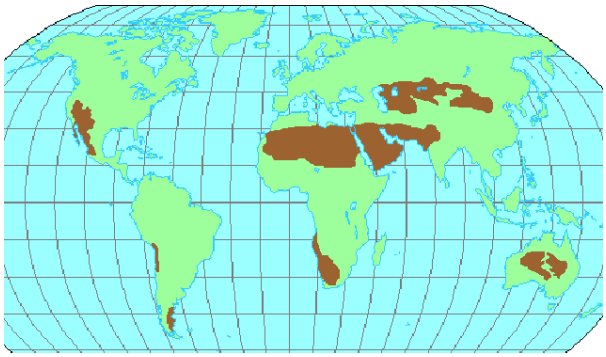
Desert



Introduction: Desert areas are rarely devoid of life. Instead, they abound with wonderfully adapted plants and animals that have evolved various mechanisms for tolerating or avoiding the extremes of aridity and temperature that might be encountered in their environment. Deserts develop under four distinct geographic conditions:

- Under zones of high atmospheric pressure associated with the subtropics and centered near 30° latitude. Air descending from the upper atmosphere at these latitudes causes evaporation to exceed precipitation. Much of the Sahara and the Australian desert can be associated with this phenomenon.
- West coasts of continents between 20° and 30° latitude. In these latitudes, prevailing winds are easterly and prevent moist air from coming onto the west coast. Cold ocean currents also occur in these locations and moisture in the sea air condenses as fog along the shore. Some of the world's driest deserts are located right on the coast; they received most of their limited precipitation from fog. Such fog deserts include Baja California in North America, the western Sahara in northern Africa; the Atacama in South America, and the Namib in southern Africa.
- Rainshadows of high mountain ranges. When air masses are forced over mountains and downslope, they warm and their capacity for holding water vapor increases. Evaporation exceeds precipitation and an arid environment or rainshadow is created on the leeward side. Such conditions account for some of the North American deserts (exemplified in Death Valley, CA), the Patagonian desert in Argentina; and the Peruvian desert.
- Interiors of continents. Usually in combination with the rainshadow effect, distance from a major source of moist air results in dry climates in the interior of a land mass. The Great Basin desert of the US, the Australian desert, and the Gobi desert of Mongolia can all be explained in large part to their interior positions.

Climate. Arid climates (BWh and BWk) are those which average less than 10 inches of precipitation a year. Potential evaporation exceeds precipitation in the annual water budget. Furthermore, rainfall is highly localized and relatively unpredictable in terms of when it will occur, although usually there are seasons of highest probability for

precipitation. Annual variation in total precipitation may also be great. Temperatures are also variable. They may exceed 100° F on summer afternoons, but dip by 20-30 degrees or more at night. Winters are cool to cold: "hot deserts" rarely experience frost; "cold deserts" may have prolonged periods of below freezing temperatures and snowfall.

Vegetation. Shrubs are the dominant growth form of deserts. They may be evergreen or deciduous; typically have small leaves; and frequently have spines or thorns and/or aromatic oils. Shallow but extensive root systems procure rainwater from well beyond the canopy of the shrub whenever it does rain. These are the true **xerophytes** adapted to tolerate extreme drought. They form an open canopy and, except after rains when annuals may cover the desert floor, the ground between shrubs is bare of vegetative growth.

Water is not entirely lacking in the desert environment and several other growth forms represent strategies to reach water or to store water:

- **Phreatophytes** are plants with long taproots that may extend downward 20 to 30 feet to tap ground water supplies. Especially along intermittent streams or under dunes, underground water may be readily available. Mesquite is a good example here in North America.

  One of the world's most unusual phreatophyes is *Welwitschia mirabilis* of the Namib.

- **Succulents** store water accumulated during rains for use during the intervening dry spells. Different species store water in different parts of the plant; hence we can recognize stem succulents, leaf succulents, root succulents, and fruit succulents. Many plant families have members that evolved succulence. Most prominent among stem succulents in the Americas are the Cactaceae; in Africa succulent euphorbias have evolved shapes and sizes resembling the cacti. The agaves (Liliaceae) are examples of leaf succulents in the Americas; their role is filled by aloes (Liliaceae) in Africa. Most succulents do not tolerate freezing temperatures so they are essentially limited to the hot deserts.
- Another growthform adapted to desert conditions is the **ephemeral**. This is an especially short-lived annual forb that completes its life cycle in two-three weeks. The seeds are encased in a waterproof coating that prevents desiccation for years if necessary. These plants essentially avoid drought by occurring as seeds most of the time.
- **Perennial forbs** with underground bulbs store nutrients and water in undergound tissues and also remain dormant most of the year. They can sprout rapidly after sufficient rains and replenish their undergound stores.

Soils. Calcification is the dominant soil-forming process, if indeed soil forming even occurs. There is poor development of horizons, with accumulation of calcium carbonate at or near the surface. Sparse vegetative cover and tiny leaves results in little humus and soils typically have a light gray color. **Aridosols** are the dominant soil order.

Fauna. Like the plants, the animals of the desert have evolved an array of strategies for dealing with aridity.

- **Behavioral adaptations** such as being nocturnal or crepuscular, being fossorial, and staying the shade during the heat of day are common.
- **Morphological adaptations** include those noticed by Bergmann, Allen, and Golger. The better to radiate body heat to the environment from warm-blooded animals, body sizes are small and appendages long. Pelage and plumage is light colored to reflect sunlight and help prevent the absorption of heat form the environment.
- Rarer, but important, are **physiological adaptations** such as aestivation (dormancy during summer), the absence of sweat glands, the concentration of urine, localized deposits of fat in tails or humps; and salt glands to secrete salt without loosing fluids.

Reptiles with their waterproof skin, production of uric acid instead of urine, hard-shelled eggs, and ability to gain body heat directly from the sun and to retreat to shade or underground to avoid heat are exceptionally well adapted to drylands and, not surprisingly, diverse there.

Many birds in the North American deserts, so fragmented by mountains offering humid habitats and permanent streams, simply fly to free water and so are not limited by the lack of open water. They maintain breeding seasons like other temperate zone birds synchronized by changing photoperiods. In Australia, where the desert geography is quite different and aridity more pervasive, bird populations synchronize their breeding readiness according to cues of rainfall, however erratic and sporadic that may be.

http://www.radford.edu/~swoodwar/CLASSES/GEOG235/biomes/intro.html