PROCEEDINGS

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Note: Detailed location data of indigenous orchid and endangered species sightings presented at the Conference have been removed from the papers in these Proceedings as a precautionary measure. Should you require access to this information please contact the respective speakers.

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List of Speakers

Bill Mincher

Bill Mincher enjoys the outdoors and served many years with FOSAF the Federation of Southern African Fly Fishers. During this time he was instrumental in creating the successful Yellowfish Working Group (YWG) which is cited as one of the greatest success stories in angler-driven conservation ever achieved in South Africa. Together with enthusiasts from the three Gauteng Orchid Societies of Witwatersrand Orchid Society, North Gauteng Orchid Society and East Rand Orchid Society they formed Wild Orchids Southern Africa (WOSA), based on the principals of the YWG. WOSA is now going National with support from the other regions gaining momentum.

Gerrit van Ede

Gerrit was born in the Netherlands and came to South Africa with his parents in 1949. He obtained the degrees BSc (Eng) Electrical and MBA from the University of Pretoria and started growing orchids in 1962 focusing on African and specifically South Africa orchids as well as Paphiopedilums. Gerrit is a past SAOC President and is an accredited South African Orchid Council Judge. In addition he edited the Orchid Council publication “Orchids South Africa” for a number of years together with his wife Dorette. Gerrit has a keen interest in conservation and has been visiting Verloren Valei for the last 26 years. The new field guide “Flowers of Verloren Valei” is the culmination of years of studying and photographing the orchids in the reserve. Recently Gerrit was involved in the successful hosting of the 21st World Orchid Conference in Johannesburg as chairman of the organising committee and Conference Chairman.

Andrew Hankey

Andrew is a Botanical Horticulturist and works for the South African National Biodiversity Institute at the Walter Sisulu National Botanical Garden where he is the Assistant Curator / Specialist Horticulturist. His principal duty is the overall co-ordination of entire Botanical Garden Operations and all that this entails. Andrew is presently doing his Master’s Degree in Nature Conservation and his thesis title is Ex-situ Plant Conservation. Andrew’s interest in orchids started in his school years when he joined WOS and spent weekends working at Doug & Shane’s nursery Orchid Specifics. Later on he decided he wanted to further his knowledge and joined the SAOC’s Learner Judges programme. Unfortunately the judges discovered that he was colour blind and suggested he take up welding instead.

Prof Craig Peter

Craig is Associate Professor at the Department of Botany at Rhodes University. He is interested in a broad range of ecological and evolutionary questions associated with plant pollination biology. His PhD. research examines the pollinator driven radiation in the orchid genus *Eulophia*. He is also interested in floral mimicry and deception in non-rewarding orchids, as well as the floral and reproductive biology of the Asclepiadoideae. He has published numerous papers related to pollination biology and recently stated OrchidMAP in association with the Virtual Museum at the University of Cape Town. Craig is currently undertaking the pollination biology studies on the critically endangered orchid *Brachycorythis conica* subsp. *transvaalensis*.

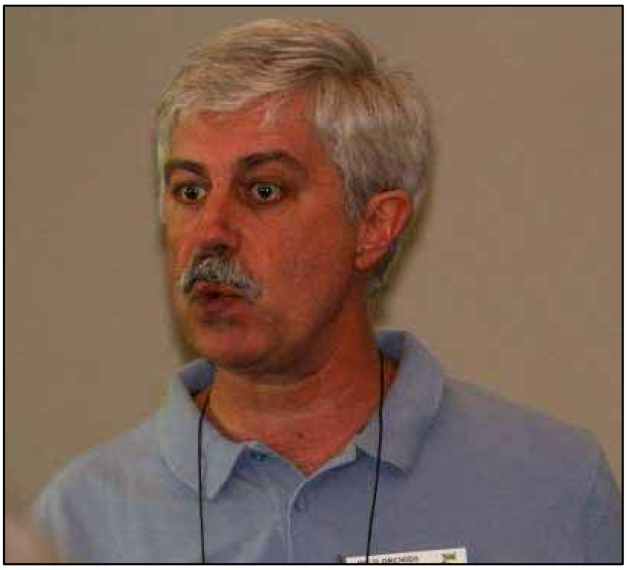
Karsten Wodrich

Karsten has been growing orchids since he was 14 with a particular interest in South African terrestrial species. Whilst attending university for a degree in Mechanical Engineering in Stellenbosch he published the book 'Growing South African Indigenous Orchids' in 1996. During that time Karsten also served on the board of Directors with the South African Orchid Council.

After leaving University Karsten started both a family and a business and orchids had to take a back seat. Now that both those undertakings have become firmly established he has returned to his love of orchids and is concentrating on propagating indigenous species and hybrids from seed. He is currently Vice-Chairman of WOSA and a member of the Witwatersrand Orchid Society.

Gabriël Joubert

Gabriël Joubert grew up in a Pastoral home traveling all over South Africa learning diverse customs of the different ethnic cultures in South Africa. His love for nature helped him tremendously as the different cultural groups were eager to teach their traits to a keenly interested young boy. Some of Gabriël's other hobbies include amateur radio, flower arranging, photography and studying biblical eschatology. Gabriël's grandmothers flower knowledge stuck with him and awakened his interest in growing orchids. One of Gabriël's greatest hobby achievement happened at the 21st World Orchid Conference where he won Overall Silver medal for his orchid photography. His keen knowledge and the will to learn are sure to take him further in future.



Dr Benny Beytebier

Benny Bytebier is a plant taxonomist and currently the curator of the Bews Herbarium at the University of KwaZulu-Natal in Pietermaritzburg, South Africa. He hails from Belgium and has a biology degree from the Free University Brussels, but has spent the last twenty six years working and living in Africa. He was employed at the University of Nairobi and later at the East African Herbarium of the National Museums of Kenya, before moving to Stellenbosch in South Africa, where he did a PhD on the large African orchid genus *Disa*. His main interest is systematics, evolution, biogeography and conservation of African orchids. He has done fieldwork in many countries in central, east and southern Africa. He is the Editor-in-Chief of the Journal of East African Natural History.

Lourens Grobler

Lourens is an accountant by profession. His orchid interest started at 10 with him participating in growing orchids with his father. He now co-owns Afri Orchids, a nursery specialising in species from around the world. Together with Douglas McMurtry, Shane Burns and his wife Jolisa he is co-author of the book 'Guide to the Orchids of Northern South Africa and Swaziland' published in 2008, contributing many of the spectacular photographs to the guide.

He has been an accredited South African Orchid Council Judge since 1998. He recently chaired the Judging Committee of the 21st World Orchid Conference held in Johannesburg. He has done presentations at three World Orchid Conferences.

Patrick Mannens

Patrick is a member of the Flemish Orchid Society and is co-webmaster of that Society. In his non-orchid life, he is an Expert Inspector of the Belgian Nuclear Power Plants. Patrick has been interested in European indigenous orchids since he was about 18.

Patrick's talk is entitled A General view on European Orchids and Conservation, with particular regard to the attitude of the Flemish Orchid Society and Flemish nature conservation associations regarding to orchid conservation.

Nicolaas (Nic) Venter

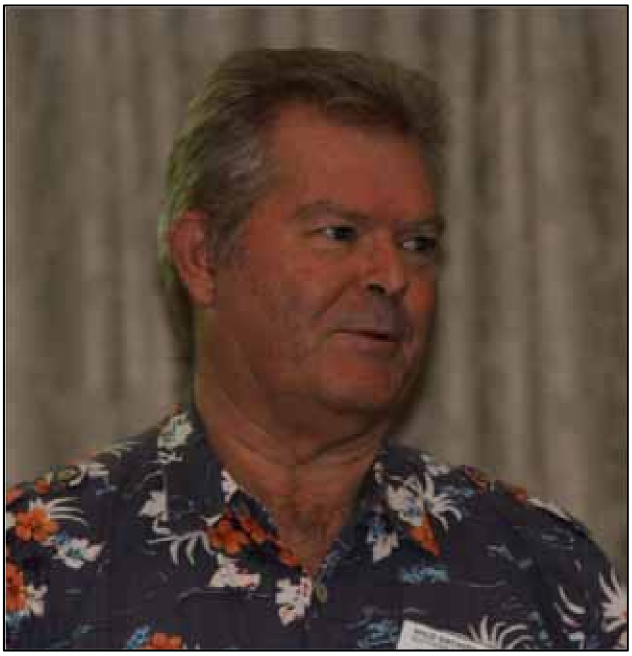
Nic works at the University of the Witwatersrand where he is the Manager of the Wits Insectary and Quarantine Research Facility. He has always had an interest in plants culminating with his Master's Thesis on "Drought responses of selected C4 photosynthetic NADP-Me and NAD-Me Panicoideae and Aristidoideae grasses". One of his research interests is Pollination Biology and for several years he has been working with Dr Craig Peter on investigating the pollination biology of the *Mystacidium* genus. He has also worked on the pollination biology of several other orchid species.

Dr Peter Ashton

Dr Peter Ashton retired from the CSIR after over 36 years working as an Aquatic Ecologist specialising in the impacts and implications of water quality issues on aquatic biodiversity in African river and lake ecosystems. During this time his career has enabled him to visit 42 of the 48 mainland African countries. His interests in orchids, and particularly central and southern African epiphytic orchids and their conservation, started when he was a teenager in Zambia and has continued to the present day. He has an extensive collection of plants and is continually looking for rare and new species.

Kay Montgomery (Workshop Chairperson)

Kay Montgomery has a Masters degree from the University of the Witwatersrand and spent three years as a lecturer in the Department of Geography and Environmental Sciences - before leaving the academic world to pursue a career in journalism. Her association with Independent Newspapers began in 1990 and she has written widely about orchids in her weekly columns for the Weekend Argus (Cape Town) and Saturday Star (Johannesburg). During a career as a magazine editor with Primedia's publishing division, she oversaw dozens of orchid features published in SA Gardening, Tuin Paleis and Environmental Management (EM).Kay has served on the board of the SA National Biodiversity Institute (SANBI) and remains on the board of the SA Nursery Association (SANA) and SA Green Industries Council (SAGIC).



Allan Abel (Workshop Chairperson)

Allan started growing orchids over 30 years ago whilst living in Zimbabwe and he joined the Witwatersrand Orchid Society after moving to Johannesburg in 1989. Allan grows a very varied collection of orchids and has a keen interest in the orchids of Africa, and South Africa in particular. For the last 20 years Allan has accompanied Gerrit van Ede on his visits to Verloren Valei Nature Reserve, cataloguing the orchids and their habitats. He regularly gives talks to orchid societies, garden clubs and other interested organisations on growing orchids. Allan also edits the Witwatersrand Orchid Society newsletter and is extremely knowledgeable with regards to orchids in general which always enriches the discussion around the plant table at society meetings.

Rear left to right: Lourens Grobler (Speaker), Jane Kratz (Assistant Organiser), Kay Montgomery (Workshop Chairperson), Nic Venter (Speaker), Marinus Kort (Audio-visual), Andrew Hankey (Speaker), Peter Ashton (Speaker), Craig Peter (Speaker), Patrick Mannens (Speaker)

Front left to right: Karsten Wodrich (Speaker), Gerrit van Ede (Organiser & Speaker), Bill Mincher (Organiser & Speaker), Allan Abel (Workshop Chairperson).

Not represented: Benny Bytebier (Speaker), Gabriël Joubert (Speaker)

Opening address

Bill Mincher

Chairman, Wild Orchid Southern Africa

WELCOME

'THE ROLE OF CIVIL SOCIETY IN ORCHID CONSERVATION' is the theme of this first WOSA conference.

I will not spend valuable time on telling you who WOSA is and what it stands for, as this has been done in the promotional material leading up to the conference. If you visit our website, wildorchids.co.za you will learn all you need to know about WOSA.
The site is still under construction and we have three of the provinces, Gauteng, Mpumalanga and the Western Cape featured with an introduction and list of species. The Gallery has photos of 159 species. We need help from the other Provinces to create their sites and we need help from whoever can supply photos of those species not yet pictured to complete the Gallery. Duncan McFarlane who has done most of the photography can be contacted at dmcfarlane@iburst.co.za for specifications. The site is popular and has had 8400 hits in a little over 18 months. You can also access our popular Facebook page by clicking on the appropriate icon on the homepage.

Now down to the affairs of state.

South Africa is a young democracy and can boast some of the best legislation in the world. We have a model Constitution, supported by a Constitutional Court which is kept very busy enforcing our rights in terms of the Constitution.

We also have perhaps the best Water Act in the world, yet our rivers are consistently being polluted by the discharge of raw sewage into rivers by Local Municipalities. Central Government is reluctant to prosecute offenders for political popularity reasons.

This is where Civil Society plays an important role in keeping up the pressure to address many important issues.

I was involved in establishing the Yellowfish Working Group in 1996, which is cited as one of the greatest success stories in angler-driven conservation ever achieved in South Africa.

The guiding principle was 'Add value to yellowfish so that people would care, and yellowfish would become worthy of protection'. This was achieved, and now 20 years later the YWG Conference continues to hold an annual ' Indaba ' where researchers can present papers and the way forward can be jointly planned and implemented. There are, incidentally, 9 yellowfish species in completely separate river systems around the country.

I remember that the largest single threat in popularising yellowfish was the fear that farmers and landowners from all over the country would want to stock the Largemouth yellowfish, the biggest and best, in rivers and dams where they did not belong. This potential tragedy, which was averted by the YWG, its members, and the public at large, voluntarily promoted 'no movement' of yellowfish from their natural habitat. It was accepted that it is far better to fish for each species in its separate natural home waters, rather than a bunch of mongrels in all waters.
This success was achieved, where the law on its own will most surely have failed to achieve this voluntary outcome.

Another example of the power of civil society.

Now onto orchids.
Why should the yellowfish success not work for orchids?

As my interest in orchids grew I realized that precious little had been done for the conservation of indigenous orchids in South Africa. Most South Africans were unaware that we have nearly 500 species, or that South Africa had any orchids at all for that matter.

Why?

The authorities created stringent legislation which listed all indigenous orchids as protected species. You are not allowed to pick flowers, remove pollen, collect seed or remove plants without a permit. To obtain this permit you need the agreement of the landowner, and you would need to motivate the application, with reasons such as for scientific study etc. You would also need a permit to transport them from source to destination at specific times and in specific quantities. Should you cross a Provincial border or two you would also need permits from each Province.

It proved to be extremely difficult to obtain permits and the question is if this is the reason for a lack of interest in orchids by the public.

I am sure that in the early days this strict control was a very successful way of conserving and protecting orchids in their natural habitat.

Perhaps this is one of the most famous pictures taken 15 years ago near White River in Mpumalanga by Angela van Rooyen, a past President of the SAOC. The picture appears regularly in print. Angela remembers that the *Eulophia angolensis* were prolific and they would be sold (illegally) as cut flowers on the side of the road. This site is still undeveloped today but is in close proximity to a residential township. You just don't see these large stands anymore.

Figure 1.1. Large colony of *Eulophia angolensis* in its native habitat.

Talking to Bes Gous in the Cape who has been involved with orchids for many years, she also talks about the disappearance of orchids over the years. I am sure there are many more laments of what it was like in yesteryear.

In point of fact what we have been witnessing is the loss of habitat and this is the greatest threat to all species of animals, birds and plants.
If this trend is taken to its logical conclusion over time orchids will only exist in protected areas. And even protected areas are under the challenges of land claims and poor administration.

You may well ask, 'What has the restrictive orchid legislation achieved?'

Has it increased the status of orchids or have orchids become a non-entity, and slipped off the radar screen?
How often are orchids ignored in Environmental Impact Assessments?
Why are orchid specialists, known to us, not consulted during the Environmental Impact Assessment process?

Orchids are under severe threat through land use changes, and species are regularly becoming extinct, due to the rapid development of industry, housing, agriculture, farming and in particular - strip coal mining. On your way to this conference you will have witnessed the large tracts of arable land laid to waste by coal mining.
In land transformation over past years, multitudes of orchids have ended up under the plough or the bulldozer and are not permitted to be translocated.

Has this been a good idea, and what has been achieved, and should we not discuss the creation of Botanical Reserves where non-threatened species can be translocated and in so doing we will increase our knowledge base. All of our actions will only be done through the provincial permitting system.

Andrew Hankey will deliver a paper later today on the subject of translocation. The recommendation is that species on the Orange, Red and Threatened or Protected Species (TOPS) lists should not be translocated. This has our full support.

We are governed by Central Government National Environmental Regulations, the power of which is delegated to the Provinces for implementation, and modified to suite regional requirements. This is why transporting orchids across three Provinces requires three sets of permits and is a complex system.

We have the Threatened or Protected Species National Regulations and Provincial orange and red data lists, controlling endangered species. By the time plants are placed on these lists, is it not almost too late to save the species, and is there an action plan to address the situation, or is the listing almost as good as an obituary?
I reiterate that very little attention has been paid to orchids in the past. Historical records for *Brachycorythis conica* subsp. *transvaalensis*, for instance, indicate it was first

described in 1918, nearly 100 years ago. Over all this time the orchid has only been recorded a mere 16 times. Not very impressive, and now we are fighting to save the last viable colony of the species at Proteadal, Mogale City, Gauteng.

Now we have it, now we don't, all in a flash of 100 years.

This is further evidence of the neglect of orchids in the past.

Craig Peter's Orchid Map presentation will provide essential data in the future to assess current distribution of orchids. Another example of the importance of civil society to modern science.

We must create an informed and concerned public who value and treasure our orchids if they are going to survive for future generations to witness and enjoy.

Back to the *Brachycorythis* Project - when Andrew Hankey rediscovered the last viable population of *Brachycorythis conica* subs. *transvaalensis*, he was successful, after a lot of effort, in escalating the conservation status from Endangered to Critically Endangered which made protection mandatory. The Proteadal Conservation Association is now taking legal steps to appeal the Record of Decision approving the development to get the authorities to observe existing legislation and save this species from extinction.

I repeat the biggest challenge that WOSA faces is that our knowledge base is almost non-existent when it comes to both in-situ conservation and ex-situ propagation. Both need to be urgently addressed and managed when you are down to the last viable population of a species. A start is being made with research being carried out on the *Brachycorythis conica* and will be under discussion at the Workshop this afternoon.

We look forward to Benny Bytebier's presentation on the *Disa barbata* Project where propagation and rehabilitation was carried out on the Cape Flats.

We have a rather small group of wild orchid specialists in South Africa. I am not aware of them being commissioned by an Environmental Impact Assessment consultant to advise them on the existence of orchids on a proposed development site. What we frequently do find is that no mention is made of orchids and other critically endangered plants in Environmental Impact Assessments. You will see what happened at Burgersfort later this morning, regarding the involvement of concerned orchidists in achieving a positive result.

We have made contact with the International Association for Impact Assessment (IAIA) and will hold discussions with them on cooperation in the near future.
In our workshop tomorrow morning we will be discussing the formation of a WOSA Specialist Consultant Orchid group to assist with orchid surveys on Environmental Impact Assessment sites.

WOSA will need to develop best practice protocols for all species through trial and error with the lessons learned from rescued plants, private collections and scientific studies by the Universities and the possible creation of orchid botanical reserves.
We have a good relationship with Dr. Noushka Reiter from Melbourne Australia who has been doing research and re-introduction of ground orchids successfully for many years.

It is important for me to state that WOSAs main objective is in-situ conservation and we should actively promote the formation of additional protected areas for orchids.

The modus operandi of WOSA is to create Chapters, made up of one or more concerned persons who will become our eyes and ears all over the country. They will identify populations of orchids and will register them with WOSA, (to place on the central register) and they will keep a watching brief on those sites in case of development, in which case they will register as an IAP with the developer. Chapters will be able to advise Practitioners handling the Environmental Impact Assessment process, of the existence of orchids on site and ensure that the appropriate action is taken.

We were hoping to get a representative from each of the South African Orchid Council Societies to the Conference, so that WOSA activities can be initiated in other regions. Thank you to those Societies that are represented here today and I hope that you will be suitably impressed by the end of the Conference and will become part of this important initiative.
We want everyone to know that there is a new kid on the block who is concerned about the conservation of indigenous orchids.

In-Situ Conservation of Orchids: Management and problems of a plant biodiversity reserve.

Gerrit van Ede

Introduction

South Africa as well as the rest of Africa is today facing a major struggle with poaching. Rhino is number one on the list followed by the Elephant. This takes Government as well as private sector funding away from other conservation matters.

In this paper I will discuss plant conservation across three areas. First and most important is Verloren Valei, a reserve situated 17km north of Dullstroom that I have been visiting on a regular basis since 1989.

Figure 2.1. *Satyrium hallackii* subsp. *ocellatum* flowering profusely in the Verloren Valei Nature Reserve.

Figure 2.2. Not only orchids but many other species such as *Agapanthus inapertus* are abundant in the Reserve.

Secondly a nature reserve called Lekgalameetse situated in the Limpopo Province about 75km south of Tzaneen in the Wolkberg.

Figure 2.3. In contrast to Verloren Valei the Lekgalameetse Nature Reserve contains dense indigenous forest, waterfalls and steep mountain slopes that are rich in epiphytic orchid species.

Finally I will discuss the conservation on my private smallholding east of Pretoria.

Figure 2.4. My own smallholding has its own share of terrestrial orchid species such as *Habenaria barbertoni*.

Reserve Management

The first and most important factor required for the management of any Nature Reserve is information. No informed decisions can be taken and no successful management plan can be drawn up without information pertaining to a reserve. This information includes general information pertaining to the size, altitude, soil types and vegetation. Table 2.1 is a comparison of this information for all three areas.

The next factor to look at in detail is the vegetation characteristics as indicated in table 2.2.

Area	Altitude (m)	Size (ha)	Soil	Soil pH	Vegetation
Verloren Valei	2050 2290	5893	Dolerite and Quartzite	7	High Altitude Sour Grassland + Wetlands
Lekgalameetse	780 1750	18718	Quartzite and sediment	?	Afro-montane Grassland + Forests
Small Holding	1600	4,77	Dolerite	5,7	Sour Grassland in Bankenveld

Table 2.1. General Information on the areas discussed.

Area	Grass	Trees		Geophytes	Orchids		Invasive
		Evergreen	Deciduous		Epiphytes	Terrestrial	
Verloren Valei	Sour	No	A Few	Yes	No	Yes	Some
Lekgalameetse	Sweet & Sour	Yes	Yes	Yes	Yes	Yes	A lot
Small Holding	Sour	Yes	Yes	Yes	No	Yes	A lot

Table 2.2. Vegetation.

Area	Mammals	Birds	Amphibians	Reptiles	Fish	Plants			
						Trees	Geophytes	Orchids	Other
Verloren Valei	Yes	Yes	No	No	No	No	Yes	Yes	Yes
Lekgalameetse	No	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
Small Holding	No	No	No	No	No	No	No	Yes	No

Table 2.3. Rare or Endangered species.

Biodiversity for both plants and animals is another important factor and with that comes the question if there are any rare or endangered species of animals or plants present in the reserve. Table 2.3 answers these questions for the three areas under discussion.

Management Plan

This information allows a management plan to be drawn up and decisions can be taken if the reserve is declared an open or a closed reserve.

Figure 2.5. The wattled crane is an endangered species found on Verloren Valei.

Looking at Verloren Valei the wattled crane has been identified as a key species that is currently endangered. It breeds in winter when it lays up to two eggs in nests built in the open in marshy areas. Only one chick normally survives. The birds are easily disturbed by human interaction in the reserve. It was thus decided that Verloren Valei should be declared a closed reserve with restricted access.

The Cape Parrot is found in the Lekgalameetse Nature Reserve. It is also endangered but has completely different breeding habits to the Wattled Crane. The parrots live in the indigenous forests and breed in tree hollows. They occur in small flocks and feed on fruit and berries. They are also not frightened by people. As a result of these characteristics it was not deemed critical to restrict access to the reserve and Lekgalameetse was thus proclaimed an open reserve.

Resources

Once the management plan for the reserve has been drawn up, the resources to manage the reserve need to be identified. The first resource any reserve requires is financial resources. Second are human resources that include reserve staff and management.

To generate and income an open reserve such as Lekgalameetse is partially dependent on state funding but can also generate and income stream from visitors. The Capital expenditure for an open reserve is high as a result of the fact that visitors need to be managed in terms of items such as collecting entrance fees, providing ablution facilities, possible accommodation etc.

For a closed reserve the visitor income stream is not available and hence the reserve becomes completely state dependent for funding. The capital expenditure is, however, much lower. Verloren Valei falls into the state funded category.

From a human resources point of view an open reserve serves two functions. That is firstly the function of a reserve and secondly one of tourism and possibly also accommodation. Both these functions require and independent and separate set of personnel. Personnel assigned to the reserve should not be expected to cater for the tourists as well.

The closed reserve focusses solely on the reserve function and hence is able to operate with only one type of personnel.

I'd like to share with you my personal experience and special tie to the Lekgalameetse Reserve which underpins the importance of the individuals that are associated with these reserves.

I originally came to the farm Cyprus and The Downs area (which later became the Lekgalameetse Nature Reserve) in 1964 to climb the 1350m high Mitre Buttress.

Figure 2.6. A view of the Mitre Buttress in Lekgalameetse.

Alex Renny and Gordon McNeil were resident on the property at the time and Alex was a proficient artist and had drawn a number of colour pencil drawings of the orchids in the reserve. It is one of these drawings that drew my attention to an unknown *Angraecum* that could be found on the Mitre Buttress, I visited the area a number of times and once specifically to find this *Angraecum*.

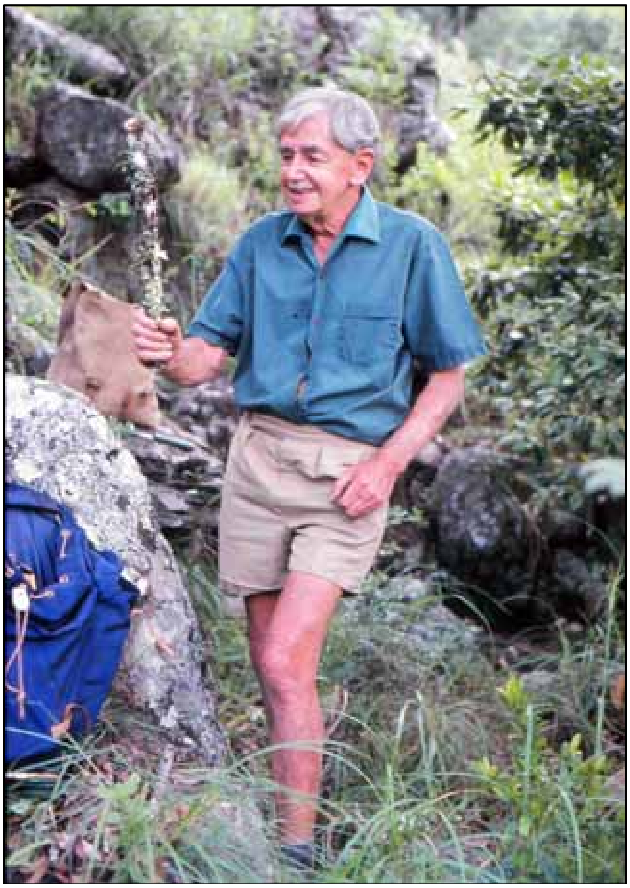


Figure 2.7. Alex Renny holding up a branch with the unknown *Angraecum* on it.

Alex had found this *Angraecum* many years ago. One of the fond memories of him is a lovely Christmas card depicting this *Angaecum*. Many years later it was described as *Angraecum stella-africae* from a plant collected in Malawi. My last visit was in 1980 and after that visit I lost contact with Alex. I later discovered that he passed away in 1981 after a very short stay in an old age home in Duiwelskloof. What happened to his drawings I did not know.

Then serendipity stepped in. Frans Krige discovered an unknown *Satyrium* at Lekgalameetse Nature Reserve. I went to Lekgalameetse with Frans to take photos of this *Satyrium*. I also wanted to look at the accommodation on the Reserve and as we had some time, drive to the gorge leading to the Mitre Buttress. Frans told me that he had a friend living in Tzaneen that knows the area. His friend had mentioned to him that there was still an old lady living on the Reserve.

Figure 2.7. *Eulophia petersii* drawing by Alex Renny.

Figure 2.8. *Angraecum stella-africae* – Christmas card drawn by Alex Renny.

Figure 2.9. *Angraecum stella-africae*.

To our delight Frans's friend was staying in the old McNeil house at the bottom of the gorge and it was our good luck that the old lady was with them. It turned out that she is the widow of Gordon McNeil. From her I could establish that Alex Renny's drawings were given to the National Herbarium in Pretoria after Alex had passed away.

I had previously met the botanical artist from SANBI in Pretoria - Gillian Condy – so I contact her and asked her if she could help. She told me that there were some files with colored drawings in them lying on a shelf in her safe and she would check. Bingo!! Alex's drawings and his correspondence file were there.

Checking through the files I found a drawing of the unknown *Satyrium* made in 1971. Figure 2.10 shows this as yet unidentified *Satyrium*.

Figure 2.10. Unidentified *Satyrium*.

It was also recorded that the *Disa aristata* type specimen came from this area (The Downs). Going through Alex's records I found his colour pencil drawing plus a dried specimen of *Disa aristata* as well as his correspondence with Dr Peter Linder regarding this *Disa*.

Figure 2.11. The type specimen of *Disa aristata* originated from the Downs in the Lekgalameetse Nature Reserve.

Finding both the unknown *Satyrium* as well as *Disa aristata* among Alex Renny's drawings, give me confidence in the number of orchids he recorded from the area. He recorded and made drawings of about 70 different orchid species from this area. We therefore have a sound basis to work from for this reserve.

Changes at Verloren Valei

Verloren Valei underwent a number of changes in the past decades. One of these was the transfer of the reserve from the National Environmental Affairs to Mpumalanga Province. The effect of this was quickly seen in the lack of finances. The reserve itself was no longer fully financed by the Province and had to generate 40% of its expenditure itself. At the same time the breeding habits of the Wattled

Crane changed and they no longer frequented the reserve. That changed the status of the reserve in that is was now possible to develop the tourism aspect without impacting on the Wattled Crane breeding.

A Strategic Management Plan to comply with RAMSAR Convention was subsequently requested by the Department of Environmental Affairs and completed in March 2012. Unfortunately this did not include a plan for tourism although visits to the reserve were picking up. The general plant species diversity and in particular the abundance of orchid species made it a favourite outing for those wanting to see the species in their natural habitat.

Figure 2.12. *Disperis oxyglossa*.

Figure 2.13. *Disa baurii*.

Figure 2.14. *Eulophia parvilabris*.

Figure 2.15. *Eulophia ovalis* var. *ovalis.*

Figure 2.16. *Satyrium trinerve*.

Friends of Verloren Valei – Management and Resource assistance

In order to ensure that Verloren Valei is conserved as a wetland and biodiversity reserve in pristine condition for future generations to enjoy the Friends of Verloren Valei was recently formed. Its primary objective is to support management of the reserve and identify and finance projects on the reserve. Friends of Verloren Valei is associated to WESSA and is also registered as an Non-profit Organisation. Should anyone require more information please contact Bill Mincher (Chairman of Wild Orchids Southern Africa).

