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SECTION B: RESEARCH REPORTS

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A preliminary botanical assessment of an isolated inselberg archipelago in the Namib Sand Sea, Namibia

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Abstract

The inselbergs of the Namib Desert serve as biodiversity refugia in a matrix of largely depauperate gravel plains or sand dunes. Despite their ecological importance and expected species richness, the biota of most Namib inselbergs has not been surveyed. An isolated and previously unexplored inselberg archipelago in the northeastern corner of the Namib Sand Sea was visited in December 2023. A preliminary botanical assessment recorded 42 plant species across three inselberg sites. The floristic survey was conducted by walk-over assessments and capturing photographic records that were uploaded to iNaturalist for public access. Euphorbia Koppie exhibited the highest diversity at 38 species, attributed primarily to its larger size and habitat heterogeneity, while the smaller Commiphora Koppie and Owl Koppie recorded 16 and 14 species respectively. Frequently recorded species across all three sites include *Commiphora saxicola*, *Cleome angustifolia* subsp. *diandra*, *Caroxylon* sp., *Euphorbia glanduligera*, *Tephrosia dregeana*, *Tetraena cylindrifolia* and *Stipagrostis ciliata*. This survey contributes valuable baseline data for future biodiversity assessments and conservation efforts in the Central Namib Desert at a time of increasing threat from tourism, infrastructure development, mineral prospecting, poaching and mining activities.

Keywords: Central Namib, inselberg, floristic diversity, Namib Desert, Namib Sand Sea, Namibia

Introduction

The Namib Sand Sea lies on the coastal plain in the Namib Desert, Namibia, between the Khoichab Depression in the south and the Kuiseb River in the north, reaching inland as far as the base of the Great Escarpment (Lancaster 1989, Stone 2013). Inselbergs of varying size and geology are found across the Namib Desert (Jürgens & Burke 2000) and represent islands of biodiversity that provide refuge habitats in a landscape that largely consists of open plains (Larson 2001). Despite their ecological significance, only a small number of inselbergs in the Namib Desert have been extensively floristically surveyed (Nordenstam 1974, Burke *et al.* 1998); the majority lack inventories for any biota.

Most inselbergs within the extensive dune fields of the Namib Sand Sea are located in its southern half (Namibia National Committee for World Heritage 2012), with the exception of a small archipelago in the northeastern corner. This archipelago is surrounded by a relatively narrow sequence of dunes that run parallel to the Kuiseb Canyon in the north, Tsondabvlakte in the south, and terminate near Saagberg in the east. The inselbergs are the southwestern-most outcrops of the Mahonda and Haris Formations of the Hakos Group along the southern margin of the Damara Supergroup, consisting of quartzites, amphibolites and mica schists that are well exposed in the Kamsberg (Hoffmann *et al.* 1994). As far as the authors are aware, these inselbergs have never received a biodiversity assessment of any kind. Furthermore, sites 1 and 2 (Figure 1) showed no evidence of having ever been visited by motor vehicles.

Unlike other inselbergs in the Central Namib Desert that are surrounded by gravel plains, this archipelago is surrounded by dunes. Sand dunes can change formation and position quite considerably over the course of even a few thousand years (Bristow *et al.* 2007). This suggests that the inselbergs, particularly the lower ridges, are likely to have been repeatedly submerged by encroaching dunes and re-exposed over time. Therefore, these inselbergs may provide a rare opportunity to study plant succession dynamics on recently exposed habitable substrate in an otherwise inhospitable matrix. Extensive exposures of the Tsondab Sandstone Formation around these inselbergs, gullies in Kamberg Calcrete Formation abutting Euphorbia Koppie along its southeastern side, and the relatively low dunes and absence of steep sand ramps suggest that these inselbergs have never been totally submerged by dunes, that would have ensured the extirpation of all lithophilic or petrophilic biota.

This survey forms part of a wider effort to document the flora of the Central Namib, in particular inselberg diversity, at a time when much of the Namib Desert is at risk of destruction from increasing tourism (Tay 2013), exploration and mining concessions (Wassenaar *et al.* 2013), poaching (The Namibian 2020) and infrastructure installations such as communication towers. As this is the first publication to document these inselbergs in any form, we additionally include *ad hoc* observations about fauna, geology and archaeology.

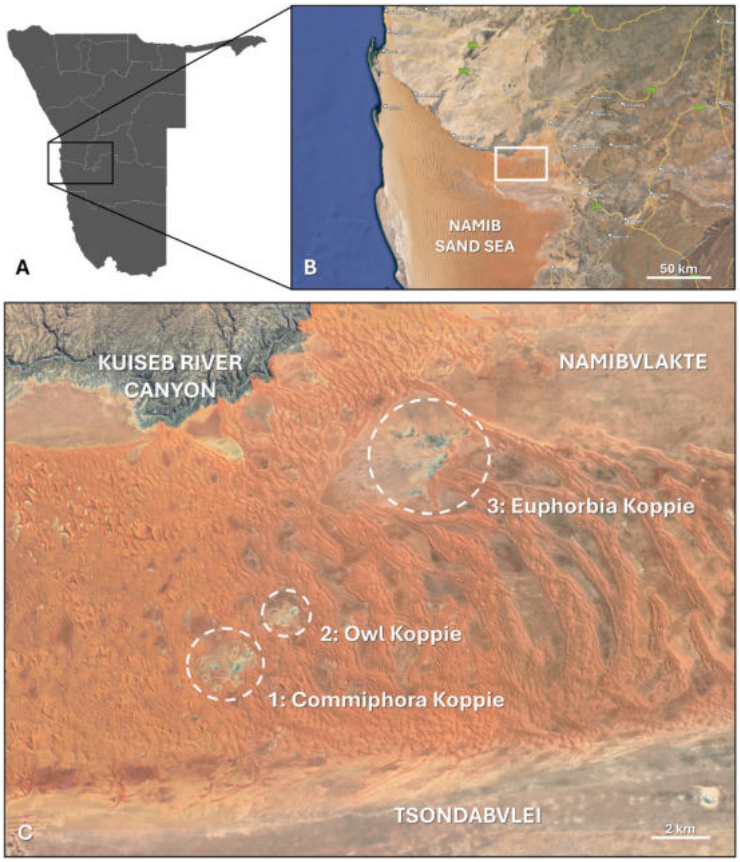

Figure 1: *The location of the inselberg sites. A) The position of (B) within Namibia is indicated by the black square. B) The position of (C) is indicated by the white square. C) The three sites inselberg sites are circled and named: Site 1 (Commiphora Koppie), Site 2 (Owl Koppie) and Site 3 (Euphorbia Koppie).*

