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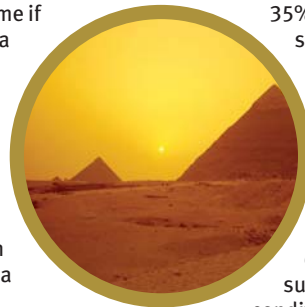
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Peter Littlewood writes...

Deserts are some of the harshest environments on our planet. At first sight, they seem completely hostile to life. Whether hot or cold, rocky or sandy, the lack of water is a real challenge to anything living there.

Some people have managed to adapt to life in the desert, using the centuries-old wisdom of their ancestors. You or I would last a very short time if suddenly transported to a desert. We would need food, something cool to store it in, shelter from the sun, protection from the cold of the night and lots and lots of water. An expert guide would also come in handy if we were to have a hope of getting out alive.



Yet there is plenty of plant and animal life that is specially adapted to living in the desert. Some life lies dormant under the soil, waiting for the rare rains that will give life and colour to the desert floor – albeit for a short time. Some animal life stays hidden underground by day, coming out only in the cool of the night. Other exceptionally hardy plants and animals face the desert's extremes without shelter, day and night, coping with the extreme lack of water.

Our ancient deserts are always shifting, dynamic places, but humans are managing to create more and more new desert. Where rainforest has been removed, the fragile soil is quickly washed away by the heavy rains, the rains become more infrequent, and eventually stop altogether. Where chemical fertiliser is used instead of a natural one, soils can become dusty and blow away. Where cattle are left to graze

too long on the same areas, the grasses can disappear and the soil gradually washes or is blown away. Up to

35% of the earth's land surface is at risk of becoming desert. Already, over 45 million square kilometres are affected by desertification.

There is a great deal we can learn from looking at the way nature has developed strategies to survive in extreme

conditions. Humans are great at creating ways of adapting to change. We don't hang around for evolution – we see a problem and work out a solution. Animal and plant species can't adapt anything like as fast as we do. The new deserts we create can appear quite suddenly, within a few years. Nature doesn't have time to adapt. That's why it's so vital we carefully preserve our precious resources, rather than exploiting them for a quick profit and leaving ourselves ultimately with nothing.



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When you hear the word 'desert', what picture does it bring to mind? Perhaps you think of a very dry place, a place without people or plants living there. In fact, a deserted place. Perhaps you also think of miles and miles of sand dunes, and a scorching sun burning down from a cloudless sky.

Deserts

One fifth of the world's land surface is desert. A desert is technically defined as an area which has on average less than 250mm of rain per year. However, annual rainfall could be as low as 20mm, leading to periods of intense dryness which often last for several years followed by periods of heavy rainfall and flooding. Surprisingly, more people die in deserts each year from drowning than from thirst.

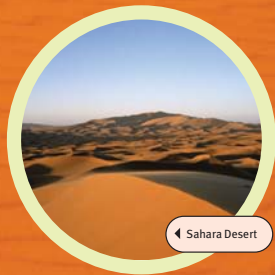
One of the most famous of all deserts, the Sahara of North Africa, is very hot and very dry. The Sahara holds the world record for being the hottest place on Earth, with a maximum recorded temperature of 58°C in the shade. Yet at night the desert becomes very cold, with temperatures often falling below freezing.

The Danakil Depression in Ethiopia holds the record for the highest average annual temperatures. 35°C (95°F) is the average temperature for the whole year here! There is no shade, just the unremitting heat of the sun.

Some deserts in Asia, such as the Gobi desert, are very cold for most of the year. Reports from a weather station at Ulan Baatar in the middle of the Gobi desert show that for more than six months of the year, the temperature does not rise above freezing, whilst during the winter months temperatures regularly drop to below -20°C. Rainfall here is on average 194mm per year.



◀ Danakil Depression



◀ Sahara Desert



◀ Gobi Desert

Types of Desert



There are four types of desert landscape. The first, and our most common vision of what a desert should look like, is the sand desert or erg.

