

# NAMIB DESERT

Landforms and landscapes

Desert Biome, Environmental Management, Visual Literacy, Numeracy, ICT, Work and Enterprise

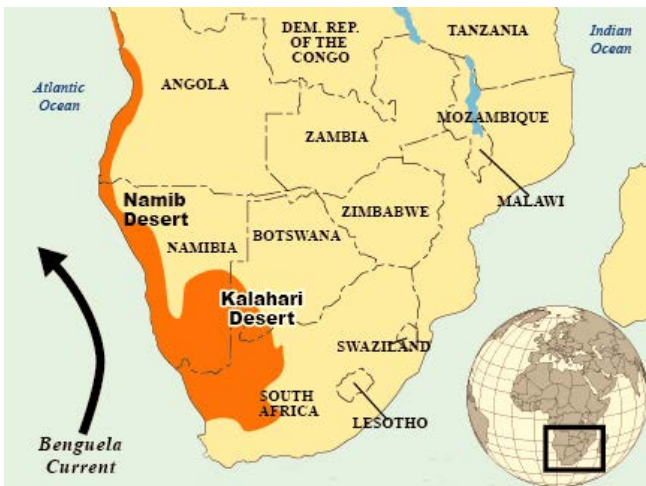
Dr Susan Bliss, Educational consultant

## OLDEST, FOGGIEST DESERT, HIGHEST SAND DUNES

The Namib is a narrow coastal desert, located lengthways along the Atlantic Coast of South West Africa. The desert stretches for 1,900km incorporating countries such as Angola, Namibia and South Africa. It subsequently extends inland to meet the Kalahari Desert in Botswana.

The Namib is thought to be the oldest continuous desert in the world, as it has endured an arid climate for 50 – 80 million years. This lengthy dry period influenced the evolution of endemic plants (e.g. Welwitschia) and animals (e.g. Barking Gecko).

### Map showing the desert region of Southern Africa



Source: C knoll, Geography in the News

### Namib-Naukluft National Park



The onshore winds are responsible for creating towering sand dunes, with some over 300 metres high. However, different types of dunes and their colour varies across the Namib Desert:

- Inland dunes: Deep orange stabilised dunes have evolved over time. The iron in the sand has been oxidised, contributing to the colour.
- Coastal dunes: The prevailing coastal winds enables greater movement of the sand. This has resulted in lighter coloured dunes, as the oxidation process has lacked sufficient time to develop.

The Namib Desert contains the Namib-Naukluft National Park that was the location of the movie '*Mad Max Fury Road*'

Source: <https://voices.nationalgeographic.org/2014/08/18/geography-in-the-news-the-strangest-desert/>

### Director George Miller shot the film *Mad Max: Fury Road*, on location in Namibian deserts to capture post-apocalyptic visuals



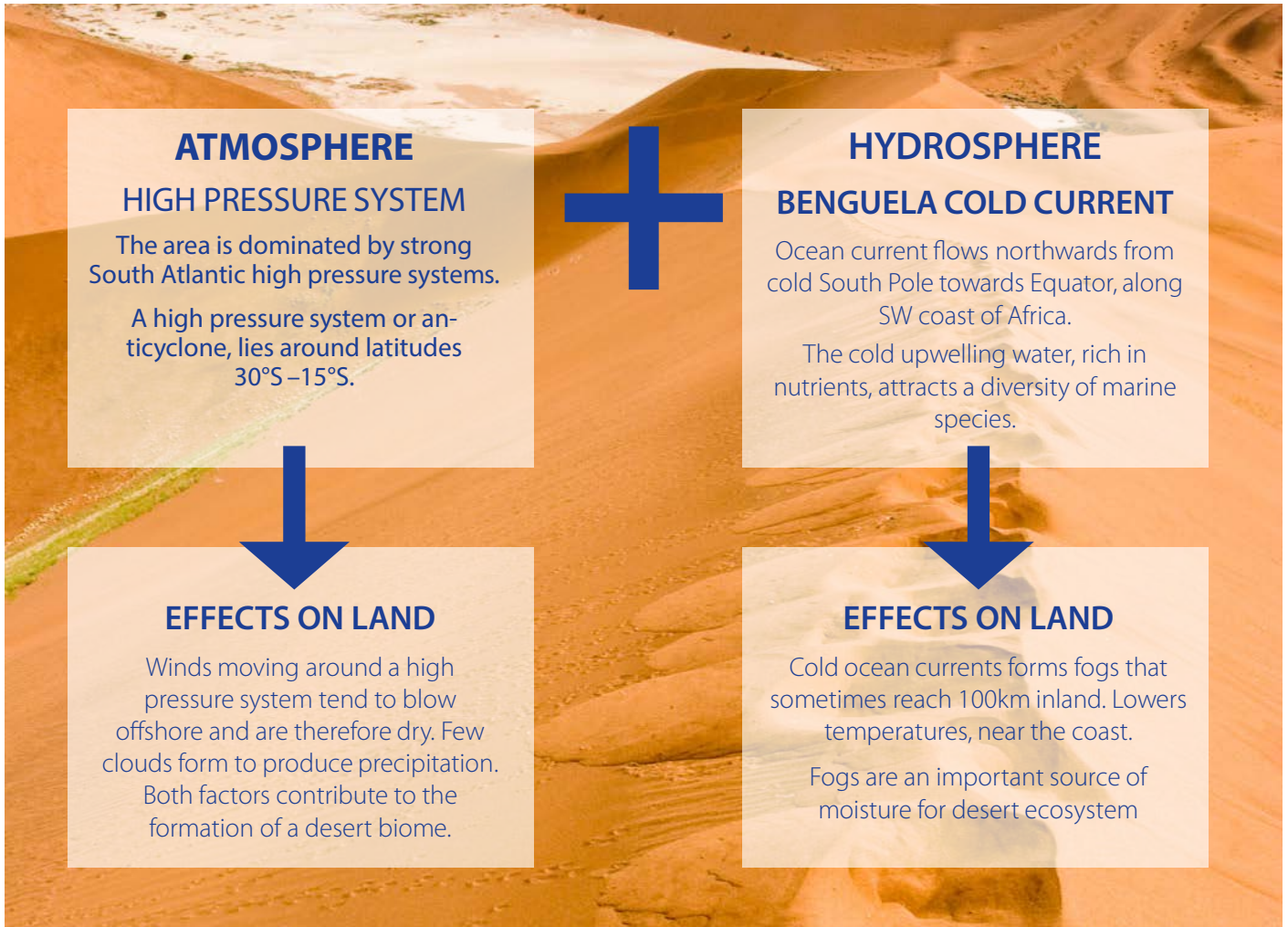
Photograph: <http://www.traveller.com.au/content/dam/images/1/m/d/d/l/w/image.related.articleLeadwide.520x294.1mcrv.png/1431647076865.jpg>