For tourism we need flowers

In order for an area to be of interest to tourist one needs to have flowers. Figures 2.17 through 2.20 show some of the spectacular flora other than the orchids that can be found on the reserve.

Figure 2.17. *Cyrtanthus tuckii*.

Figure 2.18. *Protea parvula* - one of the ground covering protea species that can be found in the reserve.

Figure 2.19. *Kniphofia rigidifolia.*

Figure 2.20. *Berkheya zeheri.*

Reserve Management

Various aspects must be considered when managing a reserve. These are as follows:

Fencing

Fencing is an important tool to assist in keeping unwanted animals and humans out of the reserve. Figure 2.21 clearly shows the difference in vegetation on the two sides of the fence which goes hand in hand with the second aspect and that is that of grazing below.

Grazing

Grazing is often a natural method of keeping vegetation in check. This would typically be associated with all types of buck. The introduction of cattle in larger numbers presents a unique problem of its own including overgrazing and also severe damage to areas in a reserve. Cattle often follow a single path day in and day out and the tracks potentially open the area up to severe erosion. Cattle had been allowed in Verloren Valei in the past but this has now been stopped. A further problem with domestic animals in a reserve such as Verloren Valei is the pollution of clean water.

Mowing

Mowing is another method to clear an area of vegetation and is often used to create fire breaks. These strips of fire breaks often present a unique flora as the clearing of the area favours certain species to the disadvantage of others.

Figure 2.21. The influence of fencing on vegetation can be seen by comparing the grazed section of the area on the left of the fence to that on the right where a minimum of grazing occurs.

Fire

Fire is generally accepted as the natural method of reducing the overburden of dry vegetation and many species have adapted to be dormant during the times that fires are most prevalent. The mechanisms and influences on the flowering of certain species are still not fully understood and timing is very important if artificial burns are to be undertaken. Research indicate each frequency favours some plants, but at no stage is the biodiversity higher than when burning takes place every year. Burning in early winter apparently favours herbaceous flowering plants while burning late in winter favours grass. This requires careful monitoring and testing to determine the optimum burning time. An example is *Disa baurii* that flowers very early in spring. A late fire is bound to destroy all flowers of this species which means that no seed will set that season.

The frequency, timing and type of burns need to be determined over a number of years and are often associated with subsequent monitoring of the areas for species numbers and flowering. Once again data is crucial for the effective management of this aspect.

Soil Management

80% or more plants are beneficially in association with a type of mycorrhiza. Ericas have their own type of fungal association and orchids have a very special type of mycorrhiza in that this type can also exist without the orchid.

Figure 2.22. Fires in Verloren Valei typically occur during the dry winter months when the vegetation is dry.

Figure 2.23. Typical vegetation when not burnt recently. An overburden of grass is present. An orchid flowering stem with seed pods can be seen. What happens to the seed when burned?

This is essential as an orchid seedling will not develop past the initial protocorm stage without the mycorrhiza being present. In addition to the mycorrhiza the soil temperature and pH is also important.

Invasive Plant Species

The fight against alien invasive species has become a major component of managing a reserve world-wide. Luckily Verloren Valei has little problems with this. However, on Lekgalameetse and on my Smallholding it is a major problem. Two of the most common and invasive species are the Pom-Pom weed (*Campiloclinium macrocephalum*) and the Lantata (*Lantata camara*).

Allelopathy is an issue where some of these invasive plants have a negative effect on natural vegetation where a biochemical is released by these invasive species which inhibits growth of other plant species in the vicinity.

Some of the invasive species such as the Pom-Pom weed propagate at phenomenal rates and produce copious amounts of seed. The plants then simply exclude natural vegetation by competition.

Pollinators

Pollinators are an important part of the survival of the flora. These can be bees, hawk moths, butterflies, beetles, birds, wasps etc. Part of the management of a reserve is to protect these pollinators from for example, insecticide drift off neighbouring farms.

Monitoring function

The monitoring function is undoubtedly the most important function of reserve management. The question is how does one assess the results of actions on a reserve? Is it actions on a reserve that cause change or are there other factors that cause change? Only observation and recording of observations allows the reserve management to determine cause and effect of actions taken on a reserve. The old saying that the farmer's footsteps are the best fertilizer also applies to a reserve. Over and above reserve personnel, visitors and especially groups should give reserve management a report of their visit. Speciality groups in particular should report to management regarding what they saw, numbers, names, locality, etc. Communication with the reserve must be placed on high priority. The information gathered from the various sources should not land up in a black hole. Then it serves no purpose.

In addition to reports from staff and visitors, an additional tool to assist in monitoring is technology. The basic data such as rainfall, temperature, humidity etc. can be recorded with weather stations. Verloren Valei has only one weather station and actually a number of these should strategically be placed on the Reserve. Looking at the map of Verloren Valei (figure 2.38), there are at least three more weather stations needed if not four. Modern weather stations can store their data and reserve personal only need to download the data once a week or once a month depending on the quality of the weather station.

Photo Points

Digital cameras are not only useful for photographing plants and animals but can be used for capturing photos from fixed points over a period of time. These pictures can then be used to determine changes in vegetation over a season or years. To illustrate this, figures 24 to 26 show the development of a colony of *Schizochilus cecilii* subsp. *culveri* over a period between December 2004 and January 2016. These photographs can be used to determine population growth by counting the number of plants in an area. It also gives an idea of the condition of the surrounding vegetation and if there is an indication whether flowering occurs reguluarly or whether things like fire or the amount of rain influence the flowering of the species.

Figure 2.24. A colony of *Schizochilus cecilii* subsp. *culveri* photographed in December 2004.

Another example of long term monitoring of orchid colony is shown in figures 2.27 to 2.29. The colony of *Orthochilus foliosus* was first photographed in 2006 and again in 2016, ten years later. It clearly shows that the colony has remained healthy and has also expanded in size.

Figure 2.25. The same colony of *Schizochilus cecilii* subsp. *culveri* photographed in January 2016.

Figure 2.26. Close view of *Schizochilus cecilii* subsp. *culveri* .

Figure 2.27. A colony of *Orthochilus foliosus* photographed in 2006.

Figure 2.28. The same colony of *Orthochilus foliosus* photographed again in 2016.

Figure 29. *Orthochilus foliosus*

Integration of information

Integration of the information obtained from the various sources is also of critical importance. Without integrating the information we may just as well be doing nothing.

Combining information like rainfall in a season, when an area was burned, maximum and minimum temperatures with observations made by staff, visitor's photo points, etc. can be of immense value to the reserve management. Scientifically this can also form a basis for some sound research.

Some very special and rare orchids have been found in Verloren Valei and surroundings. These include *Disperis tysonii* (figure 2.30),*Centrostigma occultans* (figure 2.31), *Disperis cardiophora* (figure 2.32) and the spectacular *Disa rhodantha* (figure 2.34). From a size point of view the largest orchid on the reserve must undoubtedly be *Pterygodium magnum* (figure 2.36). The smallest must be *Satyrium microrrhynchum* (figure 2.37).

Figure 2.31. *Centrostigma occultans*

Figure 2.30. *Disperis tysonii*

Figure 2.32. *Disperis cardiophora*

Figure 2.33. Frans Kriege (left) and Allan Abel relaxing after an outing at Verloren Valei.

Figure 2.35. Visitors enjoying the flowers and in particular the orchids in Verloren Valei.

Figure 2.34. *Disa rhodantha*.

Figure 2.36. *Pterygodium magnum* – undoubtedly the largest orchid found on Verloren Valei.

Figure 2.37. *Satyrium microrrhynchum* - possibly the smallest orchid found on Verloren Valei.

Figure 2.38. A field of an *Albuca* species flowering in profusion.

Figure 2.39. An almost surreal mix of colours with wild flowers blooming en masse.

Conclusion

In conclusion I would like to thank the many people that have made the visits to Verloren Valei memorable ones and I also hope that the information and detail on the orchids in the reserves will be used to further the aims of the reserve and assist in keeping the reserves in pristine condition for many generations to come. The publication of "FLOWERS OF VERLOREN VALEI - Field Guide of the Orchids and Selected Flowers of Verloren Valei Nature Reserve" which is due shortly will hopefully assist in supporting the visitor guides and stimulate the interest in our indigenous orchids and other flowering plants.

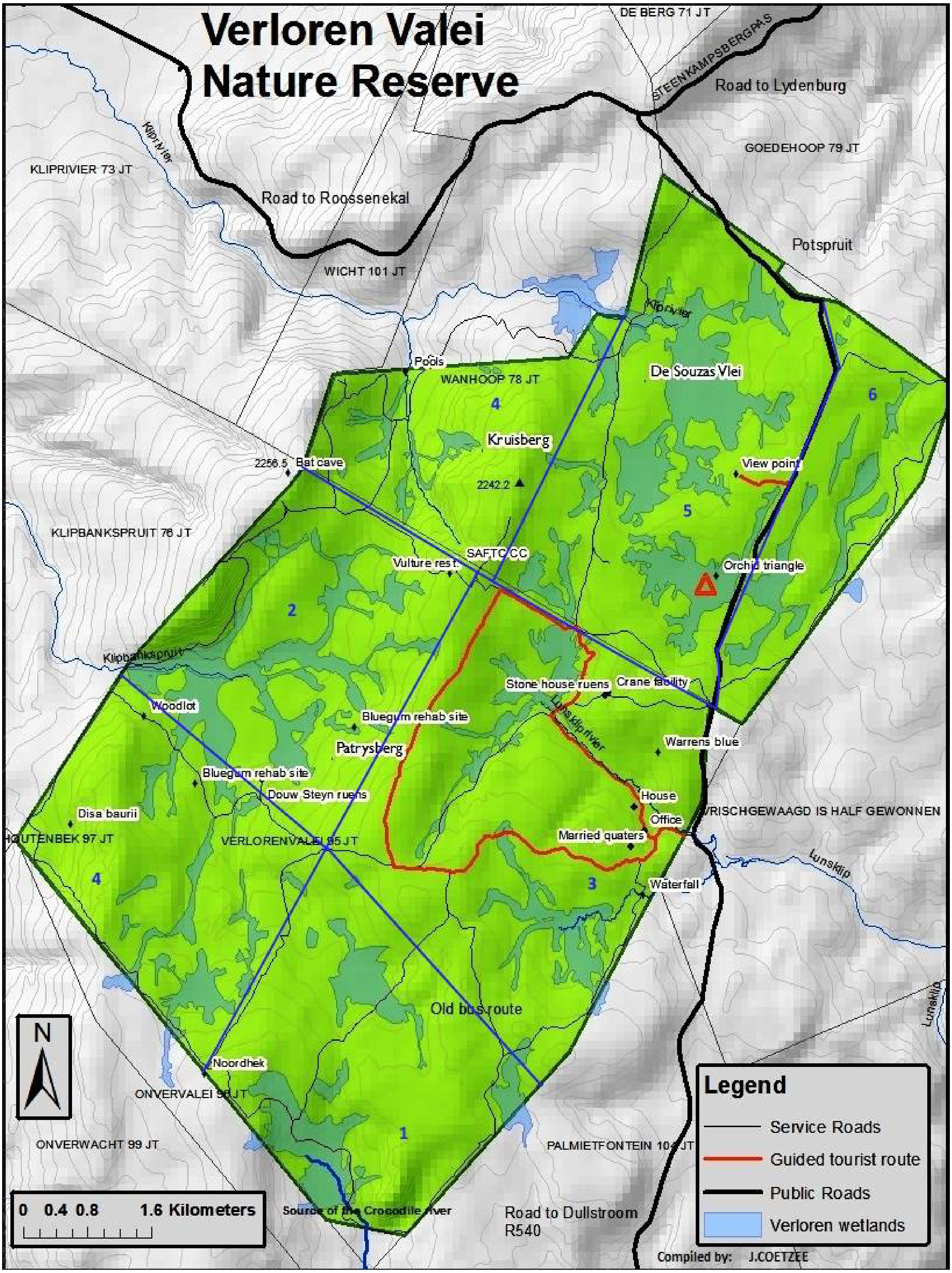


Figure 2.38. Map of Verloren Valei.

Saving the last colony on our doorstep - the *Brachycorythis conica* project.

Andrew Hankey[1], Karsten Wodrich[2], Prof Craig Peter[3]

Introduction

Brachycorythis conica (Summerh.) Summerh. subsp. *transvaalensis* Summerh. (B.c.t.) was first discovered in 1918 and was named in 1955 by V. Summerhays from a type locality in Pretoria (Summerhays, 1955). Since its first discovery the species was recorded only a further 15 times until 2007, when it was re-discovered at a locality in Krugersdorp (McMurtry et al., 2008), the same locality where it was last recorded in Gauteng 1956 by J.P.H. Acocks (Wodrich & Hankey, 2014; Hankey, 2013; Hankey & de Castro, 2014). At that time several orchid authorities had indicated that the species was becoming increasingly rare and other recent sightings of it were now non-existent (von Staden et al., 2011). This attractive ground orchid with its pretty white and purple flowers was once regarded as not uncommon, certainly in the Pretoria area; however, it has subsequently been largely eliminated by urban expansion (McMurtry et al., 2008). Despite its long scientific name this attractive wild orchid, has no recorded common names. The absence of a vernacular name may in fact be indicative of its historically restricted nature, with several of the herbarium records mentioning that only a solitary individual was encountered (McMurtry et al., 2008). Flower variability within the Krugersdorp population figures 3.1 to 3.5) indicates that the plants seem to be genetically distinct.

Discussion

Upon its rediscovery in 2007 at the Krugersdorp locality the *Brachycorythis conica* subsp. *transvaalensis* population was assessed according to the IUCN Red List categories and officially listed as Vulnerable (Vu) on the Red List of South African Plants (Raimondo et al., 2009). In 2010 the Krugersdorp population was surveyed and revealed 68 individuals.

In the same year an official search was mounted across Gauteng by a collaboration of several conservation agencies at historically recorded localities. The searches

Figure 3.1. *Brachycorythis conica* subsp. *transvaalensis*

failed to find any other extant populations in Gauteng and in 2010 the species was up-listed to Endangered (En) on the Red List (von Staden et al., 2011). Research on the species continued and by 2015 the Krugersdorp locality had yielded 117 individuals while three other localities had been recorded in Mpumalanga (Raimondo et al., 2009). The Mpumalanga localities all had ten or fewer individuals (Raimondo et al., 2009), and further assessment by the

Figure 3.2. *Brachycorythis conica* subsp. *transvaalensis*

Figure 3.3 *Brachycorythis conica* subsp. *transvaalensis*

Figure 3.4. Dark lipped form of *Brachycorythis conica* subsp. *transvaalensis*

threatened Species Program again up-listed the species, this time to (von Staden et al., 2015). Since 2011 mapping of the Krugersdorp population was undertaken and today a significant proportion of the Krugersdorp individuals are mapped with geotagged photographs. The Krugersdorp locality is comprised of a significant tract of largely pristine Protea wooded grassland, which is listed as a critically endangered ecosystem under the National list of threatened terrestrial ecosystems for South Africa (NEM:BA, 2011).

Figure 3.5. Pink lipped form of *Brachycorythis conica* subsp. *transvaalensis*.

Figure 3.6. Spotted white lipped form of *Brachycorythis conica* subsp. *transvaalensis*.

Large part of the area where the orchid occurs is also listed as 'irreplaceable' and 'ecological support' areas under Gauteng C Plan ver. 3.3. (Compaan, 2013). Several other provincial and municipal policies and guidelines (viz. Gauteng Ridges Policy; Gauteng Protected areas buffer zones, Mogale City Spatial Development Framework 2011) also afford protection to the area, independently of the occurrence of the orchid. In 2013 a feasibility study was commissioned by a partnership between SANBI, GDARD and Mogale City Local Municipality, to study the double bottom line feasibility of establishing an Urban Biodiversity Reserve in the area, including the areas occupied by the B.c.t. orchid. Unfortunately the feasibility study was terminated before its conclusion. (Archibald & Henderson, 2011).

Conservation Collaboration

Wild Orchids Southern Africa (WOSA) in partnership with the Walter Sisulu National Botanical Gardens (WSNBG) have initiated several interventions to ensure the survival of the species in its natural habitat, at the Krugersdorp locality. These include banking seed with the Millennium Seed Bank Project in England; working with local landowners to better control illegal access to the site; create awareness and appreciation for the site as a whole and monitoring and mapping the detail and extent of the population.

Figure 3.7. Typical seed of *Brachycorythis conica* subsp. *transvaalensis*.

Figure 3.8. Prof Craig Peter (left) and Allan Abel in the field during the pollination studies.

In collaboration with Wild Orchids Southern Africa and the Walter Sisulu National Botanical Gardens, Prof Craig Peter from Rhodes University in Grahamstown, has initiated pollination biology studies on the species and identified the possible pollinator.
The camera traps recorded a number of visits by *Amegilla* bees (probably a single species of *Amegilla*) or hover bees. None of these bees seemed to be carrying pollinaria although the flowers were very well visited so there were not many pollinaria left in the flowers being observed.
There was also a single visit by a large wasp, probably a *Eumendiae* that had pollinaria on its face. It was not confirmed if these were *Barchcorythis* pollinaria. Indications are that the plants attract pollinators with scent and then offer a nectar reward. Interestingly not all plants examined seem to have rewards. This is an unusual situation and needs closer examination.

Figure 3.9. Camera trap set up next to flowering plants. These traps are triggered by movement and take both video and still photographs.

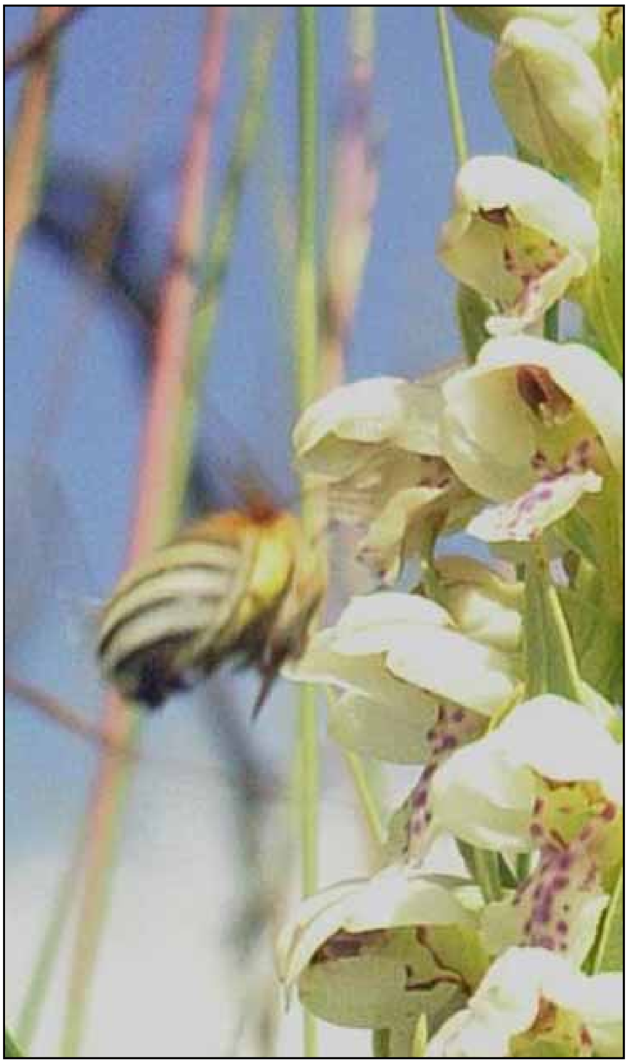


Figure 3.10. *Amegilla* bee visiting a flower caught on one of several camera traps.

Prof Jo Dames also from Rhodes University and Karsten Wodrich are undertaking to attempt to isolate and identify the fungus responsible for the mycorrhizal soil association with the species.

Karsten Wodrich (WOSA) and Mrs Hildegard Crous of the Cape Institute of Micropropagation are both independently experimenting with in-vitro germination of *Brachycorythis conica* subsp. *transvaalensis* seed. Fourteen months later, no germination has been reported on the three different sowing media used. This may be as a result of the extremely low viability of the seed collected during the 2015 season. Tests indicate the seed sown is only 5% viable (Frikkie Marais pers. comm., 2016). This is of concern and further checks need to be done to determine if this is an isolated occurrence of low viability or if that is consistent over the next few flowering seasons.

Figure 3.11. *Brachycorythis conica* subsp. *transvaalensis* seed in flask awaiting germination. The seed collected during the 2015 flowering season showed that it was only 5% viable.

Figure 3.12. Section of root tissue during teasing out of fungal pelotons in an attempt to isolate mycorrhizal fungi.

Mr Tony de Castro, a private Ecologist from De Castro & Brits Ecological Consultants has volunteered to conduct autecological studies and vegetation assessments on the site to help better understand the biology of *Brachycorythis conica* subsp. *transvaalensis* and its habitat.

Threats to the species

Threats to the Krugersdorp population include a 150ha housing development application which after an initial negative Record of Decision (RoD) by Gauteng Department of Agriculture and Rural Development (GDARD), such RoD was overturned on appeal by the Gauteng MEC for Agriculture and Rural Development. This decision has been taken on review by the Proteadal Conservation Association (PCA) in a notice of motion to the South Gauteng High Court in December 2015. The outcome of this motion will be heard in due course (Belinda Cooper pers. comm., 2015).

Other significant threats to the Krugersdorp population include damage to the habitat by the illegal access of off-road vehicles, the most significant effect of which is severe erosion and degradation of the habitat which supports the species (Wodrich & Hankey, 2014; Hankey & de Castro, 2014).

Figure 3.13. Pristine Protea woodland habitat of *Brachycorythis conica* subsp. *transvaalensis*.

Figure 3.14. Damage caused by illegal access and use of the Krugersdorp site by off-road bikers.

Figure 3.15. Paths used by off-road vehicles – especially on steeper inclines – are prone to erosion during summer rainstorms.

Figure 3.16. Damage caused by erosion. Large volumes of top soil are swept away by runoff water after rain storms.

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Alice Aubrey is thanked for editing the manuscript

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Important achievements at Burgersfort

Gabriël Joubert

I am an avid Orchid Hobbyist and a member of the Wolkberg Orchid Society.
A little bit of background in how we got involved in the protection of some species in the Waterfall river valley:

October 2014 Information of Rare Orchid
End October 2014 a farmer from waterfall river valley told us about a rare orchid that is found in this area and invited us to search for it. We found *Eulophia petersii* in abundance; we also found another *Eulophia* species but only one or two plants. But according to the farmer neither of these two were this rare orchid. We agreed to return early in January 2015 for positive identification by flower and to continue the search.
In the mean while I started researching for a possible ID on this rare orchid in that area. In a discussion with one of the farmers they indicated that many years back an international team of biologists did research on a rare medicinal plant in the area and the name Kyle Dexter was mentioned. After some sleuth work on the Internet I found a Dr Kyle G. Dexter from the School of GeoSciences from the University of Edinburgh in Scotland. I contacted him to find out if I had the right person and for possible insight into what this rare orchid in the area might be. It was the correct Dr Kyle Dexter. He mentioned that the rare plant that we were looking for was, however, not an Orchid but a *Ceropegia* – the *Ceropegia distincta* subsp. *verruculosa*, hence forth just referred to as *Ceropegia*.

January 2015 Research for the rare Orchid
On 4 January armed with my new *Ceropegia* insight we went to identify the flowering *Eulophia* and hopefully to find the *Ceropegia*. We identified the other *Eulophia* as *Eulophia leachii* and to our joy we also found a *Ceropegia* flowering. We then stumbled across the Environmental Impact Assessment (EIA) notice for the proposed Citrus development at the entrance gate to the Boerboomkraal property on our way back home.
I contacted the Environmental Services practitioner handling the environmental impact assessment to inform them of the rare find on the property and to register as an interested and affected party to the development.

A Call for Help
As this was the first EIA I was involved in I felt a bit out of my depth and decided to call for help.
As a Wolkberg Orchid Society member I receive the bi-annual South Africa Orchid Council Journal. I remembered reading an article of the wonderful work Wild Orchids Southern Africa (WOSA) is doing. I contacted them. The help Andrew Hankey and WOSA provided proved most helpful throughout the whole process and were instrumental in the outcome sofar. I also consulted with Dr Mervyn Lotter from the Mpumalanga Tourism and Parks Agency (MTPA) regarding the EIA.

Figure 4.1. *Ceropegia distincta* subsp. *verruculosa*

The *Ceropegia distincta* subsp. *verruculosa* is a perennial vine belonging to the milkwood family. The species was first recorded in the Burgersfort area by Roux in 1957. It is endemic to South Africa and occurs nowhere else other than in a small area of Bursgersfort. During the Red Data Listing of 2006 the species was listed as category DDD – Data Deficient.

Figure 4.2. *Ceropegia distincta* subsp. *verruculosa*.

Figure 4.3. Seed capsules maturing on the vine.

The *Eulophia leachii* is part of the orchid genus *Eulophia*. The species is classified as Least Concerned on the SANBI Red Data List but marked as endangered on a provincial level in Limpopo.

Figure 4.4. *Eulophia leachii*.

Figure 4.5. *Eulophia leachii*.

February 2015 Attend EIA Meeting

We were invited to attend the EIA meeting at Boerboomkraal on 4 February. Issues raised by me during the meeting were that the *Eulophia* orchids and *Ceropegia* are found in the game camp marked for development and that the camp was registered as a private nature reserve. After the meeting we were invited to go and show the EIA team the plants on the property.

After the plants were observed and identified, a small meeting was held in the veld in which they in principle agreed to look at the conservation of the plants which will include a buffer zone for chemical drift. We were approached to help with identifying the distribution of the plants on the property.

February 2015 Conduct Research and submit report

On Saturday (7 February) we assembled two teams equipped with GPSs to search the virgin bush area on the property and we then GPS marked the locations of the Eulophias and Ceropegias found. On 10 February we submitted our report with GPS positioning and maps of the distribution of affected plants.

The *Ceropegia* was found in an area of about 12ha and the *Eulophia* Orchids was also primarily found in the same area.

Figure 4.6. EIA inspection on site.

February 2015 Placed Advert in Platinum Gazette

To assess the distribution of the *Ceropegia* in the greater Burgersfort area we published an article in the Platinum Gazette newspaper on 27 February 2015 with a photo and general information on the *Ceropegia distincta* subsp. *verruculosa* asking anybody that might have seen the plant or flower to please contact us. We received no response.

Draft EIA published for comment

The Draft Basic Assessment Report for the Boerboomkraal project was released on 7 April 2015.

In the draft EIA there was still no mention of the proclaimed nature reserve and only 3 ha was earmarked for the Botanical reserve in spite of the fact that the *Ceropegia* and *Eulophia* were distributed over 12 ha.

We made objection to the size of the Botanical Reserve as it was only 3ha of the 12ha the *Ceropegia* was observed on, no mention was made of buffer zones for chemical drift. We did not believe that the Botanical Reserve would under these conditions ensure the survival of the *Ceropegia*.

Proof of Registration

On 10 April we submitted to the Environmental Services Practitioner proof of the private nature reserve proclaimed in the Government Gazette 219 of 5 March 1969. The reserve was also never de-proclaimed and thus was still in effect.

In the Draft EIA report the SANBI status of “DDD” (Data Deficient) for the *Ceropegia*, as available at the time, was downplayed as not warranting special conservation effort.

A reclassification by SANBI on the *Ceropegia* was done on the 23rd of February 2015 changing the status from DDD to Vulnerable which was published on the SANBI National Red List website in June 2015.

A formal objection on the draft EIA was made to the Environmental Services Practitioner on the 4th of May 2015 based on the updated SANBI status.

Another call for help

In the light of the updated *Ceropegia* vulnerability status and proof of the Private Nature Reserve still intact we decided to object to the whole development as proposed. Objections were submitted by the following organisations and points raised were as follows:

Dr Mervyn Lotter. Control Scientist Biodiversity at MTPA.

*As per SANBI Guidelines the Vulnerable status required a 200 m buffer zone for each plant and using our GPS data he calculated that an area of at least 26.2 ha would be required for a Botanical reserve.

*He was concerned about the lack of data regarding the pollinator.

*The Nature Reserve was a protected area and could not be developed.

*In the Limpopo Conservation plan version 2 this area is a critical Biodiversity Area and should not be developed.

Karsten Wodrich of WOSA submitted an objection and in addition questioned why the land was sold for development with the knowledge that the Nature Reserve could not be developed and recommended that the development be put on hold pending the results of a pollination study (a copy of this document is available from WOSA).

Dr Gerhard Sieburg of the Succulent Society also submitted an objection.

On the following Monday morning Dr Mervyn Lotter enquired as to why we had not submitted our Objections as his was the only objection received.

After a number of calls and e-mails L.E.D.E.T confirmed that the other Objections were found.

June 2015 Survey of other sites as per SANBI *Ceropegia* records

The reclassified SANBI Red List Taxon Report on the *Ceropegia distincta* subs. *verruculosa* indicates that the population spans over eight adjacent farms south of Burgersfort, based on data available. This information did not concur with our observations of the area. The end of May we received GPS data of the historical recorded localities of the *Ceropegia distincta* subsp. *verruculosa* in the Burgersfort area.

To verify if *Ceropegia* still occurred at these locations we planned a trip for the week of 8 to 12 June to the area. No evidence of the existence of *Ceropegia* was found. On seven of the eight farms there has been extensive cattle grazing in the past. This is now the only viable population of this endemic plant.

Final EIA published and submitted to L.E.D.E.T

On 13 August 2015 we received the final EIA report. An area of 29.3ha was set aside for the Botanical Reserve. Still no mention of the original Reserve.

This new proposed reserve area addressed all of our concerns and met with our approval. The Final EAI was summited to LEDET for approval.

October 2015 L.E.D.E.T turned down the application

On 26 October we were notified that the development project as described in the final EIA report has not been approved by L.E.D.E.T and the applicant was advised to re-apply in five years' time.

November 2015 Applicant gave notice to appeal

On 10 November we received an email from the Environmental Services Practitioner stating that the applicant has decided to appeal the outcome of the EIA process.

We will be notified of any developments in future.

Conclusion

This endeavour to protect and conserve possibly the last viable *Ceropegia distincta* subs. *verruculosa* population and also the *Eulophia* orchids was a culmination of hard work, effort and input from various groups and individuals whom made this possible. I would like to thank you all and also extend a thank you on behalf of generations to come.

Fifteen years of monitoring Disa barbata - what have we learned?

Dr Benny Bytebier

The Plant

Disa barbata (L.f.) Sw. was first described in 1782 based on a specimen collected by Sparrman between 1772 and 1776. It is currently assessed as Critically Endangered in SANBI's Red List of South African Plants.

Figure 5.1. *Disa barbata*.

Distribution

The species was originally found in sandy flats around Cape Town in Pinelands, Rondebosch and Kenilworth.
The last record near Cape Town on Kenilworth Race Course dates back to the end of October 1950. It is now only known from one remaining population in a nature reserve near Malmesbury.

Background

In 2001, while collecting as many *Disa* species as possible for phylogenetic research, only eight flowering plants could be found after a day long search. Cape Nature was informed and the question was asked: What can we do to save this species from extinction?

Figure 5.2. *Disa barbata* flowering amongst restios. The leaves of *Disa barbata* resemble those of the restios and make the plant extremely difficult to locate when not in flower.

