Two New Plant records for South Africa, a species list of Fauna and Flora, and a Socio-ecological Impact Study highlighting various concern due to Diamond Mining, on the last untouched Meso-Orange River Terrace, Pooitjiespram within the Richtersveld National Park, Northern Cape Province.

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Abstract: Pooitjiespram contains the last untouched Meso-Orange River Terrace within the Richtersveld National Park, hosting species with special conservation concerns, as well adjacent to the Endangered Lower Orange River Alluvial Vegetation; it is also home to Nama Livestock Farmers whose families have been using the locality for at least the past 100 years, and is an important campsite for tourist and community events by the park's People & Conservation department.

Introduction:

The introduction of the Biome concept, based largely on a classification of growth forms and major climatic determinants has led to the description of South Africa's 7 biomes. Of these biomes Fynbos, Succulent Karoo and Nama Karoo Biomes occupy southern Africa's southwest winter and summer rain fall region (Rutherford & Westfall 1986) and a later introduced biome, the Desert Biome (Rutherford & Westfall 1994). A map introducing the seven biomes of South Africa, namely: Savanna, Thicket, Grassland, Forest, Fynbos, Nama Karoo, Succulent Karoo and Desert where introduced later (Rutherford & Westfall 1994; Low & Rebelo 1996; Mucina and Rutherford 2006). The Richtersveld is very unique in that it is situated within three of these biomes, namely the Succulent Karoo Biome, Desert Biome and Nama Karoo biome (Jüergens 1991), and are possibly the main reason for the extreme high biodiversity found within the area. Of these biomes the Fynbos and Succulent Karoo biomes have recognition as two of Earth's biologically richest and most endangered terrestrial Eco regions (Mittermeier *et al.* 1999).

Over the past years several new rare endemics have been discovered and in 2015 the South African National Biodiversity Institute (SAMBI) together with SANParks did a first upgrading of endemic plant taxa from this region, which was published on the South African Red List of Endangered species (Raimondo et al. 2015) (see image 1). A first species list was drawn up by Dr G. Williamson (Williamson, 2000) for the region. The Richtersveld National Park is a contractual park and belongs to the Richtersveld Communities. It is jointly managed by South African National Parks (SANParks) and the Richtersveld Community Management Committee (RGBK) ever since its establishment in 1991. As part of the agreement grazing by small scale livestock farmers is allowed within the park and mining (SANParks Management Plan). Due to the parks rich geology, variable topography and two rain fall seasons the area is home to many vegetation types that were first introduced in 1991 (Jürgens) and (Mucina *et al.* 2006).

The Orange River or the Senqu, as it is called high up in the Maloti Mountain of Lesotho, started its life as a small drainage line. The rainfall where the River originates in the central mountainous areas of South Africa / Lesotho varies from more than 1000 mm per year (high lying grasslands) to less than 40 mm rain per year (rocky deserts) in the west. The river unfortunately carries with it, apart from life-giving water and also diamonds, these two items that now threatened

the “life” of the Orange River (Bezuidenhout 2014). Apart from littering and polluting the River the human has discovered that they could also extract diamonds from the River, while the water are also used for agricultural purposes. In the past, the alluvial floodplains of the River were covered with riverine shrubland and woodland. However, there are indications that this has changed and this vegetation and associated habitat has been influenced by a number of actions, namely: i) expansion of irrigated crop farming, ii) up stream dam constructions, iii) grazing pressures and iv) mining activities. Apart from these actions alien plant species also started replacing the natural vegetation, which contribute to the threatened status of the associated green belt riparian woodland of the River (Bezuidenhout 2014). Previously work in the riparian vegetation has been done by Bezuidenhout, Hendricks and Harck in September 1997 and by Hendricks in 2004. A botanical reconnaissance (13th – 17th October 2014), by Park Management and Scientists from SANParks and SAEON, was carried out along the Orange River in the /Ai -/Ais Richtersveld Transfrontier Park to determine the nature and extent of changes to the threatened riparian woodland. Most of the Orange River was classified as critically endangered due to above mentioned actions (Bezuidenhout 1993, 1996 & 2001). The northern and eastern boundaries of the Richtersveld National Park are formed by the Orange River (Annexure C). The Orange River could be divided according to Van der Riet (2004)1 into six systems, namely:

System 1: Meso-riparian

This system is characterised by three zones:

(i) Floodplain
(ii) Riparian
(iii) River-deserted zone

Comments: The River-deserted zone, which is predominantly covered by river stones, separates the riparian zone from the immediate vicinity of the Orange River.

System B: Hydro-riparian

This system is characterised by two zones:

(i) Floodplain
(ii) Riparian

Comments: The Riparian zone is found immediately next to the Orange River.

System C: Xero-riparian

This system has only a (i) Floodplain zone:
Comments: The system is characterised by a small Floodplain zone with little to no riparian vegetation. The upland is located very close to the Orange River.

System D: Absolute Xero-riparian

This system also has only a (i) Floodplain zone:
Comments: It is different from the Xero-riparian system and characterised by a large floodplain zone with absolutely no riparian vegetation.

System E: Nano-riparian

Open river system with little to no rocks in the absence of riparian vegetation.
Comments: This system consists only of the river system.

System F: Islands

An isolated landscape surrounded by the river covered by vegetation.
Comments: This system contains an island and associated vegetation.

(See Annexure C)

Mining within the Richtersveld National Park at present, is exclusively for diamonds. The Orange River is the main route for the transport of diamonds to the major deposits on the banks of the

Lower Orange River and the Namibian coastline north of the Orange mouth. Economic accumulations of diamonds were not found along the Orange River until 1966. Subsequently alluvial diamonds have been exploited from terrace gravels on both the South African and Namibian banks of the river over its lower 100 km. The lower Orange River has two distinguished suites of gravels, namely: 1. Older, higher suite, which is generally 50 to 70 m above the present river bed and is of early mid-Miocene in age (19 to 17 Ma), referred to as the **Proto-Orange River Terraces**, and 2. The Younger, lower suite, normally 30 to 40 m above the current river bed, which may be of Plio-Pleistocene (5 to 2 Ma) age, referred to as the **Meso-Orange River Terraces** (see Image 2.). Although these gravels are very low in grade, the diamonds they do yield are large (1 to 2 carat stones) and of >95% gem quality, with the best deposits in the Proto-Orange gravels. Grades are highest near the bedrock contact and in localised trap sites where levels of 10 to 50 carats per hundred tonnes are encountered as stones of 1.5 to 2.8 carats. Remnants of the Proto-Orange gravels are found over the lower 320 km of the river and thicken from <5 m upstream, to >80 m nearer the mouth. (Porter GeoConsultancy, 1999). On the Proto and Meso-Orange River Terraces, unique endemic flora evolved over the past (4-3Ma)(Williamson, 2000), and are today, due to diamond mining, one of the places of greatest conservation concern within the Richtersveld Bio Region, and South Africa, as can be seen in Image 1 (SANBI, 2015).

