

Desert as a Pattern or an Abnormality on the Earth's Surface

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ARTICLE DETAILS

Article History

Published Online: 10 October 2018

Keywords

Climate, desert, environment, Earth, temperature.

ABSTRACT

Deserts are areas that receive very little precipitation. People often use the adjectives "hot," "dry," and "empty" to describe deserts, but these words do not tell the whole story. Although some deserts are very hot, with daytime temperatures as high as 54°C (130°F), other deserts have cold winters or are cold year-round. And most deserts, far from being empty and lifeless, are home to a variety of plants, animals, and other organisms. People have adapted to life in the desert for thousands of years. One thing all deserts have in common is that they are arid, or dry. Most experts agree that a desert is an area of land that receives no more than 25 centimeters (10 inches) of precipitation a year. The amount of evaporation in a desert often greatly exceeds the annual rainfall. In all deserts, there is little water available for plants and other organisms. Deserts are found on every continent and cover about one-fifth of Earth's land area. They are home to around 1 billion people—one-sixth of the Earth's population.

Although the word "desert" may bring to mind a sea of shifting sand, dunes cover only about 10 percent of the world's deserts. Some deserts are mountainous. Others are dry expanses of rock, sand, or salt flats.

1. Introduction

A desert is a barren area of land where little precipitation occurs and consequently living conditions are hostile for plant and animal life. The lack of vegetation exposes the unprotected surface of the ground to the processes of denudation. About one third of the land surface of the world is arid or semi-arid. This includes much of the polar regions where little precipitation occurs and which are sometimes called "cold deserts". Deserts can be classified by the amount of precipitation that falls, by the temperature that prevails, by the causes of desertification or by their geographical location.

Desert are formed by weathering processes as large variations in temperature between day and night put strains on the rocks which consequently break in pieces. Although rain seldom occurs in deserts, there are occasional downpours that can result in flash floods. Rain falling on hot rocks can cause them to shatter and the resulting fragments and rubble strewn over the desert floor is further eroded by the wind. This picks up particles of sand and dust and wafts them aloft in sand or dust storms. Wind-blown sand grains striking any solid object in their path can abrade the surface. Rocks are smoothed down, and the wind sorts sand into uniform deposits. The grains end up as level sheets of sand or are piled high in billowing sand dunes. Other deserts are flat, stony plains where all the fine material has been blown away and the surface consists of a mosaic of smooth stones. These areas are known as desert pavements and little further erosion takes place. Other desert features include rock outcrops, exposed bedrock and clays once deposited by flowing water. Temporary lakes may form and salt pans may be left when waters evaporate. There may be underground sources of water in the form of springs and seepages from aquifers. Where these are found, oases can occur.

Plants and animals living in the desert need special adaptations to survive in the harsh environment. Plants tend to be tough and wiry with small or no leaves, water-resistant

cuticles and often spines to deter herbivory. Some annual plants germinate, bloom and die in the course of a few weeks after rainfall while other long-lived plants survive for years and have deep root systems able to tap underground moisture. Animals need to keep cool and find enough food and water to survive. Many are nocturnal and stay in the shade or underground during the heat of the day. They tend to be efficient at conserving water, extracting most of their needs from their food and concentrating their urine. Some animals remain in a state of dormancy for long periods, ready to become active again when the rare rains fall. They then reproduce rapidly while conditions are favorable before returning to dormancy.

People have struggled to live in deserts and the surrounding semi-arid lands for millennia. Nomads have moved their flocks and herds to wherever grazing is available and oases have provided opportunities for a more settled way of life. The cultivation of semi-arid regions encourages erosion of soil and is one of the causes of increased desertification. Desert farming is possible with the aid of irrigation and the Imperial Valley in California provides an example of how previously barren land can be made productive by the import of water from an outside source. Many trade routes have been forged across deserts, especially across the Sahara, and traditionally were used by caravans of camels carrying salt, gold, ivory and other goods. Large numbers of slaves were also taken northwards across the Sahara. Some mineral extraction also takes place in deserts and the uninterrupted sunlight gives potential for the capture of large quantities of solar energy.

A desert is a region of land that is very dry because it receives low amounts of precipitation (usually in the form of rain but may be snow, mist or fog), often has little coverage by plants, and in which streams dry up unless they are supplied by water from outside the area. Deserts can also be described as areas where more water is lost by evaporation than falls as

precipitation. Deserts generally receive less than 250 mm (10 in) of precipitation each year. Semi deserts are regions which receive between 250 and 500 mm (10 and 20 in) and when clad in grass, these are known as steppes. Deserts cover about a fifth of the Earth's surface. Deserts have extreme environments. Deserts get between 1 and 15 inches of precipitation per year. Desert plants and animals have special adaptations that help them survive in this extreme environment. Most people think of deserts as being hot and dry, but some deserts are actually cold!