The Players

Various stakeholders were identified and invited to become involved in the conservation effort. Amongst these were Cape Nature, Stellenbosch University, the Cape Institute of Micropropagation (a privately-owned *in vitro* propagation company) as well as citizen scientists. Start-up funding for the initiative totalling 3,500 US$ was provided by the Chicago Zoological Society.

The Plan

A plan was drawn up to include an annual survey of the known population, as well as searching for additional populations of this species. Furthermore the natural history of the species was investigated and a programme drawn up for *in-vitro* propagation and re-introduction into a site where it historically occurred.


DIE BURGER, bl. 14 AKTUEEL Donderdag 17 Novem

Skaars disa: In vitro-kweking bied hoop

Toekoms wink vir dié ouman

Bedreigde fraiingrige blom kan weer floreer, glo navorser

JORISNA BONTHUYS

Figure 5.3. Public awareness campaigns included articles published in local newspapers.

In addition a drive was started to improve public awareness of the plight of this rare species.

Awareness Action

The awareness action included conducting information sessions in the local schools and involving Cape Nature, the South African National Biodiversity Institute (SANBI) as well as Custodians of Rare and Endangered Wild flowers (CREW). Publications included articles in Plant Talk, Plants in Peril, as well as airing on National Television on the programme 50/50.

Propagation

From a propagation point of view the plan was to increase the population size and number through reintroduction of propagated plants into their natural habitat. In addition to propagating the plants for reintroduction a certain number of plants were to be made available to the public in order to provide a return on investment for the propagator and also to avoid poaching and take the pressure off natural populations.

There was only one problem with the propagation initiative and that was that no procedure had yet been established for micro propagation of this particular species.

Re-introduction

Seed dormancy was found to be a major problem during trials to germinate the seed. Weaning of the plants from closed, sterile to semi-natural conditions also proved to be tricky step.

Figure 5.4. Hildegard Crous pollinating plants of *Disa barbata* in the field.

The reintroduction programme started off with 10 plants which were returned to their historical location in 2009. Another 100 plants were returned in 2010 and a further 40 plants in 2011. It was found that the larger the bulb was when the plants were re-introduced into their natural habitat, the better the chance of survival.

Figure 5.5. *Disa barbata* seedlings being reflasked under aseptic conditions in the lab of the Cape Insitute of Micropropagation.

Figure 5.7. *Disa barbata* seedlings being acclimatised outside the flask with the bulb growing in sphagnum moss.

Figure 5.6. Flasks of *Disa barbata* in the light cabinet.

Figure 5.8. *Disa barbata* seedlings being hardened off in the nursery.

Figure 5.9. First flowering of an artificially propagated seedling.

Natural History

The pollinator of *Disa barbata* was found to be a carpenter bee *Xylocopa rufitarsis*. The pollination success rate was determined to be less than 15%. We also know now that individual plants are long-lived but are not flowering every year. Mass flowerings occurred two years after a fire indication a strong fire dependency for flowering in this species. Leaves are produced during the wet winter months and are mostly dry by the time the plants flower in October or November. The leaves are linear and almost impossible to detect amongst the restios.

Additional Populations

The search for additional populations within the reserve was unsuccessful but additional plants were found close by but outside of the reserve boundary on community-owned land. Thus the Malmesbury site remains the only population of this rare orchid.

Annual Surveys

Annual surveys were started in 2002 and were conducted within and outside of the reserve. The methodology was to transect the reserve with a line of 9 to 13 volunteers.

The GPS coordinates of every plant found was noted together with the number of flowers (open, bud, pollinated etc.). Permanent fire-resistant markers were placed at each plant with a temporary marker also tied to the plant so that the plant could be found again after flowering was complete.

Figure 5.10. Benny Bytebier (left) and Ted Oliver recording GPS positions and details of a plant of *Disa barbata*.

Figure 5.11. Survey team 2003.

Figure 5.12. Survey team 2004.

Response to fire

Two major veld fires took place at the Malmesbury site. In March 2006 there was a fire outside of the reserve and in February 2011 there was one inside of the reserve.

For both events data was geographically partitioned which meant that the subsequent data on the number of flowering plants could be interpreted only for the area that underwent a fire event. After the March 2006 fire we saw in a huge increase in flowering plants during the second and third flowering season after the fire. After that the number of flowering plants returned to normal. We expected to see the same increase in flowering plants after the 2011 fire in the reserve but this turned out not to be the case at all. Either the plants in the reserve were for some reason not flowering or they were dead.

Explanation

There is a suspicion that plants within the reserve may have been affected by the alien clearing programme. Working for Water started an eradication programme for *Acacia saligna* (Port Jackson). To do this, the trees were cut down and stumps poisoned with Garlon dissolved in diesel. It is possible that Garlon or the diesel is drawn through the root system of the poisoned trees and actually spread into the surrounding areas and may have poisoned some of the plants of *Disa barbata* as well.

Figure 5.13. Survey team 2007.

Figure 5.14. Survey team 2012.

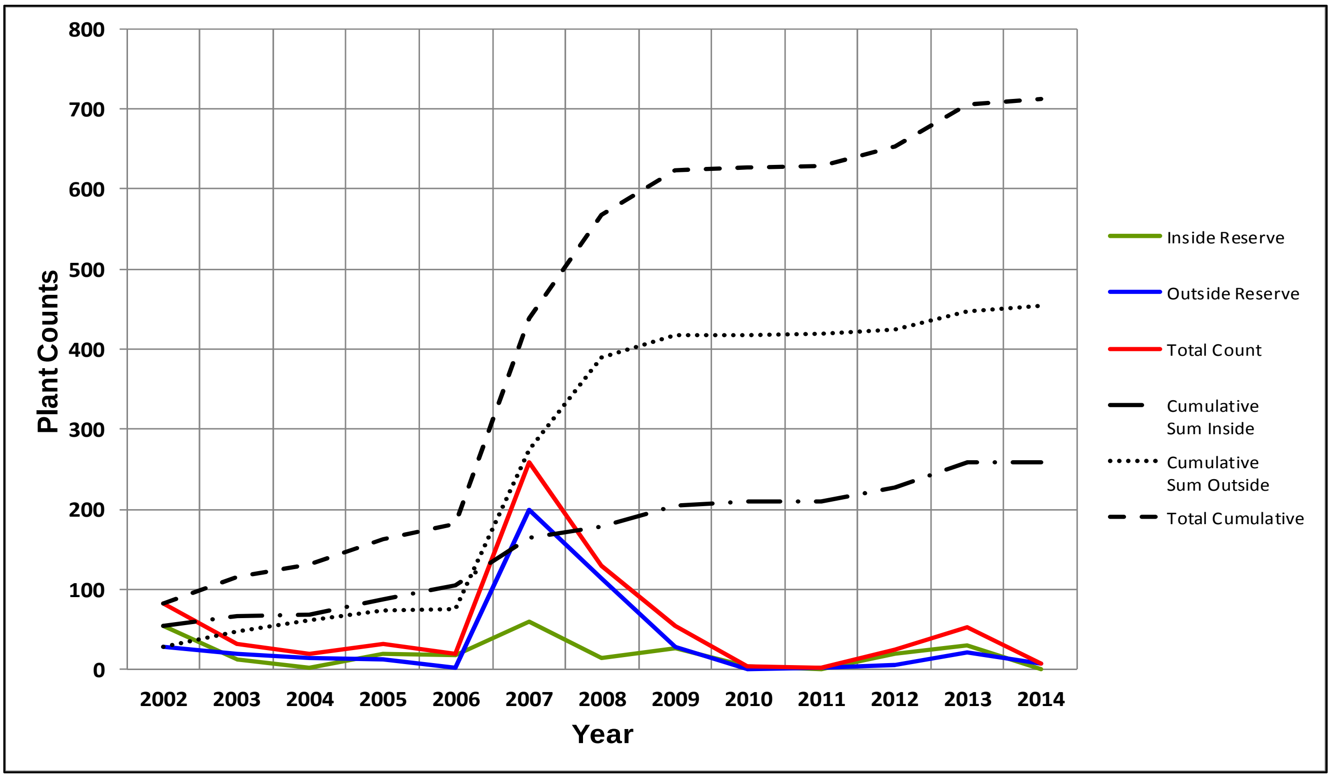

Figure 5.15. New plants and cumulative sum of plants recorded during annual filed surveys.

We noticed, for instance, that the number of *Wachendorfia* plants, a common geophyte in the area, have also declined substantially. It must be said that this is only a suspicion and further research needs to be done to establish whether this is true or not. In any case it seems that Garlon in diesel is no longer used to poison stumps of aliens. We therefore hope that the population on community land, where clearing of alien *Acacia* has also started, will not be affected.

Figure 5.16. Flowers of *Disa barbata.*

Lessons learnt

The most important lessons learnt from the *Disa barbata* project is that long term planning for the conservation of the species must be done at the beginning of the process. Some of the procedures that must be established are consistent data collection, accurate GPS location mapping (with specific attention to the actual coordinate system used, datum data and accuracy of the data). In addition comprehensive and complete field notes need to be taken (dates, names etc.). This data must be captured on the day of the surveys and must be transcribed as soon as possible.

Any project such as this one needs a dedicated 'slave driver' to make sure that the field work is carried out efficiently and under the best of circumstance.

A champion must be assigned to the project in order for the complete process to be meaningful to the conservation of the species. The above is just as relevant to the *Brachycorythis conica* subsp. *transvaalensis* conservation project that is currently underway that is just as critical and has many similarities to the *Disa barbata* project

Acknowledgements

Dirk Bellstedt, Hildegard Crous, Ismail Ebrahim, Rupert Koopman, Annelise le Roux, Ted Oliver, Tessa Oliver, Koos Steenkamp, Patrick Wiltshire, Johny Witbooi

- All the volunteers who braved the rain, horseflies, ticks and dune mole holes, etc.
- Cameron Muller did the analysis of the annual survey data as part of an MSc study
- Trevor Hill is a co-supervisor of Muller
- Herbert Stärker, Tessa Oliver for pictures used in this article
- WOSA conference organisers

Record your discovery on OrchidMAP

Prof Craig Peter

Abstract
OrchidMAP is an interactive web-based database to capture locations of indigenous orchids. This presentation gives and outline on the data currently entered and encourages users to submit their own photographs and associated data into the database.

OrchidMAP – an invaluable research tool
The Animal Demographic Unit (ADU) of the University of Cape Town has developed a number of databases for the recording of sighting of insects and other animals. The idea has since been expanded to include plants as well.

As an example figure 6.1 shows the sightings of a single species of butterfly while figure 6.2 shows the total number of records of all Lepidoptera for South Africa. An incredible amount of work has gone into the LepiMAP database with most records entered by public participants in the programme. The success that the ADU has had with these databases gave rise to the idea to use this type of database for orchids as well.

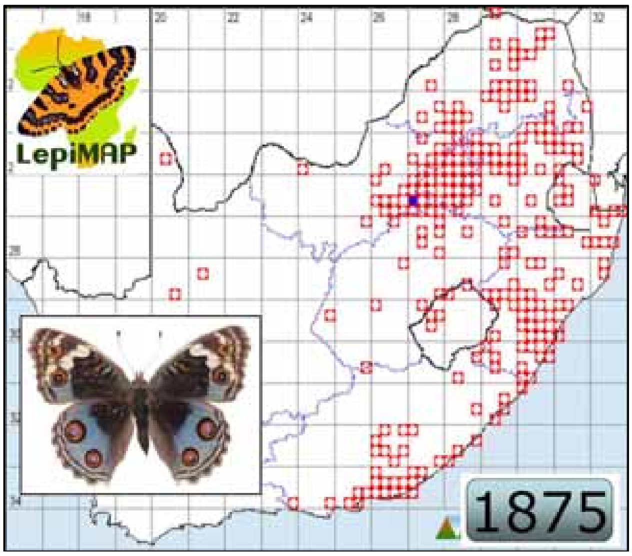

Figure 6.1. An example of the data of sightings of the butterfly *Junonia orithya madagascariensis* or Eyed Pansy in South Africa. To date over 1000 records have been accumulated since 1875.

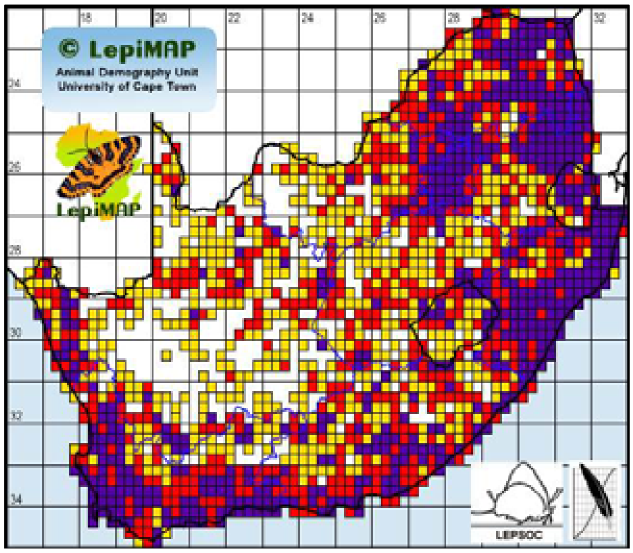

Figure 6.2. The Lepidoptera database contains 421891 records (museum specimens & sighting) for Africa of which 409379 are recorded for South Africa alone.

In the last year a separate database has been set up for the orchids found in Southern Africa. To date 470 species have been recorded in South Africa. In terms of the number of species per unit area South Africa has a relatively low orchid density. Compare this to Ecuador, a country roughly 1/5th the size of South Africa which has in excess of 2300 species recorded.

OrchidMAP is a valuable tool in analysing the distribution of the orchids and it can clearly be seen that the bulk of the records are concentrated in specific areas. Figure 6.3 shows the orchid distribution data for only the Herbarium lodged specimens from four South African Herbaria.

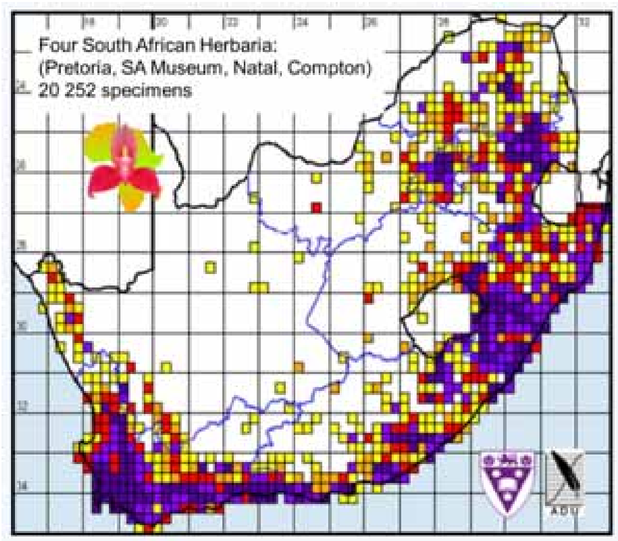

Figure 6.3. Orchid distribution data from four South African Herbaria.

Figure 6.4. The orchid family containing an estimated 23500 species is one of the largest with an incredible variety of flower morphology including size, shape, colour and arrangement. Of these 23500, nearly 500 species are found in South Africa.

Figure 6.5 shows the number of orchid specimens collected for Herbariums over the last century with a peak reached in the 1990's (figure 6.5). Specimen collections have declined since then and there have been recent discussions on the effect of specimen collection on the rarer species and the focus is shifting to a less invasive method of recording sightings.

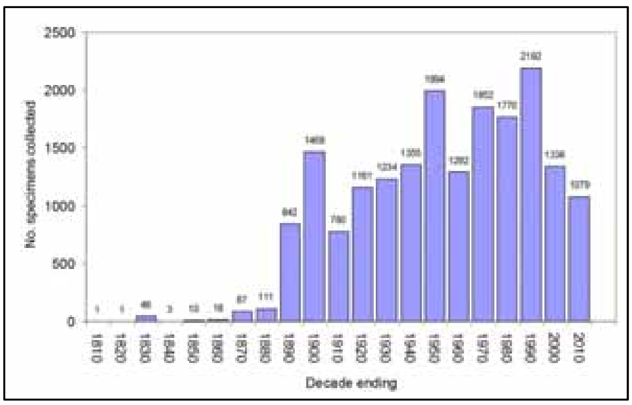

Figure 6.5. Herbarium specimens of South African orchids collected in the last century.

The OrchidMAP database is the ideal vehicle for this and to date (January 2015) a total of 1033 records have been added by various contributors (figure 6.6). A discussion at the World Orchid Conference WOC21 in September 2014 highlighted the need for a program like OrchidMAP and hence was a key catalyst for developing that.

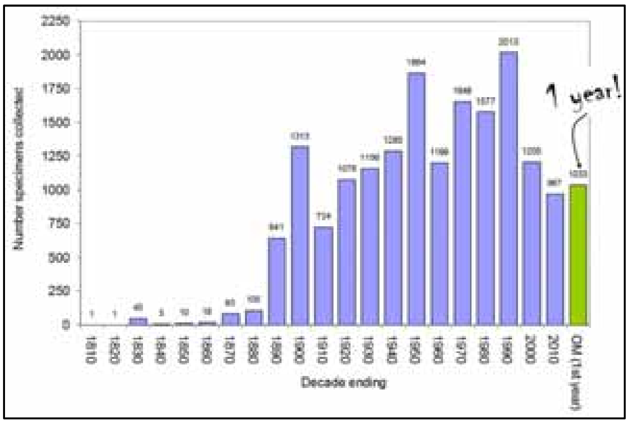

Figure 6.6. The number of OrchidMAP records added in the first year roughly matches the total herbarium specimens collected between 2000 and 2010.

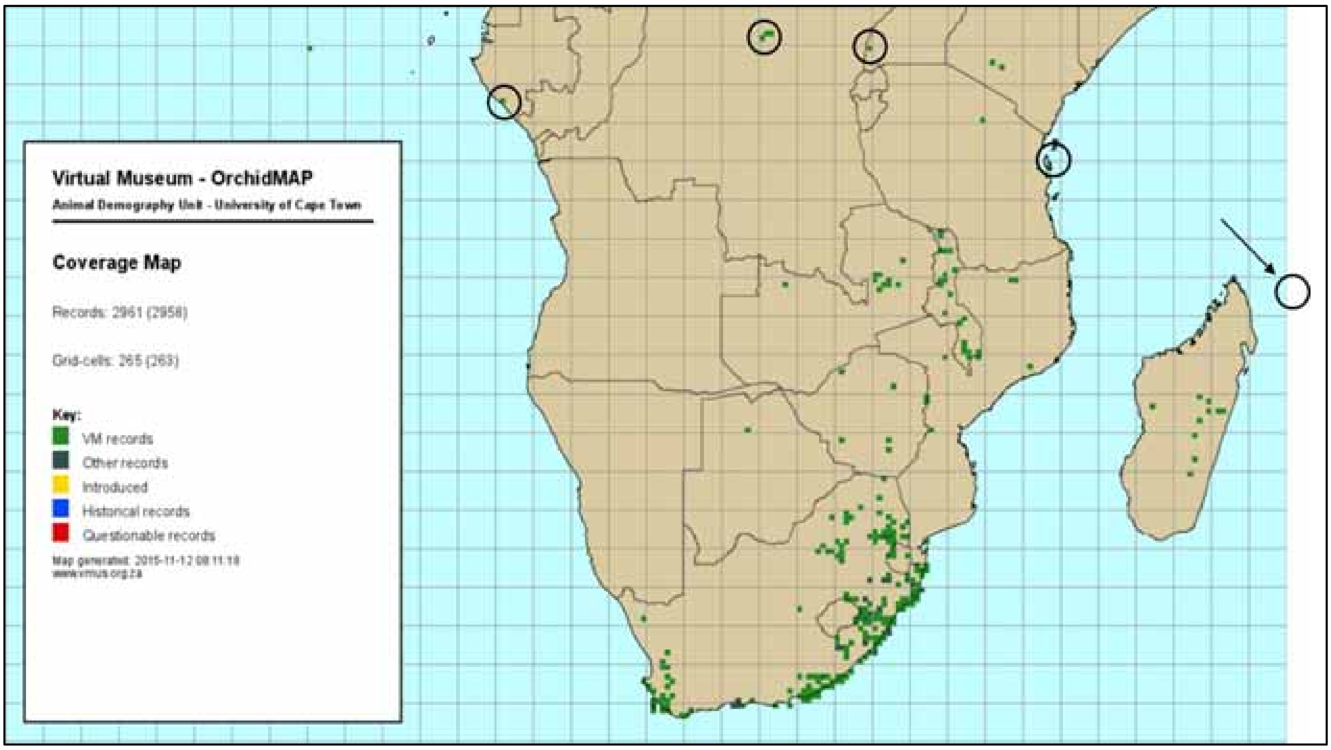

Figure 6.7. Current orchid records for Africa currently include approximately 300 species from a total of 296 quarter degree grid cells (an area of 25.25 x 27.75km each represented by a coloured square).

The distribution of data for the Africa currently contained in the OrchidMAP database is shown in figure 6.7. Analysis of this data is presented in table 6.1

	First Year	To Date (1 year, 5 months)
Total records (Africa)	2750	3285
South Africa	1033	1264
Countries	13	14
Contributors	78	100

Table 6.1. Total of new records in the OrchidMAP database to date (January 2015).

Data entries

The big question is – how safe is the location data, what data is required and how can one get involved.

To answer the first question the data is presented on the internet in quarter degree grid cells which represent an area of around 700km^2. That will not allow an internet user to pinpoint exact locations of the records. Detailed data is only available to the administrators of the OrchidMAP database.

Figure 6.8. The grid size represented on OrchidMAP covers a fairly large area and ensures that detailed location information is not compromised.

In terms of data any record will be accepted. In short – any orchid – anywhere! Even if there is only a suspicion of it being an orchid please submit. A panel of experts will go through a submission and ensure that only the orchids make it to the database. In short it is better to submit than risk the possibility of a new orchid species going unnoticed!

Submissions include new as well as repeat listings. Bear in mind that repeat listings contribute valuable data about flowering and fruiting durations and if it flowers at the same time every year. Flowering and fruiting is likely to be most affected by “climate” change and this is a really important thing to try to record. Repeat listings would also cover the same plants that are found by independent individuals. Listings can also include cultivated plants. Most cellular phones have a camera (figure 6.9) and often GPS data is often automatically included in the properties of a photograph.

An accurate GPS location of the record is important and is required to pinpoint the plant location but such GPS coordinates are easily determined during the upload process from Google Earth maps.

In addition to the GPS location, photographs should also be included. Good and bad photos can be submitted as both will assist in the positive identification confirmation that will be done by an expert panel before inclusion in the database. Ideally a photo of the whole plant, a flowering spike and a close-up of the flower should be submitted (figure 6.10).

As a rule of thumb: If in doubt – submit it!!

Social media is becoming a more and more important part of our daily lives. Various Facebook groups are available and joining these has opened new avenues of information exchange and can also be used to identify plants. Two of these Facebook group addresses are shown in figure 6.10.

Figure 6.9. Cellular phones can easily be used to take a photograph of plants as well as obtaining GPS data. A phone app is currently in development and will greatly simplify uploading images and data!

Figure 6.10. If possible uploaded photographs should contain the flowering stem, a close-up of the flower and the plant.

Figure 6.11. Facebook groups are invaluable sources of information and posts can be used to identify orchids as well. These are vibrant online communities of plant enthusiasts open to all. Orchids of southern Africa: https://goo.gl/RqeuYi. Flora of southern Africa: https://goo.gl/t5nQZE.

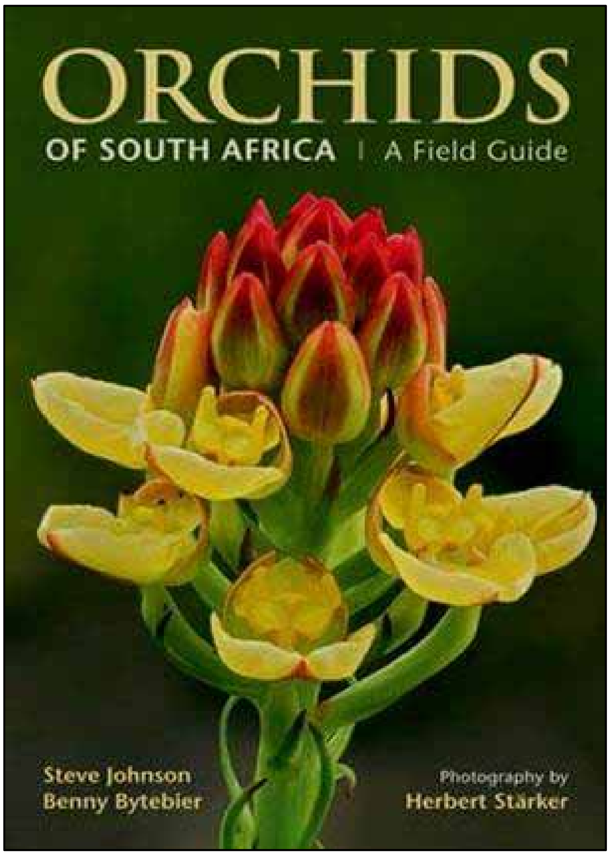

Figure 6.12. Field guides are also and invaluable sources of information.

Conclusion

The ultimate aim of OrchidMAP is to provide a research tool with the participation of the general orchid growing community and the public at large. It is becoming more and more of a reality as more people participate in the project.

With regards to the conservation of orchids, the database will provide a wealth of information. This can be utilised for Environmental Impact Studies. Other aspects include information on orchid population dynamics, flowering seasons and duration as well as determining what environmental influences (rainfall, weather etc.) impact the flowering and distribution of species.

What we need now is the participation of everyone in the project to make it a success. Competitions are being used to actively promote participation.

As such I would like to ask everyone here today to add any data that you may have to the database – no matter how insignificant you may thing that information may be. Appendix A in the proceedings contains a quick guide on how to use OrchidMAP - please refer to that and submit any location and species data you may have.

Orchids of Long Tom Pass and surrounds. One of the most diverse areas in South Africa

Lourens Grobler

Long Tom Pass was named after the Long Tom cannons used in the Anglo-Boer war. The area is also one of South Africa's hot spots for orchids with a total of 115 species found along the Long Tom / Graskop escarpment. Much of the surrounding area is covered in forest plantations which in places are threatening the habitat of some of the rarer orchids.

Figure 7.1. Spectacular views can be enjoyed from the top of the escarpment.

Figure 7.2. The Long Tom Pass (R37) transects the mountain range which is home to many orchids including a number of rare species and a few recently discovered and described species.

Figure 7.3. Some of the forest plantations visible in the distance from the slopes of the mountain.

Figure 7.4. The escarpment is in the summer rainfall area of South Africa with lush growth during the summer months.

Figure 7.5. Winters are harsh with snowfall not uncommon. For this reason epiphytes do not survive at elevated altitudes and the orchids are all terrestrial.

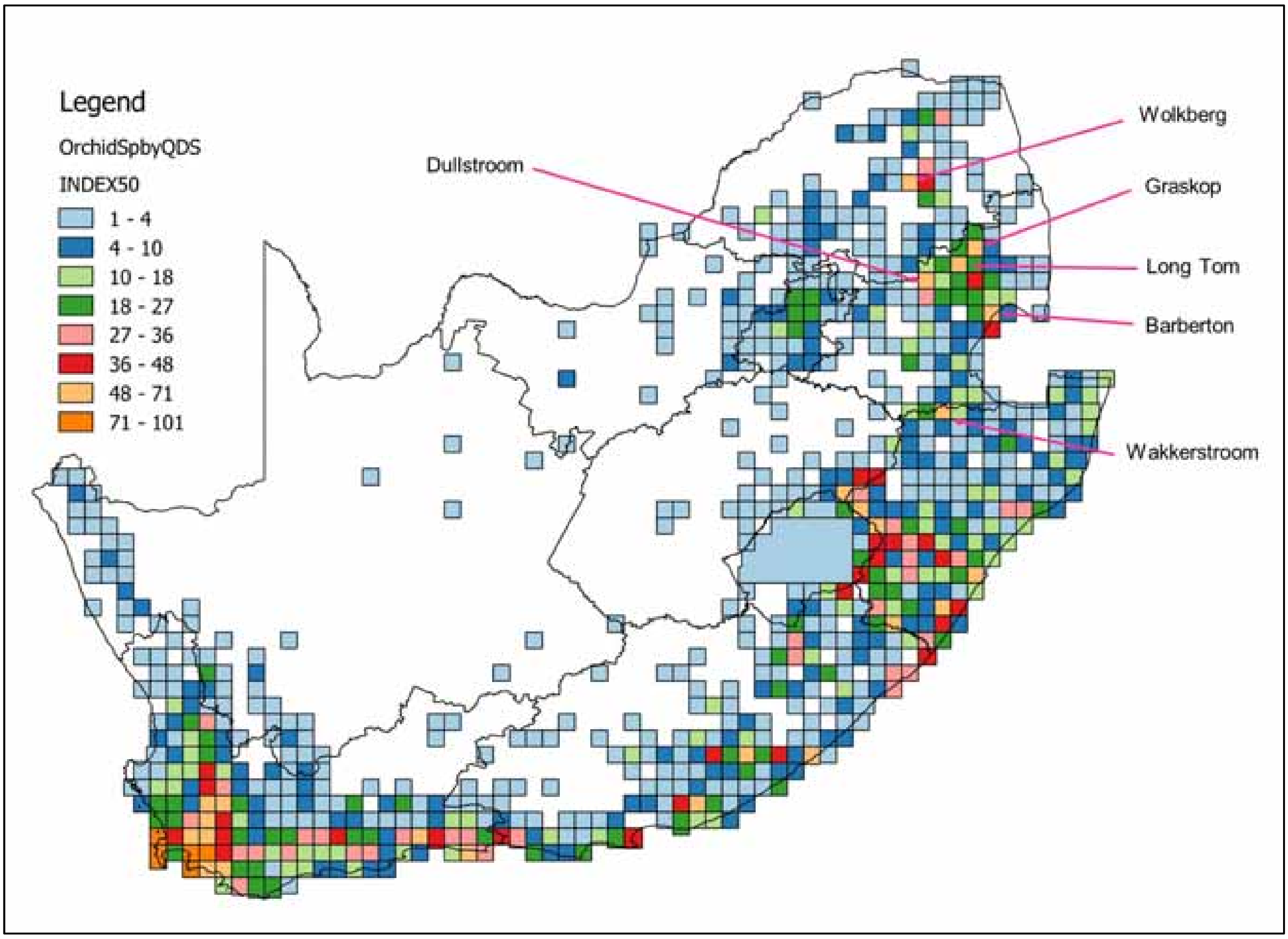

Figure 7.6. A species distribution map shows an extremely high number of orchid species found in the Long Tom and Graskop, ranging between 36 to 101 species on the distribution map depending on the location.

	AREA	TAXA	ENDEMIC TO LONG TOM	ENDEMIC TO SOUTH AFRICA
LONG TOM 1800 mASL	100 km^2	68	6	37

Table 7.1. Shows the number of Taxa as well as the high number of South African endemics and also species endemic to the Long Tom Pass area.