Materials and Methods

The authors visited the three inselberg sites in a single trip over three days (4th–6th December 2023). Plant diversity was assessed on each inselberg by a thorough walk-over survey, with photographic observations made of each new plant species record at each site. Photographic observations were selected in place of collecting herbarium specimens to minimise disturbance to the site. Furthermore, the abundance of already dead and dried plant matter would prove unsuitable for the pressing of specimens. The three inselberg sites were considered as distinct because they were separated by at least a 1 km belt of dunes or sand plains from another rocky outcrop. Species inventories were generated for each of the three sites. Although it would have been optimal to conduct the survey following rains, precipitation in the Central Namib is extremely infrequent and difficult to predict (Seely & Louw 1980). Therefore this is considered to be a preliminary survey, with the intention of returning for a follow-up survey after considerable rainfall. Additional informal notes were made on fauna, geology and archaeology of interest.

Both recent and historic maps were thoroughly searched to find existing names for these inselbergs but, with the exception of Site 3, no names were located. Discussions with nearby residents and past associates of Gobabeb also yielded no results. Therefore, we have provided suggested names for the inselberg sites, in each case named after a prominent or remarkable natural feature of the site. Site 1 is named 'Commiphora Koppie' after the large and old *Commiphora saxicola* encountered here. Site 2 is named 'Owl Koppie' after the two individuals of *Bubo* sp. encountered here. Site 3 had informally been labelled 'Euphorbia Hill' by former staff at Gobabeb - Namib Research Institute; a name that has been used in at least one published paper (Wenndt *et al.* 2021). This name is conserved here with Site 3 referred to as 'Euphorbia Koppie' after the abundance of *Euphorbia virosa* across the rocky slopes and surrounding washes.

Photographic observations were accompanied with a date, time and geographic coordinates. Photographic observations were uploaded to iNaturalist (iNaturalist.org 2024), where they can be accessed following the reference numbers cited in Appendix 1. Species identifications were carried out by Sebastian Hatt and Gillian Maggs-Kölling at Gobabeb - Namib Research Institute, with consultation of taxonomic revisions, floras, and herbarium specimens and catalogues at GBB, WIND, PRE and K. Herbaria abbreviations follow Index Herbariorum (Thiers 2024). Species classification and nomenclature follows Plants of the World Online (POWO 2024) and APG IV *et al*. (The Angiosperm Phylogeny Group 2016) for angiosperms. Names may deviate from these resources where expert opinion suggests otherwise. Abundance of each species was recorded by sight and subjectively assigned to the A.C.F.O.R. scale (Morris & Therivel 1995).

Results

A total of 42 plant species was recorded across the three inselberg sites, each vouchered as a photographic observation uploaded to iNaturalist (iNaturalist.org 2024). Figure 2 illustrates a selection of the flora and fauna species recorded. An annotated checklist is presented in Appendix 1, with notes on habitat and abundance.

Inselberg Site 1: Commiphora Koppie

Site 1 (Figure 3A) consists of an approximately rectangular interdune plain, c. 3 x 2.5 km, at an elevational range of c. 760–820 m, lying adjacent and connected to a plain about half this size to the north. Site 1 is separated from Site 2 by c. 1 km of uninterrupted sand dunes. The dominant inselberg (Figure 3B) at this site, c. 1.6 x 0.4 km, lies at the eastern edge of the plain and at its peak reaches an elevation of c. 80 m above the surrounding terrain. The southwestern tip of this ridge becomes gradually submerged by sand dunes, with occasional areas of bare rock until the edge of the plain. Running parallel at c. 0.75 km to the northeast is a string of three exposed outcrops, each no more than 300 m across. The inselbergs are predominantly Damara sequence quartzite and mica schist, while the surrounding plains are dune sands of the Sossus Sand Formation, and weathered remnants of Kamberg Calcretes and the Karpfenkliff Conglomerate Formation that overlie exposed patches of Tsondab Sandstone.

A total of 16 species was observed at this site. The inselbergs form the primary habitat for plants, followed by the dunes themselves, which harbour dune-adapted specialists. *Stipagrostis ciliata* (Desf.) De Winter is dominant across the inselberg surface, apparently suited to every available niche from rocky crags to dune sands. Also abundant across most rocky surfaces is *Cleome angustifolia* subsp. *diandra* (Burch.) Kers, readily identified in its dried state by the distinctive bristle-like glands on the basal stem. Several species frequently observed across most of the rocky slopes at this site include: *Caroxylon* sp. (Figure 3C), the taxonomy of which is in urgent need of revision, *Tetraena cylindrifolia* (Schinz) Beier & Thulin, *Tephrosia dregeana* E.Mey. (Figure 3D), *Euphorbia glanduligera* Pax (Figure 2C) and *Commiphora saxicola* Engl. Individuals of *Commiphora saxicola* were relatively young (< 0.5 m tall, stems to 100 mm thick) across the inselbergs, with the exception of a small rocky outcrop on the northeastern edge of the plain where several individuals had attained considerable size and age (Figure 3E), reaching over 1.5 m in diameter with stems to 300 mm thick. Both the rocky outcrop and the basal stems of several *Commiphora* were considerably submerged in sand. The age of the *Commiphora* here may