Image: source: Wikimedia Commons

## LOCATION AND FORMATION OF THE NAMIB DESERT

**Location:** South-west side of Africa between 30° S and 15° S

### Reasons for formation of the Namib Desert



## HYDROSPHERE: BENGUELA OCEAN CURRENT

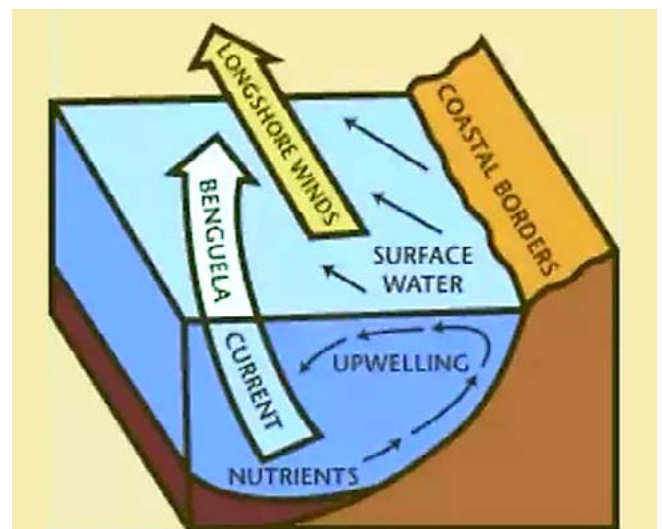
The Benguela current is where you encounter the ocean's ultimate predator, the great white shark. Attracted to the nutrient-rich cold waters that contain vast kelp forests, the current provides food for diverse marine species such as the Cape clawless otters.

### BENGUELA UPWELLING SYSTEM

It was established 5–10 million years ago. The upwelling brings cool, nutrient rich water from the bottom of the ocean up into the upper water layers at the coast.

The nutrients contribute to high rates of phytoplankton that sustains the productive Benguela ecosystem. However about once per decade, thick warm, nutrient poor water, enters the northern part of the Benguela upwelling system. This is referred to as the Benguela Niño that is similar to the Pacific El Niño.

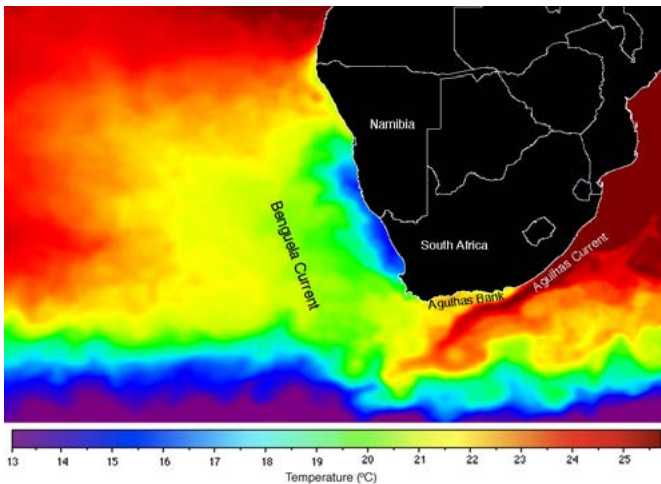
Diagram: Benguela current



Source: <https://www.quora.com/How-do-oceans-regulate-temperature>

# Landscapes and Landforms: Deserts

## Temperatures of ocean currents



Source: [http://www.seos-project.eu/modules/oceancurrents/images/c01\\_20080203\\_ostia\\_sst.jpg](http://www.seos-project.eu/modules/oceancurrents/images/c01_20080203_ostia_sst.jpg)

## ACTIVITIES

- Discuss the main reasons for the formation of the Namib Desert. Present reasons as an oral report.
- In groups, investigate the Benguela current and its importance to the marine ecosystem. Present as a diagram

## ATMOSPHERE: BENGUELA CURRENT AFFECTS LAND

Climatically, the Namib Desert is puzzling. Though it receives less than 10mm of precipitation a year, the air is frequently saturated, with fogs

## FOG

The fog is formed by the following process:

1. Cold Benguela current interacts with warm moisture above the sea
2. Atmosphere cools to form fog
3. Prevailing onshore winds push the fog inland, into the desert

Swakopmund on Namibia's Atlantic coast experiences about 300 days of fog each year. The fog forms in the early morning and remains until about 10am when it gets sufficiently warm to clear the fog

## Swakopmund, Namibia



[https://commons.wikimedia.org/wiki/Swakopmund#/media/File:Swakopmund\\_\(Namibia\).jpg](https://commons.wikimedia.org/wiki/Swakopmund#/media/File:Swakopmund_(Namibia).jpg)

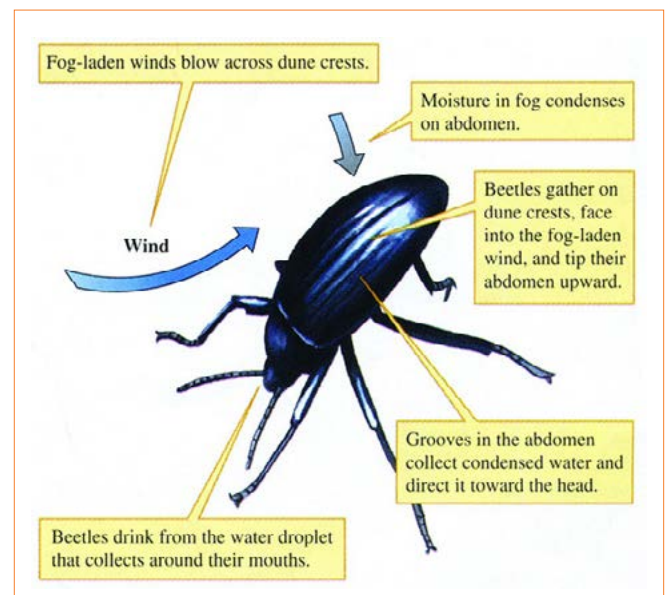


<https://upload.wikimedia.org/wikipedia/commons/0/08/02a-Great-Sand-Sea.jpg>

## Sand Sea

The Sand Sea, is a UNESCO World Heritage Site. It receives more than 180 days of fog a year. Desert plants like Welwitschia take water from the fog through its roots, and the Namib Beetle harvests water by pushing its bottom up into the air. Fog condenses on its behind and water droplets drain towards its mouth. Another example is the *Lepidochora porti* beetle that digs trenches in the sand which collects fog-a valuable source of moisture

## Diagram: Namib beetle



<http://www.bing.com/images/search?view=detailV2&ccid=Sn3kCzGE&id=8A3F0DD894764742BF87355B80D8E4C180F2336C&thid=OIP:Sn3kCzGEyEydjVpjXFdagHaGn&q=Namib+beetle&simid=608048056994631433&selectedindex=63&ajaxhist=0>

## ICT ACTIVITIES

- YouTube: How the Benguela Upwelling system works – [https://www.youtube.com/watch?v=8C9p6\\_qxgEI](https://www.youtube.com/watch?v=8C9p6_qxgEI)
- Namibian coastline – <http://www.nacoma.org.na/about-our-coast/namibias-offering.php>
- Protecting Benguela Current Large Marine Ecosystem Project – <https://stories.undp.org/protecting-benguela-together>
- Namib Beetle – <http://jerryscience7collingwood.weebly.com/group-project.html>

# Landscapes and Landforms: Deserts

## ATMOSPHERE: DESERT CLIMATES

### Coast: Swakopmund, The Skeleton Coast

Swakopmund	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Minimum Temperature (°C)	15	16	15	13	11	11	9	9	10	11	13	14	
Maximum Temperature (°C)	20	21	20	18	18	20	18	16	16	16	18	19	
Sea Temperature (°C)	17	17	17	16	15	14	14	14	14	14	15	16	
Precipitation (mm)	1	2	2	2	0	0	0	0	0	0	1	0	<b>8</b>
Days of precipitation	0	0	0	1	0	0	0	0	0	0	0	0	<b>1</b>

Coastal area:

- Annual precipitation 2–20mmpa. Rarely rains.
- Thick fog for more than 180 days a year.
- Temperatures are low as a result of the cool air coming off the Benguela Ocean Current.
- Daily (diurnal) and seasonal temperature changes are low. Daily difference only 2°C–5°C
- Only in the northernmost part of the Skeleton Coast, does the ocean becomes warmer. It reaches 23°C in March.