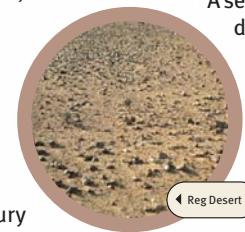
About one third of all desert landscapes are like this. The sand is blown into hills or dunes by the wind. These shift over time so that if the movements of the dunes of a sand desert were filmed and then speeded up so that the film lasted only a few minutes, the movements of the desert would look like ripples in water. It is for this reason that ergs are sometimes called "sand seas".

The dunes may shift only very slowly, but they will over long periods of time bury anything in their path, including



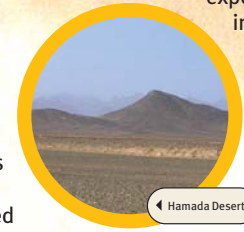
◀ Erg Desert

houses, villages and crops. For this reason, if people wish to grow crops in deserts, the dunes have to be "fixed" in place. This is done by planting grasses with very long roots which reach deep into the sand and help to hold the dunes together, preventing the wind from blowing them away.



◀ Reg Desert

A second kind of desert is the stone desert or reg. Regs are vast areas of level plain covered with rocks and boulders. Nothing can grow there, and the environment is extremely hostile to plant and animal life.



◀ Hamada Desert

The third desert landscape is of high bare mountains. All soil has been eroded away, leaving just bare rock.

Finally there is the hamada. This type of desert consists of roughly level areas of bare rock. Sand has been swept away by the wind, leaving just the bare rock underneath. Such areas are completely exposed to the sun, making it impossible for anything to grow there.

All of the types of desert landscape are very vulnerable to erosion by the wind. This is because there are very few plants in deserts to bind the soil together. Sand is easily blown by the wind. When the rains do come, the water rushes over rocky area of desert without soaking in. This adds still further to the process of erosion.

Adapting to the Desert

Just how essential is water in the desert? The plants and wildlife that do survive in the desert have managed to do so without much water and in incredible heat. They have adapted to fit into the unique desert environment.

There are naturally occurring havens for plant life in deserts called oases. These are small areas within a desert where water can be found regularly. There may even be a small pool of water. Plants and even trees can grow here.

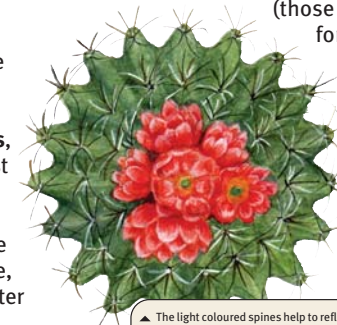
Outside of the oases, only very specialised plants are able to survive in arid deserts. There are some plants, such as xerophytes, which can survive in almost waterless conditions. Xerophytes have small waxy leaves which help the plant to retain water. Some, such as cacti, can store water



◀ Oases

in their trunks. Many plants have very deep root systems which reach deep down into the soil to search for water and also help to steady the plant in the sand. When it does rain in the desert many plants grow new leaves and cacti produce colourful flowers for a few days after the rain.

Rain in the desert also brings to life the ephemeral plants (those that only live for a short time, sometimes only for a day!) Their seeds can lie dormant in the soil for up to 20 years. Rainwater causes them to germinate very quickly so that the desert



▲ The light coloured spines help to reflect the sunlight, and the round shape of the stem helps store water and slow down water loss (transpiration).



may be carpeted in different varieties of flowers and grasses for between six and eight weeks, after which the flowers die and the desert returns to bare, dry ground until the next rainfall.

Desert dwelling animals also have to be able to cope with extremes of temperature and with chronic water shortage.

This has called for a number of adaptations. Birds are active in the cool of the morning and evening and many animals are burrowers, because burrowing

allows them to escape from the heat. Other animals come out only at night. Desert animals have had to become very specialised in order to survive. Because of this specialisation a desert can appear to be lifeless to the untrained eye.



◀ Ephemeral Plants

The Gobi Desert

Classified as a cold desert, the Gobi covers 500,000 square miles from southern Mongolia into China, across barren rocks, low mountains and drifting sand dunes.