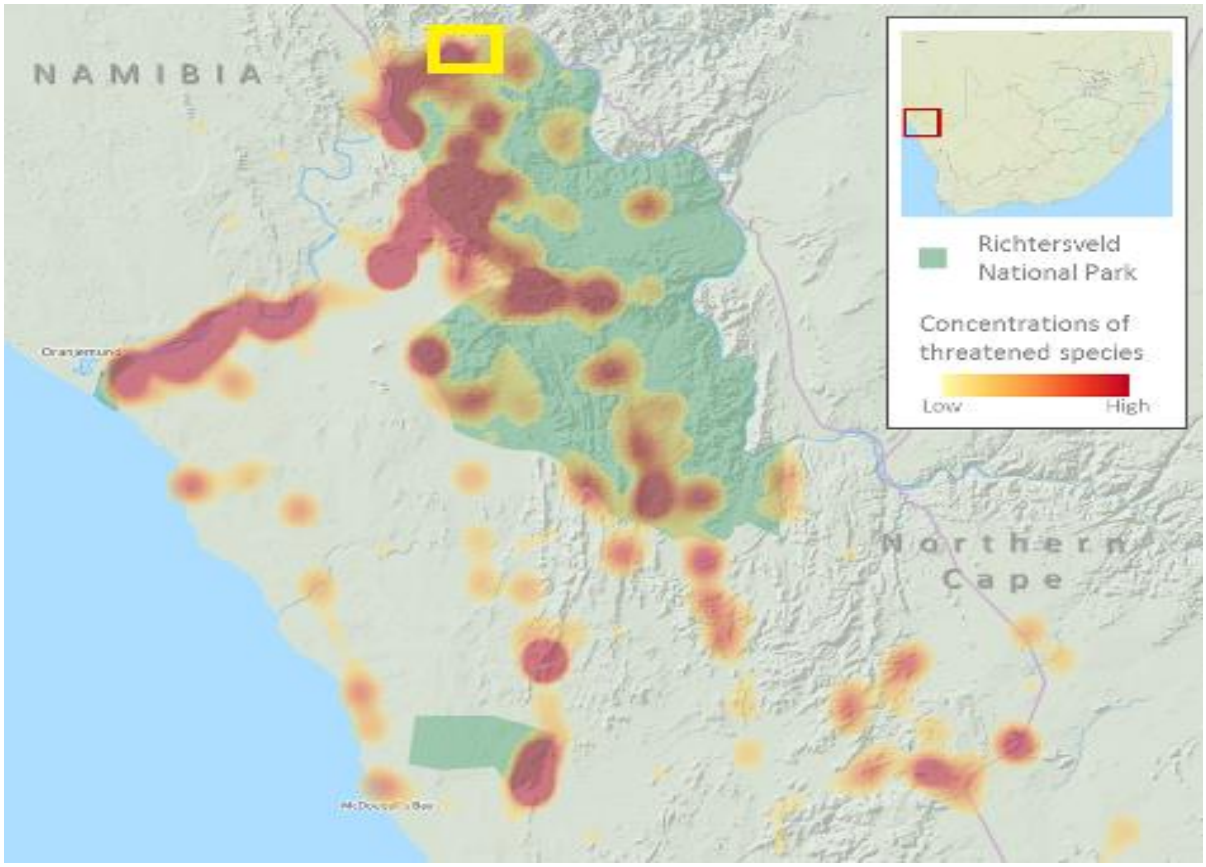


Image 1: SANBI Red List, 2015 indicating concentration of threatened species in the Richtersveld. The yellow square indicating Pooitjiespram falling within the "high" concentration of threatened species.

After the closing of the Transhex Mining Company in 2015, many concerns were raised by SANParks, due to the past negative impact of the mine on the environment and local community. One of these concerns was major habitat loss of species like *Portulacaria pygmaea* and *Monsonia multifida* and what the impact will be on such species, should mining continue in the future. For this reason SANParks, Richtersveld National Park started to assess the mining areas within the park, as a precaution, and found that only one site remained untouched within the park, namely: Pooitjiespram (see Image 2, 4 & 5). The SANParks Mandate, states the following: ***The core mandate of SANParks is the conservation of South Africa's biodiversity, landscapes and associated heritage assets, through its system of national parks. SANParks also promotes and manages nature-based tourism and delivers both conservation management and tourism services***

through a people-centred approach. It became clear that one of the park's biodiversity assets is due to be lost, namely: The Meso-Orange River Terraces, keeping in consideration that all of the Proto-Orange River Terraces, has already been destroyed by the mines within the park. The Richtersveld National Park is the only formal protected area where the Proto & Meso-Orange Terraces falls within the Gariep Eco-geographic Unit, within the Richtersveld Bio Region (Snijmann, 2013), an area characterized for having many rare endemic, especially miniature bulbs within the Hyacinthaceae, Amaryllidaceae and Ruscaceae families. The Richtersveld National Park, and the Augrabiesfalls National Park is also the only two localities where the Lower Orange River Alluvial Vegetation, are protected. Assessment was started on the site in 2014, focusing on Fauna and Flora, and then postponed until 2020, due to drought.

The study area, Pooitjiespram, is also important for SANParks and the traditional landowners, the Nama People for the following reasons: 1. It is one of only three campsites used by tourist within the park, on the banks of the Orange River; 2. The Pooitjiespram Campsite is the only campsite used by the People & Conservation Department, for community outreach and environmental education related camps; 3. The site has 5 Traditional Nama Livestock Post, which are seasonally used by the nomadic pastoralist; 5. Special biodiversity, the only locality in South Africa, where *Drimia oliverorum* grows and 6. The largest natural area containing Lower Oranje River Alluvial Vegetation within the park.

