



**DEPARTMENT OF AGRICULTURE,  
CONSERVATION, ENVIRONMENT AND LAND  
AFFAIRS**

**DIRECTORATE OF NATURE  
CONSERVATION**

**RED DATA PLANT POLICY FOR  
ENVIRONMENTAL IMPACT  
EVALUATIONS**

**FINAL DRAFT**

*MICHÈLE PFAB  
SCIENTIFIC SERVICES*

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## 1. Introduction

On 7 September 1999 a meeting was convened between the Directorate of Environment (Environmental Assessment) and the Directorate of Nature Conservation (Technological Services: Ecological Services). At this meeting, the Directorate of Nature Conservation was requested to compile a draft policy to assist with the evaluation of development applications that affected Red Data plant species.

A ranking scheme that prioritizes Red Data plant species in Gauteng from the most important to the least had already been developed for other purposes within the Directorate of Nature Conservation. This ranking scheme was revised as a basis to develop the required Red Data policy. As a justification for the draft policy, the essential details of the ranking scheme will be briefly described in section 2 of this document. For more detail, please refer to Pfab & Victor (submitted).

## 2. Priority ranking of Red Data plant species in Gauteng

Over the past four years locality information for all 31 Red Data plant species occurring in Gauteng has been collected from five sources:

- Transvaal Provincial Administration (TPA) records.
- The Pretoria National Herbarium Computerized Information System (PRECIS).
- Herbaria at the Universities of Witwatersrand and Pretoria.
- Professional and amateur botanists.
- Data recorded in the field by the Technological Services division of the Gauteng Directorate of Nature Conservation.

This information has been collated to form a provincial Red Data plant database, comprising an extensive list of all known localities within Gauteng for each Red Data plant species.

Using the Red Data List of Southern African Plants (Hilton-Taylor, 1996), the completed provincial Red Data plant database, trade information supplied by TRAFFIC (Trade Records Analysis of Flora and Fauna in Commerce) and general distribution records from general botanical literature (Fabian & Germishuizen, 1997; Retief & Herman, 1997), each species was assessed in terms of eight criteria (Table 1). Criterion A considers endemism, criteria B, D and E consider species distributions at decreasing spatial scales, criterion C considers IUCN listings of taxa evaluated at the national (South Africa) level (Pfab & Victor, submitted), criterion F considers the protection of each taxon within conservation areas and criteria G and H represent the factors of threat that are specifically important within Gauteng.

Due to the problems associated with linear ranking schemes (Given & Norton, 1993), a hierarchical approach to priority setting was adopted, where the most important criterion, endemism (Table 1), was used for the initial species sorting. Each group was then sorted progressively using the next important criterion. This was continually repeated, each subsequent group being sorted progressively until all the criteria had been used, following the order indicated below and in Table 1, until the final priority list was produced (Table 2).

- A. Endemism was deemed the most important criterion – in terms of conserving biodiversity, a taxon restricted to southern Africa would be of a higher priority than those occurring elsewhere.
- B. Similarly, in terms of distribution, taxa restricted to Gauteng or to the northern provinces of South Africa (Gauteng, Mpumalanga, Northern and North West provinces, i.e. the former Transvaal province) would be of a higher priority for the Gauteng Directorate of Nature Conservation than those taxa more widely distributed.
- C. Red Data status was based on national (South Africa) evaluations completed under the SABONET Red Listing project according to the new IUCN categories and criteria (IUCN, 2000) and using the RAMAS Red Listing software (Pfab & Victor, submitted). All taxa listed in the threatened categories of Critically Endangered, Endangered and Vulnerable are included as well as those listed as Data Deficient. As it is possible that a Data Deficient taxon may qualify for a threatened category, it is important to follow the precautionary approach and ensure that conservation action is also targeted to these taxa (IUCN, 2000).
- D. Taxa having a narrow distribution within the northern provinces would be of a higher priority than those taxa with a wider distribution in these provinces. Taxa restricted to subregions falling predominantly over Gauteng (central and south, see Retief & Herman 1997 for the positions of the five subregions) should receive higher priority than those taxa falling into one or more subregions that do not fall over Gauteng (north, east and west, see Retief & Herman 1997).
- E. Similarly, taxa recorded at fewer localities should receive higher priority than those taxa recorded at more localities.
- F. After considering distributions, it was then necessary to sort those taxa with populations protected within conservation areas from those taxa that essentially remain unprotected. Conservation areas include provincial, private and municipal nature reserves as well as the Magaliesberg Protected Natural Environment, the Sterkfontein, Kromdraai, Swartkranz & Environs Cradle of Humankind World Heritage Site, all natural heritage sites and conservancies.
- G. Urbanization is the greatest threat to species in Gauteng (Pfab & Victor, submitted), and therefore constituted the next level of sorting. Urbanization threat to taxa with populations occurring in all major urban areas in the province is expected to be higher than to those taxa with populations occurring in fewer urban areas, with taxa restricted to rural areas being the least threatened. Since most major development and urban expansion is expected in Johannesburg and Pretoria, populations occurring in these areas are considered to be at a higher risk than those occurring in the minor urban areas of Gauteng.
- H Utilization data (Newton & Chan, 1998) were incorporated into eighth-level sorting. A taxon collected from the wild for either its medicinal, food or for other values (Mander *et al.*, 1997, van Wyk *et al.*, 1997, van Wyk & Gericke, 2000) or advertized for sale on nursery catalogues on Internet sites was considered to be

a higher priority than those taxa not collected at all. Taxa related to, i.e. belonging to the same genera as, known medicinals or plants collected and/or traded were assumed to be at a higher risk, due to possible future utilization related to potential genetic and/or collector value of the taxa.

**Table 1.** Criteria used for the priority setting exercise for the Red Data plant species occurring within Gauteng. Criteria are ranked from the most important to the least, with criteria scores arranged in descending order of importance.

