave sisalana* | Agavaceae | sisal | | 2 | | | SA | | | | MA | | | SW | | |
| *Agave* sp. | Agavaceae | sisal sp. | | | | | SA | | | | | | | | | |
| *Ageratina adenophora* | Asteraceae | crofton weed | 1 | | | | SA | | | | | | | | | |
| *Ageratina riparia* | Asteraceae | creeping crofton weed | 1 | | | | SA | | | | | | | | | |
| *Ageratum conyzoides* | Asteraceae | invading ageratum | 1 | | | | SA | | | | MA | | | SW | ZA | ZI |
| *Ageratum houstonianum* | Asteraceae | Mexican ageratum | 1 | | | | SA | | | | | | | SW | ZA | ZI |
| *Agrostemma githago* | Caryophyllaceae | corn cockle | | | | | | | | L | | | | | | |
| *Ailanthus altissima* | Simaroubaceae | tree-of-heaven | | | 3 | | SA | | | L | | | | | | |
| *Albizia chinensis* | Fabaceae | Chinese false-thorn | | | | | SA | | | | | | | | | |
| *Albizia lebbeck* | Fabaceae | lebbeck tree | 1 | | | | SA | | | | MA | | | | | |
| *Albizia procera* | Fabaceae | false lebbeck | 1 | | | | SA | | | | | | | | | |
| *Alhagi maurorum* | Fabaceae | camelthorn bush | 1 | | | | SA | | | | | | | | | |
| *Alisma plantago-aquatica* | Alismataceae | water plantain | | | | | SA | | | | | | | | | |
| *Alnus glutinosa* | Betulaceae | black elder | | | | Pr | SA | | | | | | | | | |
| *Alpinia zerumbet* | Zingiberaceae | shell ginger | | | | | SA | | | | | | | | | |
| *Alternanthera pungens* | Amaranthaceae | khaki bur weed | | | | | SA | | | | | | | | | |
| *Amaranthus hybridus* | Amaranthaceae | pigweed | | | | | SA | | | L | | | | | | |
| *Amaranthus* sp. | Amaranthaceae | pigweed sp. | | | | | SA | | | | | | | | | |
| *Ambrosia artemisiifolia* | Asteraceae | annual ragweed | | | | | SA | | | | | | | | | |
| *Ammi majus* var. *glaucifolium* | Apiaceae | bishop's weed | | | | | SA | | | | | | | | | |
| *Anigozanthos flavidus* | Haemodoraceae | yellow kangaroo paw | | | | | SA | | | | | | | | | |
| *Anredera cordifolia* | Basellaceae | bridal wreath | 1 | | | | SA | | | L | | | | SW | | |
| *Antigonon leptopus* | Polygonaceae | coral creeper | | | | | SA | | | | | | | | | |
| *Apium graveolens* | Apiaceae | wild celery | | | | | SA | | | | | | | | | |
| *Araujia sericifera* | Asclepiadaceae | moth catcher | 1 | | | | SA | | | L | | | | | | |
| *Ardisia crenata* | Myrsinaceae | coralberry tree | 1 | | | | SA | | | | | | | | | |
| *Argemone mexicana* | Papaveraceae | yellow Mexican poppy | 1 | | | | SA | | | | MA | | | SW | ZA | |
| *Argemone ochroleuca* ssp. *ochroleuca* | Papaveraceae | white Mexican poppy | 1 | | | | SA | | | L | | | N | SW | | |
| *Aristolochia elegans* | Aristolochiaceae | calico flower | | | | | SA | | | | | | | | | |
| *Arundo donax* | Poaceae | giant reed | 1 | | | | SA | | | | MA | | N | SW | | ZI |

| Scientific name | Family | Common name | 1 | 2 | 3 | Pr | SA | A | B | L | MA | MO | N | SW | ZA | ZI |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Astartea fascicularis* | Myrtaceae | | | | | | SA | | | | | | | | | |
| *Aster squamatus* | Asteraceae | swamp aster | | | | | SA | | | | | | | | | |
| *Atriplex lindleyi* ssp. *inflata* | Chenopodiaceae | sponge-fruit saltbush | | | 3 | | SA | | | | | | | | | |
| *Atriplex muelleri* | Chenopodiaceae | Mueller's saltbush | | | | | SA | | | | | | | | | |
| *Atriplex nummularia* ssp. *nummularia* | Chenopodiaceae | old-man saltbush | | 2 | | | SA | | | | | | N | | | |
| *Atriplex semibaccata* | Chenopodiaceae | Australian saltbush | | | | | SA | | | L | | | | | | |
| *Azolla filiculoides* | Azollaceae | red water fern | 1 | | | | SA | | B | | MA | MO | | | ZA | ZI |
| *Baeckia* sp. | Myrtaceae | | | | | | SA | | | | | | | | | |
| *Bambusa balcooa* | Poaceae | common bamboo | | | | | SA | | | | | | | | | |
| *Bambusa* sp. yellow stems | Poaceae | bamboo sp. | | | | | SA | | | | | | | | | |
| *Bambuseae* sp. | Poaceae | bamboo sp. | | | | | SA | | | | | | | | | |
| *Banksia ericifolia* | Proteaceae | heath banksia | | | | | SA | | | | | | | | | |
| *Banksia integrifolia* | Proteaceae | coast banksia | | | | | SA | | | | | | | | | |
| *Bauhinia purpurea* | Fabaceae | butterfly orchid tree | | | 3 | | SA | | | | | | | | | |
| *Bauhinia variegata* | Fabaceae | orchid tree | | | 3 | | SA | | | | | | | SW | | |
| *Begonia cucullata* | Begoniaceae | begonia | | | | | SA | | | | | | | | | |
| *Bidens bipinnata* | Asteraceae | Spanish black jack | | | | | SA | | | L | | | | | | |
| *Bidens biternata* | Asteraceae | five-leaved black jack | | | | | SA | | | | | | | | | |
| *Bidens formosa* | Asteraceae | cosmos | | | | | SA | | | | | | | | | |
| *Bidens pilosa* | Asteraceae | black jack | | | | | SA | | | L | | | | | | |
| *Bilderdykia convolvulus* | Polygonaceae | climbing knotweed | | | | | | | | L | | | | | | |
| *Boerhavia erecta* | Nyctaginaceae | erect boerhavia | | | | | SA | | | | | | | | | |
| *Briza maxima* | Poaceae | quaking grass | | | | | SA | | | | | | | | | |
| *Bromus catharticus* | Poaceae | rescue grass | | | | | SA | | | | | | | | | |
| *Bromus diandrus* | Poaceae | ripgut brome | | | | | SA | | | | | | | | | |
| *Bromus pectinatus* | Poaceae | Japanese brome | | | | | SA | | | | | | | | | |
| *Brugmansia* X *candida* | Solanaceae | moonflower bush | | | | | SA | | | | | | | | | |
| *Bryophyllum delagoense* | Crassulaceae | chandelier plant | 1 | | | | SA | | | | | | | | | ZI |
| *Caesalpinia decapetala* | Fabaceae | Mauritius thorn | 1 | | | | SA | | | | MA | | | SW | | |
| *Caesalpinia gilliesii* | Fabaceae | bird-of-paradise | | | | | SA | | | | | | N | | | |
| *Callistemon citrinus* | Myrtaceae | crimson bottlebrush | | | | | SA | | | | | | | | | |
| *Callistemon glaucus* | Myrtaceae | Albany bottlebrush | | | | | SA | | | | | | | | | |