The aim of this paper is to access what the impact will be on the environment, SANParks in general. Also in this paper the biodiversity are accessed, by providing detailed species checklist with their conservation status. The study let to the first record of two species of Bulbs in South Africa, previously known only from Namibia, namely: *Drimia oliverorum* and *Eriospermum rautanenii*, a short description of them (See Annexure: A) as well a rare new form of *Cyanella ramosissima* is described (See Annexure: B).

Image 2: Meso-Orange River Terraces at the study area of this paper, Pooitjiespram with Hoodia gordonii (succulent in flower).

Study area:

Pooitjiespram falls within the Richtersveld National Park, Northern Cape, South Africa. The Richtersveld Bio region contains 336 known endemic plant taxa (Cowling *et al.* 1999). It is

acknowledged as one of the richest desert floras of the planet (Cowling *et al.* 1998) and forms part of a 'biodiversity hotspot' defined to set conservation priorities (Meyers *et al.* 2000). The last untouched single Meso-Orange River Terrace within the Richtersveld National Park falls within Pooitjiespram, and are the main focus for this study (see Image 2-4.). The terrace is situated immediately next to the Pooitjiespram Campsite, which is a very important campsite for the park, as there are only 4 campsites within the park, of which 3 are located next to the Orange River (see Image 5). The Pooitjiespram area is also important for hosting community groups under the People & Conservation department, and is used as a site for environmental education, as well cultural education. Pooitjiespram also has traditional livestock post, used by semi-nomadic Nama pastoralist, which is one of the main attractions to the Richtersveld (see Image 5 & 6).

The species checklists have been compiled only from what was recorded on the Pooitjiespram Meso-Orange River Terrace (see red circled area in Image 4 & 5).

It made sense to include the roads within the Pooitjiespram area, as part of the study area. This is due to the fact, that the opening of area to mining will certainly include the expansion of the roads. Also the area directly adjacent to the terrace will be used for dumps, this includes the riparian area directly north of the terrace and the low foot hills directly south of the terrace (see Image 4 & 5).

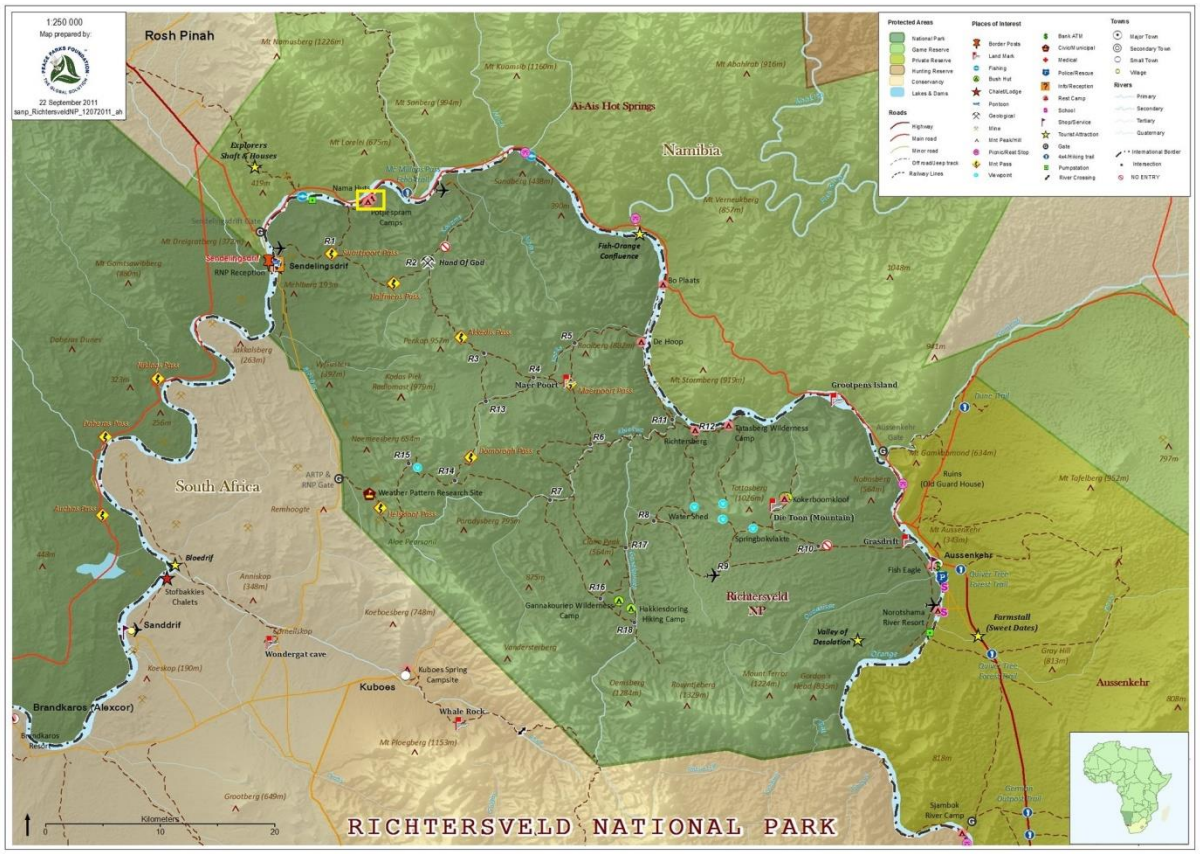


Image 3: Map of Richtersveld National Park, yellow square showing the study area.

Vegetation:

According to the Vegetation Types of South Africa, Lesotho & Swaziland (Mucina and Rutherford 2006) two vegegation types occurs at Pooitjiespram namely: Dg1 Noms Mountain Desert (Van Jaarsveld, 1981; Naußbaum, 2003, Jürgens 2004) and the AZa3 Lower Gariep Alluvial Vegetation (Acoks, 1979; Werger & Coetzee, 1977; Werger & Ellenbroek, 1978; Werger, 1980; Bezuidenhout, 1996; Bezuidenhout & Jardine, 2001; Jürgens, 2004).