2. Types of deserts

Desert are classified by their geographical location and dominant weather pattern as trade wind, mid latitude, rain shadow, coastal, monsoon, or polar deserts. Former desert areas presently in nonarid environments are paleo deserts, and extraterrestrial deserts exist on other planets.

Trade wind deserts- The trade winds in two belts on the equatorial sides of the Horse Latitudes heat up as they move toward the Equator. These dry winds dissipate cloud cover, allowing more sunlight to heat the land. Most of the major deserts of the world lie in areas crossed by the trade winds. The world's largest desert, the Sahara of North Africa, which has experienced temperatures as high as 57° C, is a trade wind desert.

Rain shadow deserts- Rain shadow deserts are formed because tall mountain ranges prevent moisture-rich clouds from reaching areas on the lee, or protected side, of the range. As air rises over the mountain, water is precipitated and the air loses its moisture content. A desert is formed in the leeward "shadow" of the range. Rain shadow deserts exist near the leeward slopes of some mountain ranges. Leeward slopes face away from prevailing winds. When moisture-laden air hits a mountain range, it is forced to rise. The air then cools and forms clouds that drop moisture on the windward (wind-facing) slopes. When the air moves over the mountaintop and begins to descend the leeward slopes, there is little moisture left. The descending air warms up, making it difficult for clouds to form.

Coastal deserts- Coastal deserts generally are found on the western edges of continents near the Tropics of Cancer and Capricorn. They are affected by cold ocean currents that parallel the coast. Because local wind systems dominate the trade winds, these deserts are less stable than other deserts. Winter fogs, produced by upwelling cold currents, frequently blanket coastal deserts and block solar radiation. Coastal deserts are relatively complex because they are at the juncture of terrestrial, oceanic, and atmospheric systems. A coastal desert, the Atacama of South America, is the Earth's driest desert. In the Atacama, measurable rainfall--1 millimeter or more of rain--may occur as infrequently as once every 5-20 years.

Cold ocean currents contribute to the formation of coastal deserts. Air blowing toward shore, chilled by contact with cold water, produces a layer of fog. This heavy fog drifts onto land. Although humidity is high, the atmospheric changes that normally cause rainfall are not present. A coastal desert may be almost totally rainless, yet damp with fog. The Atacama Desert, on the Pacific shores of Chile, is a coastal desert. Some areas of the Atacama are often covered by fog. But the

region can go decades without rainfall. In fact, the Atacama Desert is the driest place on Earth. Some weather stations in the Atacama have never recorded a drop of rain.

Mid latitude deserts- Mid latitude deserts occur between 30° and 50° N. and S., pole ward of the subtropical high pressure zones. These deserts are in interior drainage basins far from oceans and have a wide range of annual temperatures. The Sonoran Desert of southwestern North America is a typical mid latitude desert.

Polar deserts- Polar deserts are areas with annual precipitation less than 250 millimeters and a mean temperature during the warmest month of less than 10° C. Polar deserts on the Earth cover nearly 5 million square kilometers and are mostly bedrock or gravel plains. Sand dunes are not prominent features in these deserts, but snow dunes occur commonly in areas where precipitation is locally more abundant. Temperature changes in polar deserts frequently cross the freezing point of water. This "freeze-thaw" alternation forms patterned textures on the ground, as much as 5 meters in diameter.

Paleo deserts- Data on ancient sand seas (vast regions of sand dunes), changing lake basins, archaeology, and vegetation analyses indicate that climatic conditions have changed considerably over vast areas of the Earth in the recent geologic past. During the last 12,500 years, for example, parts of the deserts were more arid than they are today. Nearly 18,000 years ago, sand seas in two vast belts occupied almost 50 percent of this land area. As is the case today, tropical rain forests and savannahs were between the two belts.

Parts of the Arctic and the Antarctic are classified as deserts. These polar deserts contain great quantities of water, but most of it is locked in glaciers and ice sheets year-round. So, despite the presence of millions of liters of water, there is actually little available for plants and animals. The largest desert in the world is also the coldest. Almost the entire continent of Antarctica is a polar desert, experiencing little precipitation. Few organisms can withstand the freezing, dry climate of Antarctica.

Extraterrestrial deserts- Mars is the only other planet on which we have identified wind-shaped (eolian) features. Although its surface atmospheric pressure is only about one-hundredth that of Earth, global circulation patterns on Mars have formed a circumpolar sand sea of more than five million square kilometers, an area greater than the Empty Quarter of Saudi Arabia, the largest sand sea on our planet. Martian sand seas consist predominantly of crescent-shaped dunes on plains near the perennial ice cap of the north polar area. Smaller dune fields occupy the floors of many large craters in the Polar Regions.

