Re-thinking the use of South African Plants at 53° North

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Rod Saunders and me on the ridge of the Swartberg Mountains, Western Cape, 1800m
The tea ritual
Winter rainfall

Summer rainfall
South African Summer Rainfall Montane grassland

I began to gather together SA species from the 1980’s.

I have worked closely with Rachel and Rod Saunders at Silverhill Seeds

Why??

• Very diverse temperate grassland flora
• Many highly attractive species
• Limited understanding in the UK of this vegetation, no understanding as designed plant communities
• Potential for climate change mitigation, especially in urban heat island climates
• Problematic in UK; winter cold tolerance in a winter rainfall climate; a research challenge
• Horticultural, ecological and design opportunity to re-think the use of an entire flora!
Location of the montane grassland biome in South Africa

The red line is at $>1000$ m contour
Architecture of SA grassland species creates many Design opportunities, the see through emergent

Watsonia densiflora near Nottingham Road, Kwa-Zulu Natal

Kniphofia laxiflora near Nottingham Road, Kwa-Zulu Natal
Most of the area of interest 1500m to 3200m altitude

Summer rainfall typically 400-1200mm pa

Dry and cold in winter, down to -20°C

Very species rich; approximately 4,000 species in this area
Afro-Alpine Grasslands; 2500-3200m, most stuff from here is cold hardy in the UK

The Amphitheatre viewed from Sentinel Peak
Sentinel Peak, around 3,000m, northern Drakensberg, these grasslands are 30% *Agapanthus campanulatus*
Nerine bowdenii, (the robust form) Northern Drakensberg, 3000m
Eucomis autumnalis on the Sentinel post fire, the pink is Brunsvigia radulosa
Ranunculus bauri on steep south east slopes
Kniphofia caulescens wetland, 2800m, Eastern Cape, Ben McDhui
Tritonia drakensbergensis at Naudes Nek, 2700m
Senecio macrospermus, with Merxmuellera spp. Eastern Cape, Ben McDhui
Kniphofia northiae around drainage lines, 2800m
Kniphofia caulescens along drainage lines
Berkheya purpurea and B. multijuga in stony grassland, 2800m
Sub-alpine Temperate grasslands 2500-1000m *Dierama dracomontanum*
In search of *Cyrtanthus obliquus*
Kniphofia linearifolia, 1800m
Dierama latifolium grassland; 1800m
Watsonia densiflora 1500m
Eucomis comosa, along drainage lines 1500m, Satans Nek, Eastern Cape
The research

Phase 1
Evaluating and gathering together the palette (approx. 400 species)

Phase 2
Growing this material for seed production and to improve “Passive “ horticultural understanding

Phase 3
Experiments on seed production/Germination requirements in the lab

Phase 4
Experiments on establishment by sowing in the field

Phase 5
Experiments into competition and long term development of sown communities
The Ground Layer  100-300mm

Osteospermum jucundum  Helichrysum pallidum aff.  Geum capense  Zaluzianskya ovata

Diascia tugelensis  Gazania linearis  Kniphofia hirsuta  Kniphofia thodei
Themeda triandra, the key grass, is highly variable
Diascia integerrima, long lived and highly drought tolerant, a fantastic spp., at the Olympic Park
Anemone caffra from the Eastern Cape
In the habitat; east facing gulley, recently burnt, at “Balloch Homestead”, 1800m
The much bigger *Anemone fanninii*
Leaf marbling in *Ranunculus bauri*
Barleria monticola

Northern Drakensberg grasslands

2000m
The “mass-less” emergent geophyte layer

Eucomis bicolor  
Gladiolus saundersii  
Gladiolus flanaganii
Dierama grandiflorum
Gladiolus dalenii

Gladiolus ochroleucus

Gladiolus oppositiflorus

Nerine bowdenii
High altitude form of \textit{Gladiolus oppositiflorus}

lower altitude form of \textit{Gladiolus oppositiflorus}
Dramatic forms of *Gladiolus dalenii*, but probably not very cold hardy?
Crinum macowanii  Watsonia pillansii  Watsonia galpinii

**Low emergent with mass layer**

Agapanthus campanulatus  Crocosmia pearsei  Gladiolus geardii
Aloe cooperi

Kniphofia ritualis agg.

Galtonia candidans

Berkheya purpurea

Kniphofia triangularis
Tall emergent with mass

Gladiolus papilio claret forms
Kniphofia northiae

Moraea spathulata
Moraea alticola
Dierama pulcherrimum
Crinum bulbispermum

Kniphofia multiflora
  Mpumalanga form

Kniphofia uvaria
  Eastern Cape form

Agapanthus inapertus
Moraea spathulata flowering in May, M. reticulata is very similar but flowers in October
Kniphofia northiae is really a foliage plant, but...
Agapanthus inapertus
From Robbers Pass
2010: starting to assemble multi species communities to test competition over a 5 year period
Testing of competitive outcomes of experimental plant communities; based on Foliage height

<table>
<thead>
<tr>
<th>Community types</th>
<th>% of plants present</th>
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<tr>
<td></td>
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<td>community 4; tall dominant:medium subdominant</td>
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<td>community 5; medium dominant:low subdominant</td>
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<tr>
<td>community 6; tall dominant: low subordinate</td>
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<tr>
<td>community 7; low dominant; tall subordinate</td>
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<tr>
<td>community 8; medium dominant; tall subordinate</td>
<td>33</td>
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<tr>
<td>community 9; low dominant; medium subordinate</td>
<td>33</td>
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Kniphofia uvaria from Thomas River Eastern Cape, late September
What about winter cold-wet hardiness?