| Scientific name | Family | Common name | 1 | 2 | 3 | Pr | SA | A | B | L | MA | MO | N | SW | ZA | ZI |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Callistemon rigidus* | Myrtaceae | stiff bottlebrush | | | | Pr | SA | | | | | | | | | |
| *Callistemon viminalis* | Myrtaceae | weeping bottlebrush | | | | | SA | | | | | | | | | |
| *Calotropis procera* | Asclepiadaceae | madar | | | | | SA | | | | | | | | | |
| *Campuloclinium macrocephalum* | Asteraceae | pompom weed | 1 | | | | SA | | | | | | | | | |
| *Canna glauca* | Cannaceae | yellow-flowered glaucous | | | | | SA | | | | | | | | | |
| *Canna indica* | Cannaceae | Indian canna | 1 | | | | SA | | | | | | | | | |
| *Canna* X *generalis* | Cannaceae | garden canna | | | | | SA | | | | | | | | | |
| *Canna* sp. | Cannaceae | canna | | | | | | | | | | | | SW | | |
| *Capsella bursa-pastoris* | Brassicaceae | shepherd's purse | | | | | | | | L | | | | | | |
| *Cardiospermum grandiflorum* | Sapindaceae | balloon vine | 1 | | | | SA | | | | MA | MO | | SW | | ZI |
| *Cardiospermum halicacabum* | Sapindaceae | lesser balloon vine | | | | Pr | SA | | | | MA | | N | SW | | |
| *Cardiospermum* sp. | Sapindaceae | balloon vine | | | | | | | | | | | | | ZA | |
| *Carica papaya* | Caricaceae | papaya | | | | | SA | | | | | | | | | |
| *Castanospermum australe* | Fabaceae | Australian chestnut | | | | | SA | | | | | | | | | |
| *Casuarina cunninghamiana* | Casuarinaceae | beefwood | | 2 | | | SA | | | | | | | | | |
| *Casuarina equisetifolia* | Casuarinaceae | horsetail tree | | 2 | | | SA | | | | | | | | | |
| *Catharanthus roseus* | Apocynaceae | Madagascar periwinkle | | | | | SA | | | | | | | SW | | |
| *Cedrus deodara* | Pinaceae | deodar | | | | | SA | | | | | | | | | |
| *Celtis australis* | Ulmaceae | European hackberry | | | | Pr | SA | | | | | | | | | |
| *Celtis occidentalis* | Ulmaceae | common hackberry | | | | Pr | SA | | | | | | | | | |
| *Celtis sinensis* | Ulmaceae | Chinese nettle tree | | | | Pr | SA | | | | | | | | | |
| *Cenchrus brownii* | Poaceae | fine burgrass | | | | | SA | | | | | | | | | |
| *Centranthus ruber* | Valerianaceae | red valerian | | | | | SA | | | | | | | | | |
| *Cereus jamacaru* | Cactaceae | queen of the night | 1 | | | | SA | | | | MA | | N | SW | | |
| *Cestrum aurantiacum* | Solanaceae | yellow or orange cestrum | 1 | | | | SA | | | | | | | SW | ZA | |
| *Cestrum elegans* | Solanaceae | crimson cestrum | 1 | | | | SA | | | | | | | | | |
| *Cestrum laevigatum* | Solanaceae | inkberry | 1 | | | | SA | | | | | | | SW | ZA | |
| *Cestrum parqui* | Solanaceae | Chilean cestrum | 1 | | | | SA | | | | | | | | | |
| *Cestrum* sp. | Solanaceae | inkberry sp. | | | | | SA | | | | | | | | | ZI |
| *Chamaesyce prostrata* | Euphorbiaceae | hairy creeping milkweed | | | | | SA | | | L | | | | | | |
| *Chamaesyce serpens* | Euphorbiaceae | milkweed sp. | | | | | SA | | | | | | | | | |
| *Chenopodium album* | Chenopodiaceae | white goosefoot | | | | | SA | | | L | | | | | | |

| Scientific name | Family | Common name | 1 | 2 | 3 | Pr | SA | A | B | L | MA | MO | N | SW | ZA | ZI |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Chenopodium ambrosioides* | Chenopodiaceae | American goosefoot | | | | | SA | | | L | | | | | | |
| *Chorizema cordatum* | Fabaceae | Australian flame pea | | | | | SA | | | | | | | | | |
| *Chromolaena odorata* | Asteraceae | triffid weed chromolaena | 1 | | | | SA | | | | | MO | | SW | | ZI |
| *Cichorium intybus* | Asteraceae | chicory | | | | | SA | | | L | | | | | | |
| *Cinnamomum camphora* | Lauraceae | camphor tree | 1 | | | | SA | | | | | | | | | |
| *Cirsium arvense* | Asteraceae | Canada thistle | | | | | SA | | | | | | | | | |
| *Cirsium vulgare* | Asteraceae | spear thistle | 1 | | | | SA | | | L | | | | | | |
| *Citrus limon* | Rutaceae | lemon | | | | | SA | | | | | | | | ZA | |
| *Citrus* sp. | Rutaceae | | | | | | SA | | | | | | | | | |
| *Coix lacryma-jobi* | Poaceae | Job's tears | | | | | SA | | | | | | | | | |
| *Colocasia esculenta* | Araceae | elephant's ear | | | | | SA | | | | | | | | | |
| *Commelina benghalensis* | Commelinaceae | Benghal wandering Jew | | | | | SA | | | L | | | | | | |
| *Convolvulus arvensis* | Convolvulaceae | field bindweed | 1 | | | | SA | | | L | | | | | | |
| *Conyza albida* | Asteraceae | tall fleabane | | | | | SA | | | | | | | | | |
| *Conyza bonariensis* | Asteraceae | flax-leaf fleabane | | | | | SA | | | L | | MO | | | | |
| *Conyza canadensis* | Asteraceae | horseweed fleabane | | | | | SA | | | L | | | | | | |
| *Conyza chilensis* | Asteraceae | Chilean fleabane | | | | | SA | | | | | | | | | |
| *Coreopsis lanceolata* | Asteraceae | tickseed | | | | Pr | SA | | | | | | | | | ZI |
| *Coronopus didymus* | Brassicaceae | swinecress | | | | | SA | | | | | | | | | |
| *Cortaderia jubata* | Poaceae | purple pampas grass | 1 | | | | SA | | | | | | | | | |
| *Cortaderia selloana* | Poaceae | common pampas grass | 1 | | | | SA | | | | | | | | | |
| *Cotoneaster franchetii* | Rosaceae | orange cotoneaster | | | 3 | | SA | | | | | | | | | |
| *Cotoneaster lacteus* | Rosaceae | | | | | | SA | | | | | | | | | |
| *Cotoneaster pannosus* | Rosaceae | silver-leaf cotoneaster | | | 3 | | SA | | | L | | | | | | |
| *Cotoneaster* sp. | Rosaceae | cotoneaster | | | | | | | | | | | | | | ZI |
| *Crataegus pubescens* | Rosaceae | Mexican hawthorn | | | | Pr | SA | | | | | | | | | |
| *Crataegus* X *lavallei* | Rosaceae | lavallee thorn | | | | | SA | | | | | | | | | |
| *Crotalaria agatiflora* ssp. *imperialis* | Fabaceae | canary-bird bush | | | | Pr | SA | | | | | | | | | |
| *Cryptomeria japonica* | Pinaceae | Japanese cedar | | | | | SA | | | | | | | | | |
| *Cryptostegia grandiflora* | Asclepiadaceae | rubber vine | | | | | SA | | | | | | | | | |
| *Cuphea ignea* | Lythraceae | cigarette bush | | | | | SA | | | | | | | | | |
| *Cupressus arizonica* | Cupressaceae | Arizona cypress | | | | | SA | | | | | | | | | |

