Desert

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In geography, a **desert** is a landscape form or region that receives little precipitation - less than 250 mm (10 in) per year. Deserts have a reputation for supporting very little life. Compared to wetter regions this may be true, although upon closer examination, deserts often harbor a wealth of life that usually remains hidden (especially during the daylight) to preserve moisture. Approximately one-third of Earth's land surface is desert.

Desert landscapes have certain common features. Desert soil is often composed mostly of rocky surfaces called regs. Sand dunes called ergs and stony or hamada surfaces compose the minority of desert surfaces. Exposures of rocky terrain are typical, and reflect minimal soil development and sparseness of vegetation. Bottom lands may be salt-covered flats. Eolian (wind-driven) processes are major factors in shaping desert landscapes.

Deserts sometimes contain valuable mineral deposits that were formed in the arid environment or that were exposed by erosion. Because deserts are dry, they are ideal places for human artifacts and fossils to be preserved.

In the Köppen climate classification system, they are classed as (BW).

Types of desert

Most classifications rely on some combination of the number of days of rainfall, the total amount of annual rainfall, temperature, humidity, or other factors. In 1953, Peveril Meigs divided desert regions on Earth into three categories according to the amount of precipitation they received. In this now widely accepted system, extremely arid lands have at least 12 consecutive months without rainfall, arid lands have less than 250 millimeters of annual rainfall, and semiarid lands have a mean annual precipitation of between 250 and 500 millimeters. Arid and extremely arid land are deserts, and semiarid grasslands generally are referred to as steppes.

However, lack of rainfall alone can't provide an accurate description of what a desert is. For example, Phoenix, Arizona receives less than 250 millimeters (10 inches) of precipitation per year, and is immediately recognized as being located in a desert. The North Slope of Alaska's Brooks Range also receives less than 250 millimeters of precipitation per year, but is not generally recognized as a desert region.

The difference lies in something termed "potential evapotranspiration." The water budget of an area can be calculated using the formula P-PE+/-S, wherein P is precipitation, PE is potential evapotranspiration rates and S is amount of surface storage of water.

Evapotranspiration is the combination of water loss through atmospheric evaporation, coupled with the evaporative loss of water through the life processes of plants. Potential evapotranspiration, then, is the amount of water that *could* evaporate in any given region. Tucson, Arizona receives about 300 millimeters, (12 inches), of rain per year, however about 2500 millimeters, (100 inches), of water could evaporate over the course of a year. In other words, about 8 times more water could evaporate from the region than actually falls. Rates of evapotranspiration in other regions such as Alaska are much lower, so while these regions receive minimal precipitation, they should be designated as specifically different from the simple definition of a desert: a place where evaporation exceeds precipitation.

That said, there are different forms of deserts. Cold deserts can be covered in snow; such locations don't receive much precipitation, and what does fall remains frozen as snow pack; these are more commonly referred to as tundra if a short season of above-freezing temperatures is experienced, or as an ice cap if the temperature remains below freezing year-round, rendering the land almost completely lifeless.

Most non-polar deserts are hot because they have little water. Water tends to have a cooling, or at least a moderating, effect in environments where it is plentiful. In some parts of the world deserts are created by a rain shadow effect in which air masses lose much of their moisture as they move over a mountain range; other areas are arid by virtue of being very far from the nearest available sources of moisture (this is true in some middle-latitude landmass interior locations, particularly in Asia).

Deserts are also 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 non-arid environments are paleodeserts, and extraterrestrial deserts exist on other planets.

Montane deserts

Montanedeserts are arid places with a very high altitude; the most prominent example is found north of the Himalaya, in parts of the Kunlun Mountains and the Tibetan Plateau. Many locations within this category have elevations exceeding 3,000 meters (9,843 feet) and the thermal regime can be hemiboreal. These places owe their profound aridity (the average annual precipitation is often less than 40mm) to being very far from the nearest available sources of moisture.

Desert features

Sand covers only about 20 percent of Earth's deserts. Most of the sand is in sand sheets and sand seas—vast regions of undulating dunes resembling ocean waves "frozen" in an instant of time. In general, there are 6 forms of deserts:

- Mountain and basin deserts;
- Hamada deserts, which comprise of a plateaux landforms;

- Regs which consist of rock pavements;
- Ergs which are formed by sand seas;
- Intermontane Basins; and
- Badlands which are located at the margins of arid lands comprising of clay-rich soil.