Nearly all of our plants have experienced and survived winters down to -8 (about as cold as Sheffield goes on sloping sites)

Plants are much hardier in the ground than in pots; most damage is due to ice Formation in the basal tissues at the corm-root interface

For most species winter wet is mostly problematic in poorly drained soils

*Watsonia* stands out as a more cold intolerant genus than you would expect
From the natural distribution

We continue to work on these issues........

Many more details will be given in the book I am currently writing
Random, repeating patterns in newly planted South African gardens, base layer of Tussock Grasses (*Themeda triandra*) with geophyte and forb emergents
Sown/planted meadows of SA species at Oxford Botanic Garden, late September
Sown/planted meadows of SA species at Oxford Botanic Garden, July, *Diascia rigescens* Ex Gaikas Kop (1800m)
Sown Meadows of SA (year 2) at RHS Wisley, mid September
Winter rainfall communities

In some ways species from these have better fit with the UK climate; tolerate wet winters

Some are however sensitive to summer wet

Main issue is tolerance of winter cold below -3 to -4°C

Richest geophyte flora in world, over 5,000 species (geophytes and others) in this area

These species come from two main communities:

• Fynbos; mainly on sandy soils

• Rennosterveld, mainly on clay based soils, very geophyte rich
Fynbos showing the typical ericoid shrub structure
Temporary geophyte dominance post fire in fynbos (mainly *Watsonia borbonica*)
Rennosterveld post fire
Hesperantha pauciflora (pink) near Nieuwoudtville, 800m
Ye and Jingyu, Top of the Komsberg Pass (1700m) and very cold
Gazania rigens on the Komsberg
Bulbinella nutans in poorly drained seepage areas
Bulbinella latifolia var. doleritica, near Nieuwoudtville
*Ixia curvata* 3 month old seedlings undamaged outside by -6/-7C
Arctotis adpressa 3 month old seedlings undamaged outside in the same winter
By Spring 2014 we will have screened about 300 spp or populations for tolerance of winter cold and summer wetness tolerance across various soil types.
Obtain seed of as many different populations of each spp. as possible

Grow large numbers of seedlings of each population (100 minimum)

Subject to winter cold, or soil wetness, etc. → Kill most of the seedlings

Grow on the survivors (individuals with desirable genes) to flowering size

Produce seed from visually and functionally superior individuals, for use in research/practice

For poorly fitted species run the process again and again to arrive at maximum “environmental fit”
This vegetation will follow the same basic structural design form as previously shown.

Management involves cutting down and flash burning in early September.

Burning is a useful weed management technique and improves flowering in some species.

Species like *Amaryllis belladonna* will start to flower in late September.
Research microcosms for these spp.  Sheffield Botanic Gardens
Low forb community plus emergent low geophytes
The communities in summer 2014. The tall spp is the sub-shrubby *Scabiosa africana*. 

Ground layer, evergreen forbs and summer deciduous geophytes.

Gazania othonites and G. krebsiana
Gazania leipoldtii
Arctotis campanulata and Babiana cuneata
Romulea komsbergensis in habitat
An unknown *Spiloxene* spp. that is very cold tolerant
Hesperantha vaginata, this species is surprisingly cold tolerant.
- hummock layer, evergreen forbs and shrubs, emergent, summer dormant + evergreen geophytes

*Dimorphotheca nudicaulis*
Lessertia frutescens, 1700m on the Komsberg
Heterolepis aliena
*Ixia curvata* in habitat
The amazing *Watsonia spectabilis*
Moraea pendula from The Kamiesberg is very Cold tolerant, one of our winners
Bubinella nutans in -15C frost pockets outside Sutherland
Gladiolus cardinalis in Sheffield in July. Most pops go up to about 1400m.
Gladiolus cardinalis at 2000m on the Matroosberg
Watsonia 'Tresco Dwarf Pink'
Dilatris ixioide
• taller hummock layer, evergreen forbs and shrubs, emergent, summer dormant, + evergreen geophytes

The orange population of *Dimorphotheca cuneata* in the Kamiesberg
The white flowered population in the Roggeveld
Bulbinella latifolia var latifolia, Kamiesberg
Aristea capitata (syn. major)

Kniphofia sarmentosa
A high altitude population of *Watsonia borbonica* has huge flowers.
Tetraria are very good structural plants but difficult to get to germinate
Kniphofia sarmentosa flowers in Sheffield for about 4 months
Crinum variable is a very beautiful autumn flowering species
Crinum variabile
Lanaria lanata is also very difficult to get to germinate
Aristea species have pure blue flowers but are generally highly cold sensitive.
Aristea monticola has very blue leaves and is distributed up to 1600m, so is a very promising species.
The future??

We just keep going until we have resolved the key problems.

The main issue we face will be how does climate change pan out??