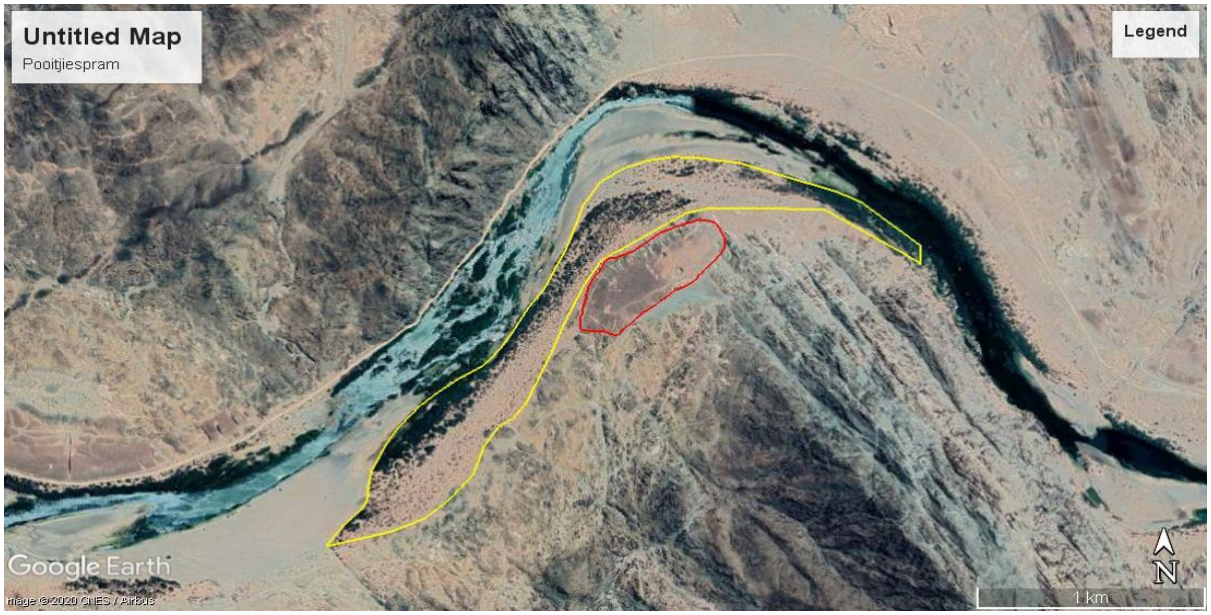


Image 4: Google earth image; Red line indicating the Meso-Orange River Terrace, which is the main focus of this study; Yellow line, showing the close proximity of the largest Orange River Riparian vegetation found within the Richtersveld National Park.

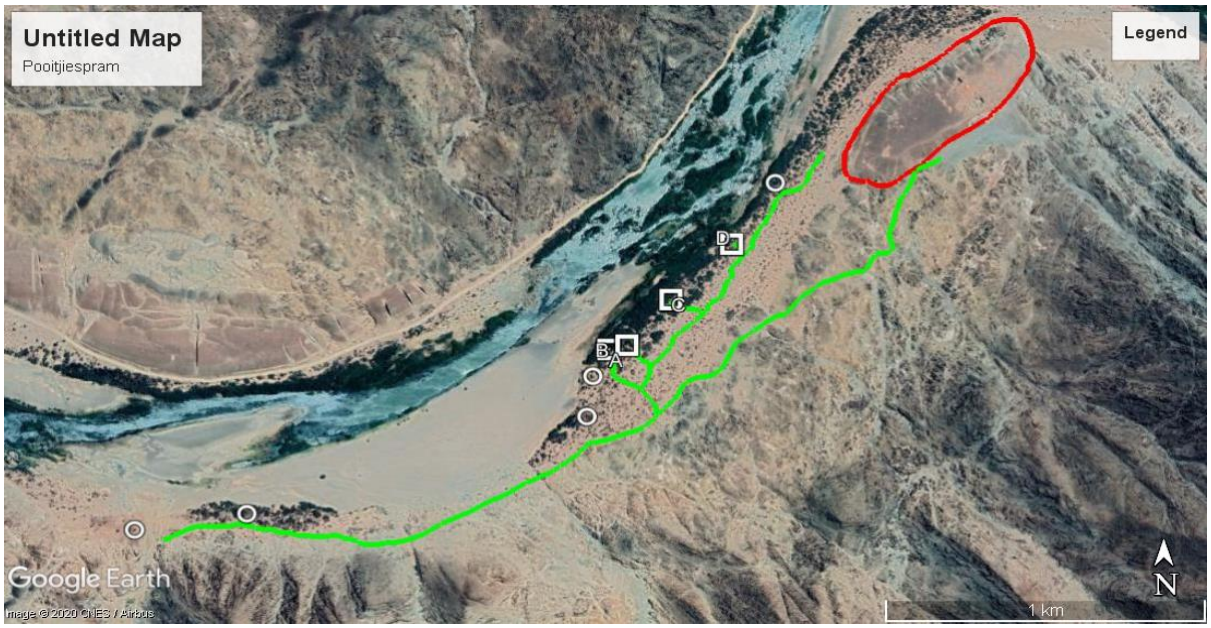


Image 5: Green line = existing roads; Circles = livestock posts; Square A-D = Richtersveld National Park campsites, and the Redline, the terrace and core area which will be mined.

Image 6: Traditional Nama livestock post at Pooitjiespram.

Image 7: From: The Vegetation of South Africa, Lesotho and Swaziland, Strelitzia 19 (2006), showing the vegetation types within the park. The yellow square indicates the study area.

Methods and Material:

Plants – Pieter Van Wyk: data collection was done from the years 2013 until 2020. Detail was gathered by taking photos of species, together with GPS. All species has been identified, and photos are stored taxonomically, and were used to create a photographic herbarium. Encase species could not be identified, using photos; herbarium collections were made. When voucher specimens were collected, the following information was also collected using a standard Herbarium Collection Form: GPS coordinates, Altitude, Vegetation Type, Substrate, Moisture regime, Soil type, Lithology, Exposure, Aspect, Slope, Biotic effect and Plant Features which included: growth form, height, flowering or fruiting. Living vouchers were given labels and grown at the Richtersveld National Park Nursery. Herbarium voucher of plants were pressed, frozen at -15°c after which it was dried at 65°c. Plant species identification was done by comparing herbarium material at Compton, Bolus, Stellenbosch, KSAN, Kimberley, SANParks and SANBI, Pretoria Herbariums. A Nikon SMZ800 micro scope was used to examine finer detail. Encase of problematic species, second opinions were obtained from several specialist.