Access to the area is not easy. Off-road vehicles can only be taken to a certain point from where access to the area is on foot. The weather is unpredictable and can range from a warm sunny day only to be engulfed by clouds moments later. In winter temperatures can be close to freezing.
Landowners permission and access permits are also required but the rewards of accessing the area are spectacular.

Figure 7.7. *Schizochilus lilacinus* is endemic to the Long Tom area and is found growing on steep rock faces. It is a high altitude species flowering between October and November.

Figure 7.8. *Schizochilus lilacinus*.

Figure 7.9. *Schizochilus lilacinus*. Grows with its roots and tubers wedged in crevasses in steep rock faces. This species has elliptic leaves. Similar flowers are found on *Schizochilus crenulatus*, however, this species has much longer leaves and flowers a little later in the season.

Figure 7.10. Also endemic to this area *Disa amoena* is found growing on slightly dryer grassy slopes.

Figure 7.11. Delicate pink flowers with a light stippling are characteristic of *Disa amoena*.

Figure 7.12. *Disa ameona* – an extremely variable species with respect to the flower colour as well as the flower markings. Almost pure white specimens with light stippling to plants dark pink flowers and heavy stippling are not uncommon.

Figure 7.12. *Disa staerkeriana* was discovered in 2013 by renowned orchid photographer Herbert Stärker and his wife Helga. It was formally described in March 2015 (McMurtry & Bytebier, 2015). The find is so recent that it was not included in Orchids of South Africa (Johnson & Bytebier, 2015) as it had not been formally described.

Figure 7.13. Although *Disa staerkeriana* resembles *Disa amoena* there are marked differences, amongst others a much shorter spur.

Figure 7.14. *Disa vigilans* with flowers facing away from the mountain slopes – ever vigilant. This species is also endemic to the area and very distinct. It is only found at altitudes between 2000m and 2200m.

Figure 7.15. *Disa vigilans*.

Figure 7.16. *Disa vigilans* is one of the species that faces potentially be threatened by encroaching forest areas.

Figure 7.17. *Disa klugei*. Another of the area endemic *Disa* species. It grows at the same elevation as *Disa vigilans* and flowers in January and February.

Figure 7.18. *Disa klugei* is distinguished from *Disa vigilans* by soft leaves and a much shorter decurved spur.

Figure 7.19. *Disa alticola*.

Figure 7.20. *Disa alticola* has a slightly wider distribution than the Disas in previous figures but it is nonetheless endemic to the area. It is normally found in small colonies in shallow, well drained sandy soil and flowers in December and January. It is also found in humus on rocky sheets and it always fascinating how the dormant tubers of these species are able to survive the cold winter months in shallow soil when the areas are often covered in a layer of snow.

Figure 7.21. *Disa clavicornis* – note the clavicle shaped spur after which the species is named. This extremely rare *Disa* is another of the 6 species endemic to the Long Tom area.

Figure 7.22. *Disa patula* var. *patula* is rare and found in grassland along a narrow band between northern Mpumalanga down to the central Eastern Cape.

Figure 7.23. *Disa patula* var. *patula* is endemic to South Africa while *Disa patula* var. *transvaalensis* is more common and also found in Swaziland and Zimbabwe.

Figure 7.24. *Disa rungweensis* is one of the smaller Disas and is found growing in shallow soil over bedrock.

Figure 7.25. To get an idea of the size of this species *Disa rungweensis* is shown next to a thumb.

Figure 7.26. *Disa fragrans* has a variable flower colour from the typical yellow to olive through pale lilac to white.

Figure 7.27. Flowering from January through to April *Disa fragrans* is a late flowering species can be found at extremely high altitudes up to 3000m.

Figure 7.28. From left to right: *Disa rhodantha*, *Disa chrysostachya* and *Disa versicolor*.

Figure 7.29. *Disa chrysostachya* in its typical habitat – normally close to or in marshy wetland areas. This species is widely distributed in the eastern part of South Africa.

Figure 7.30. Another of the rare species that is only found in the Long Tom area in South Africa is *Brownleea graminicola*. It is a late flowing species flowering from March to April.

Figure 7.31. *Brownleea graminicola*.

Figure 7.32. A species with a beautifully marked leaf is *Holothix thodei*. Its dark green basal leaves are marked with silver streaks.

Figure 7.33. *Holothix thodei*.

Figure 7.34. The inflorescence of *Holothix thodei* is hardly visible amongst the vegetation and blends in well against a backdrop of vegetation and grasses.

Figure 7.35. *Schizochilus cecilii* ssp. *transvaalensis*.

Figure 7.36. *Schizochilus cecilii* subsp. *transvaalensis* is fairly common and distinguishable from subsp. *culveri* by the flowers are white with a white or yellow lip. *Schizochilus cecilii* subsp. *culveri* has yellow flowers.

Figure 7.37. *Disperis viginalis* is another species endemic to South Africa. It is rare in indigenous forests but is becoming more common in pine plantations.

Figure 7.38. From left to right: *Disperis cooperi*, *Disperis tysonii*, *Disperis concinna, Disperis stenoplectron* and *Disperis wealei*.

The genus *Disperis* is well represented in the Long Tom area. Most of the species are pollinated by oil-collecting bees. Some of the more spectacular species are *Disperis cardiophora* and *Disperis renibractea*.

Figure 7.39. *Disperis cardiophora*.

Figure 7.40. *Disperis renibractea*.

Figure 7.41. *Disperis fanniniae* is a fairly common species found on the forest floor amongst leaf litter, in humus on rocks and in patches of moss growing on tree trunks.

Figure 7.42. One of the Satyriums found in the area is *Satyrium longicauda*. This genus has a typical double spur and the name stems from the forest Gods or Satrys in Greek mythology that are half man, half goat with two horns.

Figure 7.43. This particular plant of *Satyrium longicauda* has half the flowers on the flowering stem white and the other half pink. It is a widespread species in the eastern half of South Africa and is pollinated by Hawk Moths. Plants may form colonies of many hundreds of plants under favourable conditions and the species flowers from as early as October near the coast right through to March in the inland areas with a higher elevation. The pink mottled flower colour is characteristic of the species.

Figure 7.44. Weather in the mountains can be deceptive. It can be sunny one moment and then the clouds roll in.

Figure 7.45. Moist mist and clouds roll in over the mountain making it easy to lose one's way. For this reason it is also important to carry spare warm clothing on an outing.

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General view of European Orchids and Conservation

Patrick Mannens

Patrick Mannens presented a fascinating video presentation of his observations of European orchids. He touched on the orchid conservation research being done in Europe and in particular with respect to the Flemish Orchid Society also showed that a number of the more popular species could be grown in the garden.

The presentation was a compilation of several small films. Each film looks at a species in its natural habitat. The extra value in these films is the fact that one is able to get a good impression of the dimensions. Through the use of macro lenses it is often hard to estimate how large (or small) the plants are that one is looking at.
In the film one can see macro images, but after zooming out one has a much better idea about the environment and dimensions.

The presentation unfortunately cannot be made available due to the sensitive nature of many of the locations of orchids depicted. For further information please contact the speaker.

Figure 8.1. Photographing terrestrial orchids.

Figure 8.2. *Anacamptis piramidalis*.

Figure 8.3. *Ophrys insectifera.*

Figure 8.3. A group of orchid enthusiasts identifying one of the orchids found.

Figure 8.5. A natural hybrid *Orchis* x *spuria*, a cross between *Orchid militaris* (centre) x *Orchis anthoropora* (right).

Figure 8.6. *Orchis ustulata*.

Proposed WOSA guidelines for the translocation of wild orchids in South Africa

Andrew Hankey[1], Karsten Wodrich[2], Bill Mincher[3] and Antonio de Castro[4]

Abstract
Discussion around whether WOSA should consider translocation as a means to save orchid colonies from destruction by development activities is presented, guidelines for such translocations are also proposed.

Introduction
Notwithstanding the impending effects of climate change, the need for land and development continues to see huge losses of valuable natural habitat at a rapid rate across the world (Reiter, 2016), and indeed also in South Africa. Translocation of orchid plants from their natal site to a specially identified receiving site where the population may have some chance of re-establishment as a functional and sustainable population, has been identified as a valuable tool to combat plant extinction (Reiter, 2016). Translocation is defined by IUCN (2013) as the human mediated movement of living organisms from one area with release in another. Better conservation planning should be seen as avoidance of the habitat of subpopulations of threatened and Near Threatened species (i.e. in situ conservation) and the implementation of appropriate buffer zones around such subpopulations as recommended by provincial guidelines e.g. Gauteng 'Red List Plant Species Guidelines' document (Pfab, 2006).

Some provincial conservation departments utilise a mitigation hierarchy whereby sensitive areas are first avoided, failing that impacts are minimised or rehabilitated (which is where translocation could play a role in certain instances), failing that impacts are offset (M. Lötter pers. comm., 2016). The recommendations of the Red List (Raimondo et al., 2009, page 47) should be used as a guiding principle. Translocation cannot, in most cases, 'play a role' in 'minimising' the loss of a subpopulation of a threatened species, and similarly, the loss of a subpopulation of threatened species cannot be 'offset'. The only real conservation measure is in situ conservation. Raimondo et al., (2009) go so far as to apply this principle to all 'species of conservation concern' (threatened, Near Threatened, Declining, Rare and Critically Rare).

At the outset, it is important to emphasize that the Red List of Southern African Plants (Raimondo et al., 2009) strongly recommends the avoidance of ex situ ('search and rescue') options for conserving not only threatened species (Critically Endangered, Endangered and Vulnerable) but all 'species of conservation concern'. The Red List furthermore states the 'in situ' conservation is vital and should be recommended as the only option for conserving 'taxa of conservation concern' and that "translocation of subpopulations is unacceptable as a conservation measure". The Gauteng 'Red List Plant Species Guidelines' document (Pfab, 2006) also states that all threatened and Near Threatened species should be conserved in situ. The term 'species / taxa of conservation concern' (sensu Raimondo et al., 2009) encompasses all species that are currently regarded as being threatened with extinction (Critically Endangered, Endangered and Vulnerable) or are close to being threatened with extinction (Near Threatened) in accordance with IUCN Version 3.1 criteria (IUCN, 2013), as well as species which do not currently qualify as threatened or Near Threatened in accordance with IUCN criteria, but which are regarded as being of some conservation concern (Raimondo et al., 2009). These South Africa categories are Critically Rare, Rare and Declining, and were developed specifically to highlight species that though not threatened with extinction, require some conservation effort and monitoring.

The Red List (Raimondo et al., 2009) furthermore provides guidelines on EIA recommendations for 'taxa of conservation concern' in all the various conservation status categories and sub-categories (internal differentiation of categories based on IUCN criteria, e.g. Vulnerable A2a versus Vulnerable D2). These guidelines do not make any reference to translocation, but do specify conditions under which subpopulations of certain categories and subcategories of 'taxa of conservation concern' may be subjected to destruction (or habitat loss). In such cases, an attempt at translocation may be preferable to the destruction of a subpopulation of a 'taxa of conservation concern'.

Most orchids (especially terrestrials) exhibit highly specialized adaptations in their method of nutrient uptake which relies on a relationship with a fungus (called a symbiotic relationship) to grow successfully (Arditti, 1982). Specific types of fungi called mycorrhizal (root) fungi grow in the ground around the orchid tuber and/or roots and infiltrate the cells of the newly emerging roots and tubers in spring (Liltved & Johnson, 2012). Orchid plants derive benefit from the presence of the fungus within their tissues such as improved nutrient availability and uptake (Arditti, 1982).

This highly specialized fungal association is likely to be the reason why many of South Africa's terrestrial orchids are difficult to cultivate and propagate when removed from their natural habitat (Wodrich, 1996). This factor is likely to have a significant impact on the potential success of a translocation of orchids in particular. As such, successful translocation can only achieved if there is a reasonable similarity between the soil conditions of the donor site and the recipient site. Little is known about the exact relationship between the various species of orchids, and their various species of mycorrhizal fungi as well as their relationships with each other and the soil environments which they inhabit. These confounding variables make translocation of geophytic orchids in particular very difficult and unpredictable, consequently little literature on the subject of translocation of South African geophytic orchids available.

Probably for the same reasons, a lack of published literature exists with regard to the ex-situ cultivation of many of these orchid species. Personal experience of the authors (1 & 2) has shown that species (probably with a strong mycorrhizal dependence) will often grow and flower for one more seasons after translocation before progressively becoming weaker until the plants finally succumb over successive seasons, this usually slow gradual demise may span a couple or even several years (Wodrich, 1996). Consequently we should emphasize that translocation is not an appropriate conservation measure for subpopulations of threatened or Near Threatened terrestrial orchids].

To translocate or not to translocate?

While this paper deals in principal with the translocation of natural orchid populations, it must be made clear at the outset that translocation (including ex-situ holding of populations) is an undesired state and that in-situ conservation should always be viewed as the primary conservation objective (Mc Lean, 2003), as this is the only option that provides real long term security of the species.

While the merits of translocations remains open to debate (IUCN, 2013; Minteer & Collins, 2010; Hodder& Bullock, 1997), the development of the technology supporting translocation as well as dialogue on the ethics and philosophies surrounding the practice "at the coal face", is required. However since WOSA is not involved in policy making and is not the permitting authority, the decision to translocate is not directly for WOSA to deal with, but rather only once the authorisation to develop has been issued, should WOSA then enter into the process as to whether translocation can be considered a viable and sustainable activity for WOSA to engage with. At this stage it would be important to consider the onerous nature of translocation, which is invoked by undertaking a translocation exercise as can be seen by points 3, 4, 5 and 6 below and WOSA should not enter into such lightly.

Orchid species (Orchidaceae) are not inherently more conservation worthy than any other than species belonging to other plant taxa. The decision on whether or not a subpopulation of an orchid species merits translocation effort, or any other form of conservation effort for that matter, should be based on a common set of scientific criteria applicable to all plant taxa as follows:

1. Species that are threatened (Critically Endangered, Endangered or Vulnerable) or Near Threatened in terms of the IUCN Version 3.1 Criteria (IUCN, 2001)'. Translocation is not regarded as a suitable conservation measure for threatened species in almost all cases, unless as a last resort when the destruction of a subpopulation of such a species has been approved by the authorities at the expense of the conservation requirements of the species.
2. Species that are naturally rare species with a small 'Extent of Occurrence' and / or 'Area of Occupancy' (i.e. a Rare or Critically Rare species sensu Raimondo et al., 2009).
3. Species that, though not currently regarded as being at risk of extinction, are declining in the wild as a result or over utilization by humans (a Declining species sensu Raimondo et al., 2009).
4. Species that are 'scarce and restricted' in the region were the study site is situated. The term 'scarce and restricted' here refers to species that are not currently regarded as 'species of conservation concern' (threatened, Near Threatened, Declining, Rare and Critically Rare) in accordance to the latest Red List of South African plants (Raimondo et al., 2009 and http://redlist.sanbi.org), but

which in the opinion of the specialist nevertheless merit some conservation effort as they meet one or more of the following criteria:

a) Species that are widespread within the South Africa or even southern Africa, but which are rare and known from only a few isolated localities in the 'region' (e.g. Mpumalanga and Gauteng Highveld region) in which the study site is situated.

b) Species which are largely restricted to the 'region' where the study site is situated, where they are widespread, but are represented by relatively few and isolated localities.

c) Species which are rare in the 'region' where the study site is situated and are restricted to only a few localities in habitats which are themselves highly spatially restricted within the 'region' and are under threat from anthropogenic impacts such as transformation by alien plant species, urbanisation and reduced water qualities. On the Highveld, for example, such habitats would include indigenous forest patches, ravines (or kloof's) and seasonal wetlands of first-order, non-perennial streams.

d) Species which are represented by only one or two subpopulations (or localities) in the region where the study site is situated and these subpopulations are situated on the outer edge of the known distribution range or 'Extent of Occurrence' of these species. Such subpopulations have an elevated likelihood of comprising unique ecotypes.

It is advisable for WOSA to appoint a panel of suitably experienced conservation practitioners to assess each application based on its own merits to determine if and when a population meets the criteria for translocation. In assessing the application the Pre-cautionary principle should be applied and not the post-cautionary as often happens in practice.

Process which should be exhausted before a candidate species can be assessed for translocation

WOSA can have a significant influence on the outcome of an EIA process; as such investment in the process would be strongly advised. Such impact at the EIA phase would not however be focussed on translocation but rather wise conservation planning for in-situ conservation.

The steps outlined below refer not only to the EIA process itself but specifically how WOSA should arrive at the point of assessing a case for evaluation, notwithstanding the considerations set out in 1 above.

Step 1 Basic assessment

Basic assessment involves assessing the conservation importance and status as well as the potential increases in extinction risk that the loss of the sub/population/s likely to be impacted on by the proposed development.

Step 2- Engagement

Any translocation exercise holds an inherent risk of failure in the long term, and no guarantee can be provided for success, as such the option to translocate should only be arrived at after thorough consultation with all parties, independent expert opinions have been obtained and all other options have been completely exhausted.

Step 3 - Exploring alternatives

It is advised that WOSA or other conservation based agencies should invest heavily in engaging with applicants at an early stage of an application to explore alternative Land-Use strategies, alternative site layout options, etc. in an attempt to secure the future of an orchid population in-situ.

Step 4 - Mitigation

Only once the alternatives have been properly assessed should advise the applicant to consider various mitigation measures which may assist in the orchid being secured in its natural habitat both during and after the construction and operational phases of the project. This could be in terms of setting aside parcels of natural habitat within the project scope that will be protected and remain undisturbed for the duration of the project as conservation servitudes or protected areas and thus allow the target species to continue to survive in situ long after the closure of the project. This phase could also include the negotiation of offsets where the orchid can be formally protected in a local or remote site which is currently not secured for the long term.

Step 4 - Exhaust legislative processes

WOSA or other conservation agencies should engage this phase fully to ensure that the best interest of the orchid population is taken in to the fullest consideration and every aspect of the population is properly studied and documented. This process should serve the purpose of assembling data on the species and collating it into a workable format.

Step 5 Assess species and risks associated with translocation

Following on with the criteria listed under 1. above, all translocation exercises carry inherent risk some of which cannot be adequately assessed, as such the risks need to be carefully identified and assessed compared with the potential benefits and an informed decision arrived at. Translocation will require time and resources, it is important that efforts are invested wisely. Where the amount of uncertainty (risk) remains high, translocations should not be recommended. Richardson et al. (2009) propose the use of a decision tree for evaluating managed relocation to be based on four criteria which are plotted on a 4-dimensional space to create a 2-dimensional visual tree to assist in the decision making process. This or similarly adapted method could be developed for WOSA.

Step 6 Recommendation
Only once environmental authorisation has been granted by the legislative authority and the orchid population is in imminent danger of being destroyed should any translocation activities be considered or engaged.

Pre - Translocation.

Activities conducted under the auspices of WOSA should be regulated by predetermined set of procedures, whereby checklists and guidelines can ensure that all requirements have been met.

Once WOSA has decided to proceed with a translocation it should appoint a project coordinator who will coordinate the entire operation on behalf of WOSA, such project coordinator must:

1.1. Ensure plants meet all criteria for translocation – see above

1.2. Design a project outline; this should include a plan of action for both translocation and post translocation monitoring:

- How the transplanting will be carried out
- How the monitoring will be carried out

1.3. Ensure all necessary permits and landowners permissions are obtained in writing well in advance of the proposed translocation date. Permit applications may take authorities up to three months to process permit applications. Permit requirements vary between different provinces; ensure that the correct permits are being applied for before applying.

1.4. Launch ecological research with regard into several aspects of the species autecology, identification of pollinator/s, isolation of mycorrhizal fungi, seed banking, seed germination protocols etc.

1.5. Identify potential recipient sites and conduct ground trothing exercises. Methodology exists to use GIS or species distribution modelling programs, such as MAXENT, to predict where the target species may potentially occur. Then try and ensure that the receiving site is located within the area that the model predicts as suitable habitat for the target species. Some conservation organisations have such models available and could be accessed through collaboration. (M. Lötter pers. comm., 2016)

1.6. Prepare herbarium specimens from the donor site and submit to the national herbarium, provide detailed information on label with regard to intended translocation.

1.7. Secure the necessary permits / permissions as may be required. It is important to note that permits must be in name of the person conducting the activity.

I. Collection Permit - for the plants to be removed from the donor site
II. Translocation Permit - permit to replant the plants at a new location (such permit may not currently exist)
III. Written Permission - from the landowner of the donor site to translocate the plants,
IV. Written Permission - from landowner of the recipient site that the plants are to be translocated to
V. Transport permit - to convey plants from the donor site to the recipient site
VI. TOPS* permit - this may only be required for any ToPS* listed species (*Threatened or Protected Species).
VII. Import / export permits – these may be required if plants are to be moved from one province to another

1.8. Survey donor area to identify and mark all plants to be translocated. If plants are to be translocated during their dormant period then a suitable marker must be placed during the growing season that will not perish if the area burns during the dry season. Metal stakes or Aluminium labels can be placed a consistent distance away from the plant and in a consistent orientation to the plant to enable the collector to effectively locate the plant while dormant. GPS data should also be recorded when placing the stakes in order to be able to locate the position of the stakes later. It is always advisable to conduct the site survey during the growing season while it is desirable to conduct the removal of the plants during their dormant season. Although this is not always possible for logistical reasons.

1.9. Data collection: Detailed habitat data must include notes about the donor site that may provide useful data in the future, such as associated species, spatial data about the target species, habitat niches occupied by the target species. Make notes about areas on the donor site where the target species does not occur (i.e. habitat barriers) as well as observations about which plant species do occur in those areas. Pay particular attention to the distribution of dominant grass species on the donor site as they often provide valuable data with regard to the site specific ecological conditions.

1.10. Assess and compare suitable recipient sites with similar edaphic conditions within the natural range of the species, Harris et.al. (2014) recommend that sites with similar geological conditions to the donor site should be prioritised for recipient sites. Conditions to be assessed should include:

- soil type,
- soil depth and profile
- soil pH,
- geology
- rock cover (including percentage surface rock cover and nature of rock cover (i.e. exposed bed rock, boulders, rocks, stones or pebbles)
- Hydrology
- Aspect and slope
- Rainfall
- Vegetation type and structure
- Fire frequency and or intensity
- Distribution and occurrence of dominant grass species
- Security for the foreseeable future
- Pollinator presence (if known)

1.11. Some preparation of the recipient site prior to transfer may be required, such as:

- Fencing
- Access control
- Grazing / trampling
- Clearing of weeds/ invasive species
- Potential planting sites marked out in advance

1.12. Organise date, suitable tools, transport, manpower and logistics.

1.13. Arrange manpower and transport, which may be substantial and depend on the number of plants to be translocated and the size of the soil sods per plant, as well as crates, boxes etc. that will be used to carry the plants/ sods.

Translocation – removal of target species

a. Design a project outline; this should include a plan of action for both translocation and post translocation monitoring:

- How the transplanting will be carried out
- How the monitoring will be carried out

b. Timing and collection area identified. For soft rooted plants translocation should preferably be done during dormancy to minimise the possibility of root damage. If translocation is taking place during the growing season the plant should be removed with a large soil sod intact and transported in such a way that the soil sod cannot break apart during transport and thus sever sensitive roots or damage tubers.

c. Currently WOSA is developing a best practice policy to be included under this point regarding the risk in transferring insects and/or other species of plants and possibly also alien invading plants and seed that may be part of the soil sod that is transplanted.

d. Brief site personnel on removal procedure. This would include briefing staff of the possible extent of root systems, depth of tubers and also the distance from the main plant that replacement tubers can be expected to be found. As far as possible experienced digging staff should be deployed.

e. Removal of soil around roots, especially if the plants are not in their dormant state. This factor will vary according to the species as some species with delicate roots it is advisable to remove a complete soil sod so as to minimise the transplant stress on the target species.

f. Adequate and suitable containers for carrying the plants/ soil sods IE crates, boxes, pots etc. The container should afford protection to the plants during transit.

g. Carry out removal as quickly and as carefully as possible taking care not to allow removed plants to stand in full sun or remain locked in closed vehicles standing in the sun. Light dampening/ misting of the exposed soil sods may be required to reduce transplant stress.

h. Mark and label each individual plant or plant cluster with a unique identification number, take photographic record of each plant/cluster showing label and number. This reference number should be used to track the progress of each individual throughout the process and more importantly for monitoring during post translocation.

i. Treat damaged areas of plant if necessary – flowers of sulphur can be rubbed onto damaged tuber or pseudo bulb sections to prevent subsequent rot. Severe damage that may result in the desiccation of the tuber can be dusted with flowers of sulphur and in some cases sealed with a suitable sealant.

j. Record accurate details in a register
- Species name
- Size of each plant/ clump
- Photo record of each plant (photo number)
- Date of transfer
- Where transferred from
- Any other pertinent info

Translocation - re-planting at receiving site

a. Select planting sites carefully in an attempt to mimic the micro habitat found at the donor site, observing the original aspect of the individual plants may prove to be important with certain species.

b. To avoid that a single site is destroyed by a chance event (such as a porcupines foraging), it is proposed that not all plants removed for translocation should be planted in a single small area at the donor site. Consider what the pollinator may be, and distances it may be likely to travel, and create multiple small subpopulations that can be visited by a single pollinator. For example, it may be prudent to establish three populations about 75-100 m apart (triangular shape).

c. Damage to receiving site kept to minimum: Translocation invariably leads to physical disturbance of receiving environment. Translocated individuals may harm other taxa within receiving environment. Translocated individuals may transmit pathogens and / or parasites. If individuals of the translocated species are already present in the receiving environment, genetic contamination of the subpopulation may occur which will lead to the erosion of the genetic diversity of the species as a whole.

d. Record accurate details in a register
- Species name
- Size of each plant [not practical or possible in many cases]
- Photo record of each plant (photo number) [not practical or possible in many cases]
- Date of transfer
- GPS record of new location
- Where transferred from
- Climatic conditions immediately preceding translocation and on day of translocation.
- Any other pertinent info

Post relocation monitoring and species recovery

Translocation can only be deemed to have been successful where the translocated population successfully established itself as a sustainable and viable population at the receiving site (Harris et.al., 2009). Consequently the primary objective of post translocation monitoring should be to assess sustainability of the translocated population. It must be emphasised that the long-term viability of a translocated subpopulation in its receiving environment, cannot be accurately evaluated over a period of three or four years. Post relocation monitoring would in most cases have to continue into perpetuity as a the long-term (i.e. over decades or centuries) variability of the biophysical characteristics of the receiving environment, and the translocated species reaction to those variations, is practically impossible to predict on the basis of data gathered during a few years of monitoring.
For these reasons accurate record keeping post translocation is possibly the single most valuable aspect of the entire operation. Further to this is to consider where these records are housed. It is advisable that these records be stored in a nationally accessible database, which is available to researchers who may access the data for conservation biology related research.

a. The project coordinator should:
Design or review the project outline for post translocation monitoring, this should clearly state the objectives of translocation and should decide what factors will be used to measure progress towards the objectives.

b. Conduct regular monitoring and record detailed data.

c. Data that should be recorded during monitoring could include:

- record of mortalities
- photo records of each plant at regular intervals
- notes on vegetative progress
- records of seasonal or unseasonal burning
- period of dormancy and regrowth
- notes on flowering, number of spikes and flowers per plant /cluster
- identification of pollinators
- extent of seed set (parasitisation of seeds)
- presence of parasites and or herbivory
- seed germination/ recruitment

d. Collate all information and upload photographic data to the Orchid Atlas website (or other suitable Virtual Museum): http://vmus.adu.org.za/?vm=OrchidMAP

e. Prepare herbarium vouchers to be lodged in a recognized herbarium.

f. Write notes about experiences on information learned, successes and failures. Make this data available to other WOSA chapters to encourage information sharing and shared learning.

g. Report progress to WOSA at regular predetermined time frames.

h. Facilitate/ post updates on WOSA website.

i. Ensure closure compliance for all permits issued by permitting authorities

Conclusion

In conclusion it remains only to be said that translocation, although worthy of consideration, should be reserved for extremely rare instances where there is literally no other alternative remaining for the conservation of a species. It is an undesired state and carries with it responsibility for long term monitoring and management.

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Challenges in growing South African Terrestrial Orchids

Karsten Wodrich

The topic of my presentation today is exploring why it is so difficult to grow our indigenous terrestrials successfully when they are removed from their natural habitat and why we as WOSA advocate the in-situ conservation of many of our orchids. And we have prime examples of many these species right here in Verloren Valei.

Figure 10.1. *Pterygodium magnum*.

Delicate nature of the plants

The first and I believe most important characteristic of many of our terrestrial species which include the genera *Disa*, *Habenaria*, *Corycium*, *Pterygodium*, *Satyrium* and *Brachycorythis* amongst others is the fact that they have very delicate underground structures. And here we are talking about the roots and the tubers. The roots of these genera are extremely fragile. They are fleshy with numerous very fine root hairs covering the outer surface and any disturbance is very likely to damage the root hairs and it is also very easy to break the roots.

In their natural habitat the tuber and root system is normally tightly embedded and entwined in the root system of companion plants and specifically many of the grasses. Grasses have an extensive and very fine root system that takes up a large volume of soil they grow in. An example in figure 10.2 are the tuber lobes of *Pterygodium magnum* embedded in the roots of grasses. Trying to remove any of these tubers from the surrounding vegetation results in root breakage and damage to the tuber lobes. Each of these tuber lobes is connected to a single growing point at the apex. These two plants shown in figure 12.2 were collected in the Bedford Dam at the Ingula pumped storage scheme which will be flooded in the coming months during commissioning. I specifically waited for the dormant period in late winter when the root system dies back to remove the tubers from the surrounding grass and still managed to partially damage the surface of one of the tuber lobes. You could compare the consistency of the tubers to that of a strawberry and I am sure you will appreciate how easy it is to bruise or damage these.

Figure 10.2. *Pterygodium magnum* tubers.

Single growing point

A further characteristic is that most of the species in the listed genera only have a single growing point. Once this growing point is damaged, injured or exposed to a bacterial or fungal infection the most likely outcome is the complete loss of the plant. Figure 3 shows the single growing point on *Habenaria dives*. *Bonatea* – as with *Corycium* has a number of tuber lobes connected to the growing point with a very thin and fragile connection piece that breaks very easily. The severed tuber lobe can be discarded as there are no further growing eyes that could possibly sprout new growth.