Lighthouse & State Building, Swakopmund. Source: [https://commons.wikimedia.org/wiki/Swakopmund#/media/File:Leuchtturm\\_Swakopmund.jpg](https://commons.wikimedia.org/wiki/Swakopmund#/media/File:Leuchtturm_Swakopmund.jpg)

### Inland: Tsumeb, Namibia

Tsumeb	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Minimum Temperature (°C)	18	18	17	15	11	8	8	10	15	18	18	18	
Maximum Temperature (°C)	31	30	29	28	26	24	24	27	31	33	32	31	
Precipitation (mm)	120	140	80	40	6	0	0	0	1	20	55	95	<b>556</b>
Days of precipitation	12	12	9	5	1	0	0	0	0	3	6	11	<b>59</b>

Tsumeb, is located in the north of the Namib Desert reaching 1,300masl. It is the wettest area in country. Nearby is Etosha National Park, where the Etosha Pan (salt lake) is located. The Pan is dry most of the year, but becomes a shallow lake during the rainy season.

Inland area:

- Annual precipitation-maximum of 85mmpa in some places
- Fog is rare
- Daily and seasonal temperatures have large variations. Temperatures vary from below 0°C to above 50°C
- Because of the cooling influence of the sea on the coast in summer, the temperatures inland are higher than on the coast

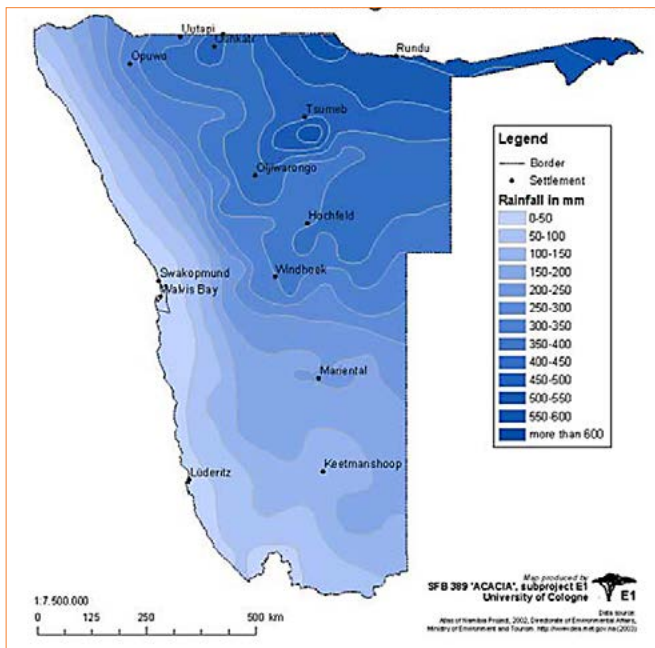


Downtown Tsumeb. Source: [https://upload.wikimedia.org/wikipedia/commons/9/97/Downtown\\_Tsumeb.jpg](https://upload.wikimedia.org/wikipedia/commons/9/97/Downtown_Tsumeb.jpg)

### ACTIVITIES

- Draw and label the two climate graphs.
- Compare the following:
  - temperature range in Swakopmund and Tsumeb
  - annual precipitation and days of precipitation in Swakopmund and Tsumeb
  - provide reasons for the differences

## Average annual rainfall in Namibia



[http://www.uni-koeln.de/sfb389/e/e1/download/atlas\\_namibia/pics/climate/rainfall-annual.jpg](http://www.uni-koeln.de/sfb389/e/e1/download/atlas_namibia/pics/climate/rainfall-annual.jpg)

### ACTIVITIES

- Using the map, calculate the difference in average annual precipitation between Walvis Bay and Windhoek.
- Using statistics, describe the variation in precipitation from the west coast to north east Namibia

## SKELETON COAST: WHERE OCEAN MEETS DESERT

The Skeleton Coast is a challenging but aesthetically beautiful landscape. Here the icy surf from the Atlantic Ocean pummels the SW African coast, and the dry desert winds from the east produces less than 10mmpa of precipitation.

The Bushmen of the Namibian interior called the Skeleton Coast *'The Land God Made in Anger'* and Portuguese sailors referred to it as *'The Gates of Hell'*. For centuries, the Skelton Coast has lived up to its sinister name, haunted by huge bleached whalebones, crumbling shipwrecks and dead plants and animals.

The Skelton Coast's name originates from:

- Whale and seal bones that were remnants of the industry
- Skeletons or wrecks of ships that fell victim to hidden rocky outcrops and dense fog. More than a thousand vessels litter the coast, notably the Eduard Bohlen, Benguela Eagle, Dunedin Star and Tong Taw.



Photograph: [https://wild-wings-safaris.com/s3\\_local/all/940/ship\\_skeleton,\\_skeleton\\_coast.jpg](https://wild-wings-safaris.com/s3_local/all/940/ship_skeleton,_skeleton_coast.jpg)

## THE SKELETON COAST: MARINE AND TERRESTRIAL ENVIRONMENTS CONVERGE

### WATER

#### Marine

Benguela current carries sand northwards, to be deposited back onto land by the ocean's surf. Wind then carries sand inland to form dunes.

#### Terrestrial

Coastal fogs provide moisture for lichens and other desert flora. Underground water nourishes vegetation, and provides water for animals. West flowing rivers such as the Hoarusib and Uniab rivers, called linear oases, allow species to move between coast and inland areas, and vice versa

### LANDFORMS

#### Marine

Waves produce sand dunes (fordunes, cusps), and sand grains move via longshore drift northwards.

The Benguela current produces some of the longest surf barrels in the world.

These high erosive waves produce prime surf sports for board riders.

#### Terrestrial

The Skeleton Coast contains different types of sand dunes e.g. hummock, traverse and crescent. It also has rugged canyons and coloured volcanic rocks.

Dunes shift at a speed of up to 15 metres per year. As they move they 'roar'. This is caused by air trapped between billions of grains of sand that creates a low rumble resembling a low flying airplane



Namib Desert meets the sea. Source: <https://i2.wp.com/lh5.ggpht.com/-x-4oahYr4ao/UWO4tZf0EtI/AAAAAAAAAJI/Aw9DdSy2yCw/namib-desert-meets-sea>

## ECOSYSTEMS

Both the coastal desert and the Benguela cold ocean current possess abundant but different plant and animal species.

### Marine

The Benguela Current Large Marine Ecosystem (BCLME) is one of the richest ecosystems on Earth. The nutrient-rich ocean off the Skeleton Coast attracts prolific bird life.

