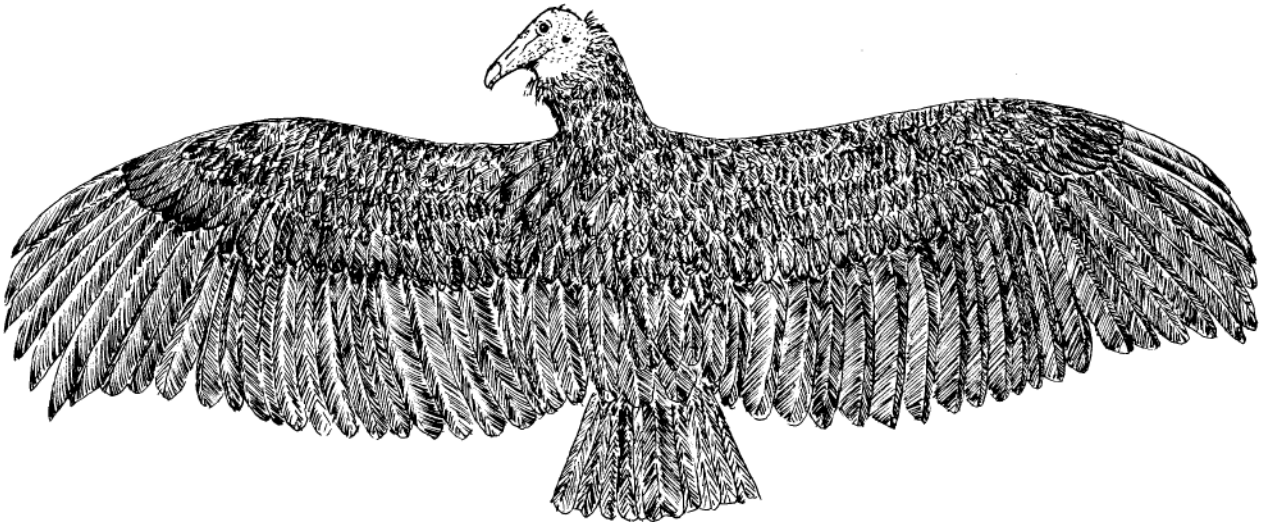

Lesson Five – Desert Adaptations of Birds

How Birds Survive Desert Conditions

Observing Bird Behavior in Temperature Extremes

Background: Birds live in deserts, but most do not have specialized desert adaptive features, as do mammals and reptiles. Birds can fly to water and to cooler areas. Mammals and reptiles are confined to narrow ranges on the desert floor where they find refuge in vegetation or in underground burrows and must sacrifice some water loss by evaporative cooling through panting or perspiring. It is not known if desert birds can endure greater water loss than non-desert birds, but here are some features of bird behavior, ***morphology*** (anatomy), and ***physiology*** (bodily processes) that assist in their survival.

This section is designed to supply the teacher with background information on the subject. The students do their own research as they work on the activities. Research questions are provided with each activity.

Birds have many inherent behaviors and characteristics that allow them to inhabit desert conditions. Birds have a high body temperature—often above 104°—much higher than other vertebrates. Therefore they do not have to cool their bodies until the air temperature exceeds their high body temperature. They can even tolerate body temperatures 5 or 6 degrees above their normal temperatures. Even on very hot desert days the shade of trees and shrubs does not exceed 110°.

The mechanism for heat loss from birds involves direct radiation of body heat to areas of lower temperature—the air. This direct radiation does not require water loss through evaporative cooling. But temperatures can climb above this and few birds can survive a body temperature of more than 115°.

Birds can avoid high temperatures through their behavior, as well. They are active in the cooler times of early morning and late afternoon. During the hotter parts of the day they seek shade. For many birds, flying is limited during hot times because the exertion of flight raises body temperatures. But birds that fly and soar high above are in cooler air.

The position of the feathers in a resting bird help cool its body. On hot days birds compress their feathers, which eliminates the insulating air space between the feathers and the body thus allowing heat to escape to the air. Their flattened feathers make them look unusually thin. It is just the reverse on cool days. Observe how birds on cool mornings appear fat, as they fluff out their feathers, forming that insulation space. Birds also radiate excess heat by raising their wings and exposing the sparsely feathered sides of their bodies and underwings. Vultures perch on the tops of saguaros or utility poles with outstretched wings, increasing their body surface area and dissipating body heat to the air—see the sketch at the beginning of this lesson.

Another heat-losing strategy is the dilation of blood vessels that go to the legs. This sends warm blood into the legs. The excess heat is then passed into the cooler air. You will see birds stand tall in summer as they extend their legs for greater heat dumping.

If more heat must be lost birds can resort to evaporative cooling. They pant. This increases the flow of air over the moist surfaces of its mouth, tongue, throat and other organs of the respiratory system. This cools the surface, which in turn cools the blood, which in turn cools the body as the blood circulates within the bird. On a very hot summer day observe birds seeking shade under a tree or on your patio. Their bills are open and they are breathing through their mouths.

Some birds hasten evaporative cooling with ***gular fluttering***. They use their throat muscles to flap loose skin at the throat which pumps air in and out. Roadrunners, owls, quail, nighthawks, doves, and many water birds do this.

Breathing, even through the nose, loses water to the air. Some birds (and some other desert animals such as the kangaroo rat) have reduced nasal moisture loss through an interesting method of condensation. As warm, moist air passes from the lungs through cooler nasal passages, condensation occurs within the nasal passages and the bird recaptures this condensation. Cactus Wrens recover up to three-quarters of water that would otherwise pass back into the air.

When temperatures are very hot, water is necessary. Birds, as well as other animals, obtain water by:

- producing water metabolically by oxidizing food that contains hydrogen (this is a limited source)
- using the water that already exists in the food they eat (moist plant material, nectar, fruit, animal prey)
- drinking free water (flying to water sources)

Another water-conservation adaptation that occurs in birds as well as many other desert animals is in their production of waste. They excrete ***uric acid***—a nitrogenous, dry, semi-solid excrement that does not dissolve in water. Unlike the watery urine of most mammals, birds lose little moisture in their wastes. The water that would otherwise be lost during defecation is reabsorbed in the intestines. It appears this is more effi ciently accomplished in desert birds.

Vultures, as well as some other bird species, practice another interesting cooling "trick". They defecate on their legs. The moisture contained in the combined urine and feces causes their deep body temperatures to cool to a level lower than they could accomplish by panting. The dried waste material paints the vultures' legs white. Turkey Vulture legs are really red and Black Vulture legs are gray.

There are other ways birds manage desert life as well. Covered nests, such as that of the Cactus Wren, protect young and adults. Drought, resulting in limited food, alters the time of the breeding season. Young may be produced later or there may be fewer broods in those years.

Deserts can become very cold, too. How do birds adapt to cold? They feed on rich energy foods such as seeds, insects, rodents, fruit, and nectar. This gives them high concentrations of glucose, which increases metabolism and therefore increases body heat. To expose less body surface to the cold, birds stand with one foot tucked in their belly feathers, sit with both feet under them, or tuck their bills into their feathers. Shivering is a temporary measure, which converts muscular energy into heat. Some birds conserve energy by lowering their body temperatures and rate of metabolism on cold nights. They also seek shelter for roosting in protected places. Roadrunners will stand with their backs to the sun and lift their feathers so that their black skin is warmed.