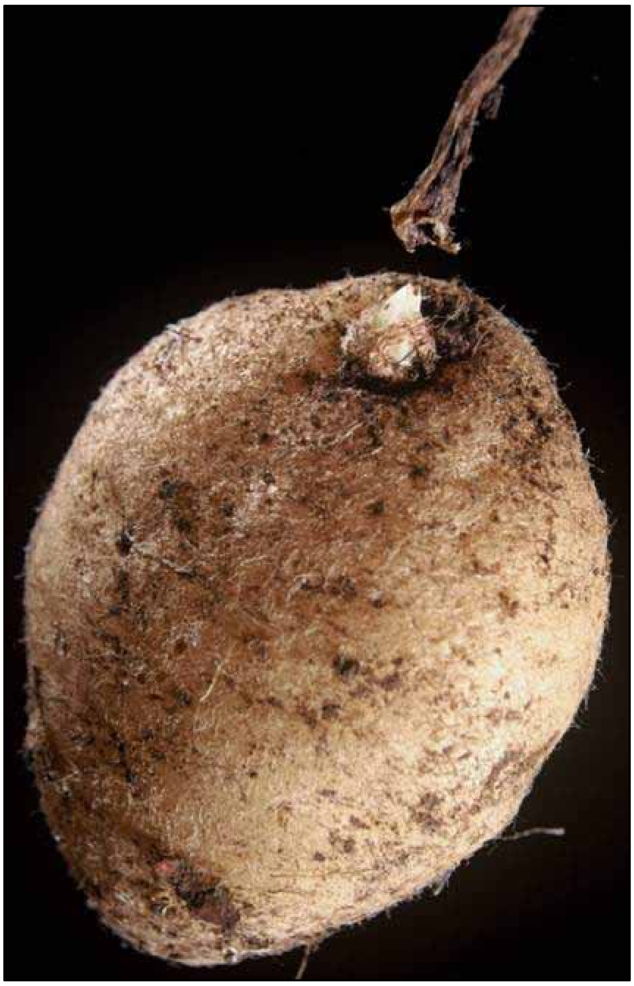

Figure 10.3. *Habenaria dives* tuber with a single growing point.

Many, if not most of the species, also produce a single replacement tuber every season and the new growing point develops at the tip of the new tuber or group of tuber lobes within the connecting tissue of the previous seasons growth. This connecting tissue dies back during dormancy and if conditions are unfavorable and the connecting tissue starts to rot, the new growing point is also in danger of being affected. This may happen if the plants in cultivation or in their natural environment are watered after the plant goes dormant. Rot of the growing point equals the loss of the plant.

Figure 10.4. *Habenaria dives*

The importance of moisture around and orchid tuber

A large factor that determines the success of an orchid in its natural habitat is how well it can get through the dry dormant period without excessive loss of moisture from the dormant tuber. My observations have shown that species with hirsute of hairy tubers withstand dry conditions extremely well. Those that have a smooth tuber surface that is not covered in hairs have very specific requirement regarding the moisture around the tuber during dormancy to prevent moisture loss and shriveling of the tuber. One of these species is *Disa versicolor* (figure 10.5). We were fortunate enough to have collected a few specimens from the Bedford Dam in the last two seasons and I had removed the dormant tuber from the surrounding grass in autumn and placed them in paper bags during dormancy as I normally do with many of the Cape *Satyrium* species (figure 10.6). To my dismay I found that the tubers shriveled rapidly and the only way to keep them drying out was to place them in damp sphagnum moss during this period. This is definitely not a practice one would want to do on a large scale as it requires very careful control of the moisture content of the sphagnum as well.

Figure 10.5. *Disa versicolor*.

Figure 10.6. *Disa versicolor* tubers quickly dehydrate if not kept slightly moist during the dormant period.

Ultimately the question is how these species keep the tubers plump during dormancy in their natural habitat and how these conditions can be recreated in culture. I do not have an answer to that yet but I believe that even though it is dry outside there is still a certain amount of moisture that rises from deeper soil levels to the surface through capillary action and that this moisture keeps the dormant tubers in good condition without excessive wetness that would start to rot the old tissue connecting the previous seasons growth to the replacement tuber.

The same goes for species of *Eulophia*. Even though the pseudobulb-like underground storage structures are

Figure 10.7. *Eulophia parvilabris* preparing for dormancy.

Figure 10.8. The roots of a *Eulophia* during dormancy.

persistent and the roots have a typical structure as that found on many of the more common orchids such as the Cymbidiums and the epiphytic species, most of the *Eulophia* species do go dormant. For those found in the Highveld and even the species found here in Verloren Valei there is a definite dry period. Once again in cultivation this dry period must be adhered to or the pseudobulbs will rot.

Figure 10.9. Rot on pseudobulbs of *Eulophia speciosa* which was kept too wet in winter.

But if they are kept completely dry the moisture loss is extreme in a pot with a relatively small volume of soil around the roots and pseudobulbs and the plants will not grow well in the subsequent growing season. If the plant cannot recover from this set-back it will invariably produce smaller pseudobulbs the next season. Once again it is extremely difficult to match the need for moisture during dormancy with the risk of rotting the underground structures as a result of excessive moisture. Even though I have been growing *Eulophias* for almost 30 years now I still have not found the ideal way of growing these and still lose plants during their dormant period. We still have to find a way of mimicking the actual dormant period moisture content of the soil in its natural habitat.

One of the eye openers was a recent programme of the Gardener on our local satellite TV.
In a discussion on growing decorative grasses it was mentioned that if the roots of grasses were not kept moist they would not survive. Putting two and two together that essentially meant that there must be moisture present around that vast root system of grasses that many of the orchid tubers are embedded in during the dry dormant period. This is what most likely also keeps the tubers from drying out in their natural habitat. Until we are able to replicate the conditions found in their natural habitats in cultivation we will keep on losing plants.

Soil temperature

Soil temperature is another factor that is extremely difficult to control in cultivation and it is believed that this is also a key requirement for the successful growing of many of our terrestrial species. It has definitely been demonstrated to be the case with the well-known *Disa uniflora* from the Western Cape that has its roots and tubers constantly submerged in cold water and requires similar conditions in cultivation.

Figure 10.10. Special water tanks used to mimic the natural environment for growing *Disa uniflora*.

Figure 10.11. *Disa uniflora* in cultivation in wet trays in New Zealand.

Figure 10.12. A view of the grassland in the Bedford Dam (upper dam of the Ingula pumped storage scheme) with *Disa versicolor* spikes visible in the foreground. This area will be flooded when the scheme is commissioned.

For those terrestrials that grow in grasslands (figure 10.12) the soil is permanently shaded – either by green grass during the warmer summer months or brown withered grass in winter. If the soil temperature is measured in the natural habitat it will not vary much between day and night but will fluctuate from season to season instead. Placed in pots, species that require high light conditions will experience serious fluctuations in soil temperature as a result of the fact that there is only a finite volume of soil in the pot. This will heat up quickly if exposed to the sun and cool down just as quickly again during the night. Soil surface temperatures with darker mixes will easily reach temperatures that will overheat and destroy any roots too close to the surface. Various methods can be employed - from placing white gravel on the surface of the pots to growing plants in white pots or even growing them in polystyrene containers as Duncan McFarlane is currently experimenting with. The other extreme is to go to temperature controlled beds which is a costly exercise both in heating in winter and cooling in summer.

Figure 10.13. Potting mix surface covered in a light gravel is useful in minimising heat absorption of dark coloured posting mixes.

On the point of temperature I noted quite by accident that one can prevent *Eulophia* seedlings from going dormant in winter simply by keeping the temperature up either in a greenhouse or indoors. That vastly improves their survival rate as there is no dry dormancy that could potentially cause the tiny seedling pseudobulbs to desiccate.

Mycorrhizal fungal association

As if the difficulties I have outlined are not enough there is another and most likely the most important factor that determines the successful growth and propagation of the indigenous terrestrial orchid. And that is the close association of most of the species with mycorrhizal fungi.

Orchid seed is tiny and has a nucleus of a few cells enclosed in a tough seed coat. It does not have nutrient reserves at all like for example the pea or bean that it can rely on during germination. The orchid seed instead relies on being infected by a mycorrhizal fungus that supplies nutrients to the developing seedling while providing a safe haven for the fungus in return. Once the seed is infected it can germinate, develop and grow into a healthy adult plant over a number of years.

When it finally flowers and produces new seed the complete cycle starts again. Infection is normally only found in the roots or the collar region of the plant. This means that when the adult plant goes dormant the mycorrhizal association may briefly come to an end as the roots die back.

The most likely explanation is that the orchid cannot risk the fungus completely taking over the cells in the tuber and possibly destroying that in the process while it is in its dormant state. Come the new growing season the new roots of the orchid need to be re-infected in order for the plant to grow to its full potential (figure 10.14).

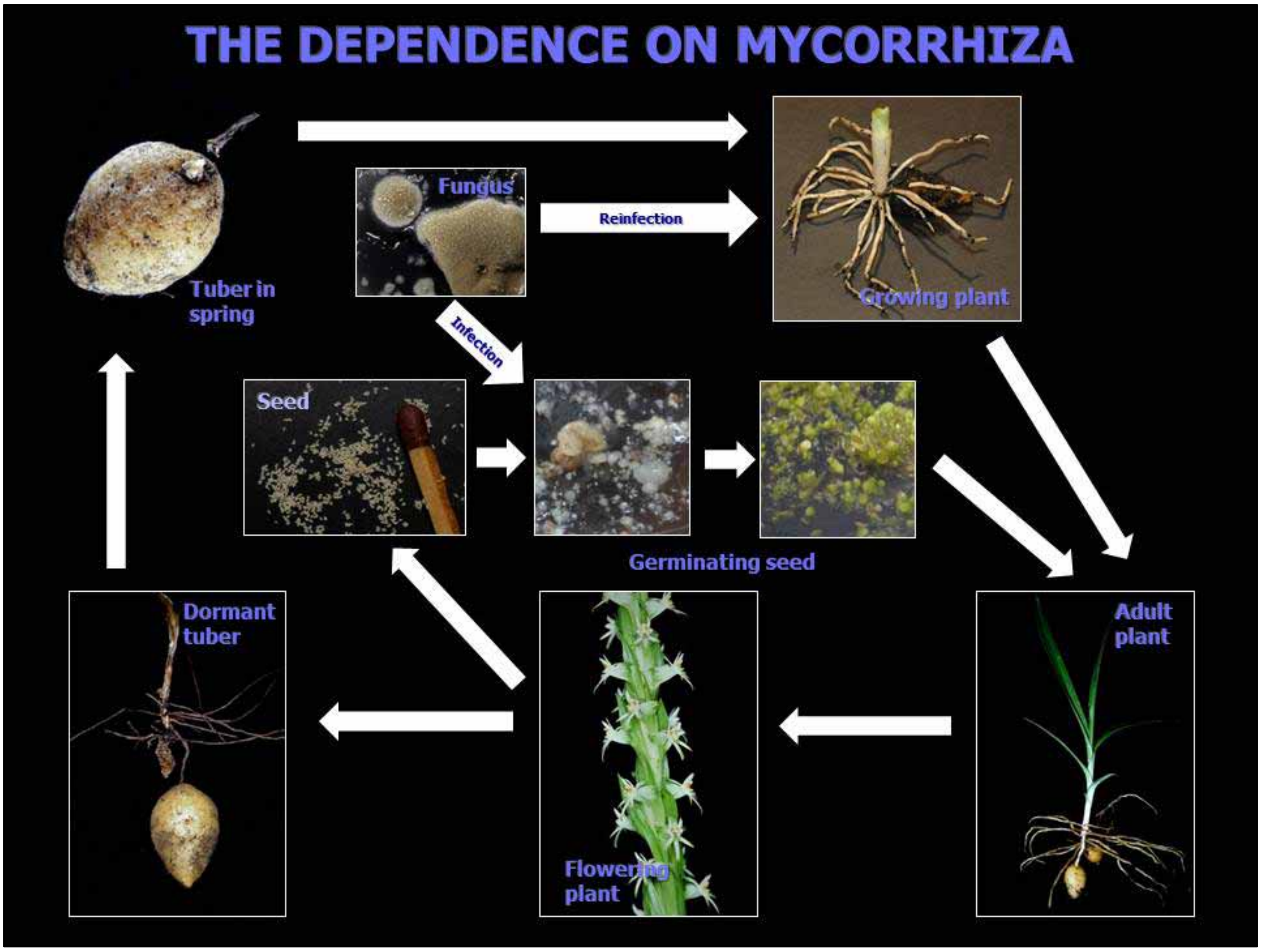

Figure 10.14. A schematic of the life cycle of *Habenaria dives* showing the likely dependence on mycorrhizal fungi.

Figure 10.15. Mycorrhizal fungi in *Acrolophia capensis* tubers.

Figure 10.15 shows successively higher magnification of a slice of an *Acrolophia capensis* plant tuber (this species that does not go dormant and the orchid allows infection of the thick tuber-like storage organs). One can clearly see the dark coloured ring of infected tissue in the tuberous root. Inside each cell lies a bundle of fungal hyphae or vegetative structures of the fungus called a peloton that is connected to a vast network of fungal filaments outside the roots. The plant cell will digest these pelotons and obtain the nutrients from that.

Once a plant is removed from its natural habitat it is extremely difficult to keep this fungal association intact and most often a plant obtained in the wild will often grow and flower for one more seasons after collection before progressively becoming weaker until the plants finally succumb over successive seasons. This usually slow and gradual demise may span two or three years.

Understanding the annual growth cycle

Another key to growing the indigenous terrestrials successfully is to understand the growth cycle of the species. That includes knowing exactly what is happening below ground level at what time of the year. In the last Orchids Journal (Wodrich, 2015) I detailed the growth cycle of many of the Western Cape Satyriums and that has been an eye opener that allowed the cultivation conditions to be adjusted to optimize growth and flowering. In order to do that one needs to be able to sacrifice some plants to determine exactly how that cycle works. Unfortunately many of the species are much too valuable to pull out of the pots five times in a growing season and possibly losing the plant in the process.

Currently one of the growth cycles that we are trying to understand is that of the species that have a flowering stem separate from the flowering stem. Examples are *Disa chrysostachya* and *Disa versicolor*. Some of the summer rainfall Satyriums such as *Satyrium longicauda* and *Satyrium neglectum* also show this type of growth.

The Bedford Dam collections allowed numerous plants of *Disa versicolor* to be collected and with that the opportunity arose to determine how the tuber and roots of this species develop throughout the season. Figure 10.16 shows the roots and tubers of *Disa versicolor* in mid-January.

Indications are that the plants only retain the replacement tuber that originally supported the vegetative or leafy shoot during the dormant period in winter. When the growing season starts this tuber starts growing a flowering stem from its dormant growing point and at the same time a replacement tuber is rapidly formed next to the original tuber. The leafy growth originates from this new tuber and keeps on growing throughout the growing season. In the process the new tuber plumps up while the plant flowers from the old tuber that carried the plant through dormancy. When the dry season approaches the tuber connected to the flowering stem dies back and the tuber shrivels. At the same time the leafy shoot connected to the new tuber dies back and the base of the now withered leafy shoot conceals the growing point that will sprout the new flowing stem in the next growing season.

Figure 10.16. *Disa versicolor* tubers on the verge of dormancy. The new tuber with the dying leafy shoot is on the left while the old tuber with the flowering stem is on the right. The new tuber will sprout the next seasons flowering stem.

So in summary the tuber with the leafy growth sprouts the next seasons flowering stem while a new tuber replacement tuber carries the leafy growth.

Conclusion

I believe that the focus on indigenous orchid conservation should be on in-situ conservation and that research projects must be increased to allow us to understand the many aspects of or indigenous orchids.

Based on this presentation you will appreciate that digging up a terrestrial orchid to 'give it a try' will most likely result in the loss of the plant. Beside the fact that is also illegal to do so without the necessary collecting permits and landowners permission.

Rather purchase propagated plants. The more popular ones are becoming available. I have purchased *Disa uniflora* hybrids, *Stenoglottis* hybrids, Ansellias and even some Eulophias at Garden Centres. You just need to keep an eye open for these and if they are species - keep the proof of purchase to prove you have acquired them legally.

My ultimate aim is to make seed propagated terrestrial species and hybrids available in future. And having started sowing again two years ago some of these plants are already out of flask. Hybrids have proven to have much more vigour than their parents and are often much easier to grow as well.

Figure 10.17. Various flasks of terrestrial species and hybrids in the light cabinet.

Figure 10.18. *Eulophia parvilabris* x *Eulophia speciosa* seedlings shortly after deflasking.

Figure 10.19. Seedlings of *Eulophia* hybrids and species established in the shadehouse.

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Moth Pollination in *Mystacidium* Species

Nic Venter and Craig Peter

Introduction

Orchids have evolved (sometimes exploitative) relationships with numerous guilds of pollinators. These include birds, bees, beetles, flies, wasps, butterflies and moths. Moths account for around 7% of the identified pollinator groups.

Moths can be categorized in two groups; 1) settling moths that land and settle on the flowers that they pollinate and 2) hawkmoths that generally pollinate flowers while hovering without actually landing.

Figure 11.1. *Stemorrhages sericea* (Crambidae) is one of the settling moth species that pollinate flowers of *Mystacidium pusillum*.

Figure 11.2. *Theretra capensis* belongs to the hawkmoth group that will pollinate flowers while hovering in front of them.

How do orchids exploit pollinators?

The orchids have developed methods of either rewarding their pollinators (oils or nectar) or deceiving their pollinators by tricking them into thinking that they are a different flowers altogether that would normally give a reward. In some cases flowers will even deceive the pollinator into thinking that they're courting an insect (sexual deception).

Figure 11.3. *Corycium dracomontanum* typically rewards insects with oil. (Photo: Carl Huchzermeyer)

Examples of oil rewarding genera are *Disperis*, *Pterygodium*, *Corycium*, *Ceratandra*, *Evotella*, *Satyrium* and *Pachites*. Sexual mimicry is exhibited by *Disa atricapilla* and *D. bivalvata*. Floral mimicry can be found in *Eulophia zeyheriana* where the flowers mimic those of *Wahlenburgia cuspidata* (Figure 11.4). *Wahlenburgia cuspidata* typically offers pollinators a nectar reward while the *Eulophia zeyheriana* does not. Many other species in the genus *Eulophia* exhibit food deception. Numerous other genera offer pollinators nectar rewards.

The genus *Mystacidium* comprises of 7 species in South Africa and can be split into green and white flowered species. *Mystacidium capense*, *M. venosum* and *M. braybоniae* are the three white flowered species while *Mystacidium pusillum*, *M. gracile, M. alicae* and *M. flanaganii* are the four green flowered species.

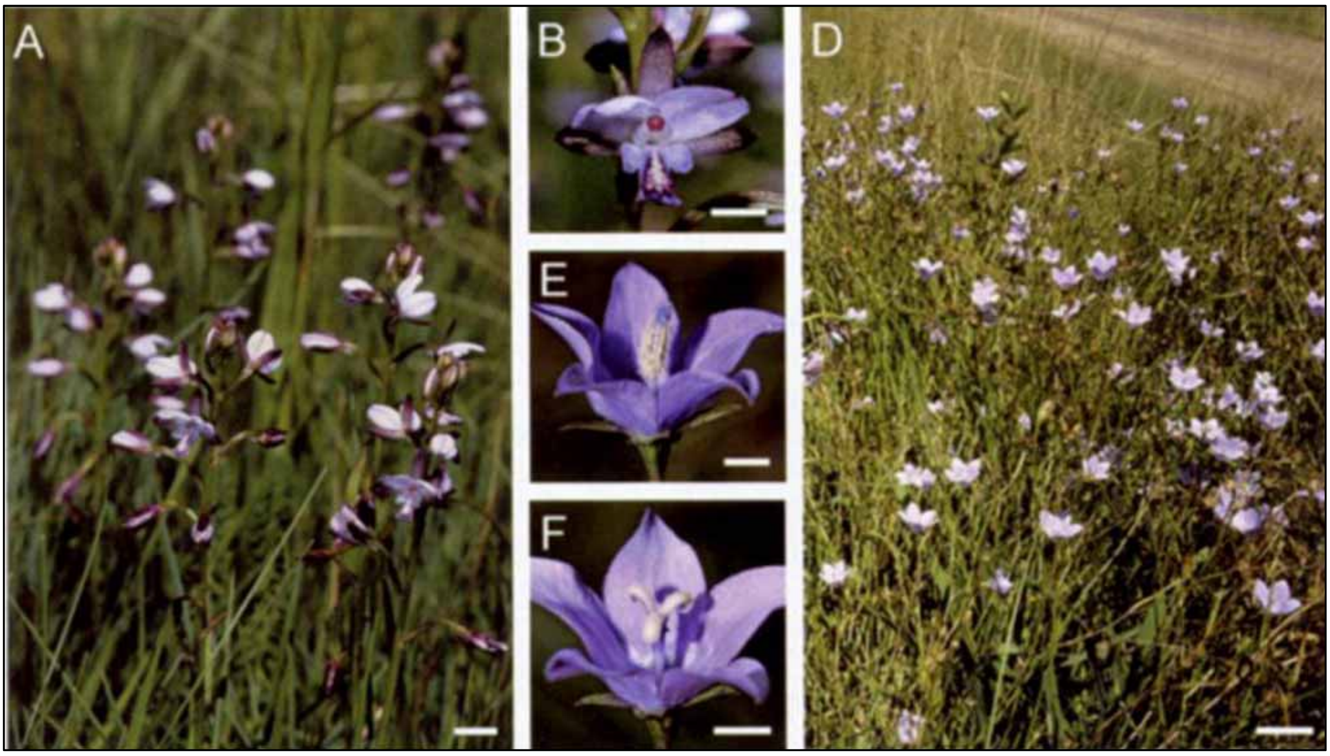

Figure 11.4. Example of floral mimicry. A, B: *Eulophia zeheriana*, D, E, F: *Wahlenburgia cuspidata* (Peter & Johnson, 2008)

Figure 11.5. *Mystacidium capense* – one of the three and larger of the white flowered *Mystacidium* species.

Figure 11.6. *Mystacidium venosum* – another white flowered *Mystacidium* species that flowers in winter.

A common trait amongst *Mystacidium* flowers is the evening activated scent. The flowers are pale (white or green) and they all offer insects a nectar reward. The green colour of the flowers camouflages them well amongst the green leaves and lichen on host trees (Figure 11.7).

Figure 11.7. Masses of the green flowered species *Mystacidium pusillum* flowering in a tree.

Figure 11.8. *Mystacidium pusillum*.

Figure 11.9. *Mystacidium gracile* – another green flowered species.

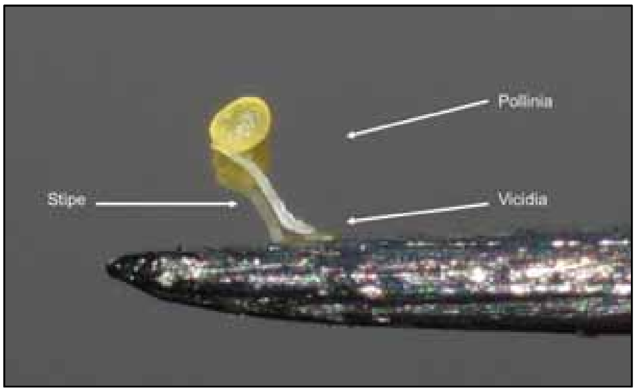

Figure 11.10. *Mystacidium pusillum* pollinarium on the tip of a pin.

Figure 11.11. *Mystacidium capense* and *M. venosum* have average spur lengths of 40-45mm. Flowers are jasmine scented in the evenings and offer a large volume of diluted nectar which is stored at the end of the spur. Hawkmoths typically pollinate the white flowering species.

Figure 11.12. Green flowered species of *Mystacidium* have 12mm average spur lengths. Flowers are evening scented but do not smell like jasmine and offer a small volume of concentrated nectar which is stored at the end of the spur. Settling moths typically pollinate the green flowering species.

Moth pollination traits

Hawkmoths have longer tongues, good vision and hover while feeding, which results in higher metabolic rate and therefore they require more but less concentrated nectar.
Settling moths on the other hand have shorter tongues, settle on plant (flowers) and thus have lower energetic demands. They are less rushed to finish drinking the nectar so can cope with more concentrated but less nectar

Setting moths were recently confirmed as pollinators of the green flowered species of *Mystacidium pusillum.*

White flower pollinators

Figures 11.13 to 11.18 illustrate the importance of hawkmoths as pollinators and cannot be overlooked.

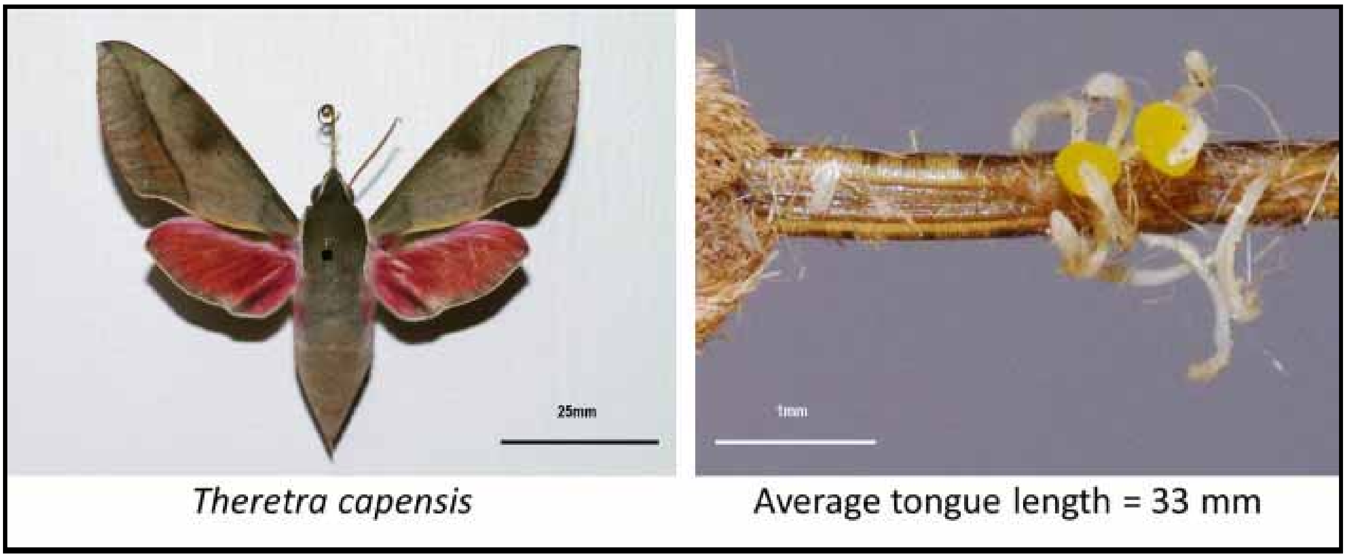

Figure 11.13. The hawkmoth *Theretra capensis* is a confirmed pollinator of *Mystacidium capense*.

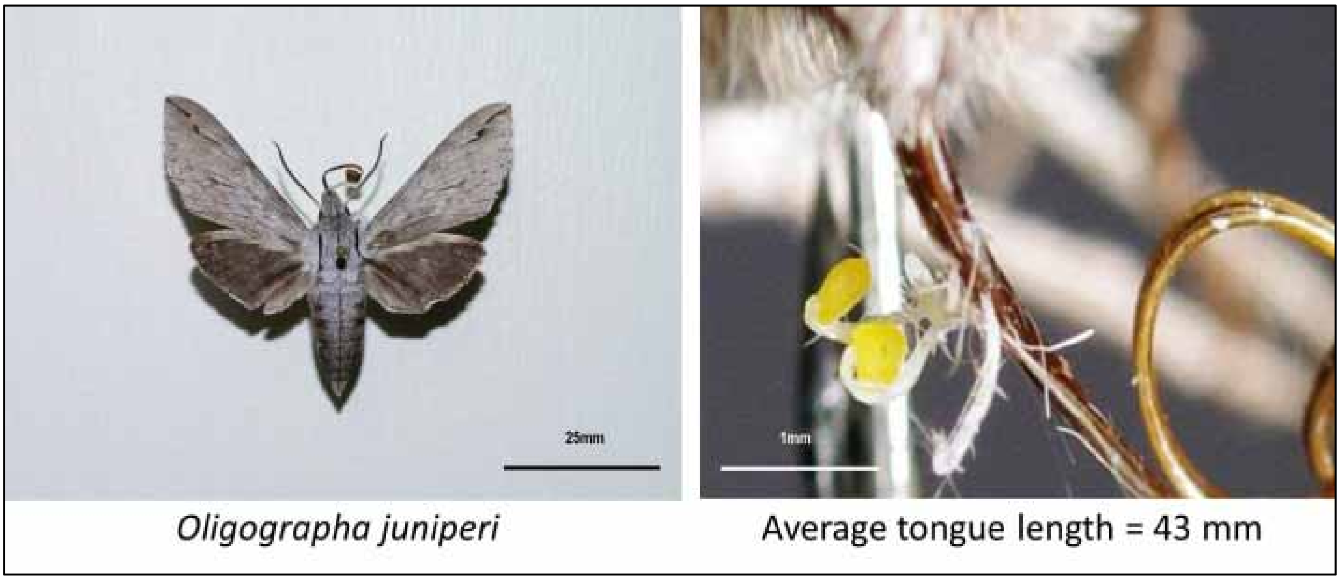

Figure 11.14. The hawkmoth *Oligographa juniperi* is another confirmed pollinator of *Mystacidium capense*.

Figure 11.15. *Oligographa juniperi* with a 49mm long tongue.

Figure 11.16. A screen shot from a video shot by Steve Johnson showing the hawkmoth species *Agrius convolvulus convolvuli* visiting *Mystacidium capense*.

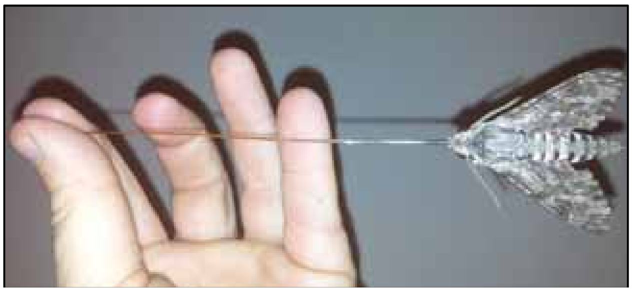

Figure 11.17. The tongue of *Agrius convolvuli convolvuli* can measure an incredible 125mm.

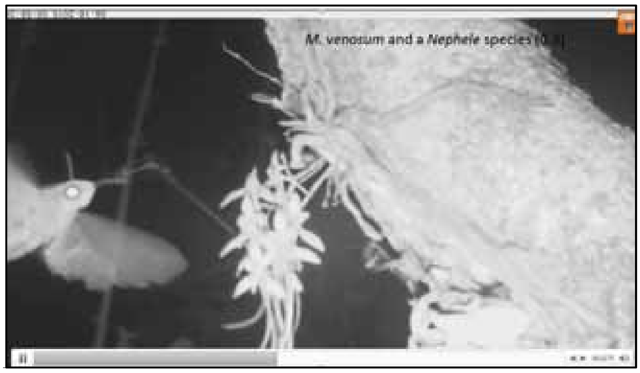

Figure 11.18. Another screen shot from a video shot by Craig Peter showing a *Nephele* hawkmoth species visiting *Mystacidium venosum*. Note the pollinia stuck to the base of the tongue.

Green flower pollinators

A number of settling moths have either been observed pollinating the green flowered *Mystacidium pusillum* species or have been caught and found with pollinia stuck to their tongues.

Figure 11.19. A settling moth *Stemorrhages sericea* (Family: Crambidae) on *Mystacidium pusillum* that has short 16.8mm spurs. The moth species has a 23mm long tongue which matches the length of the spurs on the flower.

Amongst these are: *Amerila bauri* (Family: Erebidae) with a tongue measuring 10mm (figure 11.20), *Amphidrina melanosema* (Family: Noctuidae) (figure 11.21), *Trichoplusia orichalcea* (Family: Noctuidae) with a 17mm long tongue (figure 11.22), *Plusia fracta* (Family: Noctuidae) with a 15mm long tongue (figure 11.23) and *Sommeria strabonis* (Family: Noctuidae) (figure 11.24).