Coral, wetland and mangrove ecosystems provide a diversity of fish species.

### Terrestrial

Despite aridity, animals abound. The Skeleton Coast National Park (SCNP) is home to gemsboks (oryx), springboks, jackals, hyenas, lions, giraffes, zebras, ostriches, rhinos and elephants. The SCNP is an important ancient wildlife migration route to Etosha National Park. Many wildlife species rely upon west flowing rivers (known as 'linear oases') that pass through the Park

## ACTIVITIES

- Explain how the marine environment impacts on the terrestrial environment.
- Compare the different ecosystems at the Skeleton Coast

## THE SKELETON COAST: MANAGING MARINE AND TERRESTRIAL ENVIRONMENTS

The Namib Desert is protected in a series of National Parks, World Heritage Sites, Recreation Areas and Protected Diamond Areas.

### MANAGING MARINE ENVIRONMENT

The Benguela Current Large Marine Ecosystem (BCLME) produces a diversity of species such as fur seals, whales, and migratory seabirds that serve as prey for the Skeleton Coast's lions. Up to 250,000 Cape fur seals gather at Cape Cross Seal Reserve-one of the biggest seal breeding grounds.

The marine environment is vulnerable to destruction from human activities such as fishing, boats, mining, and land pollution that runs off into the ocean and destroys habitats.

Aimed to protect the BCLME, the governments of Angola, Namibia and South Africa established the transboundary Benguela Current Commission (BCC). The three countries, in partnership with the United Nations Development Partnership (UNDP) and Global Environment Facility (GEF) are working to sustainably manage the ecosystem, such as the Namibian Dolphin Project

# Landscapes and Landforms: Deserts

## MANAGING TERRESTRIAL ENVIRONMENT

The Skeleton Coast National Park, was proclaimed in 1971. In its present form it extends from the Ugab River in the south to the Kunene River in the north. The park protects about one third of Namibia's coastline. It possesses wind swept dunes, roaring and fossilised dunes, ancient lava flows, volcanic rugged canyons, mountain ranges, castles of clay and saltpans.

There are plans to extend the Park to include the entire Namibian coastline and rename it the Namib - Skeleton Coast National Park (NSCNP). This park aims to become the sixth-largest terrestrial protected area globally, covering an area of 107,540 km<sup>2</sup>

The Park an example of conservation on a grand scale as it protects some of the most varied and extraordinary ecosystems in Namibia

Left: At Walvis Bay, flamingos are attracted to the nutrient rich Atlantic Ocean upwellings (J. Bliss)



## MANAGING THE NAMIB SAND SEA: WORLD HERITAGE SITE

The Namib Sand Sea is the only coastal desert in the world that includes extensive dune fields influenced by fog. Over millions of years, the massive dune field was developed from the physical processes of erosion, transportation and deposition. It encompasses fluvial (river), marine (ocean currents) and aeolian (wind) processes, as well as chemical weathering such (e.g. exfoliation of rock surfaces from the extreme daily range in temperature).

### Map: Location of the Namib Sand Sea



Source: [https://www.africanworldheritagesites.org/assets/files/Maps\\_and\\_Satellite\\_Images\\_of\\_the\\_Namib\\_Sand\\_Sea\\_World\\_Heritage\\_Site\\_including\\_Sossusvlei.pdf](https://www.africanworldheritagesites.org/assets/files/Maps_and_Satellite_Images_of_the_Namib_Sand_Sea_World_Heritage_Site_including_Sossusvlei.pdf)

The Namib Sand Sea was declared a World Heritage Site in 2013. It lies along the arid African coast of the South Atlantic lying wholly within Namibia's Namib - Naukluft Park.

*'It is the only coastal desert in the world that includes extensive dune fields influenced by fog. Covering an area of over three million hectares and a buffer zone of 899,500 hectares, the site is composed of two dune systems, an ancient semi-consolidated one overlain by a younger active one. The desert dunes are formed by the transportation of materials thousands of kilometres from the hinterland that are carried by river, ocean current and wind. It features gravel plains, coastal flats, rocky hills, inselbergs within the sand sea, a coastal lagoon and ephemeral rivers, resulting in a landscape of exceptional beauty. Fog is the primary source of water in the site, accounting for a unique environment in which endemic invertebrates, reptiles and mammals adapt to an ever-changing variety of microhabitats and ecological niches'*

Source: <http://whc.unesco.org/en/list/1430>

### ACTIVITIES

- Summarise the slideshow on the Namib Sea Sand – <http://www.africanworldheritagesites.org/natural-places/deserts/namib-sand-sea-namibia3.html>
- Explain why the Namib Sand Sea was declared a World Heritage Site. Present as a media report

## DESERT LANDSCAPES AND LANDFORMS

The Namib Desert is ancient. It dates back, about 37 million years, when the cold, desert-forming Benguela Ocean current started to flow. Since this era, wind patterns and dune patterns have shifted. With drier climates and stronger winds, north-oriented dunes have moved north and east. However, nature has not removed the old sand dunes. Instead these older dunes form the rectangular dune network, observed today.

### WINDS SHAPE LANDFORMS

There are different types of sand dunes in Namibia such as linear, crescent and star. The crests of the sand dunes are aligned in a northwest-southeast orientation. The dunes are moving northwards, driven by prevailing southerly winds. Famous dunes include Big Daddy, and Dune 45 (located 45 kilometres from the Sesriem gate-main entrance to Namib-Naukluft National Park).

### Namib-Naukluft National Park

Big Daddy sand dune, red Sossusvlei Lake (dry clay pan), world heritage area (Photo: J. Bliss)



Dune 40, world heritage Photo: (J/S Bliss)



### Star dunes

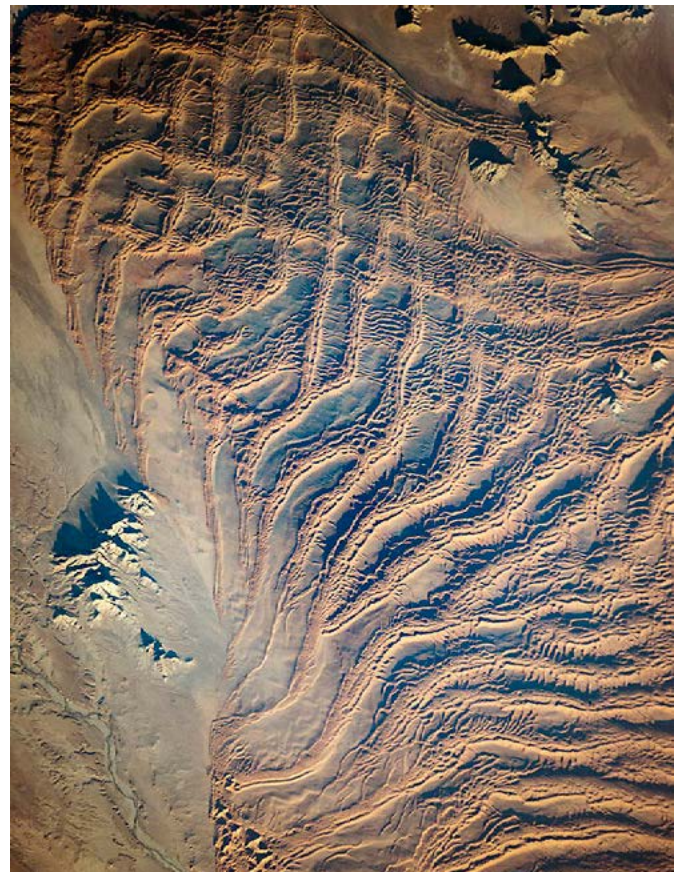
The result of weaker multidirectional winds