| Scientific name | Family | Common name | 1 | 2 | 3 | Pr | SA | A | B | L | MA | MO | N | SW | ZA | ZI |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Cupressus lusitanica* | Cupressaceae | Mexican cypress | | | | | SA | | | | | | | | | |
| *Cupressus* sp. | Cupressaceae | cypress sp. | | | | | SA | | | | | | | | | |
| *Cuscuta campestris* | Convolvulaceae | common dodder | 1 | | | | SA | | | L | | | | SW | | |
| *Cuscuta suaveolens* | Convolvulaceae | lucerne dodder | 1 | | | | SA | | | L | | | | | | |
| *Cydonia oblonga* | Rosaceae | quince | | | | | SA | | | | | | | | | |
| *Cynodon dactylon* | Poaceae | common couch grass | | | | Pr | SA | | | | | | | | | |
| *Cyphomandra betacea* | Solanaceae | tree tomato | | | | Pr | SA | | | | | | | | | |
| *Cytisus monspessulanus* | Fabaceae | Montpellier broom | 1 | | | | SA | | | | | | | | | |
| *Cytisus scoparius* | Fabaceae | Scotch broom | 1 | | | | SA | | | | | | | | | |
| *Dahlia imperialis* | Asteraceae | tree dahlia | | | | | SA | | | | | | | | | |
| *Datura ferox* | Solanaceae | large thorn apple | 1 | | | | SA | | | L | | | N | SW | | |
| *Datura innoxia* | Solanaceae | downy thorn apple | 1 | | | | SA | | | | | | N | | | |
| *Datura stramonium* | Solanaceae | common thorn apple | 1 | | | | SA | | | L | MA | | N | SW | ZA | |
| *Delonix regia* | Fabaceae | flamboyant | | | | | SA | | | | | | | | | |
| *Desmanthus virgatus* | Fabaceae | ground tamarind | | | | | SA | | | | | | | | | |
| *Duranta erecta* | Verbenaceae | forget-me-not-tree | | | | Pr | SA | | B | | | | | SW | | |
| *Echinopsis spachiana* | Cactaceae | torch cactus | 1 | | | | SA | | | | | | | | | |
| *Echium plantagineum* | Boraginaceae | Patterson's curse | 1 | | | | SA | | | L | | | | | | |
| *Echium vulgare* | Boraginaceae | blue echium | 1 | | | | SA | | | L | | | | | | |
| *Egeria densa* | Hydrocharitaceae | dense water weed | 1 | | | | SA | | | | | | | | | |
| *Eichhornia crassipes* | Pontederiaceae | water hyacinth | 1 | | | | SA | | | | MA | MO | | | ZA | ZI |
| *Elodea canadensis* | Hydrocharitaceae | Canadian water weed | 1 | | | | SA? | | | | | | | | | |
| *Eragrostis pilosa* | Poaceae | Indian love grass | | | | | SA | | | | | | | | | |
| *Eriobotrya japonica* | Rosaceae | loquat | | | 3 | | SA | | | | | | | | | |
| *Eucalyptus camaldulensis* | Myrtaceae | red river gum | | 2 | | | SA | | | L | | | N | | | |
| *Eucalyptus cinerea* | Myrtaceae | florist's gum | | | | | SA | | | | | | | | | |
| *Eucalyptus cladocalyx* | Myrtaceae | sugar gum | | 2 | | | SA | | | | | | | | | |
| *Eucalyptus cloeziana* | Myrtaceae | iron gum | | | | | SA | | | | | | | | | |
| *Eucalyptus diversicolor* | Myrtaceae | karri | | 2 | | | SA | | | | | | | | | |
| *Eucalyptus exserta* | Myrtaceae | Queensland peppermint | | | | | SA | | | | | | | | | |
| *Eucalyptus fastigata* | Myrtaceae | cut-tail gum | | | | | SA | | | | | | | | | |
| *Eucalyptus ficifolia* | Myrtaceae | red flowering gum | | | | | SA | | | | | | | | | |

| Scientific name | Family | Common name | 1 | 2 | 3 | Pr | SA | A | B | L | MA | MO | N | SW | ZA | ZI |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Eucalyptus globulus* | Myrtaceae | blue gum | | | | | SA | | | | | | | | | |
| *Eucalyptus gomphocephala* | Myrtaceae | tuart | | | | | SA | | | | | | | | | |
| *Eucalyptus grandis* | Myrtaceae | saligna gum | | 2 | | | SA | | | | MA | | | SW | | ZI |
| *Eucalyptus lehmannii* | Myrtaceae | spider gum | 1 | 2 | | | SA | | | | | | | | | |
| *Eucalyptus leucoxylon* | Myrtaceae | white ironbark | | | | | SA | | | | | | | | | |
| *Eucalyptus microcorys* | Myrtaceae | tallow gum | | | | | SA | | | | | | | | | |
| *Eucalyptus microtheca* | Myrtaceae | coolabah | | | | | SA | | | | | | | | | |
| *Eucalyptus paniculata* | Myrtaceae | grey ironbark | | 2 | | | SA | | | | | | | | | |
| *Eucalyptus regnans* | Myrtaceae | mountain ash | | | | | SA | | | | | | | | | |
| *Eucalyptus robusta* | Myrtaceae | swamp mahogany gum | | | | | SA | | | | | | | | | |
| *Eucalyptus sideroxylon* | Myrtaceae | black ironbark | | 2 | | | SA | | | | | | | | | |
| *Eucalyptus tereticornis* | Myrtaceae | forest red gum | | | | | SA | | | | | | | | | |
| *Eugenia uniflora* | Myrtaceae | pitanga | 1 | | 3 | | SA | | | | | | | | | |
| *Euphorbia heterophylla* | Euphorbiaceae | annual poinsettia | | | | | SA | | | | | | | | | |
| *Euphorbia peplus* | Euphorbiaceae | stinging milkweed | | | | | | | | L | | | | | | |
| *Euphorbia pulcherrima* | Euphorbiaceae | poinsettia | | | | | SA | | | | | | | | | |
| *Ficus carica* | Moraceae | edible fig | | | | | SA | | | L | | | | | | |
| *Ficus elastica* | Moraceae | rubber fig | | | | | SA | | | | | | | | | |
| *Ficus macrophylla* | Moraceae | Australian banyan | | | | | SA | | | | | | | | | |
| *Ficus pumila* | Moraceae | tickey creeper | | | | | SA | | | | | | | | | |
| *Flaveria bidentis* | Asteraceae | smelter's bush | | | | | SA | | | | | | N | | | |
| *Foeniculum vulgare* | Apiaceae | fennel | | | | | SA | | | | | | | | | |
| *Fraxinus americana* | Oleaceae | American ash | | | | Pr | SA | | | | | | | | | |
| *Fraxinus angustifolia* | Oleaceae | Algerian ash | | | | | SA | | | | | | | | | |
| *Fuchsia* sp. | Onagraceae | fuchsia sp. | | | | | SA | | | | | | | | | |
| *Gleditsia triacanthos* | Fabaceae | honey locust | | 2 | | | SA | | | | | | | | | |
| *Gmelina arborea* | Verbenaceae | white teak | | | | | | | | | MA | | | | | |
| *Gomphrena celosioides* | Amaranthaceae | prostrate globe amaranth | | | | | SA | | | | | | | | | |
| *Grevillea robusta* | Proteaceae | Australian silky oak | | | 3 | | SA | | | | MA | | | | | ZI |
| *Grevillea rosmarinifolia* | Proteaceae | spider flower sp. | | | | | SA | | | | | | | | | |
| *Grevillea sericea* | Proteaceae | pink spider flower | | | | | SA | | | | | | | | | |
| *Guilleminea densa* | Amaranthaceae | carrot weed | | | | | SA | | | L | | | | | | |