Spiders & Scorpions – Pieter Van Wyk: data collections were done in 2014. Details were gathered by taking photos of species, together with GPS. Scorpions where searched for by using n UV light, and spiders as well scorpions were searched for by looking under rocks and recorded also when viewed moving around. All species has been identified up to family level at least. Encase needed, specimens was made. They were collected together with general description of habitat and GPS, frozen at -10°c and directly afterwards stored in air tight containers, completely submerged in 85% ethanol. The specimens were handed to SANParks Scientific Services to distribute to the necessary specialist for identification.

Rodents – Pieter Van Wyk: data collections were done for 5 days in 2014 by putting out non-hazardous traps using different bait. In total 20 traps were used with the following bait: 10 with dried meat, bones, and salty cracks; 5 with sweet biscuits and honey; and 5 with seeds and nuts. The placement of the traps was marked with GPS, the date and time, and time of checking. The surveys were done during the day and night, to ensure quick release and less stress on animals.

Animals & Birds – Pieter Van Wyk: Day and Night surveys was done, at night using a strong spot light with binoculars, this was especially used for geckos, as their eyes reflect, when looking through binoculars and shinning a spotlight on them. The species were photographed, if not known, and possible, to identify afterwards, using guides and contacting specialist if needed. The survey was done for 5 days.

Tourism Statistics – Briston Adams & Brent Whittington: Data was obtained by pulling the statistics from the SANParks Intranet. A period of three years was chosen as sample size. This can be done for all formal facilities individually by following the links, showcased in Image 8.

People & Conservation Statistics – Aletta Links & Brent Whittington: data was obtained, by and from, the Richtersveld National Park People and Conservation Officer. A study sample of 3 years were chosen, 2017-2019 (Chart 1).

Orange River Vegetation – Dr Hugo Bezuidenhout

In the reconnaissance it was decided that, due to time constraints, we will only look at the vegetation structure of the river bank (closed woodland) and the floodplain (sparse woodland) vegetation of the river, which refer to the System B (Hydro-riparian system) of Van der Riet (2004) (Figure 1). Photographs of different height classes of different woody plant species were taken. A belt transect was done in each of the different terrain units (floodplain and river bank), with different utilizations. The belt transect for the river bank was 20 meter long and 10 meter wide with four quadrants of 5 meter by 10 meter. The belt transect for the floodplain was 40 meter long and 5 meter wide with eight quadrants of 5 meter by 5 meter. All transects were done parallel to the Orange River.

Other Materia used, not mentioned above incudes: 50 meter measure tape, 100 meter rope, camera, one meter long stick and a two meter stick, herbarium press with flimsy, mouse traps (save ones, with trap door system), plastic buckets for spiders and insects, binoculars, uv-light.

Conservation Status – Pieter Van Wyk & Domitilla Raimondo

Was obtained by searching the SANBI Red List for each species (http://redlist.sanbi.org/). The comparison of impact on vegetation units was made by comparing the Boegoebaai Port Project plan with the vegetation map, within the (Vegetation of South Africa, Lesotho and Swaziland, 2006, Strelitzia 19) and consulting with SANBI.

Results:

The Meso-Orange River Terrace at Pooitjiespram, was found to be the last almost, untouched alluvial terrace of its type within the Richtersveld National Park. In total 73 plant taxa was recorded of which 5 species has special conservation status, on the SANBI Red Data List. Three more species where found to be also of conservation concern, and need special updating of their Red Data Status (Table 1 & 2). Two first plant records were made for South Africa, and it was found that Pooitjiespram is currently the only known locality where *Eriospermum rautanenii* is found and the Pooitjiespram Meso-Orange River Terrace is currently the only known locality where *Drimia oliverorum* is found, both within South Africa (Annexure A). A strange new rare form of *Cyanella ramosissima* which is also listed as Vulnerable on the SANBI Red List was found on the Pooitjiespram Meso-Orange River Alluvial Terrace (Table 2 & Annexure B). They are only one small population of *Ammocharis longifolia* found within the Richtersveld National Park. The population has a mere 31 individuals, growing on both sides of the road that leads to the mining area (Image 9). Even though the species does not have a special conservation status, it is still of conservation concern for SANParks, as it is the only population within the park. The broadening of the road towards the mine, could potentially lead to the permanent loss of the species within the Richtersveld National Park. The close proximity of the mine to the largest patch of Lower Orange River Alluvial Vegetation, was also found, to potentially be devastating, as this vegetation type is already considered as endangered.

In total 10 vertebra taxa was recorded of which one species, *Bitis xeropaga* is of importance, as it is a regional endemic (Table 3). In total 16 invertebrate taxa was recorded (Table 4).

The mining of the Pooitjiespram Meso-Orange River Terrace, will lead to the closure of the Pooitjiespram Campsite. The Noise Pollution will go completely against, what SANParks stands for and offers to visitors. The closure of the campsite will have a major impact on the Richtersveld National Parks revenue made from camping, with an estimated figure of 10-15% camping-revenue loss (Image 8). Also it was found that there has been a steady increase in community programs and camps under the People & Conservation department of the Richtersveld National Park, at Pooitjiespram. It is the only camp which accommodate this critical important project, as it engage the local community with nature, and are the main source of environmental education for the Richtersveld community. Discussion amongst management within the Richtersveld National Park, found that the movement of heavy medium trucks, will have a major safety risk on visitors at the campsite as well the local Nama livestock farmers.

The close proximity to the Orange River, especially the Lower Orange River Alluvial Vegetation, will be negatively impacted, by water attraction, broadening of roads and dust pollution from the mine dumps and trucks.