Nearly 100 percent of desert surfaces are plains where eolian deflation—removal of fine-grained material by the wind—has exposed loose gravels consisting predominantly of pebbles but with occasional cobbles.

The remaining surfaces of arid lands are composed of exposed bedrock outcrops, desert soils, and fluvial deposits including alluvial fans, playas, desert lakes, and oases/oasis. Bedrock outcrops commonly occur as small mountains surrounded by extensive erosional plains.

There are several different types of dunes. Barchan dunes are produced by strong winds blowing across a level surface and are crescent shaped. Longitudinal or seif dunes are dunes that are parallel to a strong wind that blows in one general direction. Transverse dunes run are a right angle to the constant wind direction. Star dunes are star-shaped and have several ridges that spread out around a point.

Oases are vegetated areas moistened by springs, wells, or by irrigation. Many are artificial. Oases are often the only places in deserts that support crops and permanent habitation.

Soils

Soils that form in arid climates are predominantly mineral soils (classified as Aridisols) with low organic content such as salt. The repeated accumulation of water in some soils causes distinct salt layers to form. Calcium carbonate precipitated from solution may cement sand and gravel into hard layers called "calcrete" that form layers up to 50 meters thick.

Caliche is a reddish-brown to white layer found in many desert soils. Caliche commonly occurs as nodules or as coatings on mineral grains formed by the complicated interaction between water and carbon dioxide released by plant roots or by decaying organic material.

Vegetation

Most desert plants are drought- or salt-tolerant, such as xerophytes. Some store water in their leaves, roots, and stems. Other desert plants have long tap roots that penetrate to the water table if present. The stems and leaves of some plants lower the surface velocity of sand-carrying winds and protect the ground from erosion.

Deserts typically have a plant cover that is sparse but enormously diverse. The Sonoran Desert of the American Southwest has the most complex desert vegetation on Earth. The giant saguaro cacti provide nests for desert birds and serve as "trees" of the desert. Saguaro grow slowly but may live 200 years. When 9 years old, they are about 15 centimeters high. After about 75 years, the cacti develop their first branches. When fully grown, saguaro are 15 meters tall and weigh as much as 10 tons. They dot the Sonoran and reinforce the general impression of deserts as cacti-rich land.

Although cacti are often thought of as characteristic desert plants, other types of plants have adapted well to the arid environment. They include the pea family and sunflower family. Cold deserts have grasses and shrubs as dominant vegetation.

Water

Rain does fall occasionally in deserts, and desert storms are often violent. A record 44 millimeters of rain once fell within 3 hours in the Sahara. Large Saharan storms may deliver up to 1 millimeter per minute. Normally dry stream channels, called arroyos or wadis, can quickly fill after heavy rains, and flash floods make these channels dangerous.

Though little rain falls in deserts, deserts receive runoff from ephemeral, or short-lived, streams fed by rain and snow from adjacent highlands. These streams fill the channel with a slurry of mud and commonly transport considerable quantities of sediment for a day or two. Although most deserts are in basins with closed, or interior drainage, a few deserts are crossed by 'exotic' rivers that derive their water from outside the desert. Such rivers infiltrate soils and evaporate large amounts of water on their journeys through the deserts, but their volumes are such that they maintain their continuity. The Nile River, the Colorado River, and the Yellow River are exotic rivers that flow through deserts to deliver their sediments to the sea.

Lakes form where rainfall or meltwater in interior drainage basins is sufficient. Desert lakes are generally shallow, temporary, and salty. Because these lakes are shallow and have a low bottom gradient, wind stress may cause the lake waters to move over many square kilometers. When small lakes dry up, they leave a salt crust or hardpan. The flat area of clay, silt, or sand encrusted with salt that forms is known as a playa. There are more than a hundred playas in North American deserts. Most are relics of large lakes that existed during the last ice age about 12,000 years ago. Lake Bonneville was a 52,000-square-kilometer lake almost 300 meters deep in Utah, Nevada, and Idaho during the Ice Age. Today the remnants of Lake Bonneville include Utah's Great Salt Lake, Utah Lake, and Sevier Lake. Because playas are arid land forms from a wetter past, they contain useful clues to climatic change.