Figure 11.20. *Amerila bauri*

Figure 11.21. *Amphidrina melanosema.*

Figure 11.22. *Trichoplusia orichalcea.*

Figure 11.23. *Plusia fracta.*

Figure 11.24. *Sommeria strabonis.*

To validate the observations made in the field, the colour of the *Mystacidium venosum* and *M. pusillum* flowers were analysed. The results clearly indicated the higher reflectance of the white flowered species compare to the green flowered species. The green flowered species is also consistent with a comparison of the green leaves of *Dovyalis caffra*. The spectrum visible to the human eye lies between 400 to 700 nm on the graph shown in figure 11.25.

Hawkmoths tend to have good vision and it may be advantageous for the flowers to have a high contrast in order to identify the flowers against a dark background.

The settling moths tend to be guided by scent and once the source of the scent has been found they settle and start feeding. In this case, the flower contrast is thought not to be as important compared to the white flowers pollinated by hawkmoths.

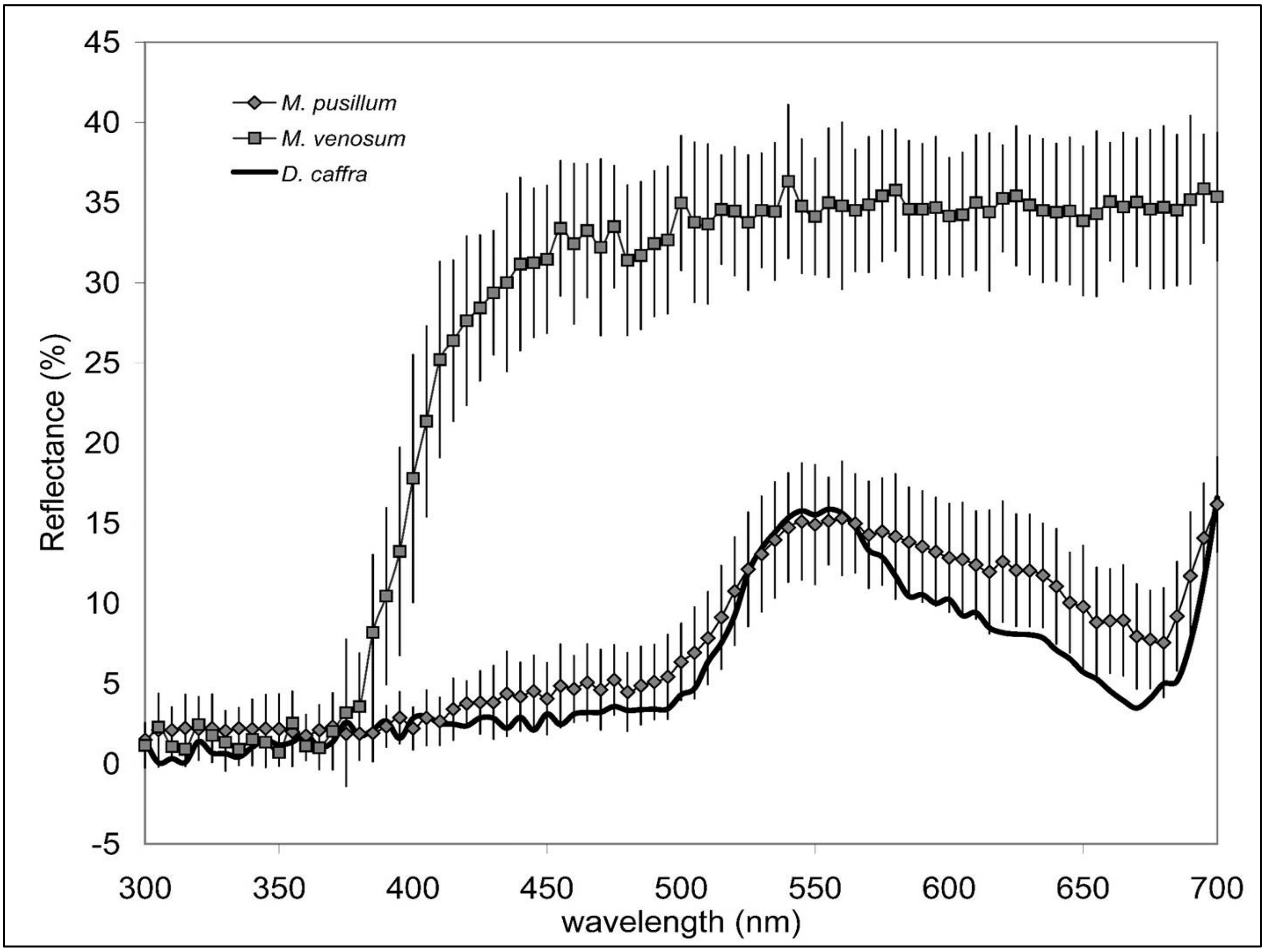

Figure 11.25. Reflectance wavelengths for two *Mystacidium* species and leaves of *Dovyalis caffra*.

Other moth pollinated orchids

A number of other indigenous orchids are moth pollinated. These include a number of terrestrials such as *Habenaria epipactidea* which is pollinated by the hawkmoth *Basiotha medea* (Peter et al., 2009) as shown in figure 11.26. Three other species pollinated by hawkmoths are *Bonatea speciosa* (Johnson and Liltved, 1997) (figure 11.27), the epiphytic species *Aerangis mystacidii* (figure 11.28) and *Cyrtorchis arcuata* (figure 11.29)

Figure 11.26. *Habenaria epipactidea.*

Figure 11.27. *Bonatea speciosa*.

Figure 11.28. *Aerangis mystacidii.*

Figure 11.29. *Cyrtorchis arcuata.*

A number of terrestrials are also pollinated by settling moths. These include *Satyrium parviflorum* (figures 11.30 and 11.31) as well as *Habenaria areanaria*. (figures 11.32 and 11.33). Note once again the difference in contrast in the floral structures in the hawkmoth pollinated species and the flowers without much contrast that are visited by the settling moths.

Figure 11.30. Settling moth on *Satyrium parviflorum*. Note the pollinia which are clearly visible.

Figure 11.31. Settling moth on *Satyrium parviflorum*.

Figure 11.32. Settling moth on *Habenaria arenaria*.

Figure 11.33. Close-up of another settling moth on *Habenaria arenaria*.

Conclusion

It has been demonstrated that there are two different moth types attracted to *Mystacidium* species, one being the hawkmoths that are attracted to the highly contrasting white flowered species and the settling moths that are attracted to the green flowered species. In order to satisfy the moths energy needs, the white flowered species offer a large volume of low concentration nectar allowing rapid uptake of fluid by the hawkmoth that drinks while hovering. The green flowered species have a lower volume of more concentrated nectar that can be sucked up by the settling moths at leisure. These reward mechanisms can also be found in a number of other epiphytic and terrestrials species that attract specific types of moths as pollinators.

Figure 11.34. The final aim of attracting the pollinators is to ensure that fertile seed is set and finally dispersed. Ripening seed capsules on *Mystacidium capense*.

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Some vulnerable epiphytic orchids of eastern Zimbabwe

Peter Ashton

Abstract

A total of 95 species of epiphytic orchids – 6 of which are endemic – have been confirmed to occur in Zimbabwe. Over 90% of these species occur in the moist forests and woodlands of eastern Zimbabwe, and several species are confined to very small areas of suitable habitat. The continued clearing of woodlands for cultivation, and the extraction of trees for fuel and house-building, has progressively decreased the available orchid habitat and increasingly threatens those species that occupy specific sensitive habitats. The use of fire to renew grazing lands and the invasion of forest margins by alien tree species has increased the rate of habitat loss.

Introduction

The mountainous higher-elevation areas in the eastern part of Zimbabwe receive high annual rainfalls and are widely renowned for their scenic beauty (**Figure 12.1**). These areas also contain patches of moist evergreen forest and riparian forest where over 90% of the epiphytic orchid species recorded from Zimbabwe have been found. The eastern parts of Zimbabwe are also home to a large proportion of the national population and continued population growth as well as economic development and expansion of agricultural lands pose major challenges to orchid habitats through habitat fragmentation, modification and loss.

Across Zimbabwe, the annual summer rainfall (November to April) varies between 400 to over 1,500 mm, with the

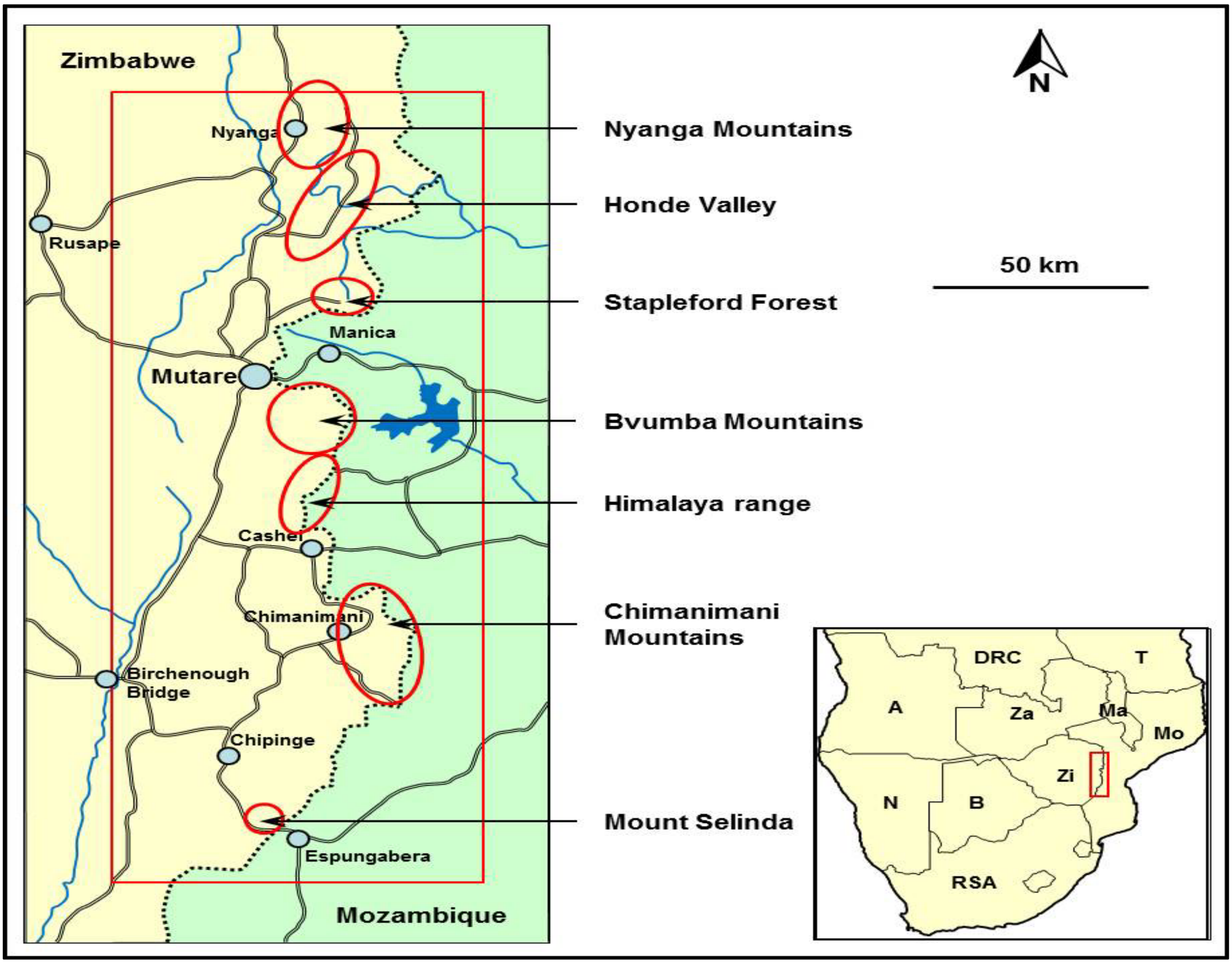

Figure 12.1. Sketch map showing the important high-elevation, moist, forested areas in eastern Zimbabwe where most species of epiphytic orchids have been recorded. (Inset map shows the position of the mapped area in Zimbabwe).

largest part of the country receiving between 700 and 900 mm of rainfall. The small, isolated, high-lying areas with evergreen forests can receive up to 2000 mm per year. While no rain falls during the winter months of June to August, the higher-lying areas often experience nocturnal cool misty conditions during the dry winter months.

The epiphytic orchid flora of Zimbabwe

Epiphytic orchids are a characteristic feature of many of the moist woodlands that cover large areas of Zimbabwe and the number of species found has slowly increased as orchid surveys have been carried out (Grosvenor, 1976; Ball, 1978), with new species being recorded from time to time (Cribb, 1977; Cribb & Podzorski, 1978; Williamson, 1990; Cribb & la Croix, 1996). To date, 95 species of epiphytic orchids in 25 genera are confirmed to occur in Zimbabwe, with six of these species regarded as being endemic (la Croix & Cribb, 1995; 1998). A total of 87 of the 95 epiphytic orchid species recorded from Zimbabwe (91%) have been recorded from the Eastern Highlands of Zimbabwe, where they grow in small patches of evergreen forest and moist riparian forest (la Croix & Cribb, 1995; 1998). Of these, 65 species are confined to the Eastern Highlands while 22 species also occur in somewhat drier areas located on hills and mountain tops in central Zimbabwe. Eight epiphytic orchid species have been recorded only from the drier areas of central and northern Zimbabwe. Very few species of epiphytic orchids grow in the drier southern and western parts of Zimbabwe.

The orchid genera with the greatest numbers of species present in Zimbabwe are: *Aerangis* (6), *Angraecum* (9), *Bulbophyllum* (12), *Diaphananthe* (5), *Microcoelia* (6), *Polystachya* (21) and *Tridactyle* (7). The 61 species in these seven genera account for 64% of the total number of the epiphytic orchid species recorded from Zimbabwe. These same seven genera account for 71% of the species found in Malawi and 73% of the species found in Zambia (la Croix & Cribb, 1995; 1998; Stewart *et al.*, 2006).

An important point to consider is that most of the epiphytic orchid species recorded from the Eastern Highlands of Zimbabwe only occur at isolated locations and usually only in very small populations of a few dozen individual plants (Figure 12.2). This means that small populations of epiphytic orchids in isolated patches of forest are vulnerable to any habitat disturbance and loss.

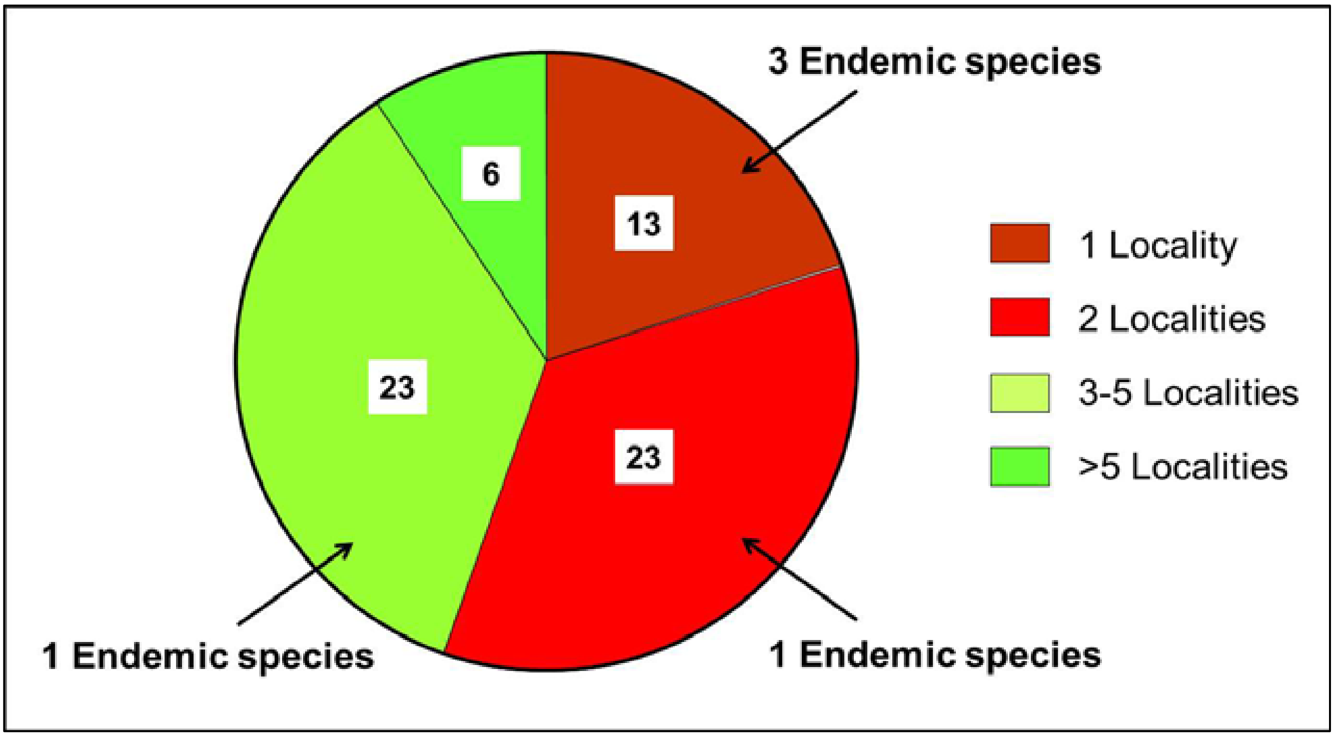

Figure 12.2. Chart showing the number of localities where epiphytic orchid species have been recorded in the Eastern Highlands of Zimbabwe.

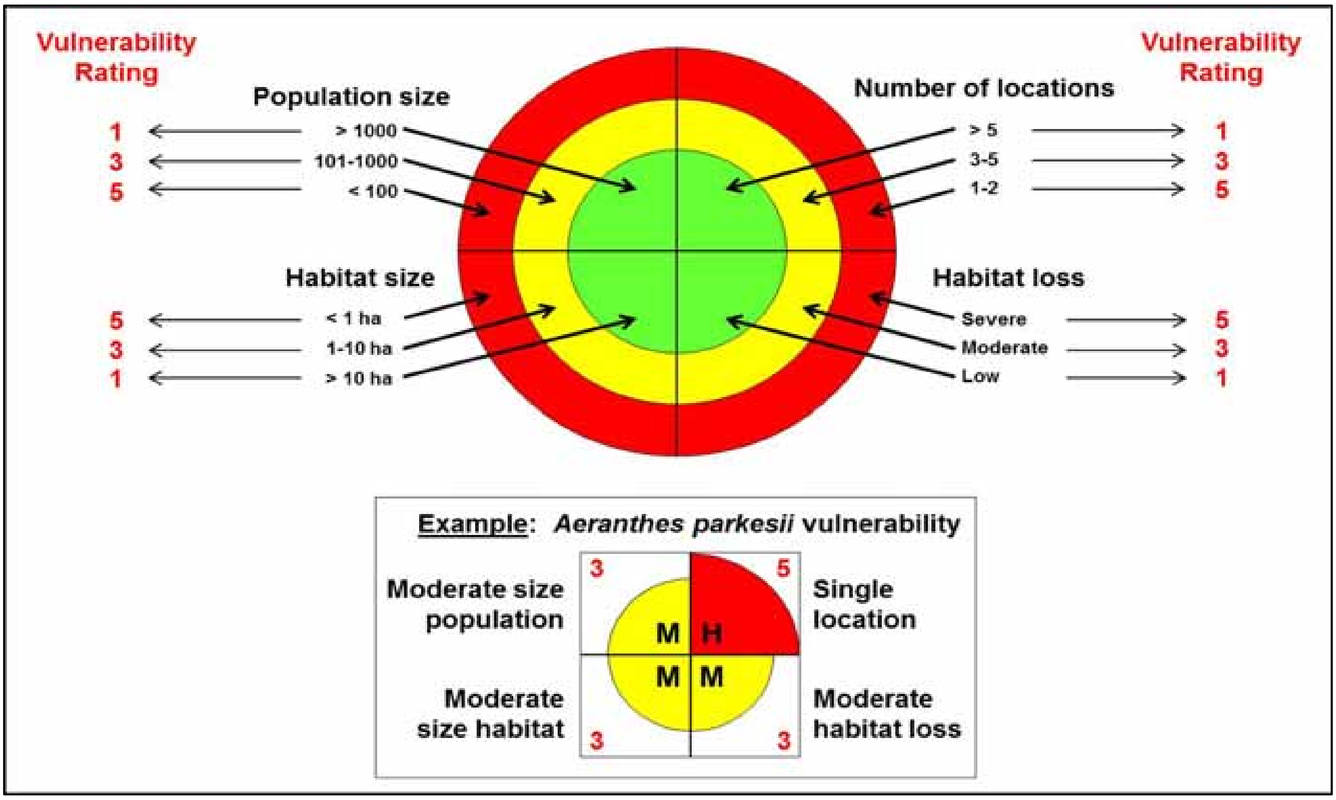

Figure 12.3. Graphical illustration of the four axes chosen to represent the relative vulnerability of epiphytic orchid species recorded from the Eastern Highlands of Zimbabwe.

Assessing the vulnerability of epiphytic orchids in Zimbabwe

The degree to which epiphytic orchid species in Zimbabwe are vulnerable is determined by several factors, including: population size, number of localities where the species is found, the availability and size of habitat occupied by a particular species, and the rate of habitat loss. Loss of habitat also brings with it additional problems such as the loss of specific insect pollinators. While some plants of a particular species may survive in isolated patches of their original habitat, the absence of their pollinators means that the plants could die out completely.

As a starting point, I have used the logic outlined above as a basis for estimating the relative vulnerability of epiphytic orchid species in the Eastern Highlands of Zimbabwe. I chose a simple three-point scale to quantify each of the four axes of vulnerability in a simple graphical form (Figure 12.3). I then used the numerical values estimated for each of the 65 species recorded from the Eastern Highlands to construct a simple bar-chart to illustrate the numbers of species in terms of their relative vulnerability (Figure 12.4). In the example shown, *Aeranthes parkesii* has a relative vulnerability score of 14 out of a possible maximum score of 20, and falls within the third quartile of the bar-chart (Figure 12.4).

A comparison of the numerical values for the relative vulnerability of the 65 epiphytic orchid species recorded from the Eastern Highlands of Zimbabwe reveals that most (62) of the species exhibit moderate to extremely high levels of vulnerability while only 3 species are considered not to be vulnerable (Figure 12.4). These figures emphasize the precarious situation faced by the many small, isolated populations of epiphytic orchids.

These results also suggest very strongly that the current methods (e.g., proclamation of forest reserves; restrictions on the exploitation of forest products; conservation of mountain catchments) that are used to conserve the upland forests and their associated flora in the Eastern Highlands of Zimbabwe appear to be relatively ineffective for orchid conservation.

The greatest challenges to epiphytic orchids in Zimbabwe are associated with habitat fragmentation, modification and loss. Perhaps the most obvious and serious threat to the survival of epiphytic orchids occurs when natural habitats are permanently cleared to make way for

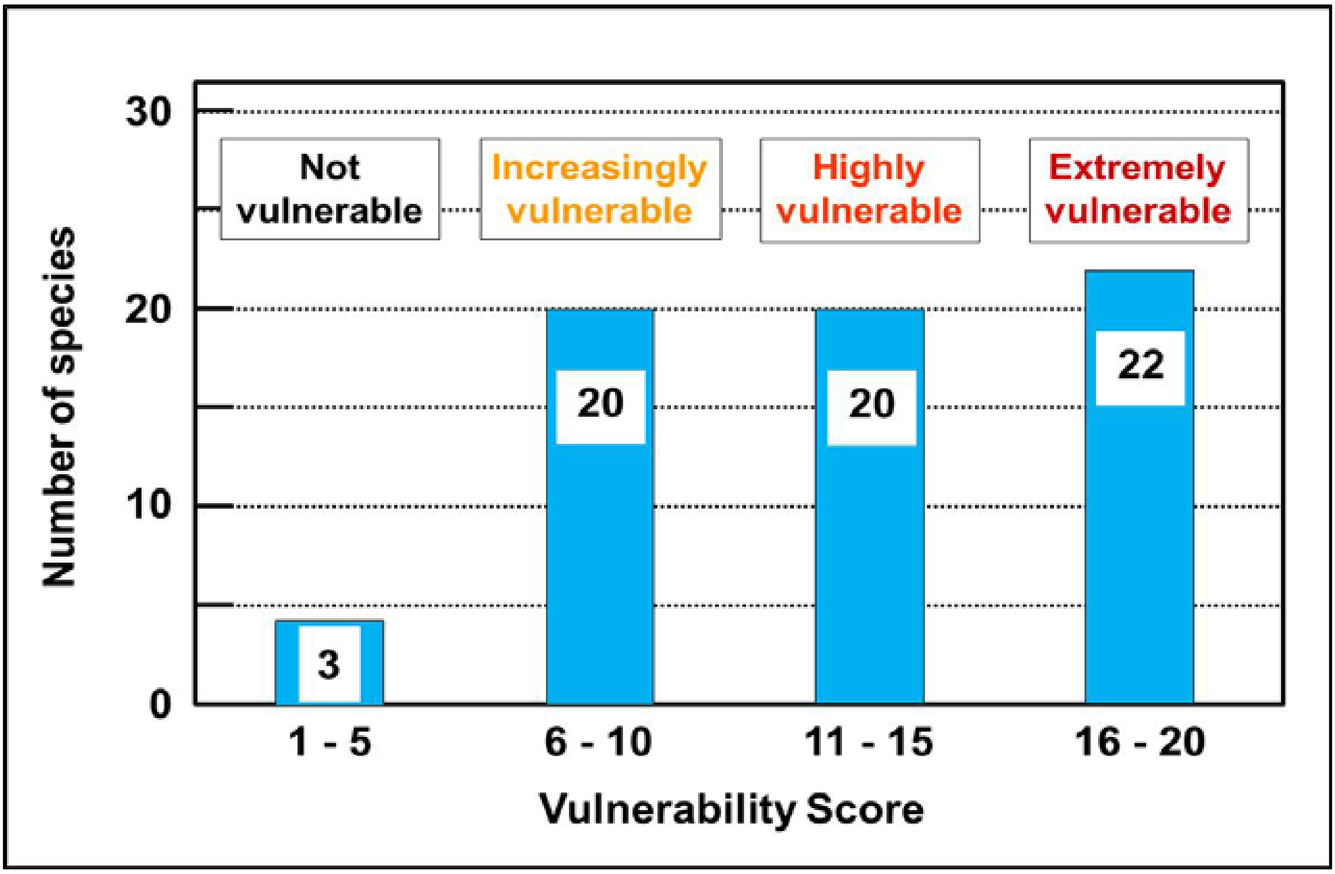

Figure 12.4. Bar-chart showing the relative vulnerability scores of epiphytic orchid species in the Eastern Highlands of Zimbabwe, segmented into four equal-sized classes.

agricultural fields and timber plantations, or where riverine forests are cleared by people needing more agricultural land or engaged in illegal gold panning. Encroachment by alien tree species and periodic uncontrolled fires also result in the gradual diminution of indigenous forest areas. In some areas of Zimbabwe, the practice of illegal panning for gold has resulted in widespread deforestation and the destruction of the associated soil profiles. This is associated with dramatically increased soil loss through erosion and the large-scale alteration of nearby stream and river ecosystems (see example in Figure 12.5).

The loss of habitat is particularly problematic for the few endemic species that are restricted to small areas of highly specific habitat. Habitat loss invariably results in the disappearance of the endemic species in question as well as any other species that may be present.

Since attaining independence in 1980, the Zimbabwe Government has emphasized the need to carefully manage sensitive catchment areas through the creation of upland forest reserves. While these reserves do help to conserve biodiversity, their number, size and distribution appears to be inadequate. The ecological integrity of many forest reserves is degraded or lost through so-called 'edge effects', including human encroachment and illegal logging. Those forest reserves that are located in areas close to towns are particularly vulnerable to human exploitation, including the commercial and subsistence extraction of trees for timber, while forests in more remote areas are at risk of being felled for new agricultural fields. The practice of burning felled trees to produce ash as a cheap form of fertilizer is closely associated with agricultural practices in rural areas. These fires are often difficult to control and the small areas of montane forest where many of the endemic orchid species are found are at particular risk from uncontrolled fires that 'escape' from neighbouring rural areas.

Conclusions: what can be done?

This brief overview of the vulnerability of the epiphytic orchids in the Eastern Highlands of Zimbabwe provides a useful backdrop against which attention can be directed at

Figure 12.5. A view of a portion of the lower Haroni River near the town of Chimanimani, where the forested hillslopes have been cleared for banana plantations and the river is choked with fine orange-coloured sediments derived from illegal gold panning activities upstream. (Photograph taken in May 2015).

formulating practical options to reduce the potentially adverse effects of specific threats to epiphytic orchids.

The Government of Zimbabwe must continue efforts to strengthen and support the social and economic development aspirations of the country and its people, while ensuring that these goals are met in a balanced and sustainable manner. The country's policies and laws need to be properly applied by government officials at all levels and careful attention must be given to ensuring that development actions are balanced across all sectors of the economy. Specific protection measures should be provided for the relatively small areas of montane forest that house the endemic epiphytic orchid species in Zimbabwe as well as most of the other species.

The existing legislation in Zimbabwe provides a clear framework for the careful and sustainable use of all of the country's natural resources, including its woodlands and forests. However, while the existing statutory framework and specific laws provide theoretical protection to ecosystems, there appear to be problems with the effective implementation of this legislation in practice.

Where large new development projects are initiated, it is important to ensure that all of the ancillary infrastructure needed to support the new development are clearly defined. This allows developers and government to gain a clear picture of the 'development footprint' that the project will occupy. In turn, this will help developers and government to plan, sequence and execute suitable actions that are designed to minimize the loss of ecosystem components such as orchids and other protected flora. The developers of all large-scale development projects should be required to mount appropriate 'search and rescue' operations for specific ecosystem components that would otherwise be lost when the project proceeds to completion.

Linked to this, there is a need for a supervised process where 'rescued' plants can be transplanted into suitable portions of habitat that are under official protection, for example a forest reserve. Another possible mechanism to enhance the conservation of rare or threatened species of epiphytic orchids would be to encourage *ex situ* cultivation of particular species – again under supervision. This last option will offer a measure of assurance – especially for the scarcer species – that the numbers of particular plants in 'wild' populations would increase. Failure to ensure effective conservation of the epiphytic orchid flora in Zimbabwe will result in the gradual demise of these plants.

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CONFERENCE WORKSHOP 1: Research needs and priorities for WOSA

Chaired by: Karsten Wodrich

The Workshop was attended by approximately 10 people and included a number of academics. The aim of the workshop was to establish key research project and obtain input from academia regarding the needs and requirements for research projects.

The first and most pressing issue was the need for research on the *Brachycorythis conica* subsp. *transvaalensis* project. The pollination biology research had just gone through one season with as yet limited field work completed by Prof Craig Peter.
Andrew Hankey pointed out the urgency of this research that even though the Proteadal Conservation Association had lodged a court application to have the decision of the MEC set aside for the development to go ahead, there was a possibility for the application to be set aside. In that case the development could possibly go ahead. On the other side – if the application was successful, the process would have to start with a new Environmental Impact Assessment which would in principle buy some time for the much needed research to be conducted.