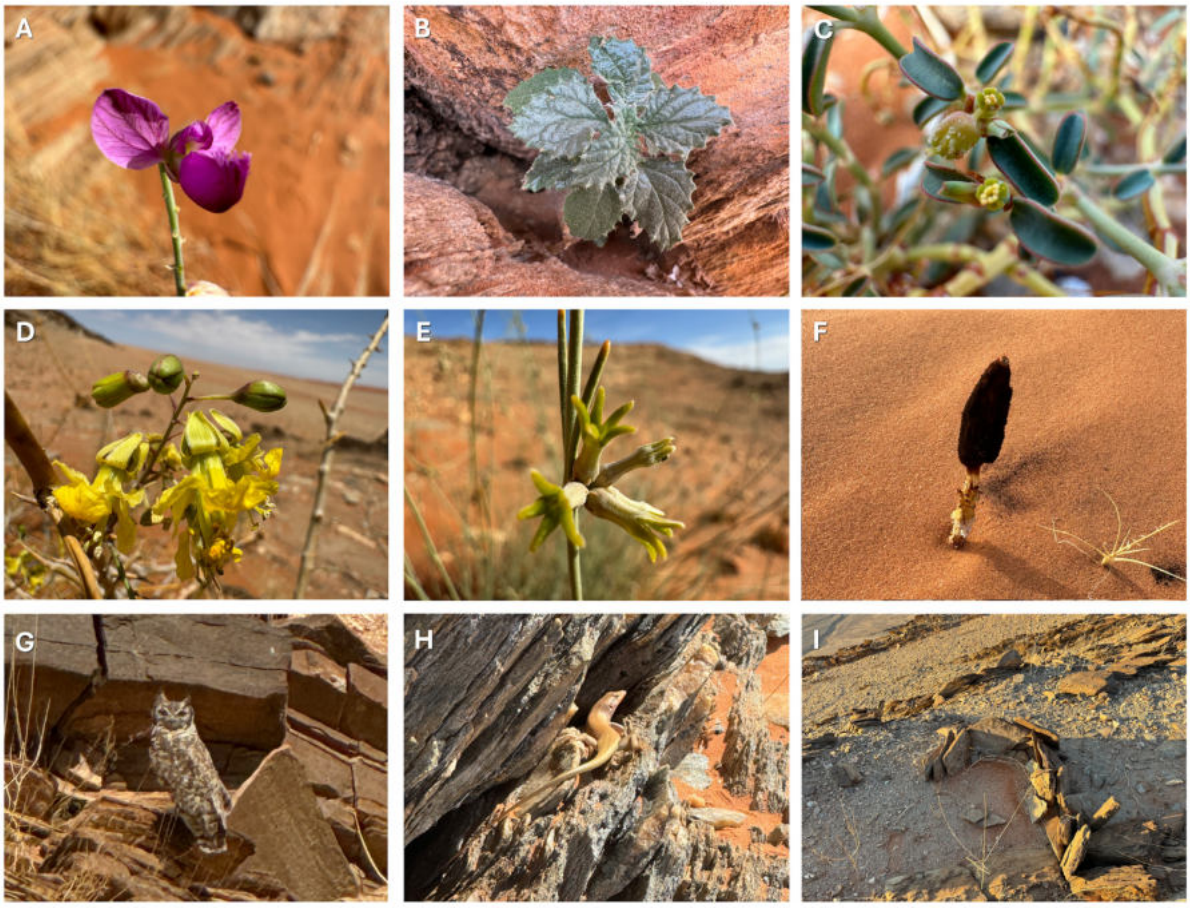

Figure 2: *Characteristic flora and fauna of the inselberg archipelago. A)* Polygala guerichiana. *B)* Forsskaolea candida. *C)* Euphorbia glanduligera. *D)* Parkinsonia africana. *E)* Orthanthera albida. *F)* Podaxis *sp. G).* Bubo *sp. H)* Trachylepis sulcata. *I) Suspected stone circle at Site 1. All photos by Sebastian A. Hatt.*

indicate that this is one of the older exposed rocky areas at this site, but is now in the process of being submerged by the surrounding dunes.

Polygala guerichiana Engl. (Figure 2A) and *Orthanthera albida* Schinz (Figure 2E) were infrequent and only found on the larger inselberg. *Osteospermum microcarpum* (Harv.) Norl. and a single *Trichodesma africanum* (L.) Sm. were located at the base of a small valley, where rain run-off from the mountain presumably concentrates water and nutrients. Two live and apparently healthy *Acacia erioloba* E.Mey. trees were located at the southeastern tip of the larger inselberg (Figure 3F), on a rocky area partially submerged by sand, while an additional dead trunk was located nearby. Dried stem remnants of *Sarcocaulon* aff. *marlothii* Engl. were located near one of the smaller inselbergs, but no live or intact individual was found.

The dune sands immediately surrounding the plain were dominated by *Stipagrostis sabulicola* (Pilg.) De Winter hummocks and *S. ciliata*. Less frequently scattered amongst these are *Stipagrostis seelyae* De Winter and *Kohautia ramosissima* Bremek. However, it important to note that this survey did not extensively cover the adjoining dunes and instead focused on the inselbergs and plains. Thus, other common dune specialists such as *Hermannia minimifolia* E.Holzh., *Cladoraphis spinosa* (L.f.) S.M.Phillips and *Stipagrostis lutescens* (Nees) De Winter are likely found here but were not observed.