Source: <https://au.pinterest.com/susannejanecke/geology-dunes-yardangs-and-arid-processes/?lp=true>

### Linear dunes

Are generally aligned parallel to the predominant wind from the south. The dunes move north until they come across a barrier, such as the Kuiseb River



<https://www.nasa.gov/image-feature/linear-dunes-namib-sand-sea>



## TSAUCHAB RIVER AND ITS LANDFORMS

The Tsauchab River, an ephemeral stream, is approximately 100 km long. From the river's source in the Naukluft Mountains it erodes and transports material, until it meets sand dunes that prevent the river flowing any further. These sand dunes, located at Sossusvlei in the Namib-Naukluft National Park, are the highest in the world.

The Tsauchab River seldom flows as far as Sossusvlei and Deadvlei, except after rain in Naukluft Mountains. The pans then become filled with water and a lake appears. The pan is called a vlei which is a large shallow hollow that fills with water during infrequent rains.

<http://www.africanworldheritagesites.org/assets/files/Namib%20Sand%20Sea%20-%20Sossus%20vlei%20Brochure.pdf>

### Aerial view of the Tsauchab River



Sources: <https://emorfes.com/2015/10/20/satellite-images-get-an-aesthetic-makeover/a-namib-desert-africa/Sossusvlei>

The Tsauchab River flows through Sesriem Canyon, Sossusvlei and Deadvlei.

Deadvlei was once an oasis, now a white clay pan located between towering orange dunes. The dead acacia trees are between 600 and 700 years old.



Source: [https://upload.wikimedia.org/wikipedia/commons/2/21/Baumgruppe\\_Deadvlei\\_Sossusvlei.JPG](https://upload.wikimedia.org/wikipedia/commons/2/21/Baumgruppe_Deadvlei_Sossusvlei.JPG)

Sesriem canyon, was formed by the Tsauchab River. Over the past two million years the river carved a 1km long and 30m deep canyon in sedimentary rock. Past the canyon, the Tsauchab River flattens and grows broader, and is surrounded by a riparian forest as it slopes towards the Sossusvlei salt pan (Photo: J/S Bliss)



## GRAVEL PLAINS, SALT LAKES, MOUNTAINS, DEEP CANYONS

### Naukluft Mountains

Located on the eastern edge of the central Namib Desert contain numerous, largely inactive, fluvial tufas within headwater streams of the ephemeral Tsondab River which currently terminates in a vlei in the Namib SandSea



Photo: (J/S Bliss)

### Organ Pipes

Volcanic basalt rock formations near Twyfelfontein in Damaraland



Source: <http://thevagabondadventures.com/us/twyfelfontein-to-sesfontein-photo-diary>

### The Spitzkoppe

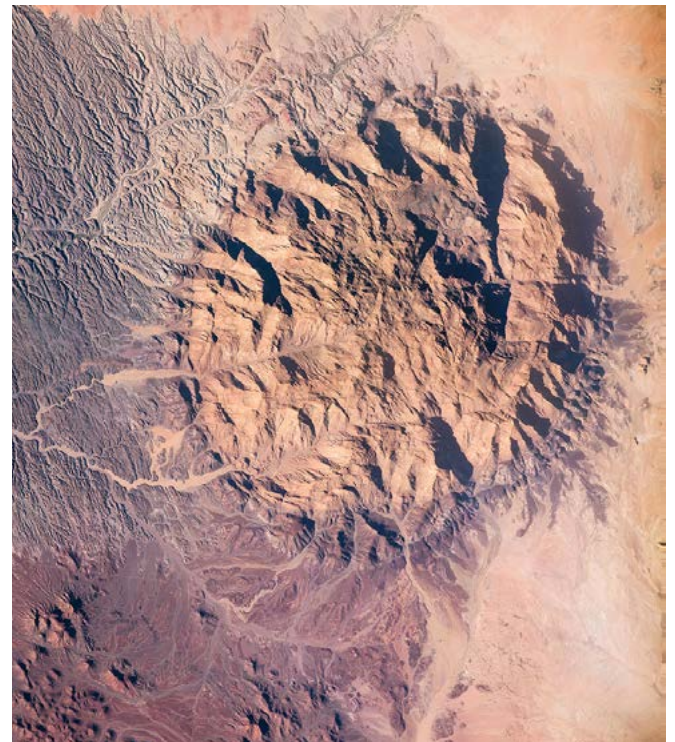
A group of bald granite peaks or inselbergs located between Usakos and Swakopmund in the Namib desert.. The highest peak is 700 metres.



Source: [https://upload.wikimedia.org/wikipedia/commons/8/83/Spitzkoppe\\_Sonnenaufgang.jpg](https://upload.wikimedia.org/wikipedia/commons/8/83/Spitzkoppe_Sonnenaufgang.jpg)

### Satellite: Brandberg Mountain

Namibia's tallest mountain, a granite massif which rises 1728m above sea level



[https://commons.wikimedia.org/wiki/File:ISS-47\\_Brandberg\\_Mountain,\\_Namibia.jpg](https://commons.wikimedia.org/wiki/File:ISS-47_Brandberg_Mountain,_Namibia.jpg)

# Landscapes and Landforms: Deserts

## Fish River Canyon

A gigantic ravine, located 30km to the west, Karas region, southern Namibia. The canyon is 160km long, 27 km wide and 550 meters deep.



[https://commons.wikimedia.org/wiki/File:Fish\\_River\\_Canyon\\_Namibia.jpg](https://commons.wikimedia.org/wiki/File:Fish_River_Canyon_Namibia.jpg)

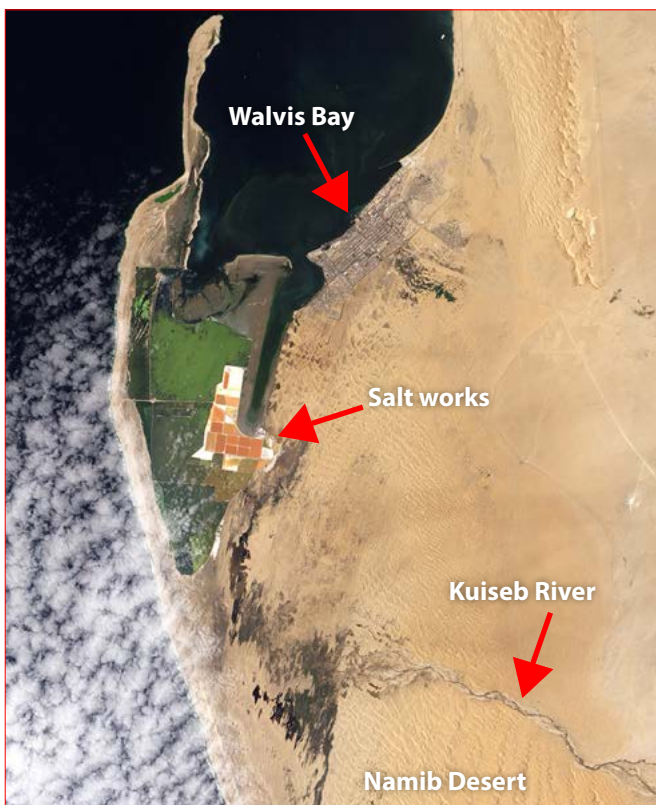
## GEOMORPHIC PROCESSES SHAPE DESERT LANDFORMS

The desert experiences continual erosion and weathering which forms different types of landforms such as:

- **REG (sandy desert)**
- **ERG (stony desert)**
- **HAMADA (rocky desert)**

Geomorphic processes also shape landscapes displaying desert pavements, inselbergs and salt pans.