Subtropical Deserts- Subtropical deserts are caused by the circulation patterns of air masses. They are found along the Tropic of Cancer, between 15 and 30 degrees north of the Equator, or along the Tropic of Capricorn, between 15 and 30 degrees south of the Equator. Hot, moist air rises into the atmosphere near the Equator. As the air rises, it cools and drops its moisture as heavy tropical rains. The resulting cooler, drier air mass moves away from the Equator. As it approaches the tropics, the air descends and warms up again. The descending air hinders the formation of clouds, so very little rain falls on the land below. The world's largest hot desert, the Sahara, is a subtropical

desert in northern Africa. The Sahara Desert is almost the size of the entire continental United States. Other subtropical deserts include the Kalahari Desert in southern Africa and the Tanami Desert in northern Australia.

Interior Deserts- Interior deserts, which are found in the heart of continents, exist because no moisture-laden winds reach them. By the time air masses from coastal areas reach the interior, they have lost all their moisture. Interior deserts are sometimes called inland deserts. The Gobi Desert, in China and Mongolia, lies hundreds of kilometers from the ocean. Winds that reach the Gobi have long since lost their moisture. The Gobi is also in the rain shadow of the Himalaya mountain to the south.

3. Desert Characteristics

Humidity—water vapor in the air—is near zero in most deserts. Light rains often evaporate in the dry air, never reaching the ground. Rainstorms sometimes come as violent cloudbursts. A cloudburst may bring as much as 25 centimeters (10 inches) of rain in a single hour—the only rain the desert gets all year. Desert humidity is usually so low that not enough water vapor exists to form clouds. The sun's rays beat down through cloudless skies and bake the land. The ground heats the air so much that air rises in waves you can actually see. These shimmering waves confuse the eye, causing travelers to see distorted images called mirages

Temperature extremes are a characteristic of most deserts. In some deserts, temperatures rise so high that people are at risk of dehydration and even death. At night, these areas cool quickly because they lack the insulation provided by humidity and clouds. Temperatures can drop to 4°C (40°F) or lower.

In the Chihuahuan Desert, in the United States and Mexico, temperatures can vary by dozens of degrees in one day. Daytime temperatures in the Chihuahua can climb beyond 37°C (100°F), while nighttime temperatures can dip below freezing (0°C or 32°F).

Water helps carve desert lands. During a sudden storm, water scours the dry, hard-baked land, gathering sand, rocks, and other loose material as it flows. As the muddy water roars downhill, it cuts deep channels, called arroyos or wadis. A thunderstorm can send a fast-moving torrent of water—a flash flood—down a dry arroyo. A flash flood like this can sweep away anything and anyone in its path. Many desert regions discourage visitors from hiking or camping in arroyos for this reason.

Many deserts have no drainage to a river, lake, or ocean. Rainwater, including water from flash floods, collects in large depressions called basins. The shallow lakes that form in basins eventually evaporate, leaving playas, or salt-surfaced lake beds. Playas, also called sinks, pans, or salt flats, can be hundreds of kilometers wide.

Wind is the primary sculptor of a desert's hills of sand, called dunes. Wind builds dunes that rise as high as 180 meters (590 feet). Dunes migrate constantly with the wind. They usually shift a few meters a year, but a particularly violent sandstorm can move a dune 20 meters (65 feet) in a single day.

4. People And The Desert

About 1 billion people live in deserts. Many of these people rely on centuries-old customs to make their lives as

comfortable as possible. Civilizations throughout the Middle East and Maghreb have adapted their clothing to the hot, dry conditions of the Sahara and Arabian deserts. Clothing is versatile and based on robes made of rectangles of fabric. Long-sleeved, full-length, and often white, these robes shield all but the head and hands from the wind, sand, heat, and cold. White reflects sunlight, and the loose fit allows cooling air to flow across the skin.

The need to find food and water has led many desert civilizations to become nomadic. Nomadic cultures are those that do not have permanent settlements. In the deserts of the Middle East and Asia, nomadic tent communities continue to flourish. Tent walls are made of thick, sturdy cloth that can keep out sand and dust, but also allow cool breezes to blow through. Tents can be rolled up and transported on pack animals (usually horses, donkeys, or camels). Nomads move frequently so their flocks of sheep and goats will have water and grazing land. Besides animals like camels and goats, a variety of desert vegetation is found in oases and along the shores of rivers and lakes. Figs, olives, and oranges thrive in desert oases and have been harvested for centuries.