Inselberg Site 2: Owl Koppie

Site 2 (Figure 4A) consists of an approximately triangular interdune plain, c. 2.4 x 2.2 km, at an elevational range of c. 800–830 m. Site 2 is separated from Site 3 by c. 6.5 km of sand dunes interrupted with occasional interdune plains. An inselberg-ridge (Figure 4B–D), briefly interrupted in the middle by a small area of flat ground, lies roughly in the centre of the plain, measuring c. 1.4 x 0.2 km and reaching an elevation of c. 40 m above the surrounding terrain. The southwestern tip becomes gradually submerged by sand dunes, with occasional areas of bare rock until the edge of the plain. This ridge forms a continuation of the ridges in Site 1, and thus shares its geology. An extensive area of exposed Tsondab sandstone ridges occurs along the outer margin of the plain to the southwest of Site 2 (Figure 4F). A number of animal-dug depressions, or *gorras*, and green shoots on closely-cropped cushions of *Stipagrostis ciliata* at the base of the sandstones

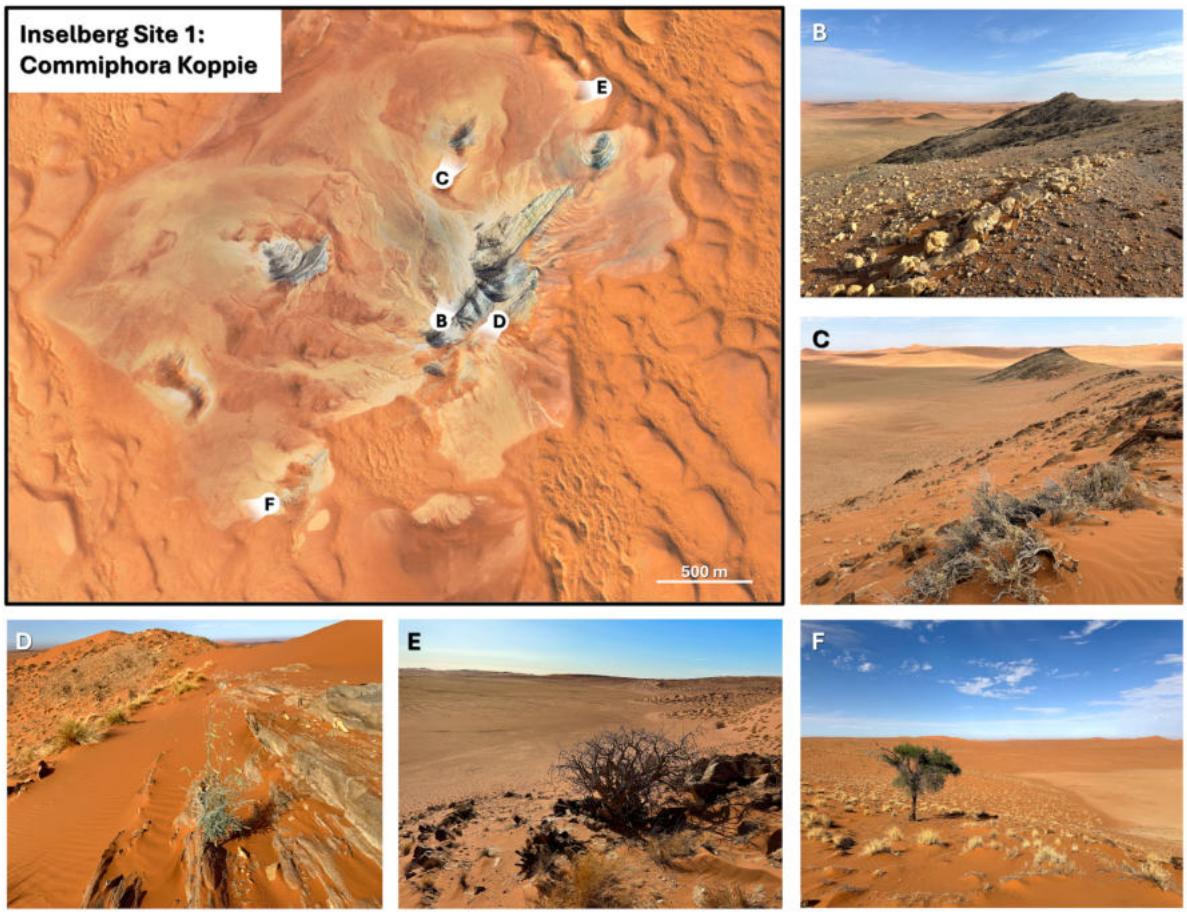

Figure 3: *Map and some notable features of Inselberg Site 1: Commiphora Koppie. A) Map of Site 1. The letters correspond to pictures B–F, and the direction of the white spotlight indicates the direction of the photograph. B) A view along the main ridge. C)* Caroxylon *sp. on partially sand-submerged rock. D)* Tephrosia dregeana *on partially sand-submerged rock. E) A large and established* Commiphora saxicola *on a partially sand-submerged rocky outcrop north of the main inselberg. F) One of* two Acacia erioloba *trees found at this site. All photos by Sebastian A. Hatt.*

and in adjacent gullies hints at the presence of ephemeral seeps after wet spells. At least one historical map suggested a seep or spring in the area where the inselbergs occur.

A total of 14 species was recorded from this site. Floristic composition was mostly the same as at Site 1, with a few notable exceptions. *Orthanthera albida*, *Polygala guerichiana* and *Sarcocaulon* aff. *marlothii* were not observed at Site 2. Species not observed in Site 1 include *Forsskaolea candida* L.f. (Figure 2B) in rocky crags, a few dried individuals of *Pogonospermum genistifolium* (Engl.) I.Darbysh. & Kiel in a wash at the base of the inselberg, and a single *Parkinsonia africana* Sond. (Figure 2D) in flower on the brief plain between the ridges. While no tree-sized *Acacia erioloba* were observed at this site, two small shrub-sized (c. 1 m tall) individuals (Figure 4E) were observed growing in the plain to the north of the inselberg, near some exposed Tsondab sandstone (Figure 4F).