## Satellite image: Kuiseb River nears the ocean



## SAND STORMS SHAPE DESERTS

- Sand storms are common in June, July and August
- Sand storms appear regularly in regions with dry conditions and scarce vegetation
- South of Kuiseb River, giant sand dunes march northward, driven by winds

Satellite image: Tendrils of dust swept off the west coast of Namibia and spread over the Atlantic in early July 2005. To the north and east of the dust is the Etosha Pan, a low expanse of land filled with clay, silt, and mineral salts. In this image it appears as a white rectangular shape.

## Satellite image: West coast of Namibia



NASA image. Source: [https://commons.wikimedia.org/wiki/File:Namibia\\_A2002221.0920.1km.jpg](https://commons.wikimedia.org/wiki/File:Namibia_A2002221.0920.1km.jpg)

At left a natural-colour satellite image of the Kuiseb River. Around Walvis Bay, where the Kuiseb has traditionally drained into the sea, salt works appear as rectangular shapes of orange and brown. Nearby shallow water appears green. Irregularly shaped dark patches indicate standing water on the desert surface where water has apparently pooled at the end of the Kuiseb River. In the east, the river's braided channels resemble dark, tangled threads.

Image at left – Source: [https://commons.wikimedia.org/wiki/File:Kuiseb\\_River\\_Nears\\_the\\_Ocean.jpg](https://commons.wikimedia.org/wiki/File:Kuiseb_River_Nears_the_Ocean.jpg)

## Swapkomund Saltpans



Source: <http://ellybrooksphotography.com.au/wp-content/uploads/2014/10/Photo25252020141005183544-3.jpg>

## THREATS TO NAMIBIAN DESERTS

- **CLIMATE CHANGE**, increases droughts and higher temperatures. This produces more wildfires that alter desert landscapes. It eliminates native slow-growing trees and shrubs, and replaces them with fast-growing introduced grasses
- **MINING** uses Potassium Cyanide in gold extraction process, oil and gas production, dumped nuclear waste and nuclear testing. These activities poison wildlife and disrupt sensitive ecosystems.
- **LICHENS** are sensitive to mechanical damage as they grow and repair slowly. Mining company vehicles on prospecting expeditions cause most damage
- **TOPNAAR PASTORALISTS** overgrazed goats and donkeys over the Kuiseb Riverbed and along the edge of the dunes. It resulted in a decline in understory plant growth
- **WATER TABLE DROPPED**, along Kuiseb River from over extraction for domestic consumption and the Rossing Uranium Mine.

If water is found, roads, pipelines and powerlines would need to be constructed through the pristine dune desert

- **TOURISM** to the Namib-Naukluft National Park, one of the largest game reserves in Africa. The prominent attraction is the Sossusvlei area, where high orange sand dunes surround white salt pans
- **OFF-ROAD DRIVING** has greatest impact on gravel plains where vehicle depressions remain for more than 40 years, because rainfall is too episodic and sparse to erase them

## ACTIVITIES

- Using ICT, design an annotated collage of desert landforms in Namibia.
- In groups, describe the threats to Namibian Deserts, and suggest strategies to manage these threats. Present as an oral report

## NAMIB DESERT BIODIVERSITY

### Plants have adapted to an arid environment

Despite aridity a diversity of succulent plants exist, such as the shrub *Welwitschia mirabilis* that has only two leaves and can live for over 1,000 years! In fact *Welwitschia* plants possess the longest-lived leaves in the plant kingdom. It is estimated that some *Welwitschia* plants are about 2,500 years old

Namib Desert is a living place. Animals have adapted to an arid environment, including the mountain zebra, gemsbok, short-eared elephant shrew and Karoo bustard. Lions of the Namib, live mostly at the northern edge of the desert. They survive in extreme conditions, feeding on gemsbok, ostriches, and seals captured along the Skeleton Coast.



**Welwitschia mirabilis**



Botanical illustration and a *Welwitschia* in the petrified forest of Khorixas  
Source: [https://en.wikipedia.org/wiki/Welwitschia#/media/File:Welwitschia\\_mirabilis0425.jpg](https://en.wikipedia.org/wiki/Welwitschia#/media/File:Welwitschia_mirabilis0425.jpg)

## ACTIVITIES

- In groups, investigate how deserts in Namibia are alive with plant and animal species. Present as a photo story.
- On gravel plains and rocky outcrops close to the coast, lichens are endemic and an important link in the food chain. Draw a lichen food web in a desert environment.
- Inland after rain, gravel plains support annual grasses that attract abundant herds of wildlife to the area. Research five animals that are attracted to the grasslands.
- In 2016 three desert-adapted lions were killed after being poisoned in a Namibian human-wildlife conflict incident. Research the incident and steps taken to conserve these species. <http://www.wilderness-safaris.com/blog/posts/a-human-wildlife-tragedy-namibia-s-desert-lions>

# Landscapes and Landforms: Deserts

## DESERT INHABITED BY TRADITIONAL HIMBA PEOPLE

A large proportion of the Namib Desert is unused and unoccupied, except for indigenous pastoral groups- Ovahimba (Himba) near the Skelton Coast, Obatjimba Herero in the north, and Topnaar Nama in the central region. These pastoralists, living a traditional lifestyle, herd livestock between water holes.

The innermost steppes in the southern half of the desert consist of private farms, operated by Europeans using local labour, devoted to raising Karakul sheep. Most of central and northern Namib has been set aside for recreation and conservation. Additionally mining for diamonds and uranium occurs across Namibian deserts

The Himba;

- Since the 16th century Himba have lived in scattered subsistence settlements. Today most of Namibia's Herero have become sedentary to breed cattle and subsist on the milk and meat of their animals.
- Their cone shaped houses are made of mud, cow dung and mopane trees to withstand the desert's extreme temperatures. Their main food is porridge made from either maize or manhangu flour.
- The Ovahimba are polygamous. They practice child marriages, with girls aged ten or younger. Boys are circumcised before puberty. They worship the God Mukuru and their clan's ancestors.



- They apply an ochre and butter mix to their bodies to protect their skin from the sun. Their hair is braided and covered with a special ochre mixture called 'otji'. They wear goat skins and jewellery made from leather, metal and shells.
- Traditionally women do not wash themselves, choosing instead to use aromatic plants, but undertake a 'smoke bath' daily.
- The women's role includes raising children and milking cattle, while men herd sheep and goats.