| Scientific name | Family | Common name | 1 | 2 | 3 | Pr | SA | A | B | L | MA | MO | N | SW | ZA | ZI |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Hakea drupacea* | Proteaceae | sweet hakea | 1 | | | | SA | | | | | | | | | |
| *Hakea gibbosa* | Proteaceae | rock hakea | 1 | | | | SA | | | | | | | | | |
| *Hakea salicifolia* | Proteaceae | willow hakea | | | | Pr | SA | | | | | | | SW | | |
| *Hakea sericea* | Proteaceae | silky hakea | 1 | | | | SA | | | | | | | | | |
| *Hakea victoriae* | Proteaceae | | | | | | SA | | | | | | | | | |
| *Harrisia martinii* | Cactaceae | harrisia | 1 | | | | SA | | | | | | | | | |
| *Hedychium coccineum* | Zingiberaceae | red ginger lily | 1 | | | | SA | | | | | | | | | |
| *Hedychium coronarium* | Zingiberaceae | white ginger lily | 1 | | | | SA | | | | | | | | | |
| *Hedychium flavescens* | Zingiberaceae | yellow ginger lily | 1 | | | | SA | | | | | | | | | |
| *Hedychium gardnerianum* | Zingiberaceae | kahili ginger lily | 1 | | | | SA | | | | | | | | | |
| *Helianthus annuus* | Asteraceae | common sunflower | | | | | SA | | | | | | | | | |
| *Heliotropium amplexicaule* | Boraginaceae | blue heliotrope | | | | | SA | | | | | | | | | |
| *Hibiscus trionum* | Malvaceae | bladderweed | | | | | SA | | | L | | | | | | |
| *Hordeum murinum* | Poaceae | wild barley | | | | | SA | | | | | | | | | |
| *Hylocereus undatus* | Cactaceae | night-blooming cereus | | | | | SA | | | | | | | | | |
| *Hypericum perforatum* | Clusiaceae | St. John's wort | | 2 | | | SA | | | L | | | | | | |
| *Hypochoeris radicata* | Asteraceae | hairy wild lettuce | | | | | SA | | | | | | | | | |
| *Ipomoea alba* | Convolvulaceae | moonflower | 1 | | 3 | | SA | | | | | | | | | |
| *Ipomoea carnea* ssp. *fistulosa* | Convolvulaceae | potato bush | | | | | SA | | | | | | | | ZA | |
| *Ipomoea indica* | Convolvulaceae | perennial morning glory | 1 | | 3 | | SA | | | | | | | SW | | |
| *Ipomoea nil* | Convolvulaceae | Japanese morning glory | | | | | SA | | | | | | | | | |
| *Ipomoea purpurea* | Convolvulaceae | morning glory | | | 3 | | SA | | | L | MA | MO | | | | ZI |
| *Jacaranda mimosifolia* | Bignoniaceae | jacaranda | | | 3 | | SA | | | | MA | | N | SW | | ZI |
| *Jasminum humile* | Oleaceae | yellow bush jasmine | | | | | SA | | | | | | | | | |
| *Jasminum mesnyi* | Oleaceae | primrose jasmine | | | | | SA | | | | | | | | | |
| *Jatropha gossypifolia* | Euphorbiaceae | coral plant | | | | | SA | | | | | | | | | |
| *Juniperus pinchotii* | Cupressaceae | red-berry juniper | | | | | SA | | | | | | | | | |
| *Juniperus virginiana* | Cupressaceae | red cedar | | | | Pr | SA | | | L | | | | | | |
| *Lactuca serriola* | Asteraceae | wild lettuce | | | | | SA | | | | | | | | | |
| *Lagerstroemia indica* | Lythraceae | pride-of-India | | | | | SA | | | | | | | | | ZI |
| *Lantana camara* | Verbenaceae | lantana | 1 | | | | SA | | | | MA | MO | | SW | ZA | ZI |
| *Lavatera arborea* | Malvaceae | tree mallow | | | | | SA | | | | | | N | | | |

| Scientific name | Family | Common name | 1 | 2 | 3 | Pr | SA | A | B | L | MA | MO | N | SW | ZA | ZI |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Lemna gibba* | Lemnaceae | duckweed | | | | | SA | | | | | | | | | |
| *Lemna* sp. | Lemnaceae | duckweed | | | | | SA | | | | | | | | | |
| *Lepidium draba* | Brassicaceae | hoary cardaria | 1 | | | | SA | | | | | | | | | |
| *Leptospermum laevigatum* | Myrtaceae | Australian myrtle | 1 | | | | SA | | | | | | | | | |
| *Leucaena leucocephala* | Fabaceae | leucaena | 1 | 2 | | | SA | | | | MA | | N | SW | | |
| *Ligustrum japonicum* | Oleaceae | Japanese wax-lvd privet | | | 3 | | SA | | | L | | | | | | |
| *Ligustrum lucidum* | Oleaceae | Chinese wax-lvd privet | | | 3 | | SA | | | L | | | | | | |
| *Ligustrum ovalifolium* | Oleaceae | Californian privet | | | 3 | | SA | | | | | | | | | |
| *Ligustrum sinense* | Oleaceae | Chinese privet | | | 3 | | SA | | | | | | | | | |
| *Ligustrum* sp. | Oleaceae | privet | | | | | | | | | | | N | | ZA | |
| *Ligustrum vulgare* | Oleaceae | common privet | | | 3 | | SA | | | | | | | | | |
| *Lilium formosanum* | Liliaceae | Saint Joseph's lily | | | 3 | | SA | | | | | | | | | ZI |
| *Limonium sinuatum* | Plumbaginaceae | statice | | | | | SA | | | | | | | | | |
| *Linaria genistifolia* | Scrophulariaceae | yellow linaria | | | | | SA | | | L | | | | | | |
| *Linaria maroccana* | Scrophulariaceae | baby snapdragon | | | | | | | | L | | | | | | |
| *Litsea glutinosa* | Lauraceae | Indian laurel | 1 | | | | SA | | | | | | | | | |
| *Lonicera japonica* var. *halliana* | Caprifoliaceae | Japanese honeysuckle | | | | Pr | SA | | | | | | | | | |
| *Lygodium japonicum* | Schizaeaceae | Japanese climbing fern | | | | | SA | | | | | | | | | |
| *Lythrum salicaria* | Lythraceae | purple loosestrife | 1 | | | | SA | | | | | | | | | |
| *Macfadyena unguis-cati* | Bignoniaceae | cat's claw creeper | 1 | | | | SA | | | | | | | SW | | ZI |
| *Maireana brevifolia* | Chenopodiaceae | small-leaf bluebush | | | | | SA | | | | | | | | | |
| *Malus pumila* var. *paradisiaca* | Rosaceae | paradise apple | | | | | SA | | | | | | | | | |
| *Malva parviflora* | Malvaceae | small mallow | | | | | SA | | | L | | | | | | |
| *Malvastrum coromandelianum* | Malvaceae | prickly malvastrum | | | | | SA | | | | | | | | | |
| *Mangifera indica* | Anacardiaceae | mango | | | | | SA | | | | | | | | ZA | |
| *Manihot esculenta* | Euphorbiaceae | bitter cassava | | | | | SA | | | | | | | | | |
| *Manihot grahamii* | Euphorbiaceae | hardy cassava | | | | | SA | | | | | | | | | |
| *Mariscus sumatrensis* | Cyperaceae | | | | | | SA | | | | | | | | | |
| *Medicago sativa* | Fabaceae | alfalfa | | | | | SA | | | | | | | | | |
| *Melaleuca hypericifolia* | Myrtaceae | red-flowering tea tree | | | | | SA | | | | | | | | | |
| *Melaleuca wilsonii* | Myrtaceae | violet honey-myrtle | | | | | SA | | | | | | | | | |
| *Melia azedarach* | Meliaceae | seringa or syringa | | | 3 | | SA | | | L | MA | | N | SW | | ZI |