Inselberg Site 3: Euphorbia Koppie

Site 3 (Figure 5A) consists of an irregularly shaped interdune plain, c. 8 x 6 km, at an elevational range of c. 800–870 m. Site 3 is separated from the adjacent Namibvlakte to the northeast by a thin strip of continuous sand dunes c. 400 m across. An arrowhead-shaped set of rocky hills lie in the centre of the plain (Figure 5B). Several washes drain from the hills into the central plain, forming a clearly defined network of channels. The lower parts of the eastern slopes of the hills are partially submerged under sand ramps. As with Sites 1 and 2, the inselberg ridges consist predominantly of quartzite and mica schist, but with exposed amphibolite outcrops along the lower elevations on the western sides.

A total of 38 species was observed at this site; twice the number of species observed at the other two sites combined. All species observed at Sites 1 and 2 were also observed here, except for *Parkinsonia africana*, *Pogonospermum genistifolium* and *Forsskaolea candida*. *Euphorbia virosa* is common on the rocky slopes (Figure 5C), and individuals are visible from a great distance as dark spots on the hill. They are also abundant in the washes and plains enclosed by the inselbergs (Figure 5D), where they are surrounded by scattered *Blepharis obmitrata* C.B.Clarke, *Blepharis grossa* (Nees) T.Anderson, *Trichodesma africanum* and *Stipagrostis ciliata*.

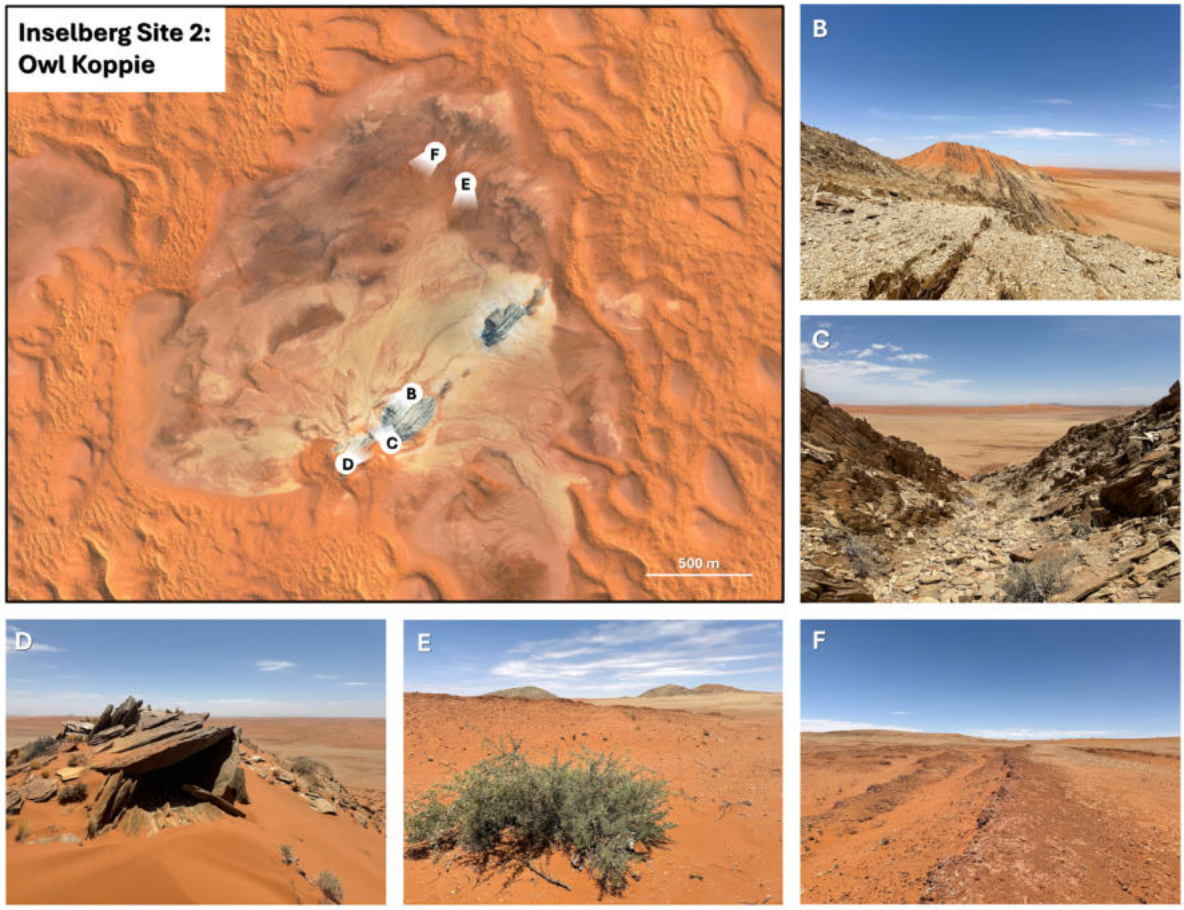

Figure 4: *Map and some notable features of Inselberg Site 2: Owl Koppie. A) Map of Site 2. The letters correspond to pictures B–F, and the direction of the white spotlight indicates the direction of the photograph. B) A view along the main ridge. C) A view down the valley between the two hills. D) A small cave or den along the crest of the ridge. E) A small shrub of* Acacia erioloba *near exposed Tsondab sandstone in the interdune plain. F) Exposed Tsondab sandstone in the interdune plain. All photos by Sebastian A. Hatt.*