Some desert areas rely on resources brought from more fertile areas—food trucked in from distant farmlands or, more frequently, water piped from wetter regions. Large areas of desert soil are irrigated by water pumped from underground sources or brought by canal from distant rivers or lakes. The booming Inland Empire of southeastern California is made up of deserts (the Mojave and the Sonoran) that rely on water for agriculture, industry, and residential development. Canals and aqueducts supply the Inland Empire with water from the Colorado River, to the east, and the Sierra Nevada snowmelt to the north. A variety of crops can thrive in these irrigated oases. Sugar cane is a very water-intensive crop mostly harvested in tropical regions. However, sugar cane is also harvested in the deserts of Pakistan and Australia. Water for irrigation is transported from hundreds of kilometers away, or drilled from hundreds of meters underground.

Air transportation and the development of air conditioning have made the sunny climate of deserts even more accessible and attractive to people from colder regions. Populations at resorts like Palm Springs, California, and Las Vegas, Nevada, have boomed. Desert parks, such as Death Valley National Park, California, attract thousands of visitors every year. People who migrate to the warm, dry desert for the winter and return to more temperate climates in the spring are sometimes called "snowbirds."

Deserts can hold economically valuable resources that drive civilizations and economies. The most notable desert resource in the world is the massive oil reserves in the Arabian Desert of the Middle East. More than half of the proven oil reserves in the world lie beneath the sands of the Arabian Desert, mostly in Saudi Arabia. The oil industry draws companies, migrant workers, engineers, geologists, and biologists to the Middle East.

5. Deserts Get Hotter

Rising temperatures can have huge effects on fragile desert ecosystems. Global warming is the most current instance of climate change. Human activities such as burning fossil fuels contribute to global warming. In deserts, temperatures are rising even faster than the global average.

This warming has effects beyond simply making hot deserts hotter. For example, increasing temperatures lead to the loss of nitrogen, an important nutrient, from the soil. Heat prevents microbes from converting nutrients to nitrates, which are necessary for almost all living things. This can reduce the already limited plant life in deserts.

Climate change also affects rainfall patterns. Climate scientists predict that global warming will lead to more rainfall in some regions, but less rainfall in other places. Areas facing reduced precipitation include areas with some of the largest deserts in the world: North Africa (Sahara), the American Southwest (Sonoran and Chihuahuan), the southern Andes (Patagonia), and Western Australia (Great Victoria).

In literature and in legend, deserts are often described as hostile places to avoid. Today, people value desert resources and biodiversity. Communities, governments, and organizations are working to preserve desert habitats and increase desert productivity.

6. The largest desert

The two largest deserts on Earth are in the polar areas. The Antarctic Polar Desert covers the continent of Antarctica and has a size of about 5.5 million square miles. The second-largest desert is the Arctic Polar Desert. It extends over parts of Alaska, Canada, Greenland, Iceland, Norway, Sweden, Finland, and Russia. It has a surface area of about 5.4 million square miles.

7. Non-Polar Desert

The rest of Earth's deserts are outside of the polar areas. The largest is the Sahara Desert, a subtropical desert in northern Africa. It covers a surface area of about 3.5 million square miles. A list of more than twenty of the largest non-polar deserts can be found below.

8. The Desert Environment

When most people think of a desert, they imagine a landscape covered with sand and sand dunes. Although many deserts are sand-covered, most are not. Many desert landscapes are rocky surfaces. They are rocky because any sand-size or smaller particles on the surface are quickly blown away. Rocky deserts are barren wind-swept landscapes.

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Most deserts receive so little precipitation that surface streams usually only flow immediately after rainfall - unless the stream has a source of water outside of the desert. Streams that enter a desert usually suffer major water losses before they exit. Some of the water is lost to evaporation. Some is lost to transpiration (taken up by plants and then released to the atmosphere from the plants). And, some is lost to infiltration (water soaking into the ground through the bottom of the stream channel).

9. Desertification

Desertification is the process of productive cropland turning into non-productive, desert-like environments. Desertification usually happens in semi-arid areas that border deserts. Human activities are a primary cause of desertification. These activities include overgrazing of livestock, deforestation, overcultivation of farmland, and poor irrigation practices. Overgrazing and deforestation remove plants that anchor the soil. As a result, wind and water erode the nutrient-rich topsoil. Hooves from grazing livestock compact the soil, preventing it from absorbing water and fertilizers. Agricultural production is devastated, and the economy of a region suffers.

The deserts of Patagonia, the largest in South America, are expanding due to desertification. Patagonia is a major agricultural region where non-native species such as cattle and sheep graze on grassland. Sheep and cattle have reduced the native vegetation in Patagonia, causing loss of valuable topsoil. More than 30 percent of the grasslands of Argentina, Chile, and Bolivia are faced with desertification.

10. Conclusion

The environment of the desert provides for a wide variety of dermatoses that can result in these regions with few of these dermatoses found in much higher incidence than in other regions. The concept of desert dermatology needs to be understood in more details to provide better care to those suffering from desert dermatoses and this article is a step forward in this regard.

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