Additional suggestions were research on the mycorrhizal fungi associated with *Brachycorythis conica* subsp. *transvaalensis* as well as a suggestion to include the other more common species such as *Brachycorythis ovata* and *Brachycorythis tenuior*. From a timing point of view the mycorrhizal research should be conducted between November and January. The flowering period was mid-January to mid-February. Seed required three to four months to set and would disperse between March and April.

Andrew Hankey pointed out that there was a possible new location for a colony in Emalahleni (Witbank) and that the checks should then also be done if both the Krugersdorp and Emalahleni populations to determine if the mycorrhiza were common to both.
Prof Craig Peter noted that this type of research should be conducted at a Master of Science (MSc) level with funding. One issue identified was finding a suitable candidate for this research. It was proposed that Dr Benny Bytebier and Prof Steve Johnson be contacted with regards to who would be able to supervise such research.

On the question of student funding WOSA enquired about typical costs for funding research. For a MSc typical annual bursary costs were around R 80,000.00 which included tuition, cost of living and food and accommodation. In addition to that there would be a requirement to fund the running expenses of a project. Funding was capped at R 120,000.00 with the National Research Foundation (NRF) – giving an indication of the maximum funding value by the National Research Foundation.

Nic Venter pointed out that funding had bene obtained from GDARD for a MSc student for work on bugweed (*Solanum mauritianum*). Nic suggested that GDARD be approached with regards to funding other projects.

A discussion ensued regarding a possible population genetic study and that the persons to contact with this regard could possibly be Professor Dirk Bellstedt at the University of Stellenbosch. Nic Venter suggested that access to the plants was critical and that hands-on research should possibly be conducted by researcher local to the area although that was not that critical with genetic work that could be done on dried material.

Another project could for example be soil respiration rates and a figure of R 1,500.00 per analysis was put forwards a rough budget per sample.

The recommendation was to physically draw up a project description for each of the topics discussed and then approach the South African Association of Botanists to vet the suggested projects.

In conclusion Hendrelien Peters noted that the colony of *Eulophia cucullata* identified in Durban was currently also at risk and Teddy Govender asked about possible fencing off this area to protect the plants. Andrew Hanky explained that it was not recommended practice as fencing restricted the free movement of many of the animals as well that were part of the ecosystem and excluding these animals could influence the plants negatively.

CONFERENCE WORKSHOP 2: The need for WOSA Indigenous Orchid Consultants to be established to assist with EIAs

Chaired by: Allan Abel

The Workshop was attended by approximately 15 people. Participants came from the North-West, Limpopo, Mpumalanga, Eastern Cape and Gauteng Provinces.

The topic was selected as it was found that many of the Environmental Impact Assessment companies had no staff or outside consultants knowledgeable on the South African Indigenous Orchids. A prime example was the Environmental Impact Assessment for the Bedford Dam area of the Ingula Pumped Storage scheme where no orchids were recorded in the Environmental Impact Assessment. Yet on visiting the upper dam area that was going to be flooded early in 2016 a total number of 13 orchid species were found.

Figure 14.1. The Bedford dam area (upper dam), Ingula pumped storage scheme. None of the thirteen orchid species found in this area were picked up in the Environmental Impact Assessment.

The following points were discussed;

1.) It was agreed that the suggestion of a pool of Indigenous Orchid Consultants was a feasible one and should be investigated.

2.) This was a long-term exercise and should not be rushed. It needed to be established correctly or else it would not have any authority or influence.

3.) It would operate under the same structure as WOSA e.g. at a regional level controlled by the main national body.

4.) Formulate a "Policy & Procedures" document to standardise efforts at all Regions.

5.) Consultants.
   - a.) how would they be selected.
   - b.) what formal qualifications (if any besides experience) needed.
   - c.) remuneration of any sort - refund of expenses only or fees.
   - d.) membership of Environment Organisations (see addendum)
   - e.) draw up a list of suitable experienced people to approach in each Province. (see addendum)

6.) Clients.
   - a.) These would be bodies such as regional, provincial and national conservation/wildlife departments
   - b.) Environmental Impact Assessment firms.
   - c.) Educational institutions.
   - d.) Other interested parties.

7.) Approach.
   - a.) always professional and non-combative.
   - b.) state the pros and cons on any report undertaken.
   - c.) stress that all indigenous orchids are protected by law.
   - d.) will make their reports more complete and professional.
   - e.) education.
   - f.) fees charged should not be exorbitant or this will discourage participation by WOSA.
   - g.) Build up a history of orchid locations.

8.) It was stressed that all legal and other aspects must be done in the correct order to prevent future embarrassing problems arising.

9.) Investigate the legal implications and resources to defend law cases if necessary.

10.) Advertise in correct areas and try to get us included by the government in the Environmental Impact Assessment requirements.

Addendums

Addendum 1

Point 5.d. - Professional bodies as advised by Dr Peter Ashton

There are actually two organizations that are applicable to your query:

The South African Council for Natural Scientific Professions (SACNASP) is the ‘parent’ professional body with which all persons carrying out natural scientific research and consultancy activities needs to be registered. SACNASP ‘houses’ many categories of scientists and each individual can be registered in one or more fields. For myself, as an example, I registered in 1983 as a ‘Professional’ or ‘Registered Botanist’ – and continue to practice under that title today. Registration has to be renewed each year and each individual has also to be a member in “good standing” with the ‘parent’ scientific society of his/her discipline. In my case, that is the South African Association of Botanists (SAAB).

Another registration which is also useful is to be registered as a ‘Certified Environmental Assessment Practitioner’. This is through the Interim Certification Board of the Association of Ecologists and Environmental Scientists. The ‘interim’ board will be replaced by another board that the Government is busy setting up. Each individual who requests to be certified by the board should already be registered with SACNASP and, ideally, a member of the South African chapter of the International Association of Impact Assessors (IAIAsa). This is the professional body that persons who undertake environmental impact assessments should belong to.

Addendum 2

Point 5.e. – People with expertise by Province. A list of possible candidates per Province was drawn up for consideration and consultation.

National

a. CREW

Jocelyn Surtherland had copied Allan’s request for the Summer-Rainfall CREW managers for the contact details for the CREW area leaders.

CONFERENCE WORKSHOP 3: How do we educate people and raise the value of indigenous orchids in the mind of the public?

Chaired by: Kay Montgomery

A round table discussion was held with over 25 delegates interested in communications and education. It was noted that the WOSA had done a remarkable job in promoting grassland orchids over the last few years. There had been a series of features in magazines and newspapers.

The top points included the following:

Common names
Delegates suggested that the Wild Orchid Community develop a set of common names for indigenous orchids. It was particularly important that the rare orchids, such as the *Brachycorythis conica*, be given a common name that could be used in the local newspapers to connect to a regional audience.

Botanical Prints
A top local artist, Daleen Roodt has offered limited edition prints to offer as prizes in a photographic competition or a competition to give local indigenous orchids attractive, appealing and common names.

Social Media
Encourage wild orchid enthusiasts to share their images, findings and sightings on Facebook. Facebook and Twitter will hopefully promote wild orchids and educate wild orchid enthusiasts. Social media is an excellent place to promote books on indigenous orchids. Kay Montgomery stressed that social media was becoming one of the most important media for promotion and stressed that the "technically challenged" generation really needed to make an effort to get involved in social media in order to be able to leverage the power of social media for promotional and activist purposes

Fundraising
Appreciate the special nature of indigenous orchids. There are a large number of eco-tourists who would be interested in seeing indigenous orchids. There is a possibility for fundraising by introducing orchid lovers to indigenous orchid spots across South Africa. Hosting an international South African orchid congress is also a possibility. To open up eyes to the possibilities Kay sketched a scenario to delegates where a cruise liner could possibly be used as the conference facility itself to attract many overseas tourists. At the same time the ship could dock in Cape Town for example and field trips arranged to see indigenous orchids – together with a visit to Kirstenbosch Garden.

Figure 15.1. Eco-tourism with field trips to orchid areas are a valuable fundraising tool.

Website
It was understood that the website must be kept up to date. It is suggested that the responsibilities be spread across a group of interested internet heroes. This job is too big for a single person.

Note by editor: As a direct result of this workshop the *Brachycorythis conica* subsp. *transvaalensis* has since been given the common name Albertina Sisulu Orchid with the blessing of the Sisulu family and the logo below developed from Daleen Roodt's illustration for promotional purposes.

CONFERENCE WORKSHOP 4: Creating new conservation areas

Chaired by: Lourens Grobler

This Workshop was attended by a number of interested people and the first item that was discussed was the need to determine which areas were orchid "hotspots" that potentially needed conservation.

It was agreed that the OrchidMAP programme currently underway under the guidance of Prof Craig Peter was the ideal tool to identify these hotspots. It was also noted that it was imperative that OrchidMAP be populated with as much data as possible as soon as possible. That would allow orchid "hotspots" to be identified by means of orchid density and species density and from that educated decisions to be made with regards to those hotspots.

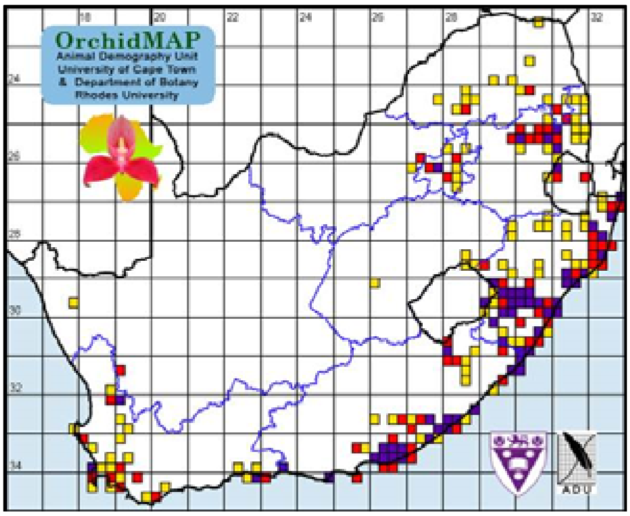


Figure 16.1. OrchidMAP – a valuable tool for identifying orchid "hotspots".

Furthermore people needed to be made aware of which species of orchids were on the endangered list and these species in particular could be used The next point that was raised that it was also important to identify areas that could be threatened in future. A typical example to illustrate this point would be the habitat of many of the rare and endemic Disas that Lourens Grobler illustrated in his presentation – some of these areas are in potential danger of being engulfed by forestry activities and plantations.

In addition the fact that many of the species planted in the forests such as the Pine tree do propagate by seed dispersal and do start to spread out from the original plantation. This becomes another threat on its own. Realising that this is a potential future problem allows action to be taken to prevent this.

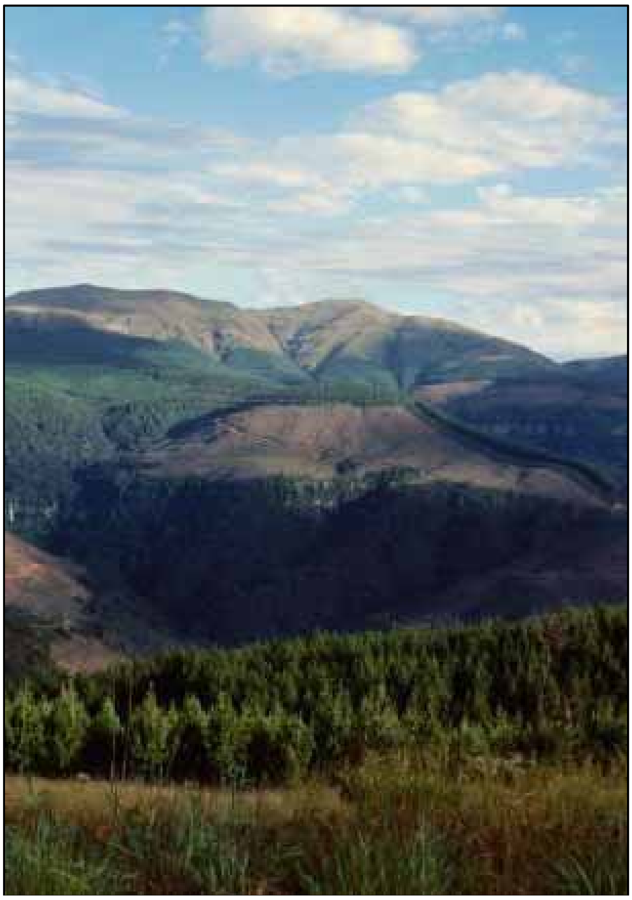


Figure 16.2. Forest for the timber and the paper and pulp industry threatens areas around the Long Tom Pass.

Figure 16.3. The ultimate aim: the nature reserve.

APPENDIX A: Submitting records to OrchidMAP

Figure A1. The main page to access the OrchidMAP is at http://vmus.adu.org.za. Select the OrchidMAP icon to enter the site after having registered here by entering your email address and other basic details: http://www.adu.org.za/register.php?project=vmus.First register (left hand side: Registration) and once you have registration details then log in (left hand side: LOGIN).

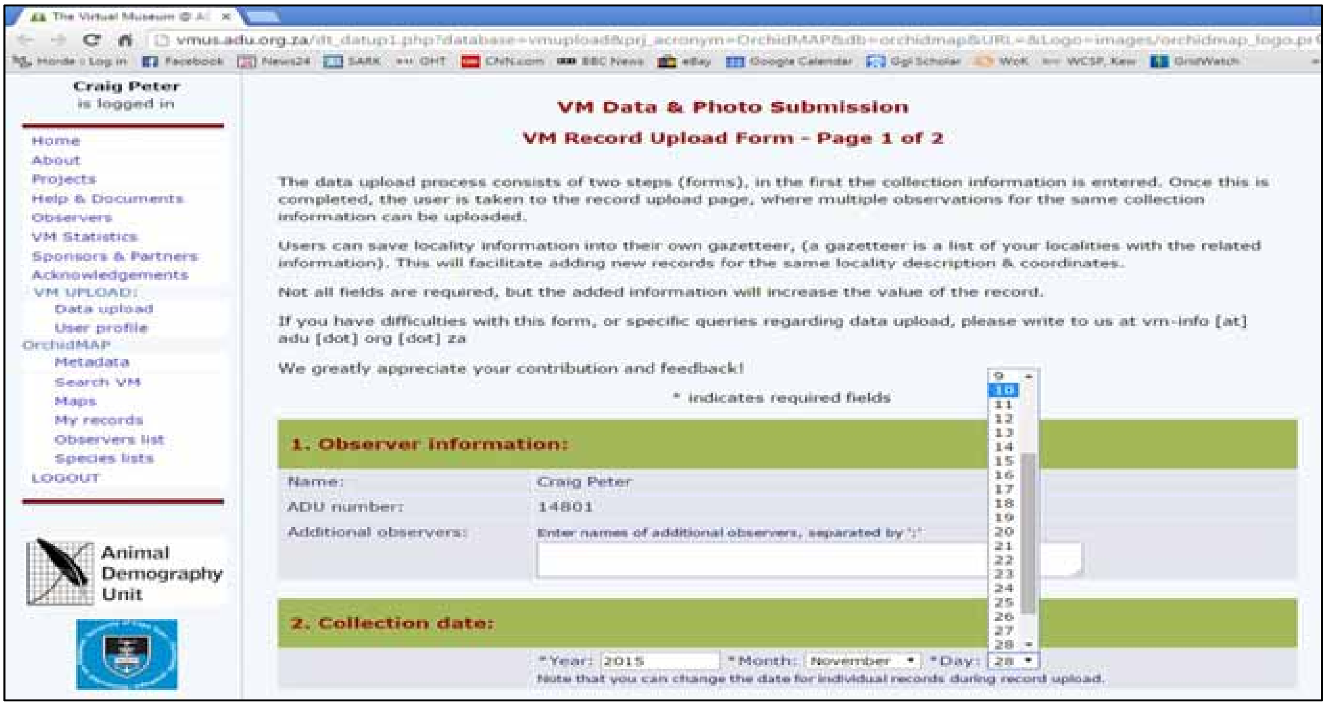


Figure A2. Once logged in the upload form is available to users in the menu on the left.

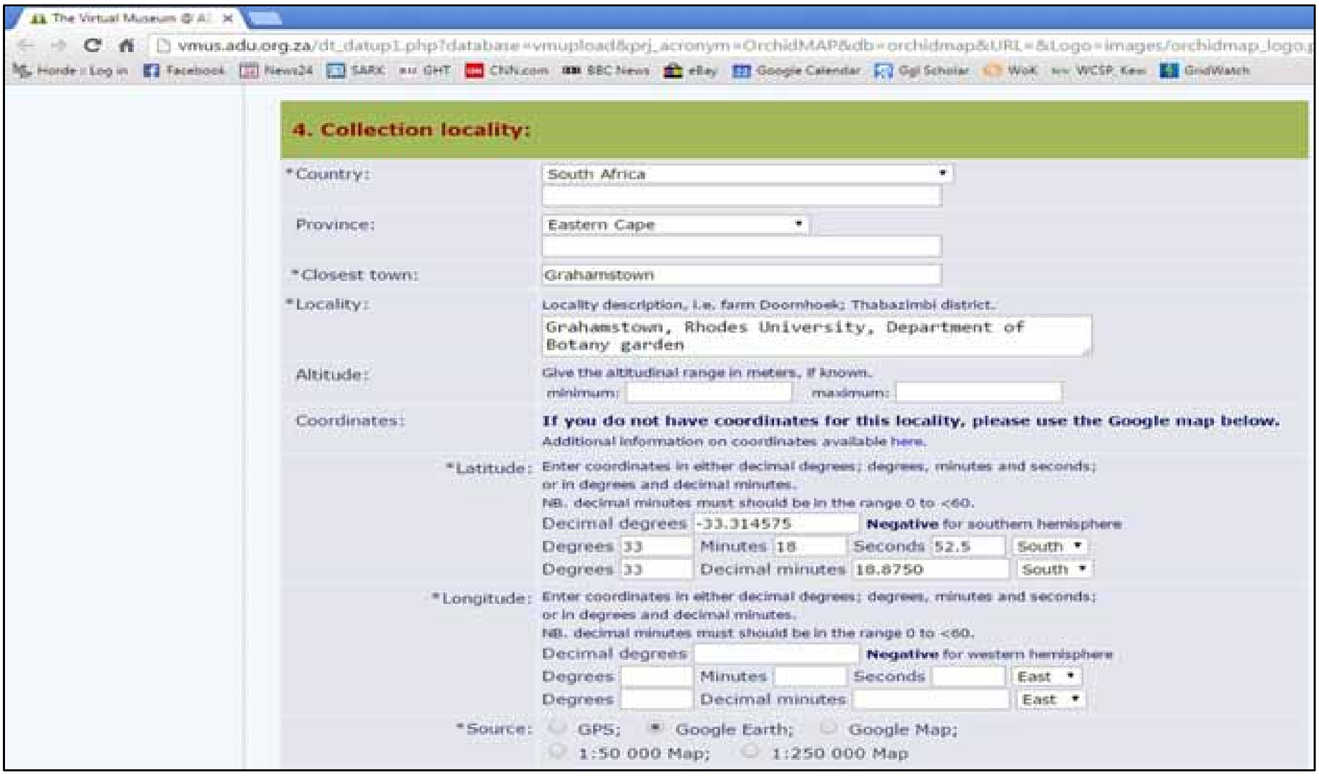


Figure A3. Add locality detail of the record

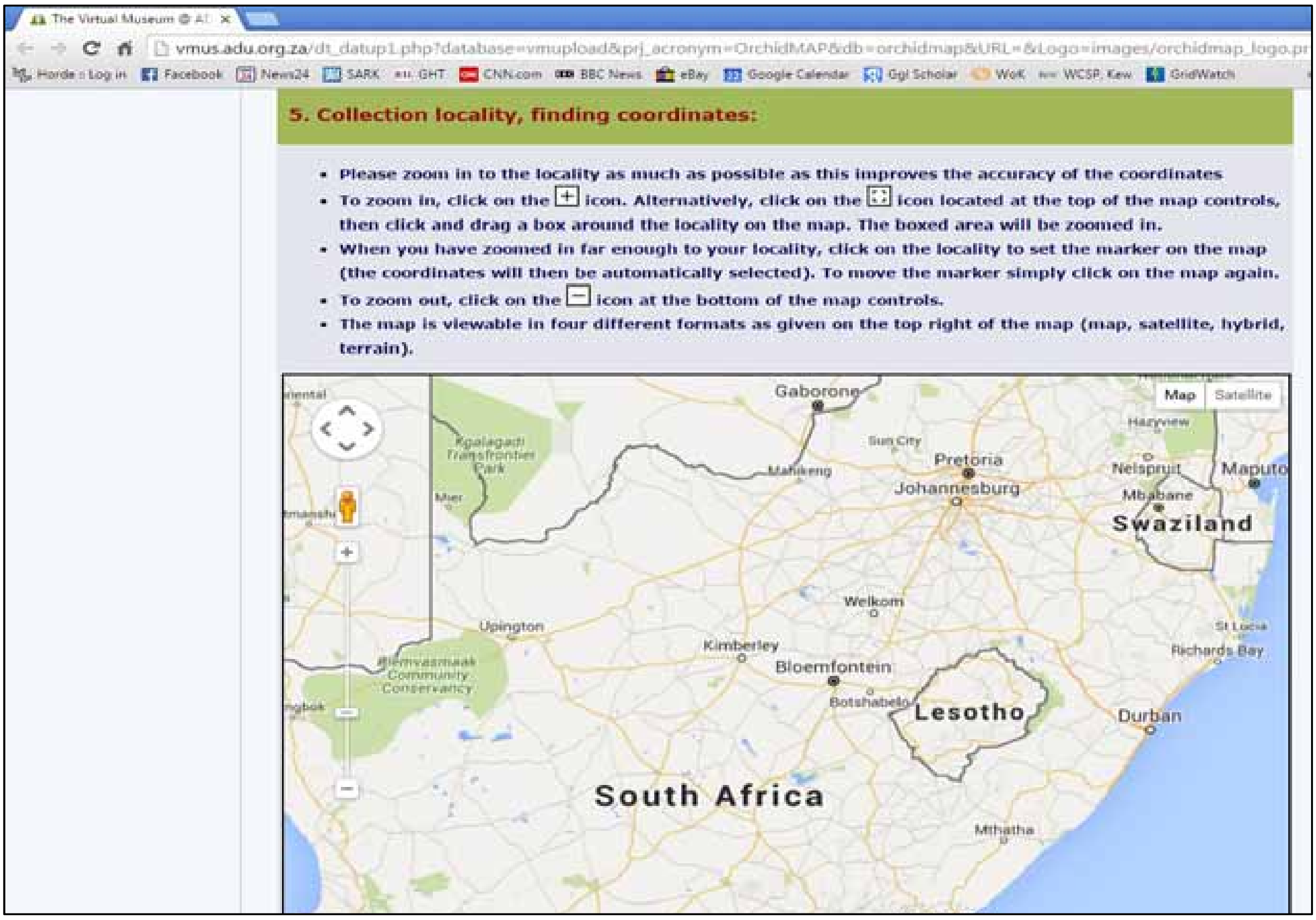


Figure A4. Various options are available to enter locality data – even if GPS coordinates are not available you can use the built in Google Earth module to find and designate the coordinates of the site.

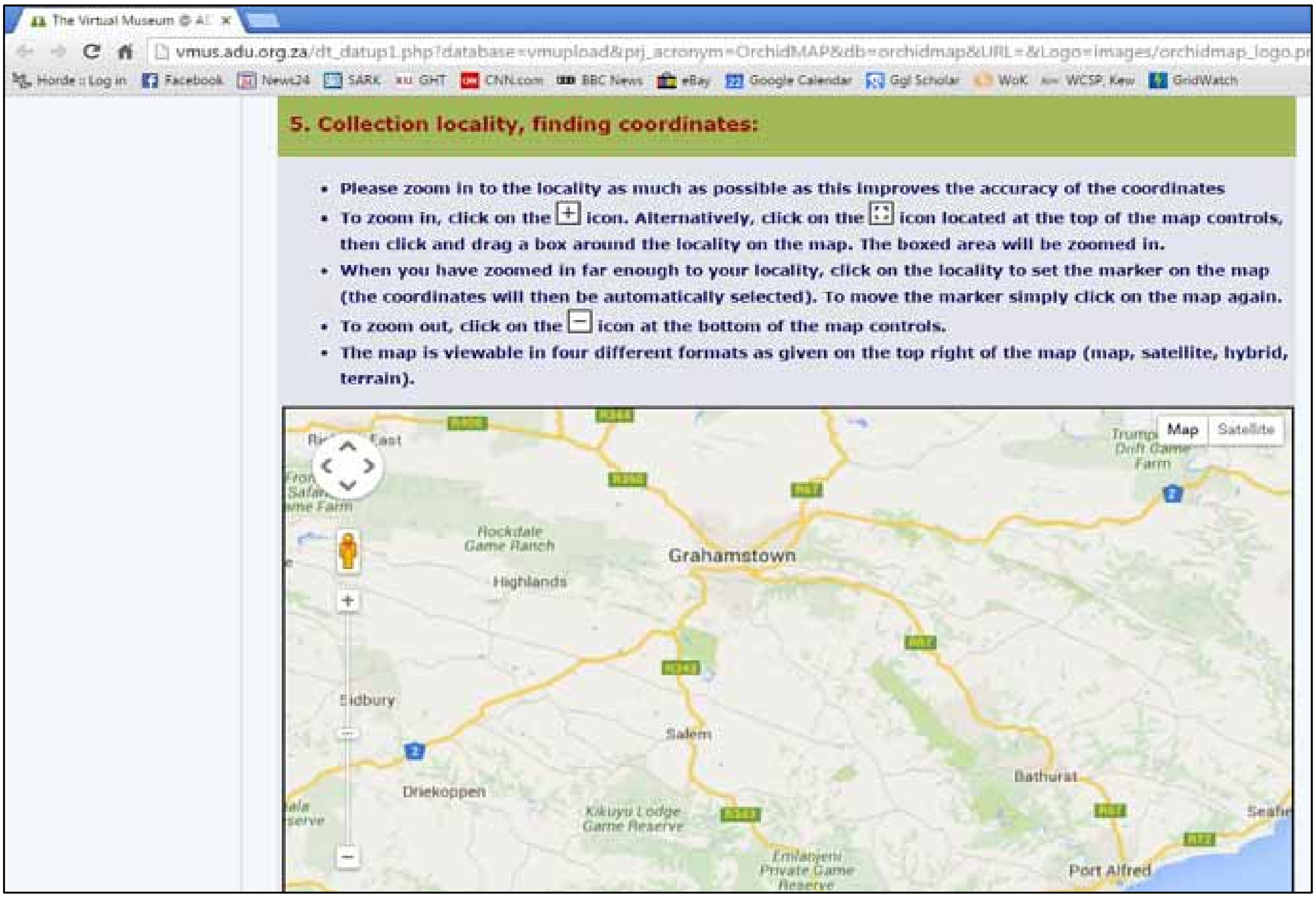


Figure A5. Alternative method of determining the location of a plant, zooming in to the Makana municipality.

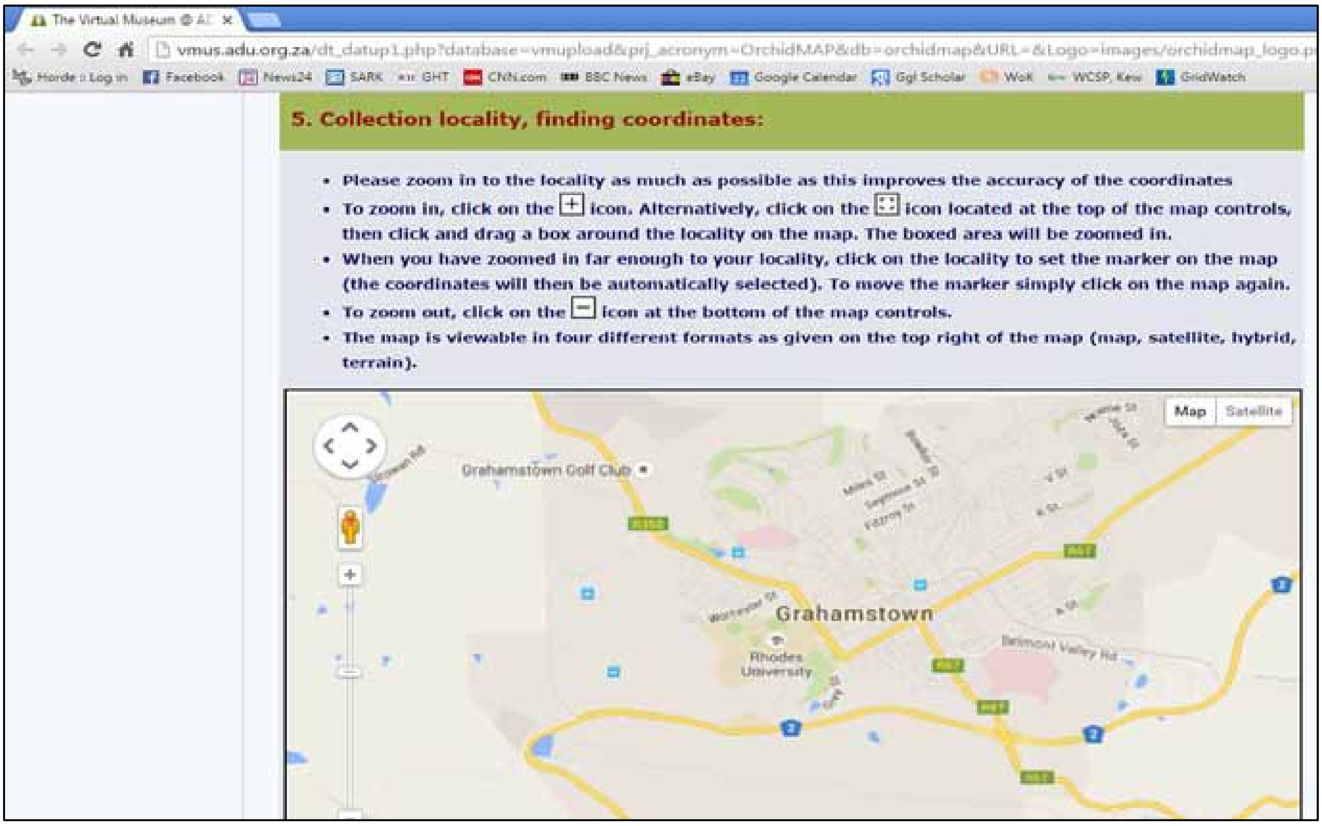


Figure A6. Zoom in to the desired location, here focusing on Grahamstown as an example

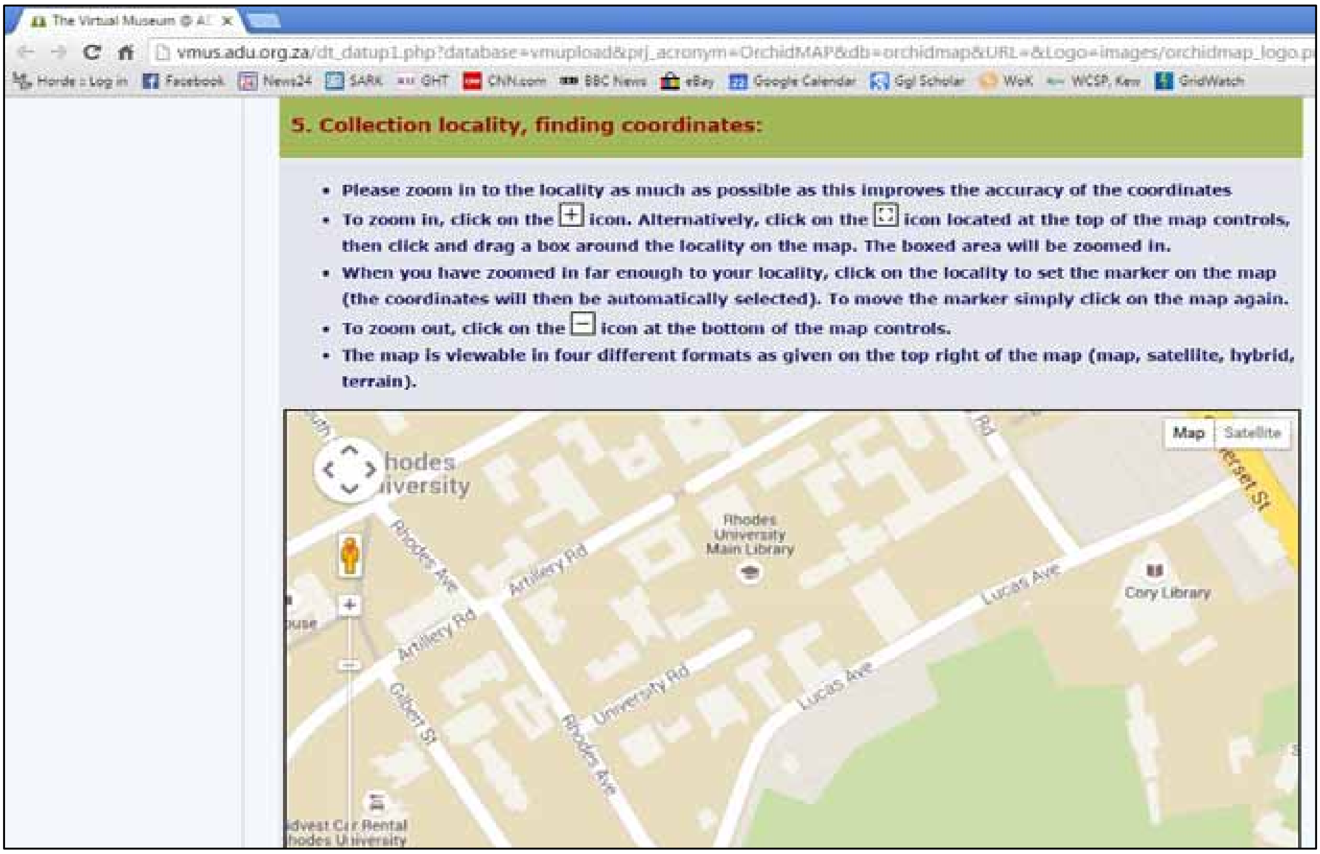


Figure A7. Zoom in closer to the location. In this example centering on Rhodes University campus.