| Scientific name | Family | Common name | 1 | 2 | 3 | Pr | SA | A | B | L | MA | MO | N | SW | ZA | ZI |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Melilotus alba* | Fabaceae | white sweet clover | | | | | SA | | | | | | | | | |
| *Metasequioa glyptostroboides* | Pinaceae | dawn redwood | | | | | SA | | | | | | | | | |
| *Metrosideros excelsa* | Myrtaceae | New Zealand bottlebrush | | | 3 | | SA | | | | | | | | | |
| *Mimosa pigra* | Fabaceae | giant sensitive plant | | | 3 | | SA | | | | | | | | | |
| *Mimosa pudica* var. *hispida* | Fabaceae | sensitive plant | | | | | SA | | | | | | | | | ZI |
| *Mirabilis jalapa* | Nyctaginaceae | four-o' clock | | | | Pr | SA | | | L | | | | | | |
| *Momordica charantia* | Cucurbitaceae | bitter cucumber | | | | | SA | | | | | | | | | |
| *Monstera deliciosa* | Araceae | Swiss-cheese plant | | | | | SA | | | | | | | | | |
| *Montanoa hibiscifolia* | Asteraceae | tree daisy | 1 | | | | SA | | | | | | | | | |
| *Moringa oleifera* | Moringaceae | horse-radish tree | | | | | SA | | | | | | | | | |
| *Morus alba* | Moraceae | white mulberry | | | 3 | | SA | | | L | MA | | | SW | | |
| *Musa* sp. | Musaceae | banana tree | | | | | SA | | | | | | | | | |
| *Myoporum tenuifolium* ssp. *montanum* | Myoporaceae | manatoka | | | 3 | | SA | | | | | | N | | | |
| *Myriophyllum aquaticum* | Haloragaceae | parrot's feather | 1 | | | | SA | | | L | | | | | | |
| *Myriophyllum spicatum* | Haloragaceae | spiked water-milfoil | 1 | | | | SA | | B | | | | N | | | |
| *Nassella tenuissima* | Poaceae | white tussock | 1 | | | | SA | | | | | | | | | |
| *Nassella trichotoma* | Poaceae | nassella tussock | 1 | | | | SA | | | | | | | | | |
| *Nephrolepis exaltata* | Davalliaceae | sword fern | | | 3 | | SA | | | | | | | | | |
| *Nerium oleander* | Apocynaceae | oleander | 1 | | | | SA | | | | MA | | | | | |
| *Nicandra physaloides* | Solanaceae | apple-of-Peru | | | | | SA | | | | | | | | | |
| *Nicotiana glauca* | Solanaceae | wild tobacco | 1 | | | | SA | | | L | | | N | | | |
| *Nicotiana tabacum* | Solanaceae | tobacco | | | | | SA | | | | | | | | | |
| *Nymphaea* X *marliacea* | Nymphaeaceae | marliac hybrid waterlily | | | | | SA | | | | | | | | | |
| *Nymphaea* X *mexicana* | Nymphaeaceae | yellow waterlily | | | | | SA | | | | | | | | | |
| *Oenothera biennis* | Onagraceae | evening primrose | | | | | SA | | | | | | | | | |
| *Oenothera glazioviana* | Onagraceae | evening primrose sp. | | | | | SA | | | | | | | | | |
| *Oenothera indecora* | Onagraceae | evening primrose sp. | | | | Pr | SA | | | L | | | | | | |
| *Oenothera jamesii* | Onagraceae | giant evening primrose | | | | | SA | | | | | | | | | |
| *Oenothera laciniata* | Onagraceae | cutleaf evening primrose | | | | | SA | | | L | | | | | | |
| *Oenothera rosea* | Onagraceae | rose evening primrose | | | | Pr | SA | | | L | | | | | | |
| *Oenothera tetraptera* | Onagraceae | white evening primrose | | | | Pr | SA | | | L | | | | | | |
| *Olyra latifolia* | Poaceae | | | | | | SA | | | | | | | | | |

| Scientific name | Family | Common name | 1 | 2 | 3 | Pr | SA | A | B | L | MA | MO | N | SW | ZA | ZI |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Opuntia aurantiaca* | Cactaceae | jointed cactus | 1 | | | | SA | | | | | | | SW | | |
| *O. engelmannii* var. *lindheimeri* | Cactaceae | small round-lvd pr pear | 1 | | | | SA | | | | | | | | | |
| *Opuntia exaltata* | Cactaceae | long-spine cactus | 1 | | | | SA | | | | | | | | | |
| *Opuntia ficus-indica* | Cactaceae | sweet prickly pear | 1 | | | | SA | | | L | MA | MO | N | SW | ZA | |
| *Opuntia fulgida* | Cactaceae | rosea cactus | 1 | | | | SA | | | | | | | | | |
| *Opuntia humifusa* | Cactaceae | large-flwd prickly pear | 1 | | | | SA | | B | | | | | | | |
| *Opuntia imbricata* | Cactaceae | imbricate prickly pear | 1 | | | | SA | | | | | | | | | |
| *Opuntia microdasys* | Cactaceae | yellow bunny-ears | | | | | SA | | | | | | | | | |
| *Opuntia monacantha* | Cactaceae | cochineal prickly pear | 1 | | | | SA | | | | | | | | | |
| *Opuntia robusta* | Cactaceae | blue-leaf cactus | | | | | SA | | | | | | | | | |
| *O.* sp. (subgenus *Tephrocactus*) | Cactaceae | | | | | | SA | | | | | | | | | |
| *Opuntia spinulifera* | Cactaceae | large round-lvd p pear | 1 | | | | SA | | | | | | | | | |
| *Opuntia stricta* | Cactaceae | Australian pest pear | 1 | | | | SA | | | | | | N | SW | | |
| *Opuntia stricta* X *humifusa?* | Cactaceae | | | | | | SA | | | | | | | | | |
| *Orobanche minor* | Orobanchaceae | clover broomrape | 1 | | | | SA | | | | | | | | | |
| *Oxalis corniculata* | Oxalidaceae | creeping oxalis | | | | | SA | | | L | | | | | | |
| *Pandanus* sp. | Pandanaceae | screw-pine | | | | | SA | | | | | | | | | |
| *Paraserianthes lophantha* | Fabaceae | stinkbean | 1 | | | | SA | | | | | | | | | |
| *Parkinsonia aculeata* | Fabaceae | Jerusalem thorn | | | | | SA | | | | | | | SW | | |
| *Parthenium hysterophorus* | Asteraceae | parthenium | 1 | | | | SA | | | | | MO | | SW | | |
| *Parthenocissus quinquefolia* | Vitaceae | Virginia creeper | | | | | SA | | | | | | | | | |
| *Paspalum dilatatum* | Poaceae | common paspalum | | | | | SA | | | | | | | | | |
| *Paspalum urvillei* | Poaceae | tall paspalum | | | | | SA | | | | | | | | | |
| *Passiflora caerulea* | Passifloraceae | blue passion flower | 1 | | | | SA | | | | | | | | | |
| *Passiflora edulis* | Passifloraceae | purple granadilla | | | | P | SA | | | | MA | | | | | |
| *Passiflora mollissima* | Passifloraceae | banana poka | 1 | | | | SA | | | | | | | | | |
| *Passiflora suberosa* | Passifloraceae | devil's pumpkin | 1 | | | | SA | | | | | | | | | |
| *Passiflora subpeltata* | Passifloraceae | granadina | 1 | | | | SA | | | | | | | | | |
| *Passiflora* sp. | Passifloraceae | passion flower | | | | | | | | | | | | | | ZI |
| *Pennisetum clandestinum* | Poaceae | Kikuyu grass | | | | Pr | SA | | | | | | | | | |
| *Pennisetum purpureum* | Poaceae | napier grass | | | | Pr | SA | | | | MA | | | SW | | |
| *Pennisetum setaceum* | Poaceae | fountain grass | 1 | | | | SA | | | | | | | | ZA | |