<b>CRITERION</b>	<b>SCORE</b>
A. <i>Endemic to southern Africa?</i> *	
Yes	1
No	2
B. <i>Distribution within southern Africa</i>	
Gauteng	1
Gauteng + one other province/country*	2
Gauteng + two or more other provinces/countries*	3
C. <i>Red Data status in South Africa</i> (see Pfab and Victor submitted)	
Critically Endangered	1
Endangered	2
Vulnerable	3
Data Deficient	4
D. <i>Distribution within the Northern Provinces</i> (Retief and Herman 1997)	
One subregion	1
Two subregions, two over Gauteng	2
Two subregions, one over Gauteng	3
Three subregions, two over Gauteng	4
Three subregions, one over Gauteng	5
Four/five subregions	6
E. <i>Distribution within Gauteng</i>	
One recorded locality	1
2-4 recorded localities	2
5-9 recorded localities	3
10 or more recorded localities	4
F. <i>Occurrence in conservation areas</i>	
No recorded localities inside conservation areas	1
One or more localities inside conservation areas	2
G. <i>Urbanization threat</i>	
Recorded localities in Johannesburg, Pretoria and other large towns	1
Recorded localities in Johannesburg and Pretoria	2
Recorded localities in Johannesburg <u>or</u> Pretoria and other large towns	3
Recorded localities in Johannesburg <u>or</u> Pretoria	4
Recorded localities in other large towns	5
Recorded localities outside of urban areas	6
H. <i>Utilization</i>	
Traded/collected/utilized taxon	1
Potentially traded/collected/utilized taxon	2
No known or potential trade/collection/utilization	3

\*Including former Transvaal province (now includes Gauteng, North West province, Northern province and Mpumalanga), former Cape province, Free State and KwaZulu-Natal and the countries Lesotho, Swaziland, Namibia, Botswana and Zimbabwe

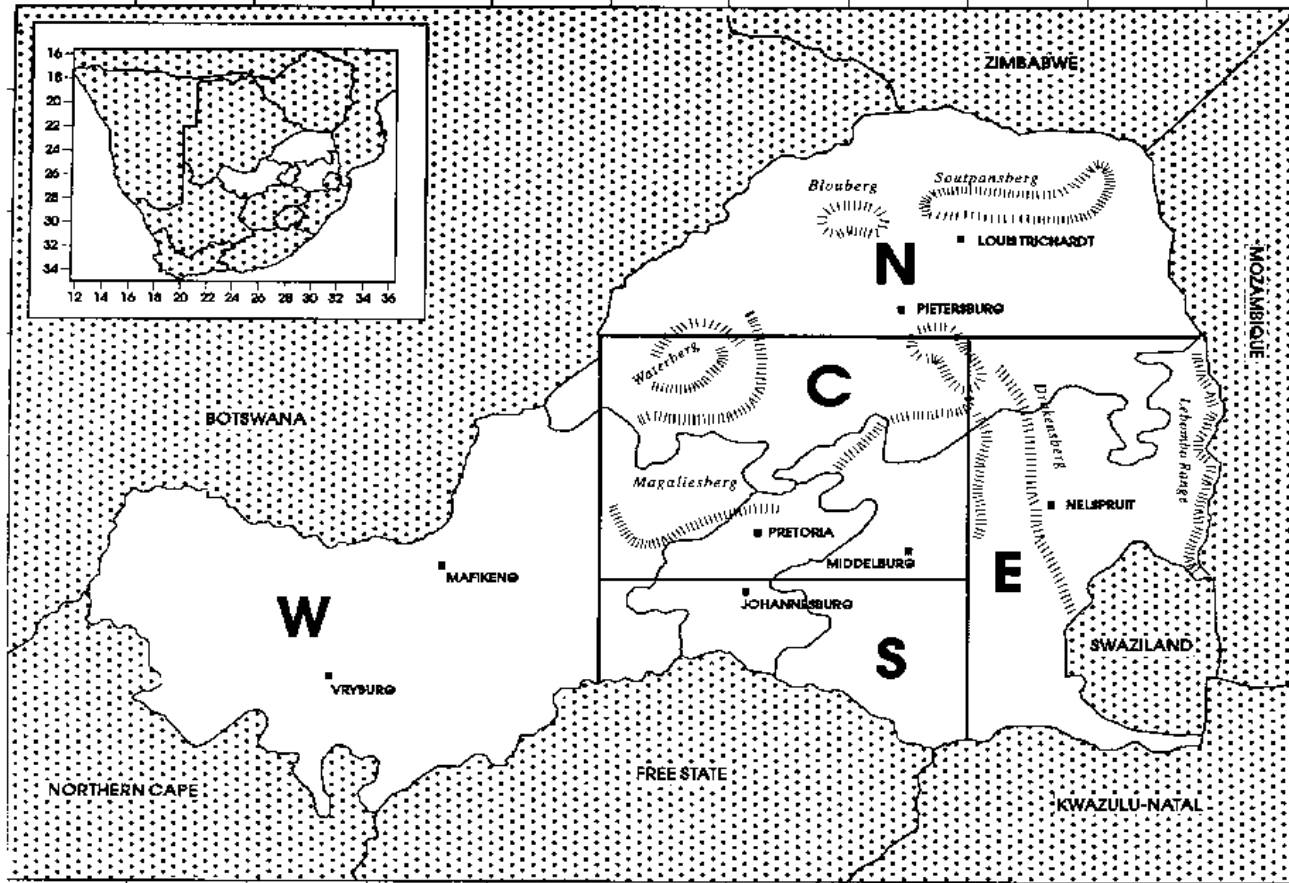


Figure 1. The five subregions of the northern provinces of South Africa (from Retief & Herman, 1997).

**Table 2.** Priority ranking of Red Data plant species for the province of Gauteng. The priority profile for each species is indicated in terms of the scoring of all species against eight criteria (Table 1). A1, A2, A3 and B refer to groupings of species used as a basis for the draft Red Data policy.