Species Checklist

(Table 1)
Checklist of plant taxa observed with Least Concern Red Data Status

Scientific Names		
Aloe gariepensis	*Chrysocoma puberula*	*Limeum aethiopicum var. lanceolatum*
Aloidendron dichotomum	*Dicoma capensis*	*Hermannia gariepina*
Trachyandra bulbinifolia	*Didelta carnosa var. carnosa*	*Grielum humifusum*
Trachyandra muricata	*Eriocephalus pedicellaris*	*Dyerophytum africanum*
Albuca longipes	*Foveolina dichotoma*	*Gaillonia crocyllis*
Dipcadi brevifolium	*Gazania lichtensteinii*	*Kohautia caespitosa subsp. brachyloba*
Cenchrus ciliaris	*Gorteria diffusa subsp. diffusa*	*Anticharis scoparia*
Enneapogon desvauxii	*Helichrysum gariepinum*	*Peliostomum virgatum*
Enneapogon scaber	*Helichrysum herniarioides*	*Forsskaolea candida*
Pentameris airoides subsp. airoides	*Osteospermum microcarpum*	*Forsskaolea hereroensis*
Schismum schismoides	*Osteospermum polycephalum*	*Chascanum garipense*
Stipagrostis ciliata var. capensis	*Othonna opima*	*Sisyndite spartea*
Stipagrostis obtusa	*Trichodesma africanum*	*Tetraena microcarpa*
Tribolium utriculosum	*Heliophila deserticola var. deserticola*	*Tetraena patenticaula*
Galenia crystallina var. crystallina	*Cleome foliosa var. lutea*	*Tetraena prismatocarpa*
Sesuvium sesuvioides	*Portulacaria fruticulosa*	*Tetraena sp. nov segmentatum*
Trianthema parvifolia var. rubens	*Euphorbia rhombifolia*	*Tetraena sp.*
Caroxylon sp.	*Mesembryanthemum nucifer*	*Tribulus cristatus*
Searsia populifolia	*Indigastrum argyroides*	
Hoodia gordonii	*Indigofera hololeuca*	
Microloma incanum	*Indigofera pungens*	
Orthanthera albida	*Tephrosia dregeana*	
Amellus nanus	*Gisekia africana*	
Total Taxa: **64**		

(Table 2)
Taxa of Conservation Concern (with their SANBI Red Data Status)

Scientific Name	Status	Criteria
Namaquanula bruce-bayeri	Criticaly Endangered	C2a(i)
Eriospermum rautanenii		
Cyanella ramosissima	Vulnerable	B1ab(iii,v)+2ab(iii,v)
Cephalophyllum herrei	Vulnerable	B1ab(iii,v)
Portulacaria pygmaea	Endangered	B1ab(iii,v)
Lotononis strigillosa	Near Threatened	B1ab(iii,v)
Lotononis sp. nov		
Drimia oliverorum		
Total Red Data Taxa: **5**		
Total Taxa of Conservation Concern: **8**		
Total Taxa of plants including Table 1 & 2: **73**		

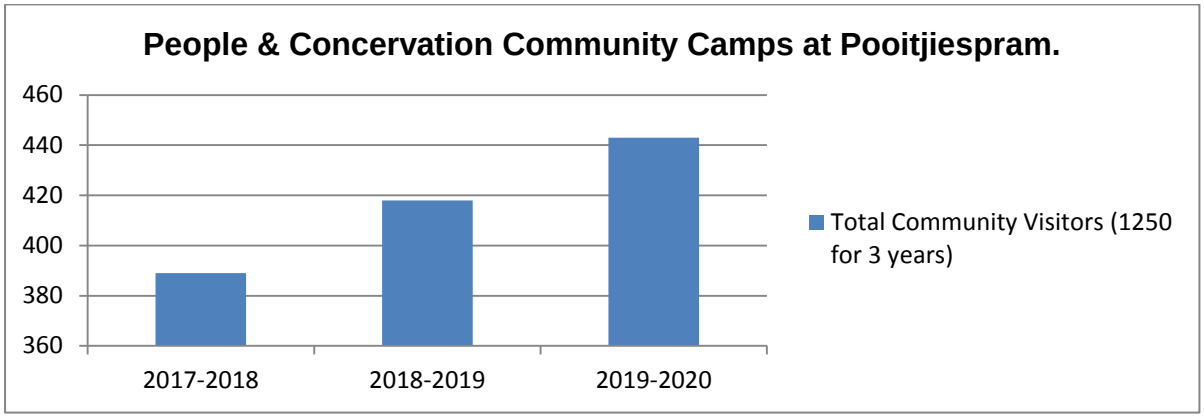
(Table 3)
Vertebra Taxa Recorded with their status

Scientific Name	Status	Notes
Pachydactylus atorquatus	LC	
Pachydactylus carinatus	LC	
Chondrodactylus angulifer	LC	
Bitis xeropaga	LC	Regional Endemic
Bitis caudalis	LC	
Psammophis namibensis	LC	
Meroles suborbitalis	LC	
Desmodillus auricularis	LC	
Pronolagus rupestris	LC	
Calendulauda albescens	LC	
Total Taxa: **10**		

(Table 4)
Invertebrate Taxa Recorded with their status

Scientific Name	
Oxypilus sp.	*Curculionidae sp.*
Browns desert mantid	*Eumeta sp.*
Pamphagid sp.	*Solifugid sp.*
Conistica saucia	*Parabuthus villosus*
Schistocerca gregaria	*Parabuthus granulatus*
Nemia costalis	*Opistophthalmus carinatus*
Anthia sp.	*Sparassid leucorchestris*
Eurychora sp.	
Somaticus aeneus	
Total Taxa: **16**	

(Chart 1)