| Scientific name | Family | Common name | 1 | 2 | 3 | Pr | SA | A | B | L | MA | MO | N | SW | ZA | ZI |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Pennisetum villosum* | Poaceae | feathertop | 1 | | | | SA | | | | | | | | | |
| *Pereskia aculeata* | Cactaceae | pereskia | 1 | | | | SA | | | | | | | | | |
| *Persea americana* | Lauraceae | avocado pear | | | | | SA | | | | | | | | | |
| *Persicaria lapathifolia* | Polygonaceae | spotted knotweed | | | | | SA | | | | | MO | | | | |
| *Phoenix canariensis* | Arecaceae | canary date palm | | | | | SA | | | | | | | | | |
| *Phoenix dactylifera* | Arecaceae | real date palm | | | | | SA | | | | | | | | | |
| *Phormium tenax* | Phormiaceae | New Zealand flax | | | | | SA | | | | | | | | | |
| *Physalis peruviana* | Solanaceae | cape gooseberry | | | | | SA | | | | | | | | | |
| *Physalis viscosa* | Solanaceae | sticky gooseberry | | | | | SA | | | | | | | | | |
| *Phytolacca dioica* | Phytolaccaceae | belhambra | | | 3 | | SA | | | | | | | | | |
| *Phytolacca octandra* | Phytolaccaceae | forest inkberry | | | | Pr | SA | | | | | | | | | |
| *Pinus canariensis* | Pinaceae | canary pine | | 2 | | | SA | | | | | | | | | |
| *Pinus uncinata* | Pinaceae | | | | | | SA | | | | | | | | | |
| *Pinus elliottii* | Pinaceae | slash pine | | 2 | | | SA | | | | | | | SW | | |
| *Pinus halepensis* | Pinaceae | aleppo pine | | 2 | | | SA | | | L | | | | | | |
| *Pinus patula* | Pinaceae | patula pine | | 2 | | | SA | | | L | MA | | | | | ZI |
| *Pinus pinaster* | Pinaceae | cluster pine | | 2 | | | SA | | | | | | | | | |
| *Pinus pinea* | Pinaceae | umbrella pine | | | | | SA | | | | | | | | | |
| *Pinus radiata* | Pinaceae | radiata pine | | 2 | | | SA | | | L | | | | | | |
| *Pinus roxburghii* | Pinaceae | chir pine | | 2 | | | SA | | | | | | | | | |
| *Pinus taeda* | Pinaceae | loblolly pine | | 2 | | | SA | | | | | | | | | |
| *Pistia stratiotes* | Araceae | water lettuce | 1 | | | | SA | | | | MA | | | | | ZI |
| *Pittosporum undulatum* | Pittosporaceae | Australian cheesewood | 1 | | | | SA | | | | | | | | | |
| *Pityrogramma calomelanos* | Adiantaceae | golden fern | | | | | SA | | | | | | | | | |
| *Plantago lanceolata* | Plantaginaceae | narrow-leaved ribwort | | | | | SA | | | L | | | | | | |
| *Plantago major* | Plantaginaceae | broad-leaved ribwort | | | | | SA | | | L | | | | | | |
| *Plantago virginica* | Plantaginaceae | dwarf plantain | | | | | SA | | | | | | | | | |
| *Platanus* sp. | Platanaceae | plane-tree sp. | | | | | SA | | | | | | | | | |
| *Plectranthus comosus* | Lamiaceae | Abyssinian coleus | | | 3 | | SA | | | | | | | SW | | |
| *Polygonum aviculare* | Polygonaceae | prostrate knotweed | | | | | | | | L | | | | | | |
| *Polypogon monspeliensis* | Poaceae | beardgrass | | | | | SA | | | | | | | | | |
| *Pomaderris kumerho* | Rhamnaceae | kumarahou | | | | | SA | | | | | | | | | |

| Scientific name | Family | Common name | 1 | 2 | 3 | Pr | SA | A | B | L | MA | MO | N | SW | ZA | ZI |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Pontederia cordata* | Pontederiaceae | pickerel weed | | | 3 | | SA | | | | | | | | | |
| *Populus alba* | Salicaceae | white poplar | | 2 | | | SA | | | L | | | | | | |
| *Populus deltoides* | Salicaceae | match poplar | | | | Pr | SA | | | | | | | | | |
| *Populus nigra* var. *italica* | Salicaceae | lombardy poplar | | | | Pr | SA | | | | | | | | | |
| *Populus x canescens* | Salicaceae | grey poplar | | 2 | | | SA | | | L | | | | | | ZI |
| *Portulaca oleracea* | Portulacaceae | purslane | | | | | SA | | | L | | | | | | |
| *Prosopis glandulosa* var. *torreyana* | Fabaceae | honey mesquite | | 2 | | | SA | | | | MA | | | | | |
| *Prosopis glandulosa* var. | Fabaceae | mesquite hybrids | | 2 | | | SA | | | | | N | | | | |
| *Prosopis velutina* | Fabaceae | velvet mesquite | | 2 | | | SA | | | | | | | | | |
| *Prunus armeniaca* | Rosaceae | apricot | | | | | SA | | | | | | | | | |
| *Prunus cerasoides* | Rosaceae | Himalayan flag cherry | | | | | | | | | | | | | | ZI |
| *Prunus persica* | Rosaceae | peach | | | | | SA | | | | | | | SW | | ZI |
| *Prunus serotina* | Rosaceae | black cherry | | | | | SA | | | | | | | | | |
| *Pseudognaphalium luteo-album* | Asteraceae | Jersey cudweed | | | | | SA | | | | | | | | | |
| *Psidium cattleianum* | Myrtaceae | strawberry guava | | | 3 | | SA | | | | | | | | | |
| *Psidium guajava* | Myrtaceae | guava | | 2 | | | SA | | | | MA | | | SW | ZA | ZI |
| *Psidium guineense* | Myrtaceae | Brazilian guava | | | 3 | | SA | | | | | | | | | |
| *Psidium* X *durbanensis* | Myrtaceae | Durban guava | | | 3 | | SA | | | | | | | | | |
| *Pterocarya stenoptera* | Juglandaceae | Chinese wing-nut | | | | | SA | | | | | | | | | |
| *Pueraria lobata* | Fabaceae | kudzu vine | 1 | | | | SA | | | | | | | | | |
| *Punica granatum* | Punicaceae | pomegranate | | | | | SA | | | | | | | | | |
| *Pyracantha angustifolia* | Rosaceae | yellow firethorn | | | 3 | | SA | | | L | | | | | | |
| *Pyracantha coccinea* | Rosaceae | red firethorn | | | | | SA | | | L | | | | | | |
| *Pyracantha crenulata* | Rosaceae | Himalayan firethorn | | | 3 | | SA | | | L | | | | | | |
| *Pyracantha* sp. | Rosaceae | firethorn | | | | | | | | | | | | | ZA | |
| *Pyrus* sp. | Rosaceae | pear tree | | | | | SA | | | | | | | | | |
| *Quercus palustris* | Fagaceae | pin oak | | | | | SA | | | | | | | | | |
| *Quercus robur* | Fagaceae | English oak | | | | | SA | | | L | | | | | | |
| *Rhus succedanea* | Anacardiaceae | wax tree | 1 | | | | SA | | | | | | | | | |
| *Richardia brasiliensis* | Rubiaceae | tropical richardia | | | | | SA | | | | | | | | | |
| *Richardia humistrata* | Rubiaceae | Peelton richardia | | | | | SA | | | | | | | | | |
| *Ricinus communis* | Euphorbiaceae | castor-oil plant | | 2 | | | SA | | | L | MA | MO | N | SW | ZA | ZI |