SPECIES	FAMILY	A	B	C	D	E	F	G	H	RANK	
<i>Khadia beswickii</i>	Aizoaceae	1	1	1	1	2	1	3	1	1	A1 – Species endemic to Gauteng
<i>Delosperma macellum</i>	Aizoaceae	1	1	1	1	2	2	5	1	2	
<i>Ceropegia decidua</i> subsp. <i>pretoriensis</i>	Apocynaceae	1	1	1	1	4	2	4	1	3	
<i>Delosperma purpureum</i>	Aizoaceae	1	1	2	1	2	1	4	2	4	
<i>Delosperma gautengense</i>	Aizoaceae	1	1	2	1	2	2	4	2	5	
<i>Holothrix micrantha</i>	Orchidaceae	1	1	2	1	3	2	3	2	6	
<i>Cineraria longipes</i>	Asteraceae	1	1	2	1	4	2	3	2	7	
<i>Lotononis adpressa</i> subsp. <i>leptantha</i>	Fabaceae	1	1	2	2	2	2	3	2	8	
<i>Melolobium subspicatum</i>	Fabaceae	1	1	2	2	2	2	3	3	9	
<i>Habenaria mossii</i>	Orchidaceae	1	1	2	2	3	2	1	2	10	
<i>Delosperma vogtsii</i>	Aizoaceae	1	1	2	2	4	2	3	2	11	
<i>Delosperma knox-daviesii</i>	Aizoaceae	1	1	4	1	1	1	4	2	12	
<i>Delosperma framesii</i>	Aizoaceae	1	1	4	1	1	1	4	2	12	
<i>Dicoma pretoriensis</i>	Asteraceae	1	1	4	1	1	1	4	2	12	
<i>Agorostis eriantha</i> var. <i>planifolia</i>	Poaceae	1	1	4	1	1	1	4	2	12	
<i>Harveya anisodonta</i>	Scrophulariaceae	1	1	4	1	2	1	3	3	13	
<i>Delosperma davyi</i>	Aizoaceae	1	1	4	2	3	2	3	1	14	
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<i>Encephalartos middelburgensis</i>	Zamiaceae	1	2	1	1	2	2	6	1	15	A2 – Species endemic to Gauteng + one other province/ country
<i>Eulophia coddii</i>	Orchidaceae	1	2	2	2	3	2	1	1	16	
<i>Aloe peglerae</i>	Asphodelaceae	1	2	2	2	4	2	3	1	17	
<i>Frithia pulchra</i>	Aizoaceae	1	2	3	1	1	2	6	1	18	
<i>Frithia humilis</i>	Aizoaceae	1	2	3	1	3	2	5	1	19	
<i>Nerine gracilis</i>	Amaryllidaceae	1	2	3	3	3	1	5	2	20	
<i>Lepidium mossii</i>	Brassicaceae	1	2	4	1	1	1	4	2	21	
<i>Delosperma leendertziae</i>	Aizoaceae	1	2	4	2	2	2	3	2	22	
<hr/>											
<i>Cleome conrathii</i>	Capparaceae	1	3	2	4	2	2	4	2	23	A3 – Species endemic to Gauteng + two or more other provinces/ countries
<i>Brachystelma discoideum</i>	Apocynaceae	1	3	3	1	1	2	6	1	24	
<i>Trachyandra erythrorrhiza</i>	Asphodelaceae	1	3	3	4	4	2	2	2	25	
<hr/>											
<i>Holothrix randii</i>	Orchidaceae	2	2	3	2	4	2	2	2	26	B – Species not endemic to southern Africa
<i>Cucumis humifructus</i>	Cucurbitaceae	2	3	2	1	1	1	6	2	27	
<i>Eulophia leachii</i>	Orchidaceae	2	3	3	3	1	1	4	2	28	

### 3. Draft Red Data policy principles

The Red Data plant policy is based on the following basic principles.

- 3.1. Goal 1 of the White Paper on the Conservation and Sustainable Use of South Africa's Biological Diversity: "Conserve the diversity of landscapes, ecosystems, habitats, communities, populations, species and genes in South Africa". As the relevant provincial authority, this Department is obliged to ensure that this goal is achieved. By conserving representative landscape units and communities (higher hierarchical levels), 85-90% of species can be targeted (Noss, 1987). The 10-15% of species neglected in higher level considerations are essentially the rare, threatened or Red Data species. As such, this Department is obliged to ensure that the Red Data plant species of the province are conserved, currently totalling 31 out of the approximately 3300 plant species recorded in Gauteng.
- 3.2. Species endemic to the province of Gauteng must be afforded the utmost protection, as they occur nowhere else in the world. As the relevant provincial agency, this Department's responsibility towards Gauteng endemics is absolute.
- 3.3. Conservation of only one population essentially ignores the lowest level of biodiversity, that is genetic diversity. It is therefore imperative that all populations of Red Data plant species are protected.
- 3.4. *In situ* conservation is preferable to *ex situ* conservation. Removing a population from its natural habitat and placing it under artificial conditions results in the erosion of the inherent genetic diversity and characteristics of that species.
- 3.5. In order to ensure the persistence of a population, it is imperative that the ecological processes maintaining that population persist.
- 3.6. In order to ensure the persistence of a plant population, it is vital that pollinators are conserved (Tepedino *et al.*, 1997). If the isolation of fragmented plant populations becomes greater than the foraging range of pollinators, if the local pollinator population becomes small enough or if wide-ranging pollinators avoid small populations, the outcome may be reduced pollination services (Keams *et al.*, 1998) and local extinction of plant populations. To conserve pollinators, the habitat must be managed to provide appropriate nest sites for pollinators and a seasonal succession of suitable forage and host plants. Pollinators must be protected from herbicide and pesticide application (Kearns *et al.*, 1998) and soil disturbance must be prevented. This is particularly important considering the current global pollination crisis, i.e. the worldwide declines in pollinator populations caused by habitat fragmentation and other changes in land use, agriculture and grazing, pesticide and herbicide use and the introduction of non-native species (Kearns *et al.*, 1998).
- 3.7. Translocation of Red Data species is an unacceptable conservation measure since the translocated species may have undesirable ecological effects. For

example, alterations to habitat by translocated species may be harmful to other species and translocations may lead to transmission of pathogens or parasites (Hodder & Bullock, 1997). Translocation may result in rapid changes in the species itself (Conant, 1988). Translocations are expensive and rarely successful (Griffith *et al.*, 1989). Success entails not only survival of the translocated individuals but also establishment of a self-sustaining, viable population able to reproduce and adapt to changing environmental conditions (Milton *et al.*, 1999). Adequate research into habitat requirements and availability is essential as well as good integration with habitat management (Hodder & Bullock, 1997).

- 3.8. Rural parts of the province should be protected from insensitive developments and urban sprawl/encroachment should be discouraged. Policy guiding developments should therefore be less lenient in rural areas. In terms of this policy, urban areas are those areas contained within the urban edge defined in the "Gauteng Spatial Development Framework, Phase III", dated July 1999 and prepared for the Gauteng Department of Development Planning and Local Government. Although problems are associated with this urban edge (Bryan McCourt, pers. comm.), it is a useful guideline until such time as the urban edge has been clarified.
- 3.9. Red Data plant species historically recorded on a site, but not located during searches within species flowering seasons (Table 3) may be dormant (as a seed bank or subterranean structures such as bulbs/tubers/etc.) due to unfavourable environmental conditions. A species would only be assumed locally extinct when surveys over a time frame appropriate to the taxon's life cycle and growth form have failed to record an individual (IUCN, 2000). Many of the species in Gauteng would exhibit some type of dormancy as grassland is characterized by disturbance events such as fire, frost, grazing and drought. Using Raunkiaer's classification of life forms as a basis (Crawley, 1986), herbs, grasses and geophytes could generally be grouped as those species exhibiting dormancy or becoming inconspicuous during unfavourable conditions, while trees and shrubs are conspicuous if they are present (Table 3).
- 3.10. Suitable habitat (Table 3) adjacent to known populations of Red Data plant species has a high probability of being colonized.
- 3.11. In order to protect a plant population that occurs in a fragmented landscape from edge effects, it is necessary to protect it with a buffer zone that extends from the edge of the population (see section 4 of this document).
- 3.12. The transformation of natural vegetation to crops is considered as permanent as urbanization and may cause the extinction of Red Data plant populations and their pollinators. As such, the conversion of natural land to crops must be considered for authorization by this Department (listed activity 2(d), EIA regulations).