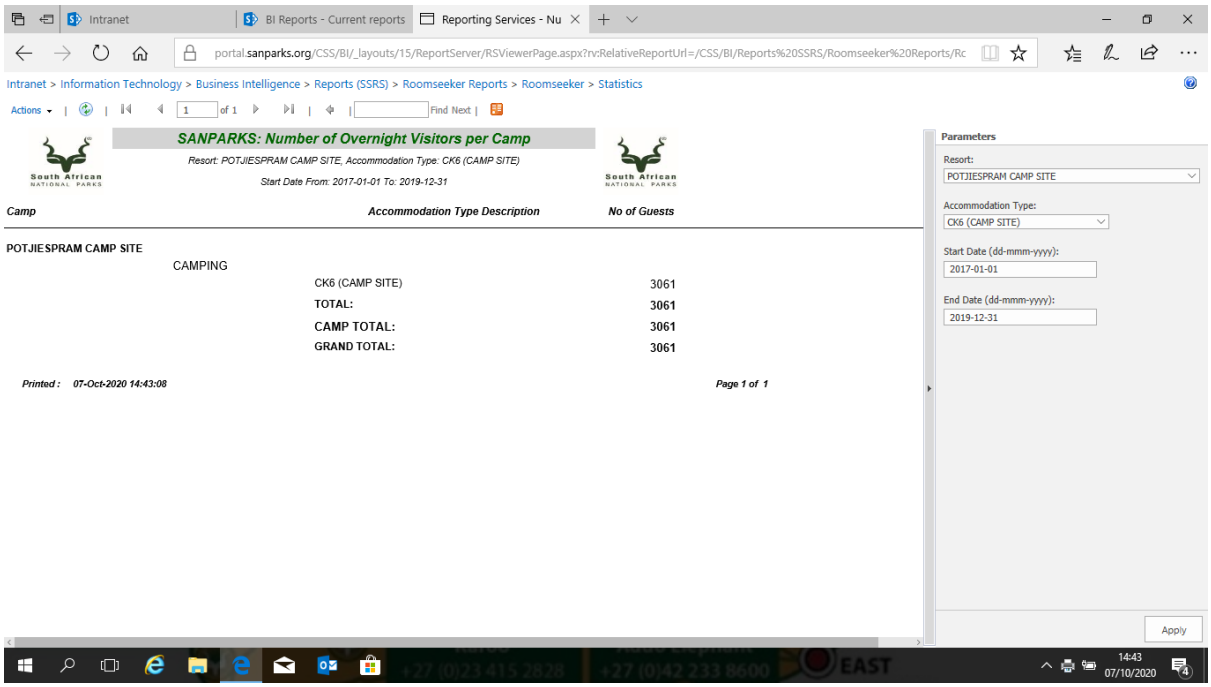


Image 8, SANParks intranet, statistics of bookings for Pooitjiespram Campsite over a period of 3 years, 2017-2019.

Image 9: Google earth, road to mine, red marked area showing the locality where Ammocharis longiflora grows.

Conclusion:

Pooitjiespram is an important area for biodiversity within the Richtersveld National Park, and should be protected. The opening of the area for mining will have a devastating socio-ecological impact. No consultation has been done in the past by the mine, or at present, with the local semi-nomadic Nama Livestock Farmers within the Richtersveld National Park. Evidence of their existence within the park dates back to 3 000 years ago (Webley 1997). The mining will cause the only know population of *Drimia oliverorum* to go extinct within South Africa and may lead to the loss of the only *Ammocharis longiflora* population within the Richtersveld National Park. Also should Pooitjiespram be mined, it will lead to the closure of the locality as a campsite which will have a major impact on the Richtersveld National Park.

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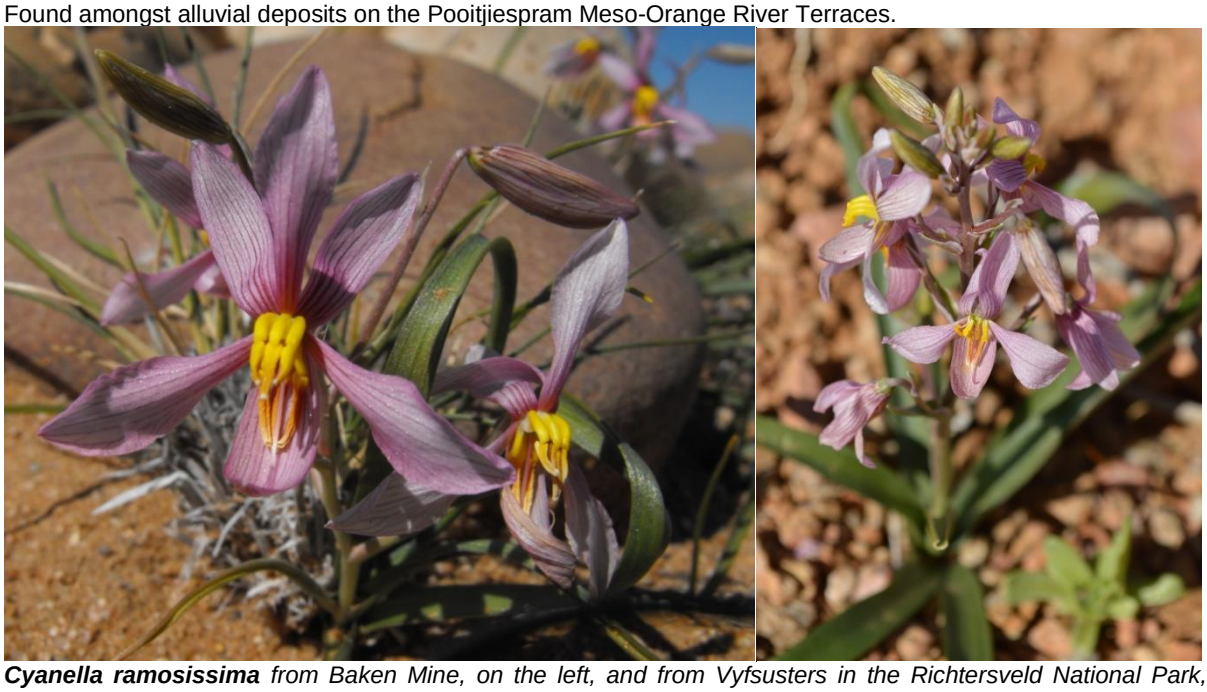
Annexure: A

Eriospermum rautanenii Schinz; ERIOSPERMACEAE; PC2374; 04/05/020; Pooitjiespram; GPS: 28°04.04.86"S 016°58.23.99"E; Alt. 74m. Description: A deciduous herbaceous geophyte, with underground tubers. Leaf is mostly single, dark green, pressed on the ground or suberect, ovate, leathery, smooth, the margins entire; it can grow up to 7cm long, dying before flowering. Flowers are white, with a green stripe in the middle of the petals, borne in a dense, short raceme. Flowering December to May. Distribution: Previously known only in Namibia and Angola. Found amongst alluvial deposits on the Pooitjiespram Meso-Orange River Terrace and surroundings. Abundant.