In fact the Gobi goes from one extreme to the other, reaching highs of 45°C during the summer and



▼ Bactrian Camel Taxi, South Gobi Desert, China

dropping to below freezing in winter, resulting in long periods when the ground is covered in snow.

The animals and plants that live in the Gobi have had to adapt to survive the extreme heat and cold, as well as the lack of water. Some animals escape the

high temperatures by migrating to cooler climates or by burrowing underground during the day to become active at night.

Gobi desert dwellers also have to protect themselves against the freezing cold by developing extra layers of fur, fat or feathers during the winter. Many creatures hibernate below ground throughout winter and return to the surface when the snow thaws in spring.

The Bactrian Camel

The camel is a classic example of an animal that is well adapted to the desert environment. There are two types of camel – the **dromedary**, which is native to North Africa and the Middle East and only has one hump, and the **bactrian camel**, which has two humps and is native to the Gobi Desert.



evening searching for food and the hot afternoons chewing the cud.

The bactrian camel can tolerate great changes in its body temperature. It has thick fur, which in the winter and at night keeps it warm and during the day insulates it from the hot sun, actually keeping it cooler for longer. In the summer it sheds most of its thick coat.

The camel has particularly long eyelashes in double rows that help protect its eyes from windblown sand, and it can close its nostrils shut for the same reason. It also has very thick soles on its feet with elastic pads, which protect it from the heat of the sand and also help spread its weight in the soft, shifting sand. You won't often see a camel falling over!

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The bactrian camel was once common across Asia, but now just 500 to 1,000 animals can be found in the Mongolian Gobi Desert. Despite being so well adapted to its desert environment it is now on



The bactrian camel has two humps on the top of its back in which it stores water and food reserves as fat, enabling it to go for long periods without food or water. It is able to survive on extremely sparse vegetation such as tough grass, herbs and thin shrubs, spending the cooler times of early morning and

The World Conservation Union (IUCN) endangered species list because of loss of habitat. Gradually towns have spread into the edges of the Gobi desert and around oases taking away the camels' water sources. The camels are also in competition with domestic herds for grazing, and hunters kill the bactrian camel for its thick fur.

DID YOU KNOW

- 1 The bactrian camel is capable of drinking up to 30% of its body weight at any one time!
- 2 In 1860, 15 bactrian camels were imported to the US to haul salt across 320 km of desert.
- 3 Humans have been using the bactrian camel as a beast of burden since at least 2000 BC.
- 4 Camels have also been used as a source of wool, milk and meat, and their manure is used for fire fuel.

The Giant Saguaro

Probably the most famous cactus, from western movies and photos of American deserts, is the giant saguaro (pronounced sah-wah-roh).

It inhabits desert slopes and flats, especially rocky **bajadas** – shallow rocky at the bottom of rocky hills, where rocks and debris form a type of soil from the weathering of the rocks. Bajadas are able to hold onto some water making them an ideal home to a variety of plant and animal life.



▲ Bajadas in the Organ Pipe Cactus National Monument in the south of Arizona

The saguaro has smooth, waxy skin and the stems have thick two-inch spines on the ribs. During dry periods the folds in the column-like stem gather together into ridges. When it absorbs water the folds expand like an accordion. It can actually increase its weight by up to a ton. The saguaro often begins life in the shadow of a tree or shrub that provides shelter and moisture.

▼ Saguaro National Monument, Arizona, USA



Despite growing up to 50 feet tall the saguaro has a shallow root system. It has a single tap root which is about 3 feet long and a series of stout roots about a foot long radiate from the base. More small roots run outwards in a circle at an equal distance to the height of the saguaro, and wrap around rocks and other plant roots to provide anchorage from winds.

The saguaro blooms at night with white petals about three inches wide around a tube about four inches long. It relies on **cross-pollination** for fertilisation (that means it needs pollen from a different saguaro plant) and so the flowers produce sweet nectar to attract birds, bats and insects. Once fertilized the saguaro produces a large oval, green fruit that ripens just in time for the rainy season. The bright red flesh inside is a popular source of food for birds, mammals and insects.