**Table 3.** A description of suitable habitat for Gauteng Red Data plant species. \*\*Indicates species that are inconspicuous during unfavourable environmental conditions. Those species not marked with \*\* are considered conspicuous outside of their flowering season.

SPECIES	FLOWERING SEASON	SUITABLE HABITAT
<i>Agrostis eriantha</i> var. <i>planifolia</i> **	December	Plants grow in typical bankenveld grassveld on flat or undulating plains. The grass grows in amongst other grass species often in full sunlight.
<i>Aloe peglerae</i>	July-August	Rocky places, often on gravelly quartzite, confined mainly to the Magaliesberg range, usually on the northern slopes and summit; scanty grassland, very little soil.
<i>Brachystelma discoideum</i> **	November	Savanna in gravelly sandy soil.
<i>Ceropegia decidua</i> subsp. <i>pretoriensis</i> **	December-April	Direct sunshine or shaded situations, rocky outcrops of the quartzitic Magaliesberg mountain series, in pockets of soil among rocks, in shade of shrubs and low trees, can be seen twining around grass spikes.
<i>Cineraria longipes</i> **	March-May	Koppies to the south of Johannesburg, amongst rocks and along seep lines in association with <i>Pteridium</i>
<i>Cleome conrathii</i> **	May	On stony slopes, usually on sandy soil, open to closed deciduous woodland, quartzites, red sandy soil, all aspects, 1515m.
<i>Cucumis humifructus</i> **	January & April	Woodland and grassland, on deep sand.
<i>Delosperma davyi</i>	August-March	On dolomite rocks at the edge of dense, shady scrub above river.
<i>Delosperma framesii</i>	August-March	Unknown.
<i>Delosperma gautengense</i>	August-March	Among rocks of Magaliesberg quartzite in grassland in transition to sour grassveld.
<i>Delosperma knox-daviesii</i>	August-March	Unknown.
<i>Delosperma leendertziae</i>	August-March	Rocky ridges.
<i>Delosperma macellum</i>	August-March	In loose gravel in open places near trees
<i>Delosperma purpureum</i>	August-March	Quartzite slopes: S aspect, usually on steep dipping rock strata forming slabs/sheets; skeletal soil associated with "sheet rock mat formation" typified by the sedge <i>Coleochloa setifera</i> .
<i>Delosperma vogtsii</i>	August-March	On rather steep south facing slopes of quartzite in mountain grassveld.
<i>Dicoma pretoriensis</i>	April	Hillsides.
<i>Encephalartos middelburgensis</i>	Unknown	Open and grassy with rather sparse bush and tree cover in sheltered valleys, steep rocky slopes
<i>Eulophia coddii</i> **	Early December	Steep hillsides on soil derived from sandstone, grassland or mixed bush.
<i>Eulophia leachii</i> **	December-January	Bushveld on stony, black and heavy soils.
<i>Frithia humilis</i> **	December-February	Sandy flat areas associated with rough rocky outcrops.
<i>Frithia pulchra</i> **	December-January	Shallow soil pockets between small, gravelly quartzite stones on large flat slabs of rock. On summits and top of Magaliesberg.
<i>Habenaria mossii</i> **	March-April	Open grassland on dolomite or in black sandy soil.
<i>Harveya anisodonta</i> **	December	Moist/damp grassland.

Table 3. continued

<i>Holothrix micrantha</i> **	October	Terrestrial on grassy cliffs, recorded from 1500 to 1800 m.
<i>Holothrix randii</i> **	September-January	Grassy slopes & rocky ledges.
<i>Khadia beswickii</i>	October-March	Open areas on shallow surfaces above rocks in grassland.
<i>Lepidium mossii</i> **	Unknown	Unknown.
<i>Lotononis adpressa</i> subsp. <i>leptantha</i> **	February-May	Open grassland.
<i>Melolobium subspicatum</i>	October-May	Grassland.
<i>Nerine gracilis</i> **	February-March	Undulating grasslands in damp, moist areas; the plants grow in full sun in damp depressions, near pans or on the edges of streams; grassland, riverbanks, vleis.
<i>Trachyandra erythrorrhiza</i> **	October	Marshy areas, grassland, usually in black turf marshes.

#### 4. Setting of buffer zone widths

A buffer zone is a collar of land that filters out inappropriate influences from surrounding activities (Shafer, 1999), also known as edge effects, including the effects of invasive plant and animal species, physical damage and soil compaction caused through trampling and harvesting, abiotic habitat alterations and pollution. Buffer zones can also provide more landscape needed for ecological processes such as fire (Shafer, 1999).

There is much debate on the width of the buffer zone required to protect a threatened plant population as evidenced by the range of opinions received (Table 4) in response to a request for recommendations on buffer zone widths that this office posted on the listserve of the Ecological Society of America, to which scientists from all over the world are subscribed. Using these responses (Table 4) and information from the literature (Table 5), it is proposed that the minimum buffer zone that should be set for a Red Data plant population in grassland, which is predominant in Gauteng, is 200m.

However, as described in principle 3.8, rural parts of the province should be given more protection from fragmentation, habitat transformation and urban sprawl. Thus, in order to encourage the preservation of larger habitat fragments and the maintenance of natural habitat connectivity, it is proposed that buffer zone widths are larger in rural areas. Furthermore, higher priority species should be allowed larger buffer zones in rural areas.

**Table 4.** Responses received from ecologists subscribing mainly to the listserv of the Ecological Society of America regarding buffer zone widths required for the protection of threatened plant populations.