## CONTROVERSIAL ISSUE: BUILD OR NOT BUILD DAMS

### NAMIBIA: AN ARID COUNTRY, AFFLICTED BY DROUGHTS

#### Namibian Government addresses water scarcity

Large rivers only flow along Namibia's northern and southern borders, and are a long distance from population centres and mines, which are large water users.

In order to confront this challenge the government has:

- Built dams to capture water flow from ephemeral rivers
- Constructed pipelines to transport water over long distances
- Pioneered potable water reuse in its capital city Windhoek
- Built sub-Saharan Africa's first large seawater desalination plant to supply water to a uranium mine and the city of Swakopmund

#### Main sources of water in Namibia:

- Fog
- Groundwater, ephemeral rivers and perennial rivers
- Kunene River provides drinking water for northern Namibia
- Developments planned for Omdel Scheme and the Lower Kuiseb aquifers. Aimed to supply sufficient water for the next 20 years to the central area

#### Kunene/Cunene River

Over decades, the Namibian government has intended to build a hydroelectric scheme on the Kunene River.

The Kunene River is one of five perennial rivers in arid Namibia. This precious resource has for centuries supported the semi-nomadic Himba people.

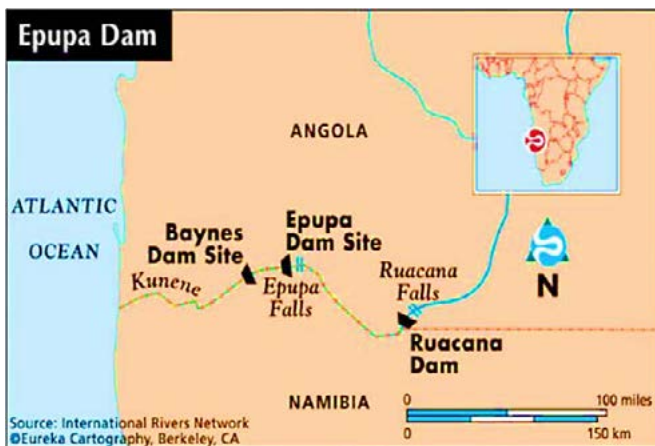
The Himba community opposes the Government's plans to construct the Epupa dam on the Kunene River, as dam will flood the valleys where they live and their burial grounds, as well as threaten ancient traditions and lifestyles.

# Landscapes and Landforms: Deserts

In 2014, the Himba marched in protest against the dam.

In 2017, the chief of the Ovahimba community in the Epupa area faced a leadership challenge over his decision to drop his opposition to the proposed hydroelectricity scheme near Epupa Falls (<https://www.namibian.com.na/168440/archive-read/Himba-brothers-fight-over-leadership>)

## Map: Epupa Dam location



Source: <https://www.internationalrivers.org/sites/default/files/styles/600-height/public/images/campaign/admin-old/map.jpg>

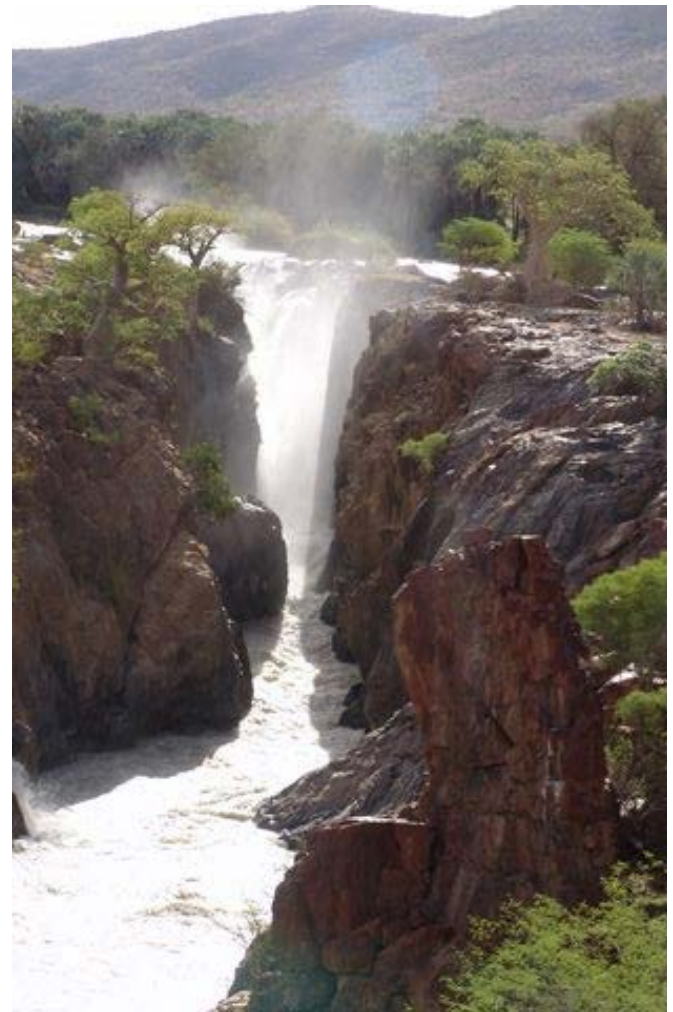
## IMPACTS OF EPUPA DAM ON KUNENE RIVER

The Epupa Falls, created by the Kunene River, are located on the border of Angola and Namibia. The river is 0.5km wide and drops in a series of waterfalls, with the greatest drop at 37m. As the lush banks of the Kunene River contrast starkly with the surrounding desert, it is a haven for diverse wildlife, such as crocodiles and rhinoceroses.

Impacts will include:

- **LOSS OF RIVERINE RESOURCES**  
The inundation would destroy the riverine forests, and result in the loss of hundreds of tonnes of palm nuts. The fruit can be eaten and used to brew drinks, similar to whisky. The Himbas peel the outer skin of the seed and make objects of art to sell.
- **LOSS OF MARKET GARDENS**  
The alluvial soils along the Kunene River are prime commercial agricultural locations. About 75% of Himba households engage in commercial agriculture to produce supplementary food
- **LOSS OF WILDLIFE**  
The wildlife would move elsewhere and be lost as a community resource
- **LOSS OF ANCESTRAL GRAVE SITES**  
A dam at Epupa would flood 160 graves. Graves demonstrate a continuity of settlement and long term ownership of the land

## Epupa Falls on Kunene River



Source [https://en.wikipedia.org/wiki/Cunene\\_River#/media/File:Epupa\\_Falls\\_3.jpg](https://en.wikipedia.org/wiki/Cunene_River#/media/File:Epupa_Falls_3.jpg)

- **INCREASE IN WATERBORNE DISEASES**  
The Epupa dam is expected to produce higher incidences of malaria and bilharzia (schistosomiasis), a disease caused by a parasite associated with still or slow-flowing water.
- **LOSS OF CONTROL OVER AREA**  
Poses a serious threat to Himba culture and their livelihoods

## ACTIVITIES

- List the main sources of water in Namibia.
- Explain how the government has provided water to the Namibians over time.
- In groups list the economic, social and environmental advantages and disadvantages regarding the construction of the dam on the Kunene River. Present as a table

# Landscapes and Landforms: Deserts

## DID YOU KNOW?

- The name Namib, is from the Nama language meaning 'immense'.
- Namib-Naukluft National Park is the largest game park in Africa.
- Although Benguela Niños do occur, they are less intense and less frequent than Pacific El Niños.
- Most significant river in Namibia is the Fish River, which is 650 km long. Its flow is seasonal, and during winter the river bed dries up.
- Highest point is Brandenburg (Konigstein) at 2,606 metres.
- Cold-water currents tend to have a cooling effect on coastlines they border.