Several bird species, such as the whitewing dove and house finches, rely on the saguaro for food and they help with the cross-pollination. The gila woodpecker and the gilded flicker also make their homes in the cactus by drilling holes in the thick stems. Pygmy owls, other birds, insects and lizards sometimes use old holes too. Hawks will build nests on tall saguaro branches.

Although it is quite common within its range, even forming thick cactus forests in areas of the desert, the saguaro is still a rare plant because it only exists in one region. It is vulnerable to environmental damage such as strong winds that can blow it down or break it, lightning and frosts.

DID YOU KNOW

- 1 The largest plants, with more than five arms, are about 200 years old!
- 2 A mature saguaro can soak up 200 gallons of water during a storm!
- 3 The saguaro cactus is the state flower of Arizona.
- 4 It was an important source of food for native Americans in the region for its flesh, seeds and juice.
- 5 One saguaro fruit can hold as many as 4,000 seeds.



The Sonoran Desert

The Sonoran desert covers 300,000 sq km of the south-west corner of North America from northern Mexico, across Arizona and into the Gulf of Mexico.

The Sonoran includes sandy and rocky plains and barren mountains. It is hot and dry almost all year round and rainfall is limited to very distinct seasons, causing temporary desert streams which pour off the mountains during brief storms. There are also two major permanent rivers that cross the Sonoran: the Colorado and its tributary the Gila.

The animals and plants of the Sonoran Desert have adapted to cope with fierce heat and long periods of drought. The shrubs and trees have long probing roots that take up as much moisture as possible from the sand, and they often have small, waxy leaves that lessen water loss.

Cacti are probably the most famous desert plants, with their spines – which are actually modified leaves. After a rainstorm, their roots absorb water very quickly, and this is stored for long periods within the thick stems. Sudden, violent rainstorms also bring out fields of flowers such as desert marigold and bluebonnet.

The Sahara Desert

The Sahara is the biggest desert in the world. It covers an estimated 3,500,000 square miles and runs 3200 miles from east to west across North Africa.

It starts on the Atlantic coast in Morocco, West Africa, travelling eastward through Algeria, Libya, Sudan and Egypt, and around the Red Sea into the Arab states.

Over 8,000 years ago the Sahara was a fertile plain where farmers cultivated millet but gradually conditions have become drier and the process of **desertification** has forced man to abandon the ever-growing desert.

The Sahara is so large it has a range of environments from rock-strewn plains and huge sand dunes, to a high central

plateau, mountains and even underground rivers that run down from the Atlas Mountains occasionally creating oases.

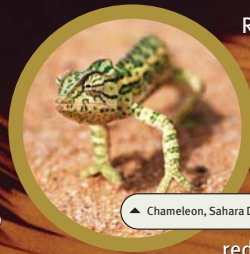
The Sahara is uniformly dry with an average rainfall of less than 127mm per year; some areas get no rainfall for years at a time.

Temperatures range from freezing to over 54.4°C. This means that except for the oases there is almost no vegetation in the Sahara.

Where there is some water to be found, small thorny shrubs and occasional date palms or acacia trees will grow. Gazelle and antelope can be found in some parts

of the desert, as well as jackal, fox, badger and hyena. The Sahara is home to nearly 100 species of reptile, mainly lizards and snakes.

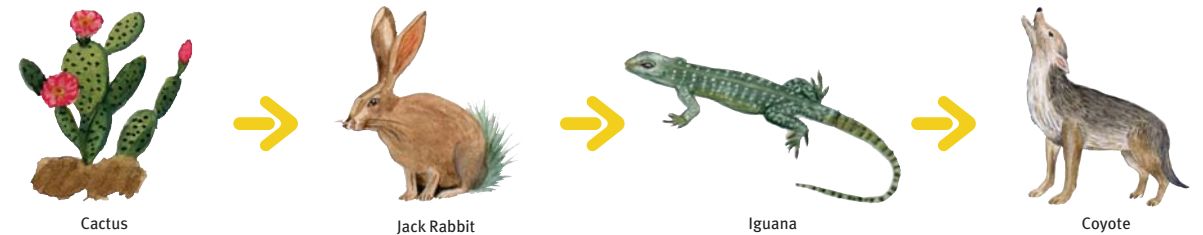
Reptiles are well adapted to the desert environment because they are **cold-blooded** which means they need the sun's heat to maintain their body temperature and give them energy. They also have very thick skin that reduces water loss. Most reptiles are active during the day, hiding in shadows and hunting for food.