<b>RESPONSE FROM</b>	<b>GUIDELINE INFORMATION</b>
Daniel Press, Associate Professor, Environmental Studies Department, University of Santa Cruz, USA	<ul style="list-style-type: none"> <li>No widely applicable formulas for buffer zones; varies from species to species and case to case.</li> </ul>
William Null, Wetlands Biologist, Washington State Department of Transportation, USA	<ul style="list-style-type: none"> <li>No known established widths for threatened plant populations.</li> <li>Wetland buffer zones recommended in USA range from 8m to 530m.</li> <li>Riparian buffer zones recommended in USA range from 3.5m to 305m.</li> <li>Buffer zones for endangered/threatened species recommended at 50m by Ontario Ministry of Natural Resources.</li> <li>Buffer zone needs of fish and wildlife range between 9m (for muskrat feeding and denning) to 183m (for some bird species)</li> </ul>
David Le Maitre, Environmentek CSIR, South Africa	<ul style="list-style-type: none"> <li>Depends on ecological processes that need to be maintained.</li> </ul>
David Inouye, ECOLOG Listserv moderator	<ul style="list-style-type: none"> <li>The conservation of pollinator species must be considered</li> </ul>
Carlo Popolizio, U.S. Fish and Wildlife Biologist, USA	<ul style="list-style-type: none"> <li>Reluctant to set standard buffer zones.</li> <li>Depends on autecology of species.</li> </ul>
Vincent Tepedino, USDA ARS Bee Biology & Systematics Lab, Utah State University, USA	<ul style="list-style-type: none"> <li>U.S. Fish and Wildlife Service opt for a rough (and rather liberal) buffer zone of 4.8km around plant populations based on maximum distance a bee may fly from nest-site to foraging area and based on distances that crop growers clear around some crops to prevent unwanted hybridizations with wild conspecifics or congeners—estimate not based on reliable data.</li> <li>Depends on habitat, type of pollinator, nest site availability, density of flowering plants, etc.</li> <li>Recommends a minimum buffer of 1.6km.</li> <li>Resources for pollinators must be provided, e.g. a variety of nesting sites (e.g. dead wood, south-facing semi-bare partially compacted soil, vertical embankments), a source of water and/or mud if none is readily available, alternative blooming plants, sources of leaf, resin, plant hairs, etc. Developers should be required to include open spaces for such “pollinator amenities”.</li> </ul>
Patricia Gordon-Reedy, Senior Botanist, Conservation Biology Institute, California, USA	<ul style="list-style-type: none"> <li>Is also looking for information on buffer requirements for endangered or threatened plant species.</li> </ul>
Karen Holl	<ul style="list-style-type: none"> <li>Maintenance of ecosystem processes must be ensured.</li> <li>Depends on what one is trying to buffer against.</li> </ul>
Anna Ballance, Environmentek CSIR, South Africa	<ul style="list-style-type: none"> <li>Ecosystem processes must be maintained.</li> </ul>

Table 4. continued

Ingrid Parker, Assistant Professor, University of California, USA	<ul style="list-style-type: none"> <li>• As long as pollinators are available, small patches of plants can be self-sustaining without a huge buffer, but patch itself must be completely protected.</li> <li>• Fence in the impact rather than fencing in the rare species.</li> </ul>
Dan Doak	<ul style="list-style-type: none"> <li>• Abiotic changes in forest can extend up to at least 200-300m from the edge.</li> <li>• Abiotic effects likely to decline much more rapidly in grassland.</li> <li>• A buffer zone of 200m in grassland seems reasonable since abiotic effects are going to be low at this distance, it is beyond the normal home range size of most pollinators, it is far enough to give some warning of important exotic invasions.</li> </ul>
Macolm Hodges, Stewardship Ecologist, the Nature Conservancy of Georgia	<ul style="list-style-type: none"> <li>• Buffer needs will vary according to the species.</li> <li>• Ecological processes need to be considered.</li> <li>• Fire may require a fairly large buffer while the maintenance of hydrological processes will require a smaller buffer.</li> </ul>

Table 5. Information obtained from the literature useful for setting buffer zone widths for the protection of threatened plant populations.

LITERATURE	GUIDELINE INFORMATION
Saunders & Hobbs, 1991	<ul style="list-style-type: none"> <li>• Edge effects in forests have been found to penetrate <b>250m</b> from the edge.</li> </ul>
<i>In Ecological Principles of Nature Conservation</i>	<ul style="list-style-type: none"> <li>• Forest-interior birds avoid the <b>50m</b> nearest to the forest edge.</li> <li>• Forest microclimate is affected up to <b>100m</b> into the forest stand.</li> <li>• Nest predation occurs up to <b>200m</b> from surrounding agricultural landscapes.</li> <li>• Light-loving butterflies can be found up to <b>300m</b> into a forest stand.</li> </ul>
Burger <i>et al.</i> , 2000	<ul style="list-style-type: none"> <li>• Airborne dust is predicted to exceed DEAT (Department of Environmental Affairs and Tourism) daily air quality guidelines up to <b>100m</b> to <b>300m</b> away from a road construction site.</li> <li>• Oxides of nitrogen are expected to exceed DEAT air quality guidelines up to <b>20m</b> to <b>250m</b> away from a road edge.</li> <li>• Carbon monoxide emissions are expected to exceed DEAT air quality guidelines up to <b>15m</b> to <b>30m</b> away from a road edge and up to <b>65m</b> using World Health Organization standards.</li> <li>• Diesel Particulate Matter is predicted to exceed World Health standards up to <b>65m</b> away from a road edge.</li> <li>• Lead is expected to exceed World Health standards up to <b>15m</b> to <b>28m</b> away from a road edge.</li> <li>• Significant impacts of particulate matter can be expected up to <b>20m</b> from a road edge.</li> </ul>
Carvalho & Vasconcelos, 1999	<ul style="list-style-type: none"> <li>• Ant community composition within <b>200m</b> from edges differs from that in forest interiors.</li> </ul>
Dawson, 1994	<ul style="list-style-type: none"> <li>• Plots of less than 0.2ha (an edge of <b>25m</b>) are considered entirely edge for some forest bird species.</li> <li>• Core species are outnumbered by edge species in forest patches in Germany of less than 2 to 5ha (edge of <b>75m</b> to <b>125m</b>) for carabid beetles and less than 10ha (edge of <b>175m</b>) for "wandering" spiders.</li> </ul>