Drimia oliverorum J.C. Manning (Urgineodeae); Hyacinthaceae; PC2558; 31/08/2020; Pooitjiespram; GPS: 28°04.04.86"S 016°58.23.99"E; Alt. 74m. Description: A perennial, deciduous herbaceous geophyte that can grow up to 8cm tall, with a small bulb. The lower part of the stem is covered with papery sheaths. Leaf is ovate, striped and softly hairy above; it can grow up to 2cm long, and is absent at flowering. Flowers are white, light brown to creamy or slightly greenish, with a brownish stripe in the middle of the petals, borne slightly nodding on flaccid, branched pedicles, the petals recurved; they can grow up to 8mm in diameter. Stamens grow spreading outwards. Opening during the day. Flowering December to January. Distribution: A very rare species, know from only two plants collected in Namibia previously. Found amongst alluvial deposits on the Pooitjiespram Meso-Orange River Terrace.

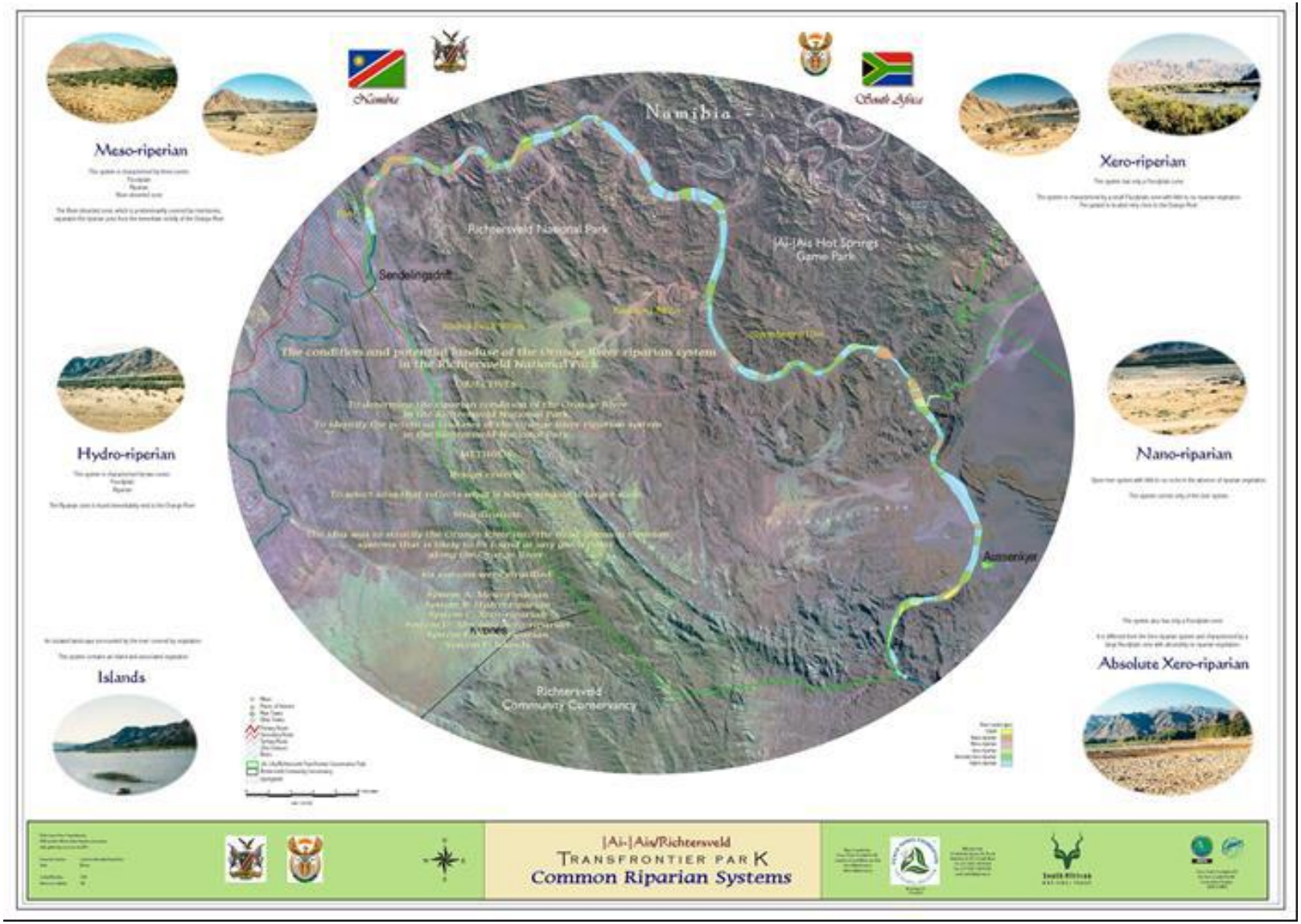
Annexure: B

Cyanella ramosissima (Engl. & K.Krause) Engl. & K.Krause; TECOPHILAEACEAE; PC2654; 31/08/2020; Pooitjiespram; GPS: 28°03.58.07"S 016°58.26.09"E; Alt. 73m. Description: A perennial, deciduous herbaceous geophyte that can grow up to 10cm tall, with a corm. Leaves are lanceolate, curled, hard, smooth or corrugated, glabrous, the margins entire; they can grow up to 8cm long. Flowers are fragrant, pink to bluish, borne on suberect pedicels; they can grow up to 2cm in diameter. Stamens are yellow. Anthers are 3 upper and 3 lower; the upper median anther is larger than the upper laterals. Filaments are partially fused. The style is longer than the lower stamens. Flowering July to September. This species is unusual, in its very long, shiny green leaves, tall inflorescence, and the first record of the species with white flowers. Previously the species was known to have only mauve to light magenta flowers (see Image below) Distribution: previously known from 6 localities within the Richtersveld National Park, of which the closes record is at Vyf Susters 5km south of Sendelingsdrif. Found amongst alluvial deposits on the Pooitjiespram Meso-Orange River Terraces.



Cyanella ramosissima *from Baken Mine, on the left, and from Vyfsusters in the Richtersveld National Park, picture on the right, both showing the normal low growth form of the species and light purple flowers.*

Annexure: C



/Ai-/Ais Richtersveld Transfrontier Park and the location of the Orange River in the Park (Van der Riet 2004).