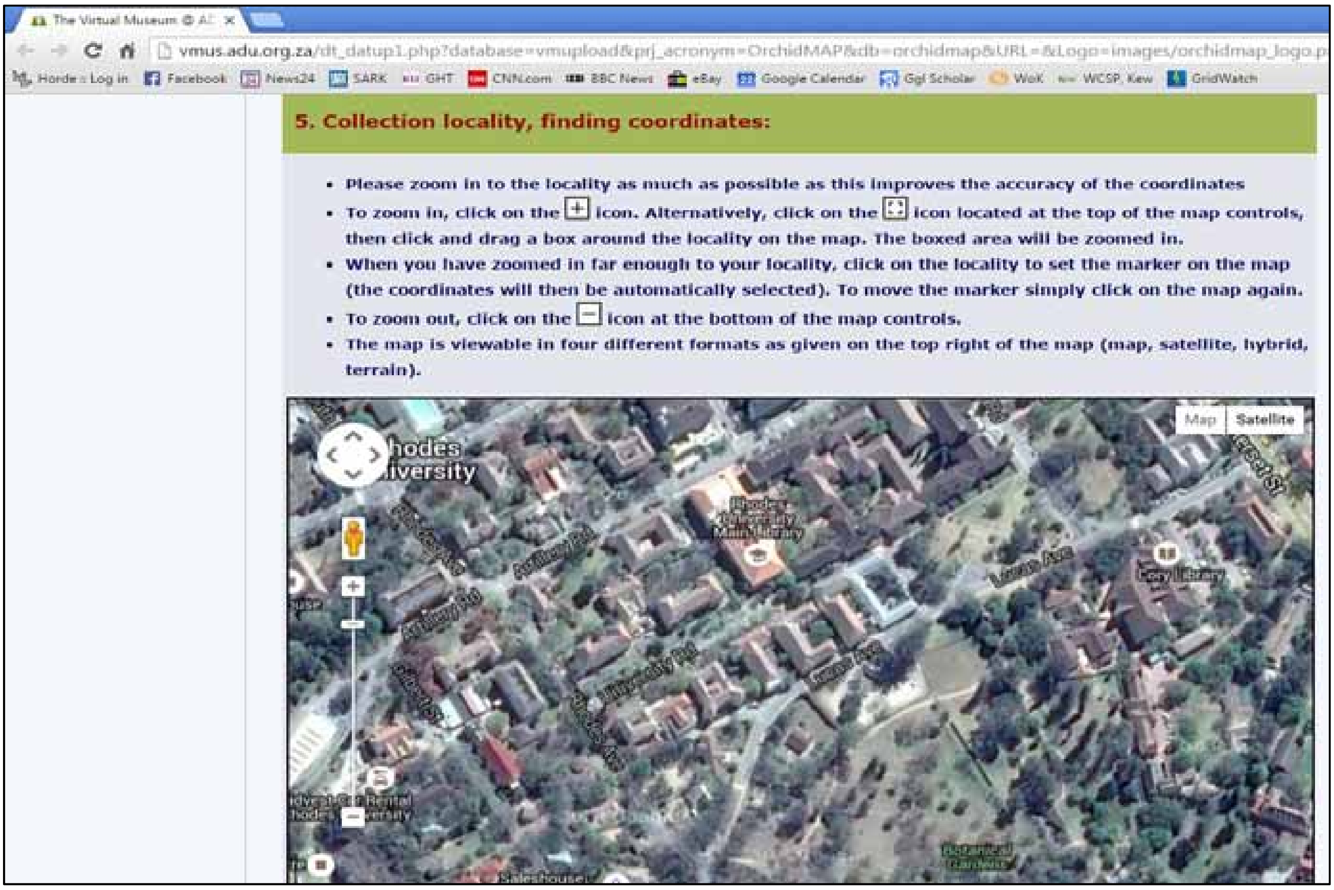


Figure A8. Toggle to satellite view to see details of the surroundings.

Figure A9. Zoom in still closer to finally "pin" the locality in the garden of the Department of Botany at Rhodes University.

Figure A10. Once the correct point has been located save the location.

Figure A.11. Add any additional data as required

Figure A.12. Select "Choose file" to upload the pictures you plan on adding to the record. Up to three pictures can be added per record. Ideally choose a picture of the complete plant, one of the flowering stem and then a close-up of the flower

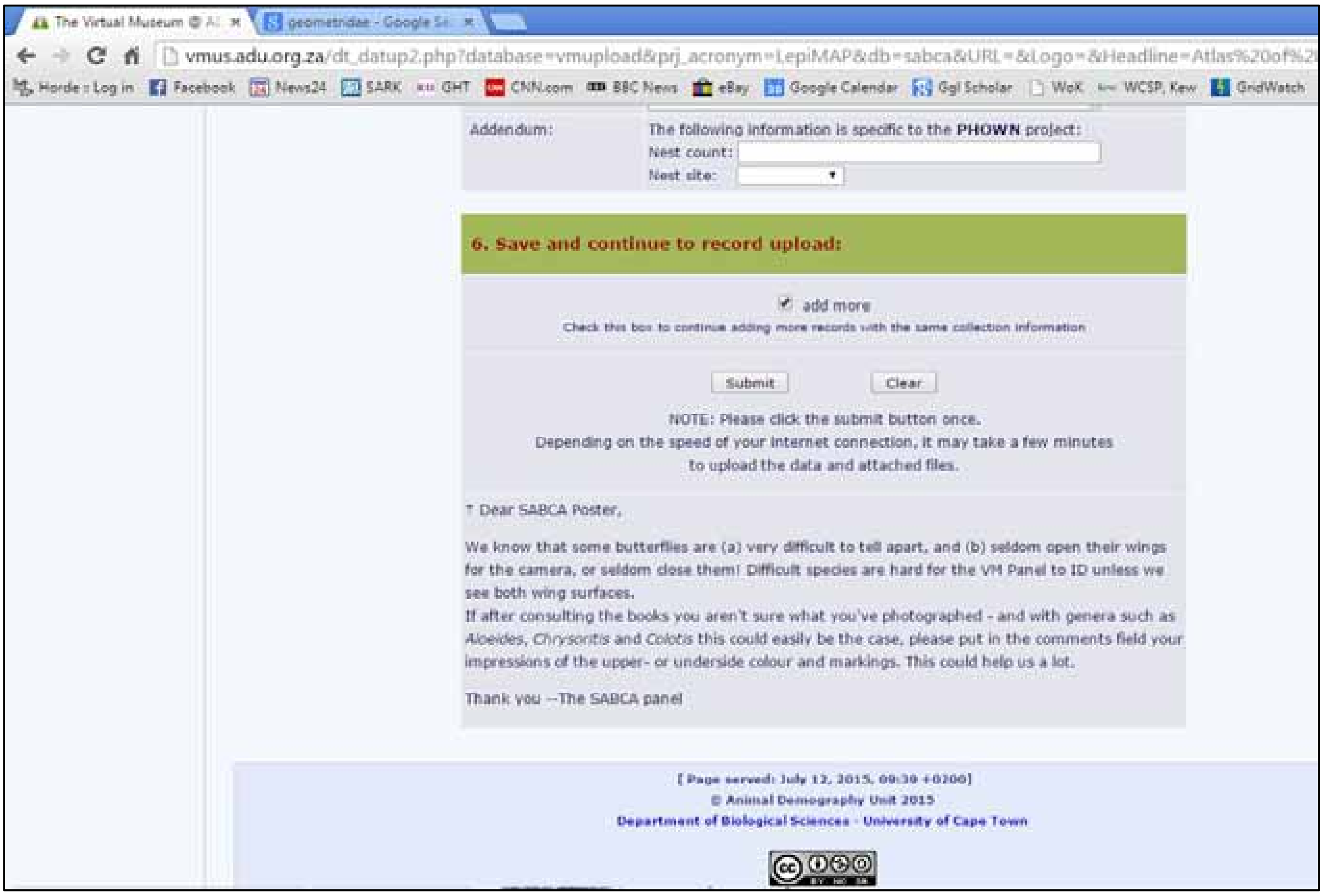


Figure A13. By checking the "add more" check box you are able to add additional records with the same location data. Then

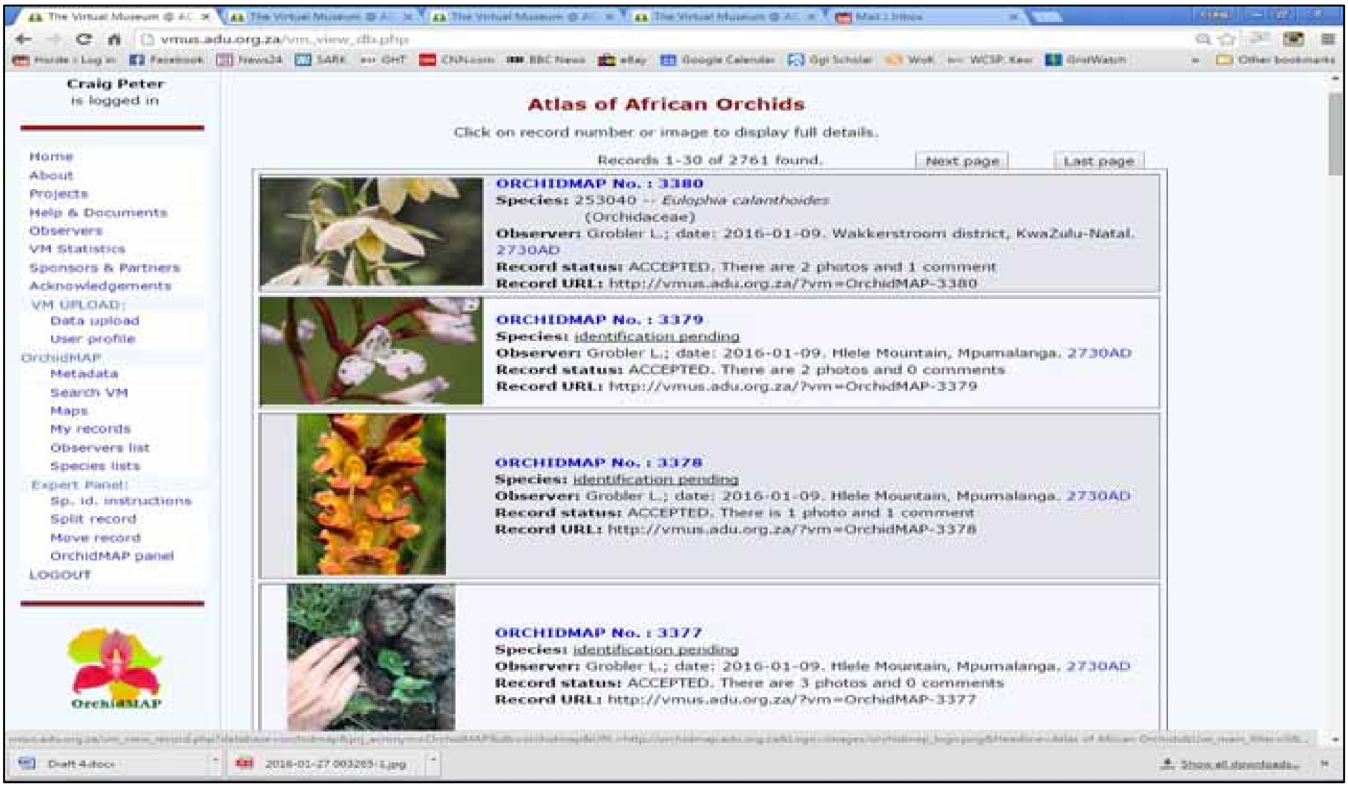
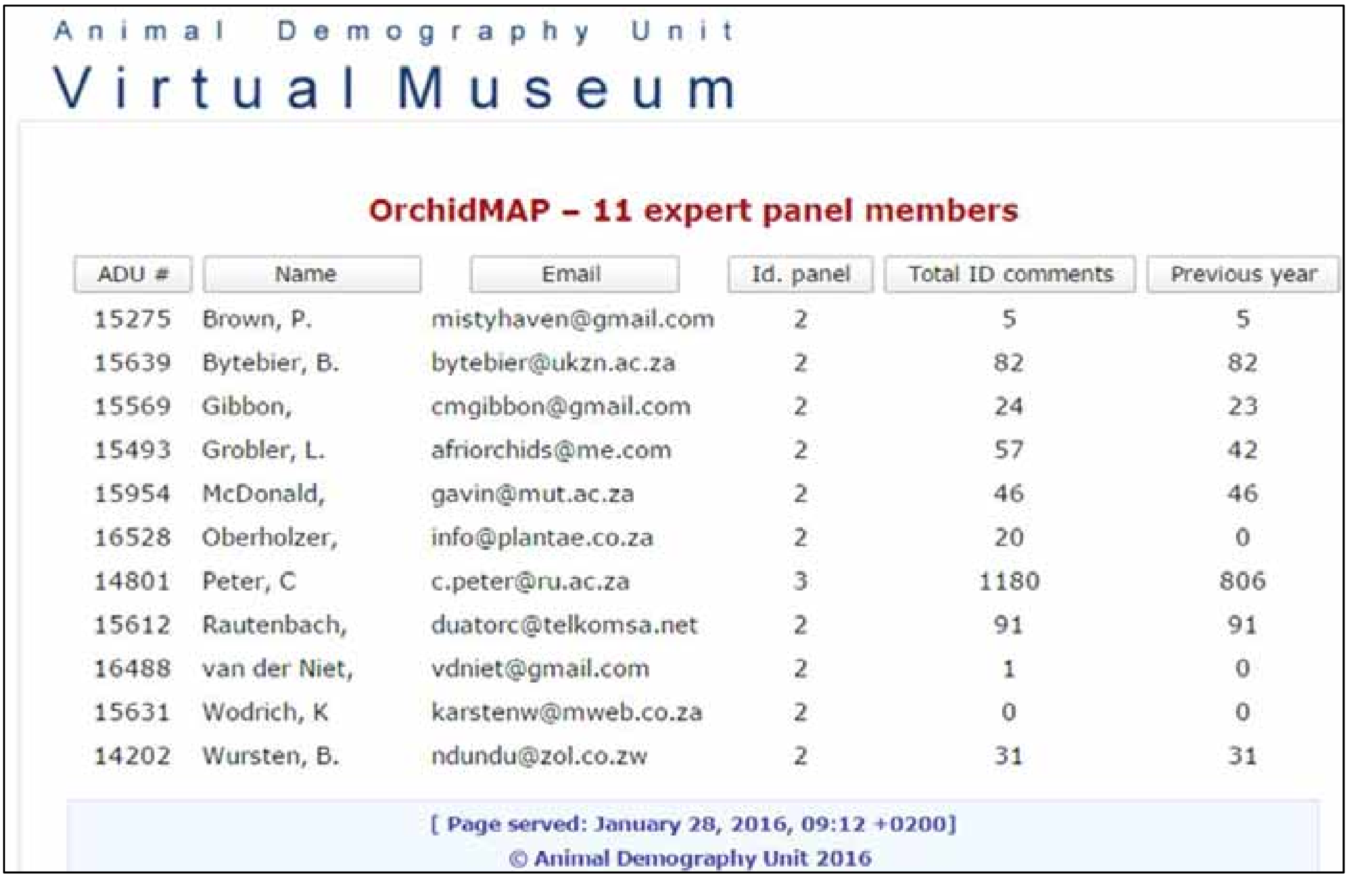


Figure A14. Searches for entries can be carried out to various search criteria



Animal Demography Unit

Virtual Museum

OrchidMAP – 11 expert panel members

ADU #	Name	Email	Id. panel	Total ID comments	Previous year
15275	Brown, P.	mistyhaven@gmail.com	2	5	5
15639	Bytebier, B.	bytebier@ukzn.ac.za	2	82	82
15569	Gibbon,	cmgibbon@gmail.com	2	24	23
15493	Grobler, L.	afriorchids@me.com	2	57	42
15954	McDonald,	gavin@mut.ac.za	2	46	46
16528	Oberholzer,	info@plantae.co.za	2	20	0
14801	Peter, C	c.peter@ru.ac.za	3	1180	806
15612	Rautenbach,	duatorc@telkomsa.net	2	91	91
16488	van der Niet,	vdniet@gmail.com	2	1	0
15631	Wodrich, K	karstenw@mweb.co.za	2	0	0
14202	Wursten, B.	ndundu@zol.co.zw	2	31	31

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Figure A15. Currently a number of expert panel members have volunteered to review submissions on OrchidMAP.

Figure A16. The "Search VM" function allows searches to be refined by selecting the required tab at the top. Once the records have been retrieved that can be accessed individually.

Figure A17. The "Maps" entry on the left hand side gives access to the map display functions which can be selected from the tabs at the top of the screen.

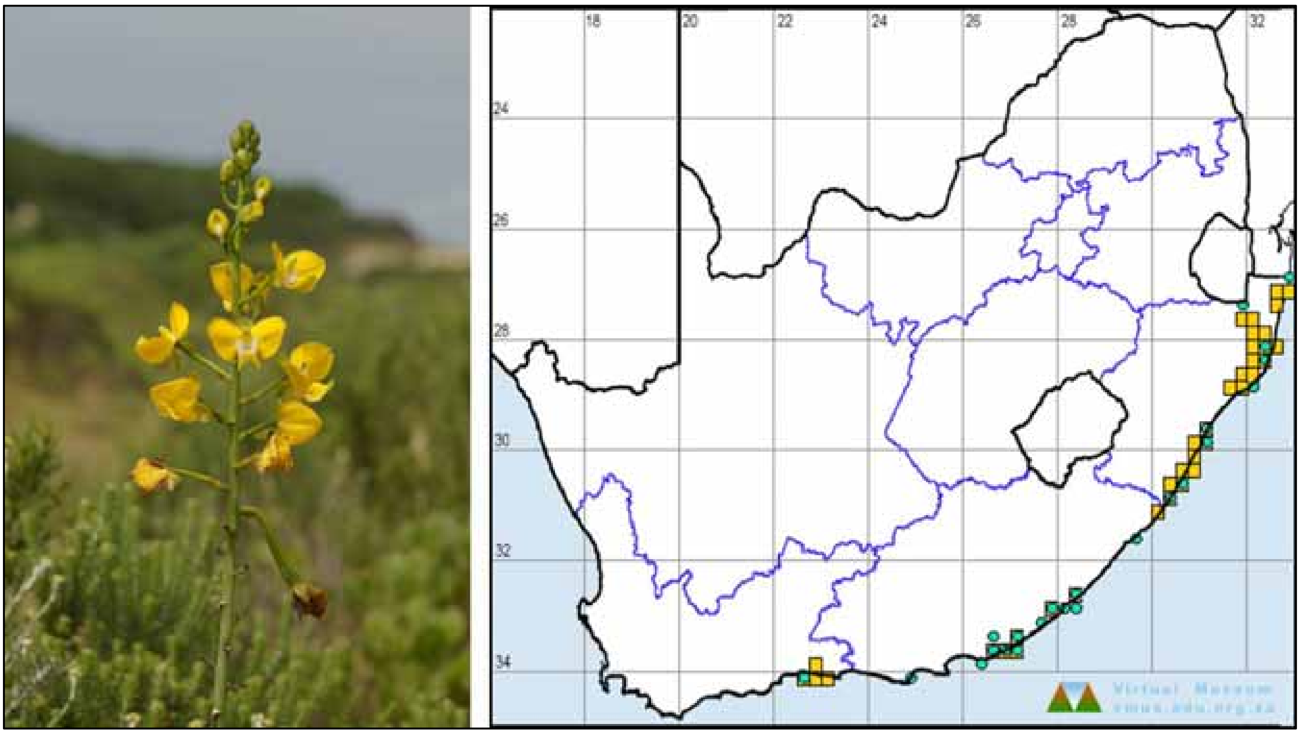

Figure A18. An example of the distribution map for the records for *Eulophia speciose* showing a combination of photographic records (green dots) and traditional herbarium specimens (yellow squares).

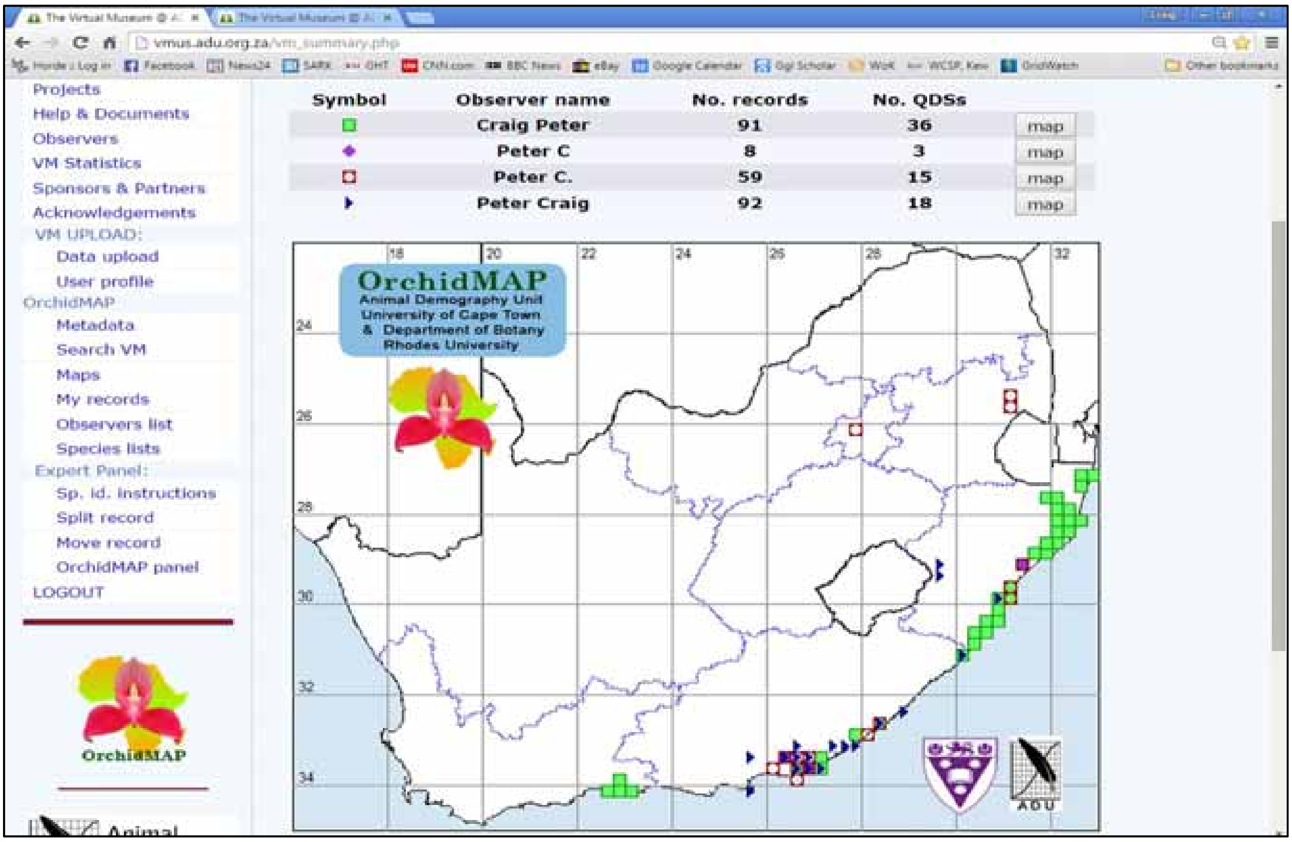

Figure A19. Various methods and summaries can be displayed in the map format such as all the sites you have submitted records from as in this example.

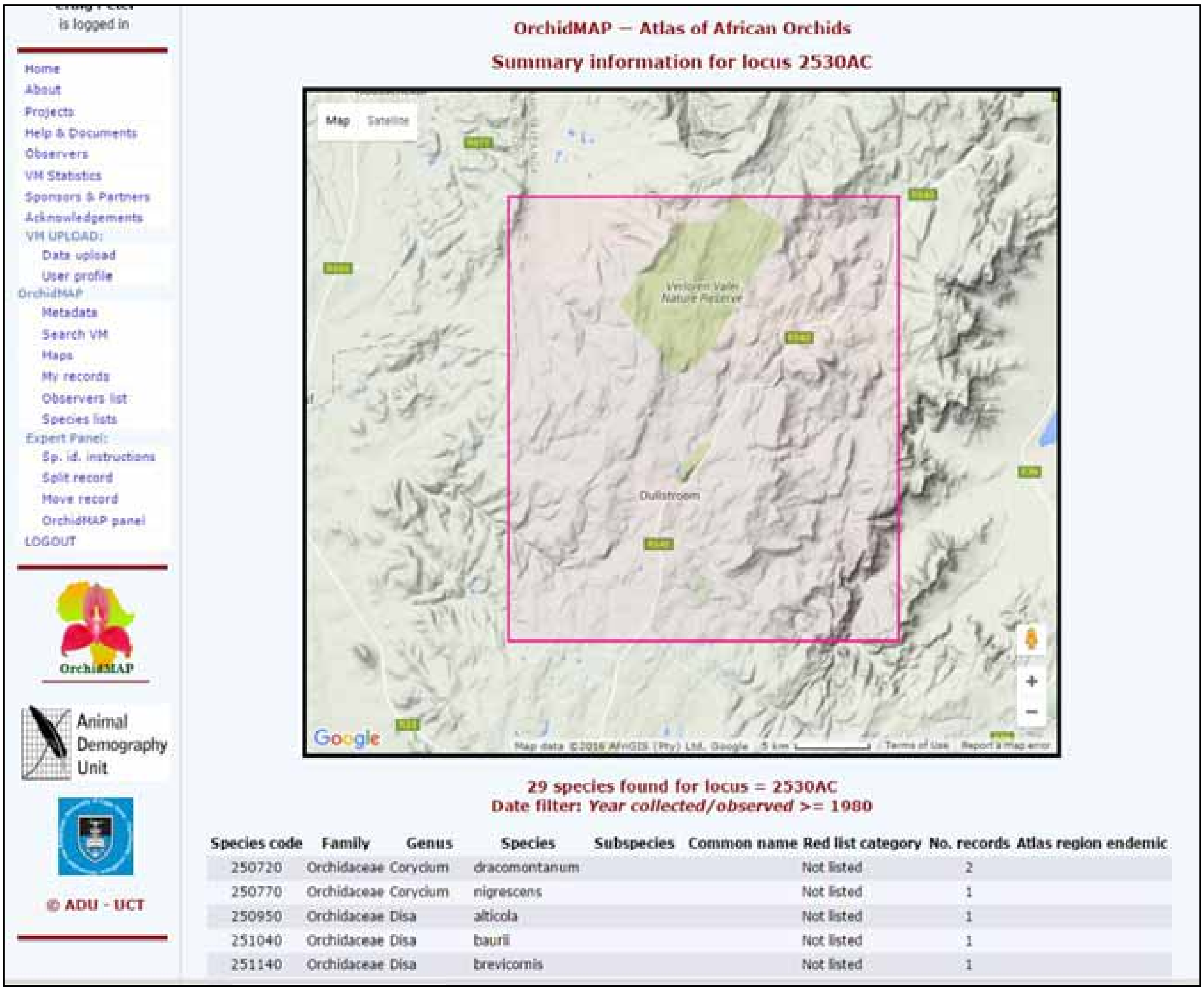

Figure A20. A further example of a search function filtered by date for a specific grid area.

For more information contact :
OrchidMAP@ru.ac.za

UPCOMING EVENT:

SECOND WILD ORCHIDS SOUTHER AFRICA CONFERENCE Dullstroom

THEME - ' Getting to know our orchids'

The Conference will take place at the ***Dunkeld Country Estate*** *on the Tonteldoos Road,* ***Dullstroom, 20 - 22 January 2017***

Programme includes two Field Trips to Verloren Valei and a full conference programme covering topics such as ' ***South African orchids and the 'muti' trade,*** *and many more interesting topics.*

REGISTER NOW BY CONTACTING:

Joey Kok: joeykok77@gmail.com

OR

Bill Mincher: billmincher@wildorchids.co.za