| Scientific name | Family | Common name | 1 | 2 | 3 | Pr | SA | A | B | L | MA | MO | N | SW | ZA | ZI |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Rivina humilis* | Phytolaccaceae | bloodberry | 1 | | | | SA | | | | | | | | | |
| *Robinia pseudoacacia* | Fabaceae | black locust | | 2 | | | SA | | | L | | | | | | |
| *Rorippa nasturtium-aquaticum* | Brassicaceae | watercress | | 2 | | | SA | | | L | | | | | | |
| *Rosa multiflora* | Rosaceae | multiflora rose | | | | | SA | | | | | | | | | |
| *Rosa odorata ?* | Rosaceae | tea rose | | | | | SA | | | | | | | | | |
| *Rosa rubiginosa* | Rosaceae | eglantine | 1 | | | | SA | | | L | | | | | | ZI |
| *Rubus cuneifolius* | Rosaceae | American bramble | 1 | | | | SA | | | | | | | | | |
| *Rubus flagellaris* | Rosaceae | | | | | Pr | SA | | | | | | | | | |
| *Rubus fruticosus* agg. | Rosaceae | European blackberry | | 2 | | | SA | | | | | | | SW | | |
| *Rubus pascuus* | Rosaceae | | | | | | SA | | | | | | | | | |
| *Rubus* X *proteus* | Rosaceae | bramble, Graskop Sabie | 1 | | | | SA | | | | | | | | | |
| *Rubus* sp. | Rosaceae | bramble | | | | | | | | | MA | | | | ZA | |
| *Rumex angiocarpus* | Polygonaceae | sheep sorrel | | | | | | | | L | | | | | | |
| *Rumex crispus* | Polygonaceae | curly dock | | | | | SA | | | | | | | | | |
| *Rumex saggitatus* (indigenous?) | Polygonaceae | red sorrel | | | | | SA | | | | | | | | | |
| *Rumex usambarensis* | Polygonaceae | rumex | | | | | SA | | | | | | | SW | | |
| *Saccharum officinarum* | Poaceae | sugarcane | | | | | SA | | | | | | | | | |
| *Salix babylonica* | Salicaceae | weeping willow | | 2 | | | SA | | | L | | | | | | |
| *Salix caprea* | Salicaceae | pussy willow | | | | | SA | | | | | | | | | |
| *Salix fragilis* | Salicaceae | crack willow | | 2 | | | SA | | | | | | | | | |
| *Salsola kali* | Chenopodiaceae | Russian tumbleweed | | | | | SA | | | L | | | N | | | |
| *Salvinia molesta* | Salviniaceae | Kariba weed | 1 | | | | SA | | B | | MA | | | | | |
| *Sambucus canadensis* | Caprifoliaceae | Canadian elder | | | | Pr | SA | | | | | | | | | |
| *Sambucus* sp. | Caprifoliaceae | | | | | | SA | | | | | | | | | |
| *Samolus porosus* (indigenous?) | Primulaceae | | | | | | SA | | | | | | | | | |
| *Schinus molle* | Anacardiaceae | pepper tree | | | | Pr | SA | | | | | | N | | | |
| *Schinus terebinthifolius* | Anacardiaceae | Brazilian pepper tree | 1 | | 3 | | SA | | | | | | N | SW | | ZI |
| *Schkuhria pinnata* | Asteraceae | dwarf marigold | | | | | SA | | | | | | | | | |
| *Senna bicapsularis* | Fabaceae | rambling cassia | | | 3 | | SA | | | | | | | SW | | |
| *Senna corymbosa* | Fabaceae | autumn cassia | | | | | SA | | | | | | | | | |
| *Senna didymobotrya* | Fabaceae | peanut butter cassia | | | 3 | | SA | | | | MA | | | SW | | ZI |
| *Senna hirsuta* | Fabaceae | | | | | | SA | | | | | | | | | |

| Scientific name | Family | Common name | 1 | 2 | 3 | Pr | SA | A | B | L | MA | MO | N | SW | ZA | ZI |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Senna multiglandulosa* | Fabaceae | | | | | | SA | | | | | | | | | |
| *Senna obtusifolia* | Fabaceae | | | | | | SA | | | | | | | | | |
| *Senna occidentalis* | Fabaceae | wild coffee | | | | | SA | | | | | | | SW | | |
| *Senna pendula* var. *glabrata* | Fabaceae | | | | 3 | | SA | | | | | | | SW | | |
| *Senna septemtrionalis* | Fabaceae | arsenic bush | | | | Pr | SA | | | | | | | SW | | ZI |
| *Sesbania bispinosa* | Fabaceae | spiny sesbania | | | | | SA | | | | | | | | | |
| *Sesbania punicea* | Fabaceae | red sesbania | 1 | | | | SA | | | L | | | | SW | | ZI |
| *Sesbania sesban* (indigenous?) | Fabaceae | river bean | | | | | SA | | | | | | | | | |
| *Sigesbeckia orientalis* | Asteraceae | St. Paul's wort | | | | | SA | | | | | | | | | |
| *Silybum marianum* | Asteraceae | milk thistle | | | | | SA | | | | | | | | | |
| *Sisymbrium orientale* | Brassicaceae | Indian hedge mustard | | | | | SA | | | | | | | | | |
| *Sisyrinchium* sp. | Iridaceae | | | | | | SA | | | | | | | | | |
| *Solanum aculeastrum* (indigenous?) | Solanaceae | goat bitter apple | | | | | SA | | | | | | | | ZA | |
| *Solanum capsicoides* | Solanaceae | devil's apple | | | | | SA | | | | | | | | | |
| *Solanum elaeagnifolium* | Solanaceae | silver-leaf bitter apple | 1 | | | | SA | | | L | | | N | | | |
| *Solanum hispidum* | Solanaceae | devil's fig | | | | | SA | | | | | | | | | |
| *Solanum mauritianum* | Solanaceae | bugweed | 1 | | | | SA | | | | | | | SW | ZA | ZI |
| *Solanum nigrum* sensu lato | Solanaceae | nightshade | | | | | SA | | | | | | | | | |
| *Solanum panduriforme* | Solanaceae | yellow bitter apple | | | | | SA | | | | | | | | | |
| *Solanum pseudocapsicum* | Solanaceae | Jerusalem cherry | | | | Pr | SA | | | | | | | | | |
| *Solanum retroflexum* (indigenous?) | Solanaceae | nasgal | | | | | SA | | | | | | | | | |
| *Solanum seaforthianum* | Solanaceae | potato creeper | 1 | | | | SA | | | | | | | SW | ZA | ZI |
| *Solanum sisymbriifolium* | Solanaceae | dense-thorned bitter ap | 1 | | | | SA | | | | | | | SW | | |
| *Sonchus oleraceus* | Asteraceae | sowthistle | | | | | SA | | | | | | | | | |
| *Sophora japonica* | Fabaceae | Japanese pagoda tree | | | | | SA | | | | | | | | | |
| *Sophora* sp. cf *S. davidii* | Fabaceae | | | | | | SA | | | | | | | | | |
| *Sorghum halepense* | Poaceae | Johnson grass | | 2 | | | SA | | B | | | | N | SW | | |
| *Spartium junceum* | Fabaceae | Spanish broom | 1 | | | | SA | | | | | | | | | |
| *Spathodea campanulata* | Bignoniaceae | African flame tree | | | | | SA | | | | | | | | | |
| *Spiraea cantoniensis* | Rosaceae | cape may | | | | | SA | | | | | | | | | |
| *Stellaria media* | Caryophyllaceae | chickweed | | | | | SA | | | L | | | | | | |
| *Stenocarpus sinuatus* | Proteaceae | firewheel tree | | | | | SA | | | | | | | | | |