Table 5. continued

Shafer, 1999	<ul style="list-style-type: none"> <li>• 95% of all human trampling and firewood gathering in suburban forest fragments has been recorded at <b>83m</b> and <b>130m</b> respectively.</li> <li>• Dry pollutants such as heavy metals and salt can extend <b>120m</b> from roads.</li> </ul>
Wood <i>et al.</i> 1994	<ul style="list-style-type: none"> <li>• With intensive management, ecological processes necessary for species survival can be maintained in natural areas as small as 6ha (edge 125m).</li> </ul>
Conservation Biology Institute, 2000	<ul style="list-style-type: none"> <li>• Alien plant species have been found to extend up to about <b>99m</b> into natural habitat from primary roads, secondary roads and backcountry trails.</li> <li>• Invasive plants have been found to be abundant within <b>198m</b> from forest edges and lower (but still elevated) levels of invasive plants <b>500m</b> from the edges.</li> <li>• In sclerophyll forests in Australia, most invasive species occur within <b>31m</b> from the edge.</li> <li>• Domestic dogs and cats (that may affect populations of seed dispersal agents such as rodents) are active within reserves at a distance of more than <b>99m</b> and within <b>30-61m</b> from the urban-wildland interface respectively.</li> <li>• Reduced recruitment in a herbaceous perennial plant species (<i>Trillium ovatum</i>) has been recorded within <b>61m</b> of a forest edge.</li> <li>• Activity of the invasive Argentine ants, which displace native ant species (crucial to the life history of many butterflies) that may act as pollinating or seed dispersing agents, has been found to be highest within <b>99m</b> of the nearest urban edge, whereas areas sampled beyond <b>198m</b> have been found to contain few or no Argentine ants. However, Argentine ants have also been found at distances of approximately <b>396-1000m</b> from the edge in other urban reserves in California.</li> <li>• A number of empirical studies have concluded that detrimental effects to biological resources can extend up to <b>46-183m</b> from the edge of the urban-wildland interface.</li> </ul>
Marrs <i>et al.</i> , 1993	<ul style="list-style-type: none"> <li>• Seedlings are sensitive to glyphosate spray drift up to <b>20m</b> downwind, some species show a small effect on seedling mortality between <b>20m</b> and <b>40m</b>.</li> </ul>

## 5. Policy guidelines

- If environmental assessment falls within an urban area, please follow flow chart on page 16.
- If environmental assessment falls outside an urban area, please follow flow chart on page 17.
- For Red Data plant policy rules referred to in flow charts on pages 16 and 17, see Table 6 on page 18.
- For priority profiles of Red Data plant species, see Table 2 on page 6.
- For information on the suitable habitat and flowering seasons of Red Data plant species, see Table 3 on page 9.
- For Figure 2, see page 21.
- For Figures 3 and 4, see page 22.

# ENVIRONMENTAL ASSESSMENT FALLS INSIDE AN URBAN AREA

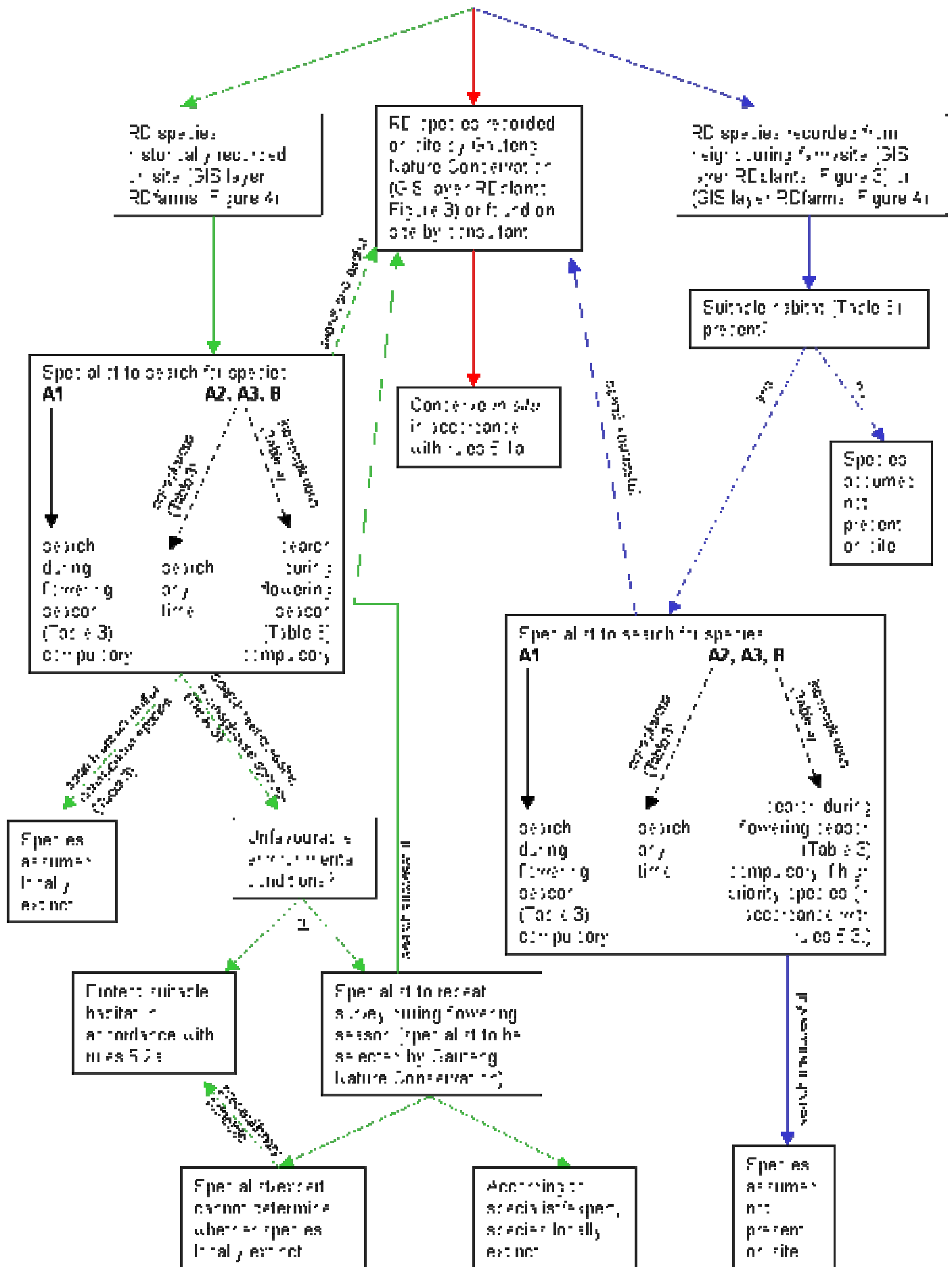




Table 6. Red Data policy rules applicable to flow charts on pages 16 and 17.