The inselbergs featured several small valleys where the following species were commonly observed: *Sesamum marlothii* Engl. (Figure 5E), *Polygala guerichiana*, *Tribulus* sp., *Orthanthera albida*, *Roessleria gazanioides* (Harv.) Stångb. & Anderb. and *Cleome* aff. *suffruticosa* or *foliosa*. Subshrubs and shrubs frequently observed across the rocky slopes include *Euphorbia lignosa* Marloth, *Jamesbrittenia maxii* (Hiern) Hilliard, *Cryptolepis decidua* (Planch. ex Benth.) N.E.Br. and *Pogonospermum cleomoides* (S.Moore) I.Darbysh. & Kiel. Less frequently observed shrubs include *Barleria merxmuelleri* P.G.Mey. and *Commicarpus squarrosus* (Heimerl) Standl. Additional herbs observed on the rocky slopes include *Chascanum garipense* E.Mey., *Emilia marlothiana* (O.Hoffm.) C.Jeffrey, *Pegolettia senegalensis* Cass. and *Forsskaolea hereroensis* Schinz.

Larger shrubs such as *Kissenia capensis* Endl., *Boscia foetida* Schinz and *Acacia erioloba* were infrequently observed on rocky slopes, particularly on the eastern faces. Several dense populations of *Acanthosicyos horridus* Welw. ex Benth. & Hook.f. were observed on the sand-covered eastern slopes of the inselberg (Figure 5F), presumably tapping into groundwater deep beneath the sand. A further population was observed mounting the dune on the northern edge of the plain.

Ad hoc *Observations*

We did not attempt any intensive surveys to supplement the floristic inventory, but recorded *ad hoc* observations of life associated with the inselbergs. Western rock skinks (*Trachylepis sulcata*) (Figure 2H) and plain sand lizards (*Pedioplanis inornata*) were observed infrequently on the rocky slopes. Cape hares (*Lepus capensis*) were observed on the inselbergs and surrounding plains. Two large owls (*Bubo* sp.) were observed around noon on the rocky valley at Site 2 (Figure 2G). Oryx (*Oryx gazella*) were frequently observed crossing the dunes surrounding the inselbergs, while droppings of Hartmann's Zebra (*Equus zebra hartmannae*) were frequently observed on the outcrops. Peringuey's adder (*Bitis peringueyi*), a wedge-snouted desert lizard (*Meroles cuneirostris*) and evidence of the Namib golden mole (*Eremitalpa granti namibensis*) were observed in the dunes surrounding the inselbergs. At least one spotted hyaena (*Crocuta crocuta*) was observed entering and leaving a rocky den at Site 3. Speckled pigeons (*Columba guinea*) were observed feeding on *Boscia foetida* fruit on the rocky slopes at Site 3, and an ostrich (*Struthio camelus*) egg was observed in the plains