| Scientific name | Family | Common name | 1 | 2 | 3 | Pr | SA | A | B | L | MA | MO | N | SW | ZA | ZI |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Surrya heterophylla* | Pittosporaceae | | | | | | SA | | | | | | | | | |
| *Syncarpia glomulifera* | Myrtaceae | turpentine tree | | | | | SA | | | | | | | | | |
| *Syzygium cumini* | Myrtaceae | jambolan | | | 3 | | SA | | | | | | | | | |
| *Syzygium jambos* | Myrtaceae | rose apple | | | 3 | | SA | | | | | | | | | |
| *Syzygium paniculatum* | Myrtaceae | Australian water pear | | | | Pr | SA | | | | | | | | | |
| *Tabebuia chrysotricha* | Bignoniaceae | yellow trumpet tree | | | | | SA | | | | | | | | | |
| *Tagetes minuta* | Asteraceae | khaki weed | | | | | SA | | | L | | | N | | | |
| *Tamarix chinensis* | Tamaricaceae | Chinese tamarisk | 1 | | 3 | | SA | | | | | | | | | |
| *Tamarix ramosissima* | Tamaricaceae | pink tamarisk | 1 | | 3 | | SA | | | | | | | | | |
| *Tamarix* sp. | Tamaricaceae | tamarisk sp. | | | | | SA | | | | | | | | | |
| *Taraxacum officinale* sensu lato | Asteraceae | dandelion, common | | | | | SA | | | | | | | | | |
| *Tecoma stans* | Bignoniaceae | yellow bells | 1 | | | | SA | | | | MA | | N | SW | ZA | |
| *Tephrocactus* cf. *articulatus* | Cactaceae | | | | | | SA | | | | | | | | | |
| *Tephrocactus* sp. *(aoracanthus?)* | Cactaceae | | | | | | SA | | | | | | | | | |
| *Thelechitonia trilobata* | Asteraceae | Singapore daisy | 1 | | 3 | | SA | | | | | | | | | |
| *Thevetia peruviana* | Apocynaceae | yellow oleander | 1 | | | | SA | | | | | | | | | |
| *Tipuana tipu* | Fabaceae | tipu tree | | | 3 | | SA | | | | | | | | | |
| *Tithonia diversifolia* | Asteraceae | Mexican sunflower | 1 | | | | SA | | | | MA | | | SW | | |
| *Tithonia rotundifolia* | Asteraceae | red sunflower | 1 | | | | SA | | B | | | | | SW | ZA | ZI |
| *Toona ciliata* | Meliaceae | toon tree | | | 3 | | SA | | | | MA | | | | ZA | ZI |
| *Torilis arvensis* | Apiaceae | | | | | | SA | | | | | | | | | |
| *Tragopogon dubius* | Asteraceae | | | | | | SA | | | | | | | | | |
| *Tribulus terrestris* | Zygophyllaceae | dubbeltjie | | | | | SA | | | | | | | | | |
| *Tridax procumbens* | Asteraceae | tridax daisy | | | | | SA | | | | | | | | ZA | |
| *Triplaris americana* | Polygonaceae | triplaris | 1 | | | | SA | | | | | | | | | |
| *Triticum aestivum* | Poaceae | volunteer wheat | | | | | SA | | | | | | | | | |
| *Tropaeolum majus* | Tropaeolaceae | nasturtium | | | | | SA | | | | | | | | | |
| *Ulex europaeus* | Fabaceae | European gorse | 1 | | | | SA | | | | | | | | | |
| *Ulmus parvifolia* | Ulmaceae | Chinese elm | | | | Pr | SA | | | | | | | | | |
| *Ulmus procera* | Ulmaceae | English elm | | | | | SA | | | | | | | | | |
| *Verbena bonariensis* | Verbenaceae | wild verbena | | | | | SA | | | | | | | | | |
| *Verbena brasiliensis* | Verbenaceae | slender wild verbena | | | | | SA | | | | | | | | | |

| Scientific name | Family | Common name | 1 | 2 | 3 | Pr | SA | A | B | L | MA | MO | N | SW | ZA | ZI |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Verbena officinalis* | Verbenaceae | European verbena | | | | | SA | | | | | | | | | |
| *Verbena tenuisecta* | Verbenaceae | fine-leaved verbena | | | | | SA | | | | | | | | | |
| *Verbena venosa* | Verbenaceae | vervain (veined) | | | | | SA | | | | | | | | | |
| *Verbena* X hybrida | Verbenaceae | garden verbena | | | | | | | | L | | | | | | |
| *Verbesina encelioides* | Asteraceae | golden crownbeard | | | | | SA | | | | | | | | | |
| *Veronica anagallis-aquatica* | Scrophulariaceae | water speedwell | | | | | SA | | | | | | N | | | |
| *Vinca major* | Apocynaceae | greater periwinkle | | | | | SA | | | | | | | | | |
| *Vitis* sp. | Vitaceae | grape | | | | | SA | | | | | | | | | |
| *Washingtonia* | Arecaceae | petticoat palm | | | | | SA | | | | | | | | | |
| *Wigandia caracasana* | Hydrophyllaceae | wigandia | | | | | SA | | | | | | | | | |
| *Wisteria floribunda* | Fabaceae | Japanese wisteria | | | | | SA | | | | | | | | | |
| *Xanthium spinosum* | Asteraceae | spiny cocklebur | 1 | | | | SA | | | L | | | N | SW | | |
| *Xanthium strumarium* | Asteraceae | large cocklebur | 1 | | | | SA | | | L | | | | SW | ZA | |
| *Yucca aloifolia* | Agavaceae | Spanish bayonet | | | | | SA | | | | | | | | | |
| *Zinnia peruviana* | Asteraceae | redstar zinnia | | | | | SA | | | | | | | | | |

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