<b>Rules 5.1a.: Rules for <i>in situ</i> conservation of Red Data plant species – within urban areas</b>	
<b>A1</b>	<ul style="list-style-type: none"> <li>• Development to be fenced off. Mitigatory measures are required to prevent access of people and vehicles to area containing species; however, movement of all fauna must be allowed.</li> <li>• A buffer zone of at least 200m from the edge of the population must be allowed.</li> <li>• Connectivity of area containing species with adjacent natural urban open spaces must be ensured.</li> <li>• EIA/scoping report must contain specialist botanical report by a suitably qualified person (at least a BSc(Hons) in Plant Ecology / Botany) or equivalent as approved by department.</li> <li>• A management plan for the area containing species must be compiled by a suitably qualified ecologist (at least a BSc(Hons) in Plant Ecology) or equivalent as approved by department. The implementation of this management plan is the responsibility of the developer and must be stated as such in the record of decision. The management plan must: <ul style="list-style-type: none"> <li>❖ Ensure the persistence of the population</li> <li>❖ Include a monitoring programme</li> <li>❖ Facilitate/augment natural ecological processes</li> <li>❖ Provide for the habitat and life history needs of important pollinators</li> <li>❖ Minimize artificial edge effects (e.g. water runoff from developed areas &amp; application of chemicals)</li> <li>❖ Include an ongoing eradication programme for non-indigenous species</li> <li>❖ Result in a report back to DACEL on an annual basis</li> </ul> </li> <li>• Mitigatory measures are required to protect the population during construction.</li> <li>• The use of non-indigenous species in landscaping associated with the development must be prohibited.</li> <li>• Landscaping associated with development must include forage and host plants required by pollinators.</li> <li>• If the development is predicted to cause a decline in the population, the development may not be approved and alternative sites/ development options should be proposed.</li> <li>• Where there is a lack of information to predict the effect of the development on the population, the precautionary principle must be used and the development may not be approved and alternative sites/ development options should be proposed.</li> </ul>
<b>A2</b>	
<b>A3</b>	
<b>B</b>	
<b>Rules 5.1b.: Rules for <i>in situ</i> conservation of Red Data plant species – outside urban areas</b>	
<b>A1</b>	<ul style="list-style-type: none"> <li>• Buffer zone required (see below).</li> <li>• Mitigatory measures are required to prevent access of people and vehicles to area containing species; however, movement of all fauna must be allowed.</li> <li>• Development outside of buffer should be low impact; development structures may not be placed on any area of suitable Red Data habitat and should be clustered to retain as much undisturbed land as possible; <u>urban</u> development should <u>not</u> be permitted.</li> <li>• Connectivity with the landscape matrix (i.e. adjacent natural vegetation) must be ensured.</li> <li>• EIA/scoping report must contain specialist botanical report by a suitably qualified person (at least a BSc(Hons) in Plant Ecology / Botany or equivalent as approved by department).</li> <li>• A management plan must be compiled by a suitably qualified ecologist (at least a BSc(Hons) in Plant Ecology or equivalent as approved by department). The implementation of this management plan is the responsibility of the developer and must be stated as such in the record of</li> </ul>
<b>A2</b>	
<b>A3</b>	
<b>B</b>	

	<p>decision. The management plan must:</p> <ul style="list-style-type: none"> <li>❖ Ensure the persistence of the population</li> <li>❖ Include a monitoring programme</li> <li>❖ Facilitate/augment natural ecological processes</li> <li>❖ Provide for the habitat and life history needs of important pollinators</li> <li>❖ Minimize artificial edge effects (e.g. water runoff from developed areas &amp; application of chemicals)</li> <li>❖ Include an ongoing eradication programme for non-indigenous species</li> <li>❖ Result in a report back to DACEL on an annual basis</li> </ul> <ul style="list-style-type: none"> <li>• Mitigatory measures are required to protect the population during construction.</li> <li>• The use of non-indigenous species in landscaping associated with the development must be prohibited.</li> <li>• If the development is predicted to cause a decline in the population, the development may not be approved and alternative sites/ development options should be proposed.</li> <li>• Where there is a lack of information to predict the effect of the development on the population, the precautionary principle must be used and the development may not be approved and alternative sites / development options should be proposed.</li> </ul>
<b>A1</b>	<ul style="list-style-type: none"> <li>• A buffer zone of at least 600m from the edge of the population must be allowed.</li> </ul>
<b>A2</b>	<ul style="list-style-type: none"> <li>• A buffer zone of at least 500m from the edge of the population must be allowed.</li> </ul>
<b>A3</b>	<ul style="list-style-type: none"> <li>• A buffer zone of at least 400m from the edge of the population must be allowed.</li> </ul>
<b>B</b>	<ul style="list-style-type: none"> <li>• A buffer zone of at least 300m from the edge of the population must be allowed.</li> </ul>
<b>Rules 5.2a.: Rules for protection of suitable habitat (Table 3) – within urban areas</b>	
<b>A1</b>	<ul style="list-style-type: none"> <li>• Site must be mapped indicating location of suitable habitat (Table 3).</li> <li>• Development structures may not be placed on any area of suitable habitat (Table 3).</li> <li>• An area of suitable habitat (Table 3) and of sufficient size must be set aside and managed as an urban open space; connectivity of area with adjacent natural open spaces must be ensured; and a management plan must be compiled by a suitably qualified ecologist (at least a BSc(Hons) in Plant Ecology or equivalent as approved by department). The implementation of this management plan is the responsibility of the developer and must be stated as such in the record of decision. The management plan must: <ul style="list-style-type: none"> <li>❖ Facilitate/augment natural ecological processes</li> <li>❖ Provide for the habitat and life history needs of important pollinators</li> <li>❖ Minimize artificial edge effects (e.g. water runoff from developed areas &amp; application of chemicals)</li> <li>❖ Include an ongoing eradication programme for non-indigenous species</li> <li>❖ Result in a report back to DACEL on an annual basis</li> </ul> </li> <li>• The use of non-indigenous species in landscaping associated with the development must be prohibited.</li> </ul>
<b>A2</b>	<ul style="list-style-type: none"> <li>• If the species is not recorded from a conservation area (assigned a value of 1 for criterion F) <u>or</u> species is narrowly distributed in Gauteng (1 or 2 for criterion E) <u>or</u> narrowly distributed in the northern provinces (3 or less for criterion D), then apply rules as for A1 species.</li> <li>• If species does not comply with these conditions, then mitigate against impacts on suitable habitat (Table 3).</li> </ul>
<b>A3</b>	<ul style="list-style-type: none"> <li>• If the species is narrowly distributed in Gauteng (1 or 2 for criterion E) <u>and</u> narrowly distributed in the northern provinces (3 or less for criterion D), then apply rules as for A1 species.</li> </ul>