Chameleon, Sahara Desert

Food Chains in the Desert

As in any habitat, the community of plants and animals in a desert interact with each other and with their non-living surroundings (the habitat itself, made up of things like air, water, rocks and sand) to form an ecosystem.



The sun is the source of energy for all living things. Green plants use the sun's energy to make their food (a process called photosynthesis). Animals get their energy by eating plants... or other animals that have eaten plants. The plants are known as producers and the animals as consumers.

Plant-eating consumers are called herbivores and consumers that eat other animals are called carnivores. Carnivores are often called predators. When a herbivore eats a plant... then a

carnivore eats the herbivore... energy is transferred and the sequence of events is called a food chain. Each animal and plant can be thought of as a link in the chain. In a desert community there are hundreds of food chains, mostly with three or four links, but there may be some with five or six links.

In a four-link chain, the first carnivore is eaten by a second carnivore, which is usually larger and more aggressive. In any food chain the herbivore is known as a primary consumer, the first

carnivore as a secondary consumer and the second carnivore as a tertiary consumer. The tertiary consumer is at the end of a food chain and is not usually eaten by anything else. Animals normally have a varied diet and therefore there are many connections between food chains. The connections between the food chains mean that every plant and animal can be thought of as part of a complex food web, rather than as a link in a straight chain.

Sidewinders

Sidewinders are viper snakes that live in the desert and are so called because of the way they travel sideways across the sand.

They move by looping their bodies up in the air and pushing against the ground where they land. The tracks they leave are a series of straight lines that run at an angle. This means the snake is able to keep most of its body off the hot sand while moving, which reduces heat **absorption** from the ground and at the same time allows for quick movement over the loose shifting sand. Sidewinders include the horned viper, the sand viper and the sidewinder viper.

They are usually less than a metre long and have heavily ridged scales that they use to make loud rasping noises when they wind their coils together to scare off predators

and other snakes. They come in a variety of colours from red to yellow, brown and grey, which help to camouflage them in their sandy surroundings.

Sidewinders can go for months without eating and don't need any water to survive, getting all the moisture they need from their infrequent meals. They burrow into the sand where they lie in wait to ambush passing mammals, lizards or birds.