## ACTIVITIES

- Circle the correct answer in the following questions:
  - East coasts generally have warm/cold ocean currents
  - West coasts generally have warm/cold ocean currents
  - East coast climates will generally be warmer/cooler than anticipated
  - West coast climates will generally be warmer/cooler than expected
  - Ocean currents travel in a clockwise/anticlockwise in the northern hemisphere
  - Ocean currents travel in a clockwise/anticlockwise in the southern hemisphere
- Climatically, the Namib is a contradictory area: It is almost rainless, yet its air is normally at or near the saturation point, as fog is common. Explain how fogs are formed.
- Describe the Benguela Upwelling System. Explain its relationship to marine species.
- List the different landforms located in the Namibian desert landscape.
- The Namib Desert's most famous landforms are its sand dunes, which are some of the oldest in the world. Sketch and annotate four different types of sand dunes.
- Huge salt pans are located in Namibia's desert landscapes. Investigate: Where some are located? How they are they formed?
- Draw and explain the Namib Desert food web.
- In pairs research the importance of two of the following mining activities in Namibia and their importance to the economy and peoples' lifestyles: diamonds, tungsten, zinc, tin and salt. Present as an e-poster



## NARA

Nara is endemic to the Namib Desert. The shrub produces round spiky fruits, the size of a large orange, once a year. The fruits are nutritious and hold water. The plant has adapted to the arid environment with a taproot that penetrates to a depth of 50 metres, and has spikes instead of leaves.

The Nara is eaten by gemsbok, hyenas, porcupines and birds. Jackals swallow the seeds, distributing them via faeces over many kilometres.

Nara sustains indigenous people, and the Topnaars harvest the fruits annually

## ACTIVITY

In pairs, using ICT, answer the following questions:

- How has Nara adapted to the arid environment?
- What is the value of Nara for people living in the Namib Desert?
- Discuss the importance of conserving Nara.
- Research two other plant species that have adapted to the arid environment in Namibia. Sketch the plants and explain how they have adapted



[https://commons.wikimedia.org/w/index.php?search=Nara+fruit&title=Special:Search&go=Go&searchToken=4enxmbd0fqxi3xyj7duqyn07q#/media/File:Nara\\_cut\\_fruit.jpg](https://commons.wikimedia.org/w/index.php?search=Nara+fruit&title=Special:Search&go=Go&searchToken=4enxmbd0fqxi3xyj7duqyn07q#/media/File:Nara_cut_fruit.jpg)



## CIRCLES – NATURE'S GREAT MYSTERY

The Namibian desert contains a 1,800km-long strip of grass-ringed patches called 'fairy circles'.

Millions of circles occur in a band where arid grasslands transition to desert. Most flank the red sands of the Namib Desert.

The Himba, claim the circles are footprints of the gods. Scientists haven't come up with a definitive explanation for their existence.

Is it caused by poisonous soil, ostriches, ants or termites?

## ACTIVITY

Answer the following questions:

- What are fairy circles?
- Where do fairy circles occur?
- Research theories concerning the formation of fairy circles. Which theory do you support and why?
- Collect and annotate two photographs of 'fairy circles' at different scales. Present answers as an e-poster.

Source: <http://www.bbc.com/earth/story/20140916-mystery-fairy-circles-defy-explanation>

## USING ICT

- Review global wind patterns within the Causes of Climate Change module, to identify and understand the predominant winds along the Namibian coast. <http://www.ces.fau.edu/nasa/content/resources/global-wind-patterns.php>.
- View video showing an animation of how surface currents form <http://highereduc.wiley.com/legacy/college/strahler/0471417416/animations/ch05/page6.mov>. As these currents flow along the edges

of continents, they affect the land's climate. In this activity, students will identify and label the major surface currents, especially those along the SW coast of Africa.

- Life differs in the two contrasting ocean currents-cold and warm. Research the differences. Include diagrams, causes and effects. <https://images-na.ssl-images-amazon.com/images/I/51KBM3JPCXL.jpg>

## ICT

- Exploring the Skeleton Coast <http://edition.cnn.com/travel/article/namibia-skeleton-coast/index.html>
- Landsat imagery – Google Earth ([earth.google.com](http://earth.google.com)) and NASA Zulu site (<https://Zulu.ssc.nasa.gov/mrsid/mrsidpl>).
- Desert landforms in Namibia-a Landsat interpretation [https://web.natur.cuni.cz/geografie/vzgr/monografie/gm/gm\\_goudie2.pdf](https://web.natur.cuni.cz/geografie/vzgr/monografie/gm/gm_goudie2.pdf)
- Skeleton Coast <http://www.thedailybeast.com/namibias-spooky-skeleton-coast>
- Namib Sand Sea: Maps [http://whc.unesco.org/en/list/1430/multiple=1&unique\\_number=1915](http://whc.unesco.org/en/list/1430/multiple=1&unique_number=1915)
- Salt flats <http://www.sharonmcelvain.com/Category/SKELETON-COAST-AERIUS/i-tHmvN5N/A>
- Climate, weathering, crust formation, dunes, and fluvial features of the Central Namib Desert [http://www.the-eis.com/data/literature/Climate\\_weathering\\_crust%20formation\\_dunes\\_and%20fluvial%20features%20of%20the%20Central%20Namib%20Desert.pdf](http://www.the-eis.com/data/literature/Climate_weathering_crust%20formation_dunes_and%20fluvial%20features%20of%20the%20Central%20Namib%20Desert.pdf)
- YouTube <https://www.youtube.com/watch?v=B3EXopTRzew>
- Primary resource <http://www.pbs.org/edens/namib/>. How hot is Namib? My life as an insect in Namib. The Sidewinder. How much water will the desert hold? Who's in charge? How can I hide in Namib? Namib from Space.

## REFERENCES

- Barnard, Phoebe. *Biological Diversity in Namibia: A Country Study*. Windhoek, Namibia: The Task Force, 1998. ISBN 0869764365
- Bartlett, Des, and Jen Bartlett. "Africa's Skeleton Coast." *National Geographic* (January 1992): 54–85.
- Lovegrove, Barry. *The Living Deserts of Southern Africa*. Vlaeberg: Fernwood Press, 1994. ISBN 978-0958315470
- Kinahan, John. *Pastoral Nomads of the Central Namib Desert: The People History Forgot*. Windhoek: Namibia Archaeological Trust, 1991. ISBN 9789991631028
- Keen, Cecil. *Greatest Places Physical Geography: Namib* Science Museum of Minnesota, 1997.



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- Bennelong and the Wangal

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- Water in the World – Wetlands
- Water in the World – Urban
- Place and Liveability

### Stage 5

- Environmental Change and Management
- Changing Places

### Stage 6

- Biophysical Interactions
- Urban Places – Urban Renewal
- Ecosystems at Risk

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