	<ul style="list-style-type: none"> <li>If species does not comply with these conditions, then mitigate against impacts on suitable habitat (Table 3).</li> </ul>
<b>B</b>	<ul style="list-style-type: none"> <li>If the species is not protected in a conservation area (assigned a value of 1 for criterion F) <u>and</u> the species is narrowly distributed in Gauteng (1 or 2 for criterion E) <u>and</u> narrowly distributed in the northern provinces (3 or less for criterion D), mitigate against impactson suitable habitat (Table 3).</li> </ul>
<b>Rules 5.2b.: Rules for protection of suitable habitat (Table 3) – outside urban areas</b>	
<b>A1</b>	<ul style="list-style-type: none"> <li>Site must be mapped indicating location of suitable habitat (Table 3).</li> </ul>
<b>A2</b>	<ul style="list-style-type: none"> <li>Development structures may not be placed on any area of suitable habitat (Table 3) and should be clustered to retain asmuch undisturbed land as possible.</li> <li>A management plan must be compiled by a suitably qualified ecologist (at least a BSc(Hons) in Plant Ecology or equivalent as approved by department). The implementation of this management plan is the responsibility of the developer and must be stated as such in the record of decision. The management plan must: <ul style="list-style-type: none"> <li>❖ Facilitate/augment natural ecological processes</li> <li>❖ Provide for the habitat and life history needs of important pollinators</li> <li>❖ Minimize artificial edge effects (e.g. water runoff from developed areas &amp; application of chemicals)</li> <li>❖ Include an ongoing eradication programme for non-indigenous species</li> <li>❖ Result in a report back to DACEL on an annual basis</li> </ul> </li> <li>Urban development should not be permitted.</li> <li>The use of non-indigenous species in landscaping associated with the development must be prohibited.</li> <li>Connectivity with the landscape matrix (i.e. adjacent natural vegetation) must be ensured.</li> </ul>
<b>A3</b>	<ul style="list-style-type: none"> <li>If the species is narrowly distributed in Gauteng (1 or 2 for criterion E) <u>or</u> narrowly distributed in the northern provinces (3 or less for criterion D), then apply rules as for A1/A2 species.</li> <li>If species does not comply with these conditions, then mitigate against impacts on suitable habitat (Table 3).</li> </ul>
<b>B</b>	<ul style="list-style-type: none"> <li>If the species is not protected in a conservation area (assigned a value of 1 for criterion F) <u>and</u> the species is narrowly distributed in Gauteng (1 or 2 for criterion E) <u>and</u> narrowly distributed in the northern provinces (3 or less for criterion D), then apply rules as for A1/A2 species.</li> <li>If species does not comply with these conditions, then mitigate against impacts on suitable habitat (Table 3).</li> </ul>
<b>Rules 5.3.: Rules for searching neighbouring sites</b>	
<b>A1</b>	<ul style="list-style-type: none"> <li>If the species flowering time coincides with the environmental assessment, suitable habitat (Table 3) must be searched.</li> </ul>
<b>A2</b>	
<b>A3</b>	
<b>B</b>	
<b>A2</b>	<ul style="list-style-type: none"> <li>If the species is narrowly distributed in Gauteng (1 or 2 for criterion E) <u>or</u> narrowly distributed in the northern provinces (3 or less for criterion D), suitable habitat must be searched during the flowering season (Table 3).</li> </ul>
<b>A3</b>	<ul style="list-style-type: none"> <li>If the species is narrowly distributed in the northern provinces (3 or less for criterion D), suitable habitat must be searched during the flowering season (Table 3).</li> </ul>
<b>B</b>	<ul style="list-style-type: none"> <li>If the species is narrowly distributed in Gauteng (1 or 2 for criterion E) <u>and</u> narrowly distributed in the northern provinces (3 or lessfor criterion D), suitable habitat must be searched during the flowering season (Table 3).</li> </ul>

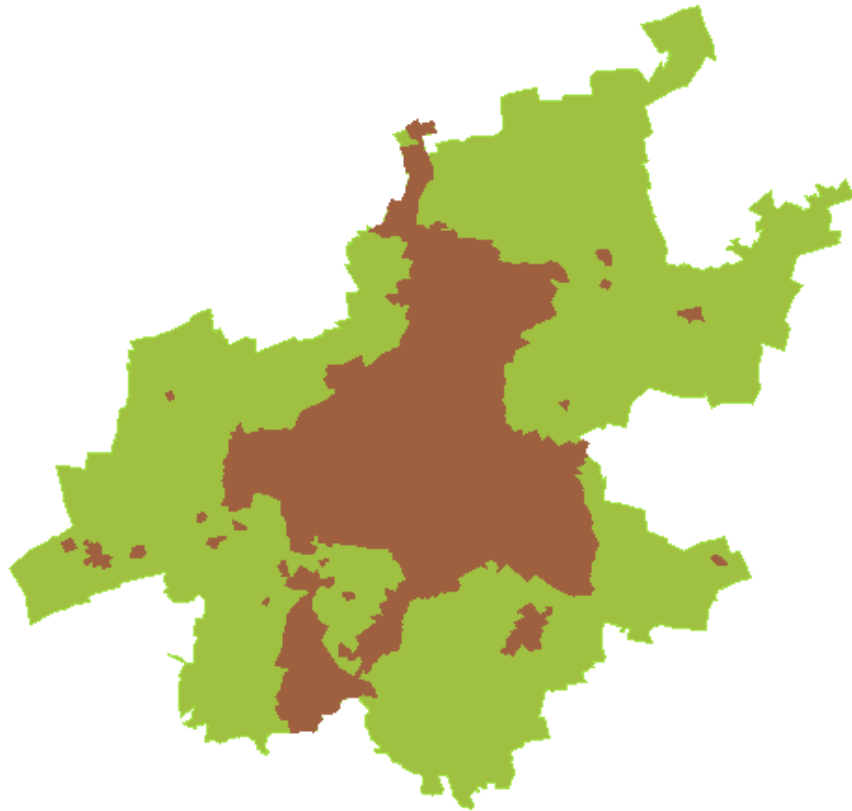


Figure 2: Urban (brown) and rural areas (green) of Gauteng as defined in the Gauteng Spatial Development Framework, Phase III (July 1999), prepared for the Gauteng Department of Development Planning and Local Government..

**CONFIDENTIAL**  
**SENSITIVE INFORMATION**

Figure 3. Sites where Red Data plant species have been located by the Gauteng Directorate of Nature Conservation since 1997. Data contained in GIS file RDplants.

**CONFIDENTIAL**  
**SENSITIVE INFORMATION**

Figure 4. Farms on which Red Data plant species have been historically recorded (mainly according to herbarium records) but their current presence have not yet been confirmed by the Gauteng Directorate of Nature Conservation. Data contained in GIS file RDfarms.

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