When the occasional precipitation does occur, it erodes the desert rocks quickly and powerfully. Wind is the other factor that erodes deserts- they are constant yet slow.

The flat terrains of hardpans and playas make them excellent race tracks and natural runways for airplanes and spacecraft. Ground-vehicle speed records are commonly

established on Bonneville Speedway, a race track on the Great Salt Lake hardpan. Space shuttles land on Rogers Lake Playa at Edwards Air Force Base in California.

Mineral resources

Some mineral deposits are formed, improved, or preserved by geologic processes that occur in arid lands as a consequence of climate. Ground water leaches ore minerals and redeposits them in zones near the water table. This leaching process concentrates these minerals as ore that can be mined.

Evaporation in arid lands enriches mineral accumulation in their lakes. Playas may be sources of mineral deposits formed by evaporation. Water evaporating in closed basins precipitates minerals such as gypsum, salts (including sodium nitrate and sodium chloride), and borates. The minerals formed in these evaporite deposits depend on the composition and temperature of the saline waters at the time of deposition.

Significant evaporite resources occur in the Great Basin Desert of the United States, mineral deposits made forever famous by the "20-mule teams" that once hauled borax-laden wagons from Death Valley to the railroad. Boron, from borax and borate evaporites, is an essential ingredient in the manufacture of glass, ceramics, enamel, agricultural chemicals, water softeners, and pharmaceuticals. Borates are mined from evaporite deposits at Searles Lake, California, and other desert locations. The total value of chemicals that have been produced from Searles Lake substantially exceeds US$1 billion.

The Atacama Desert of South America is unique among the deserts of the world in its great abundance of saline minerals. Sodium nitrate has been mined for explosives and fertilizer in the Atacama since the middle of the 19th century. Nearly 3 million tonnes were mined during World War I.

Valuable minerals located in arid lands include copper in the United States, Chile, Peru, and Iran; iron and lead-zinc ore in Australia; chromite in Turkey; and gold, silver, and uranium deposits in Australia and the United States. Nonmetallic mineral resources and rocks such as beryllium, mica, lithium, clays, pumice, and scoria also occur in arid regions. Sodium carbonate, sulfate, borate, nitrate, lithium, bromine, iodine, calcium, and strontium compounds come from sediments and near-surface brines formed by evaporation of inland bodies of water, often during geologically recent times.

The Green River Formation of Colorado, Wyoming, and Utah contains alluvial fan deposits and playa evaporites created in a huge lake whose level fluctuated for millions of years. Economically significant deposits of trona, a major source of sodium compounds, and thick layers of oil shale were created in the arid environment.

Some of the more productive petroleum areas on Earth are found in arid and semiarid regions of Africa and the Mideast, although the oil fields were originally formed in

shallow marine environments. Recent climate change has placed these reservoirs in an arid environment.

Other oil reservoirs, however, are presumed to be eolian in origin and are presently found in humid environments. The Rotliegendes, a hydrocarbon reservoir in the North Sea, is associated with extensive evaporite deposits. Many of the major U.S. hydrocarbon resources may come from eolian sands. Ancient alluvial fan sequences may also be hydrocarbon reservoirs.

List of Largest Deserts in the World

Reference:
Dowling, Mike, "Mr. Dowling's Bedouins Page," available from http://www.mrdowling.com/607-bedouins.html; Internet; updated Monday, July 4, 2005.

Sahara (Northern Africa), 3,500,000 square miles

Gobi (Mongolia and China) 500,000 square miles

Patagonia (Argentina) 300,000 square miles

Rub al-Khali ("Empty Quarter") (Saudi Arabia) 250,000 square miles

Kalahari (Southern Africa) 225,000 square miles

Great Sandy (Australia) 150,000 square miles

Great Victoria (Australia) 150,000 square miles

Taklimaken (China) 140,000 square miles

Chihuahuan (Texas, New Mexico, Arizona, and Mexico) 140,000 square miles

Kara Kum (Turkmenistan) 120,000 square miles

Gibson (Australia) 120,000 square miles

Thar (India and Pakistan) 100,000 square miles

Kyzyl Kum (Kazakhstan and Uzbekistan) 100,000 square miles