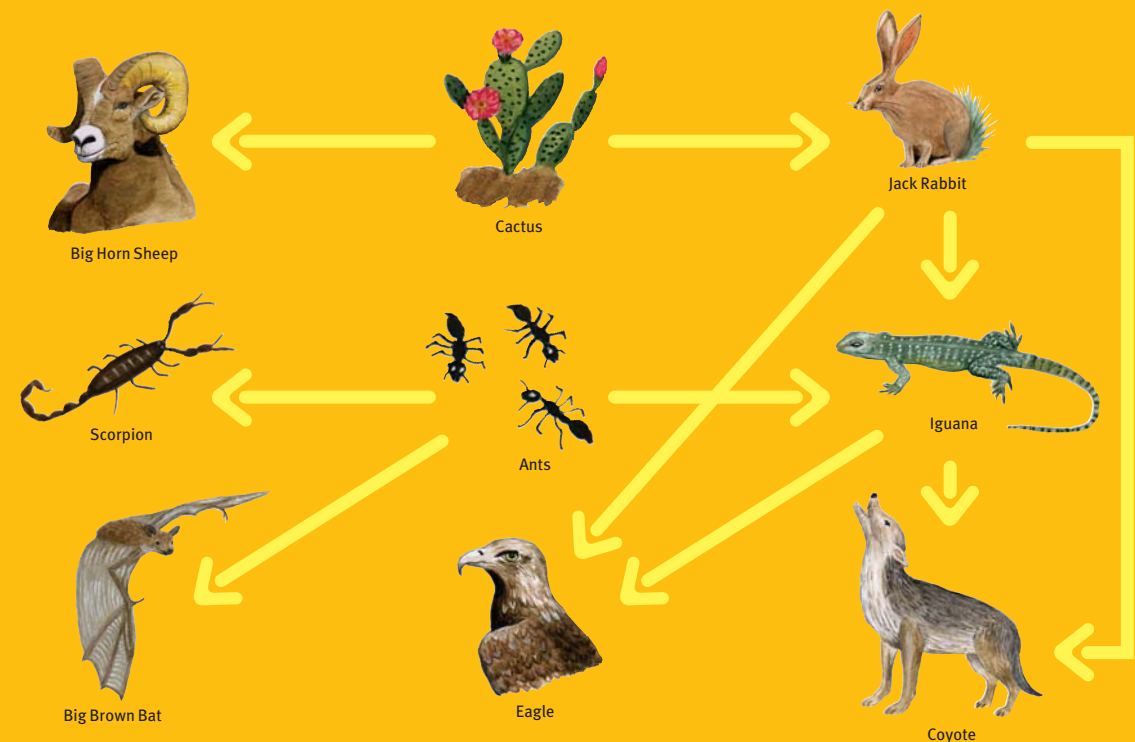
The horned viper of the Sahara is one of the most **venomous** desert snakes. It has horn-like scales above its eyes which are capable of folding down over the eye to form an eyelid which protects the eye when the snake is travelling through its underground burrow. It is almost entirely nocturnal, spending the day under anything that provides shelter from the sun or burrowed into the sand with just its horns visible.



DID YOU KNOW

- 1 Sidewinders have long hinged teeth that sometimes reach up to 4cm long!
- 2 Sidewinders are very poisonous – first causing paralysis and then death!
- 3 The sidewinder hibernates over winter in the burrows of desert rodents.
- 4 The venom of the sand viper is used in the preparation of anti-venom serum.
- 5 As with most snakes, the sidewinder is totally deaf and depends on vibrations of sound waves to find its prey.

A Desert Food Web





School Project Ideas

Imagine that your class is going on an expedition into the Sahara Desert.

What means of transport would you use? What kind of clothing would you need? How much food and water would you have to take with you? Think about the ways in which you would have to adapt to be able to survive in a desert.

You could also plan a similar expedition to a cold desert, such as the Gobi Desert. What changes would you need to make to your supplies and equipment?

Find out more about animals and plants which live in the desert. How are they adapted to live in intense heat, or in the case of animals and plants living in cold deserts, how are they adapted to living in sub-zero temperatures during winter and the heat of summer? How do they survive with very little water?

A screenshot of a web browser window. The address bar shows 'www.yptenc.org.uk'. The page title is 'Good Websites' in a large, yellow, cursive font. Below the title, there is a list of links to various desert-related websites. The browser interface includes a status bar at the bottom that says 'Internet zone'.

Good Websites

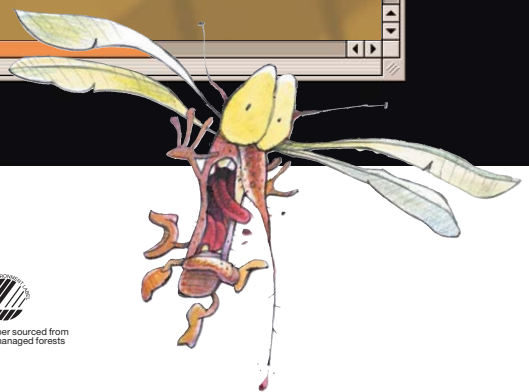
The World Conservation Union:
<http://www.iucn.org/>

The Gobi Desert:
<http://baatar.freeyellow.com/>

The Sonoran Desert:
http://www.desertusa.com/du_sonoran.html

The Sahara Desert:
<http://www.calacademy.org/exhibits/africa/exhibit/sahara/>

General:
<http://www.nationalgeographic.com/kids/>
<http://teacher.scholastic.com/products/instructor/desertlife.htm>
<http://childrenoftheearth.org/>



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