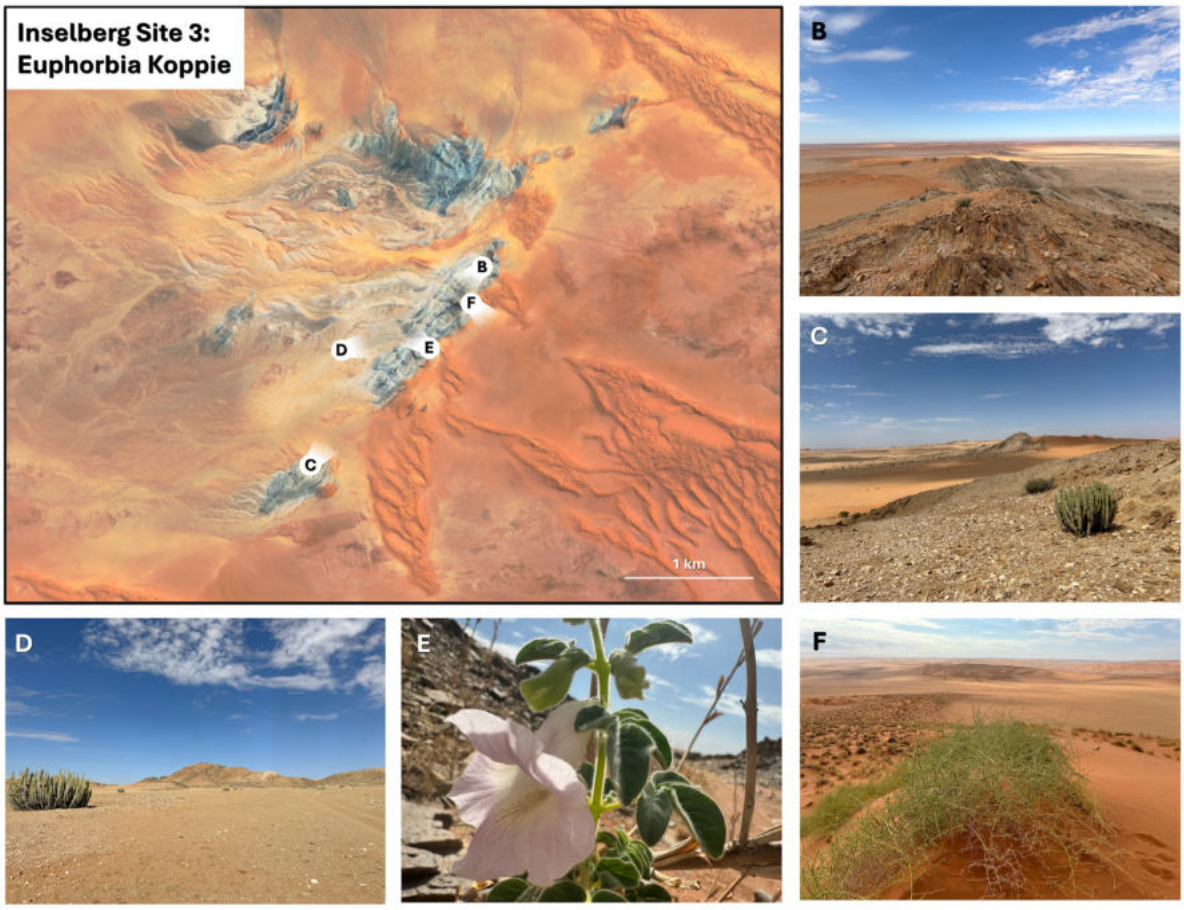

Figure 5: *Map and some notable features of Inselberg Site 3: Euphorbia Koppie. A) Map of Site 3. The letters correspond to pictures B–F, and the direction of the white spotlight indicates the direction of the photograph. B) A view along the main ridge. C)* Euphorbia virosa *on the rocky slopes. D)* Euphorbia virosa *on the sandy washes surrounding the inselberg. E)* Pedalium marlothii *in flower in a small valley. F) A sandy hummock of* Acanthosicyos horridus. *All photos by Sebastian A. Hatt.*

surrounding Site 3. Lappet-faced vultures (*Torgos tracheliotos*) were observed in the plains at Site 2, where the fresh remains of an Oryx calf occurred near the ephemeral seeps at the base of a Tsondab sandstone ridge. Cocoons of the African silk moth (*Gonometa postica*) were found on the *Acacia erioloba* at Site 1. Termite inkcaps (*Podaxis* aff. *pistillaris*) were infrequently observed in the dune sands surrounding the inselbergs (Figure 2F).

A suspected stone circle, similar to those at Rooikamer (Shackley 1985), was observed along a game trail near the apex of the ridge at Site 1 (Figure 5I), with slate stones arranged in a circle about 1 m in diameter. Some Early Stone Age bifaces were observed along the route between the sites and on the plains at Site 3.

Discussion

The inselbergs display floristic affinity with the Kuiseb Canyon and Mt Kamberg to the northeast, according to existing plant records from these areas (GBIF.org 2024). They also share a common geology as the same metamorphic rocks, predominantly schists, quartzites and amphibolites (Hoffmann *et al.* 1994) occur at the Kamberg. As the observations were made after many years of scanty rain, the list presented here is certainly not exhaustive – returning after good rains of > 10 mm would likely reveal several more annuals or geophytes that are not detectable in drier years (Seely & Louw 1980, Günster 1994, Huntley 2023). The majority of perennials observed were alive but not in flower. Annuals that were visible were represented only by dead remains.

Site 3 was the most biodiverse of the three sites (38 species) and was at least four times larger by surface area than Site 1 or 2 (16 and 14 species, respectively). Most species at Site 1 and 2 could also be found at Site 3, but many species at Site 3 could not be found at Site 1 or 2. This result primarily reflects the greater size and habitat heterogeneity at Site 3. The floristic composition of Sites 1 and 2 may also be influenced by their greater isolation afforded by their position deeper in the dunes, coupled with their lower elevation making them potentially more readily affected by shifting windblown sand over time. *Euphorbia virosa*, a long-lived perennial, is abundant at Site 3, forming a dominant part of the vegetation on both the rocky slopes and surrounding washes. Despite its abundance at Site 3, it is entirely absent from Sites 1 and 2, which may suggest the recent partial emergence of these inselbergs from the dunes. However, this is not supported by the observation of two other long-lived perennial species at Sites 1 and 2: *Commiphora saxicola* and *Acacia erioloba*.

Despite their isolated location, there are several potential threats to the biodiversity of the inselberg sites. Sites 1 and 2 are not accessible by any established track, but a tourist 4x4 track runs through Site 3. Off-road driving is illegal in the Namib-Naukluft National Park (Ministry of Environment, Forestry and Tourism 2021) yet remains extremely common and is often committed by poachers (pers. obs.). There are also sustained pressures by tourism operators and entrepreneurs for access and sites to develop visitor accommodation facilities (pers. obs.), where inselbergs offer scenic landscapes and stable surfaces to develop infrastructure. The accessibility of Site 3 makes it vulnerable to development and destructive driving. Poaching remains a serious problem in the Namib-Naukluft National Park and has decimated the population of many large mammals, notably Oryx and Zebra (Clements *et al.* 1984, Namibian 2020). Such disturbance to the ecosystem will likely have an indirect impact on the flora of these inselbergs (Whitford & Duval 2020).

These inselbergs lie within the Namib Sand Sea World Heritage Site, which has been withdrawn from any prospecting and exploration that may lead to mining. Despite being a designated protected area and the focal area for Namibia's only Strategic Environmental Management Plan, other areas within the Namib-Naukluft National Park are not as fortunate as new prospecting and mining licences continue to be granted (Mulonga *et al.* 2017). Disruption of ecological processes from mining operations can be devastating to biodiversity in and around the affected areas. (Wassenaar *et al.* 2013), particularly where dispersal resilience and population recovery are as vulnerable to landscape fractionation as in the Namib Desert.

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Appendix 1: Annotated checklist of the plants of the three inselberg sites.

A complete list of species recorded are described here, arranged by plant family. Habitat notes are recorded according to where the species were observed. Abundance is assigned to either Abundant (A), Common (C), Frequent (F), Occasional (O) or Rare (R) depending on their perceived abundance by the authors, recorded separately for each of the three inselberg sites, indicated by (1-3). Vouchers are provided for observations of each species at each of the three inselberg sites: Site 1 (Commiphora Koppie), Site 2 (Owl Koppie) and Site 3 (Euphorbia Koppie). The 9-digit number of the reference ID for the associated iNaturalist observation, accessed online by prefixing the code with 'https://www.inaturalist.org/observations/'. n/s = not seen.

FAMILY	SPECIES	HABITAT	ABUNDANCE	SITE 1	SITE 2	SITE 3
Poaceae	*Cladoraphis spinosa* (L.f.) S.M.Phillips	Dunes	C (3)	n/s	n/s	194703466
Poaceae	*Stipagrostis ciliata* (Desf.) De Winter	Rocky slopes, plains, dunes	A (1,2,3)	194679214	194701136	194702194
Poaceae	*Stipagrostis lutescens* (Nees) De Winter	Dunes	F (3)	n/s	n/s	193937203
Poaceae	*Stipagrostis sabulicola* (Pilg.) De Winter	Dunes	A (1,3)	194679586	n/s	193937205
Poaceae	*Stipagrostis seelyae* De Winter	Dunes	C (1,3)	193936968	n/s	193937202
Zygophyllaceae	*Tetraena cylindrifolia* (Schinz) Beier & Thulin	Rocky slopes	C (1,2,3)	194679254	194680895	194704038
Zygophyllaceae	*Tribulus* sp.	Rocky washes, rocky slopes	O (3)	n/s	n/s	194704006
Fabaceae	*Parkinsonia africana* Sond.	Rocky washes	R (2)	n/s	194691532	n/s
Fabaceae	*Tephrosia dregeana* E.Mey.	Rocky slopes	C (1,2,3)	194680545	194680817	194702336
Fabaceae	*Vachellia erioloba* (E.Mey.) P.J.H.Hurter	Dunes-covered rocks	R (1, 2); O (3)	194679824	194701175	193210008
Polygalaceae	*Polygala guerichiana* Engl.	Rocky slopes	O (1,3)	194679624	n/s	194702060
Urticaceae	*Forsskaolea candida* L.f.	Rocky slopes	R (2)	n/s	194700827	n/s
Urticaceae	*Forsskaolea hereroensis* Schinz	Rocky slopes	O (3)	n/s	n/s	194702124
Cucurbitaceae	*Acanthosicyos horridus* Welw. ex Benth. & Hook.f.	Dunes, dune-covered rocks	F (3)	n/s	n/s	194703497
Euphorbiaceae	*Euphorbia glanduligera* Pax	Rocky slopes	C (1,2,3)	194680583	194700857	194703768
Euphorbiaceae	*Euphorbia lignosa* Marloth	Rocky slopes	O (3)	n/s	n/s	194703319
Euphorbiaceae	*Euphorbia* virosa Willd.	Rocky slopes, plains	C (3)	n/s	n/s	194703155
Geraniaceae	*Sarcocaulon* aff. *marlothii* Engl.	Rocky slopes	R (1); O (3)	194680624	n/s	194703846
Burseraceae	*Commiphora saxicola* Engl.	Rocky slopes	F (1,2,3)	194680597	194701072	194704050
Malvaceae	*Hermannia minimifolia* E.Holzh.	Dunes	C (3)	n/s	n/s	194702513
Capparaceae	*Boscia foetida* Schinz	Rocky slopes	F (3)	n/s	n/s	194703270
Cleomaceae	*Cleome* aff. *suffritucosa/foliosa*	Rocky slopes	O (3)	n/s	n/s	194703700
Cleomaceae	*Cleome angustifolia* subsp. *diandra* (Burch.) Kers	Rocky slopes	A (1,2,); F (3)	194679913	194700998	194704095
Amaranthaceae	*Caroxylon* sp.	Rocky slopes	C (1,2,3)	194680510	194700868	194703603
Nyctaginaceae	*Commicarpus squarrosus* (Heimerl) Standl.	Rocky slopes	R (3)	n/s	n/s	194703370

Loasaceae	*Kissenia capensis* Endl.	Rocky slopes	O (3)	n/s	n/s	194703345
Rubiaceae	*Kohautia ramosissima* Bremek.	Dunes	F (1,2)	194679548	194701191	n/s
Apocynaceae	*Cryptolepis decidua* (Planch. ex Benth.) N.E.Br.	Rocky slopes	O (3)	n/s	n/s	194704012
Apocynaceae	*Orthanthera albida* Schinz	Rocky slopes	O (1); C (3)	194679171	n/s	194703253
Boraginaceae	*Trichodesma africanum* (L.) Sm.	Rocky washes	R (1); O (2,3)	194676349	194700903	194701864
Scrophulariaceae	*Jamesbrittenia maxii* (Hiern) Hilliard	Rocky slopes	F (3)	n/s	n/s	194703535
Pedaliaceae	*Sesamum marlothii* Engl.	Rocky washes	F (3)	n/s	n/s	194701819
Acanthaceae	*Barleria merxmuelleri* P.G.Mey.	Rocky slopes	O (3)	n/s	n/s	194703144
Acanthaceae	*Blepharis grossa* (Nees) T.Anderson	Plains	F (3)	n/s	n/s	194703807
Acanthaceae	*Blepharis obmitrata* C.B.Clarke	Rocky slopes, plains	F (3)	n/s	n/s	194703824
Acanthaceae	*Pogonospermum cleomoides* (S.Moore) I.Darbysh. & Kiel	Rocky slopes	F (3)	n/s	n/s	194703220
Acanthaceae	*Pogonospermum genistifolium* (Engl.) I.Darbysh. & Kiel	Rocky washes	R (2)	n/s	194700676	n/s
Verbenaceae	*Chascanum garipense* E.Mey.	Rocky slopes	F (3)	n/s	n/s	194703110
Asteraceae	*Emilia marlothiana* (O.Hoffm.) C.Jeffrey	Rocky slopes	O (3)	n/s	n/s	194703680
Asteraceae	*Osteospermum microcarpum* (Harv.) Norl.	Rocky slopes, rocky washes	R (1); C (2,3)	194676406	194700878	194703054
Asteraceae	*Pegolettia senegalensis* Cass.	Rocky slopes	R (3)	n/s	n/s	194701462
Asteraceae	*Roessleria gazanioides* (Harv.) Stångb. & Anderb.	Rocky washes	R (3)	n/s	n/s	194703961