

# Defenders of Wildlife

## Climate Change and the Sonoran Desert Region



### A Unique Desert Ecosystem

Not all deserts are the same—in fact, the state of Arizona has four distinct deserts, differentiated by their geography, elevation, rainfall patterns, and plant and animal species. The Sonoran Desert encompasses 120,000 square miles of southwestern Arizona, southeastern California, and in Mexico, northwestern Sonora and most of the Baja Peninsula. With nearly 3500 species of plants, 500 species of birds, and 1,000 species of bees, the Sonoran is the most biodiverse desert on earth.



Photo: U.S. Geological Survey

Elevation and rainfall patterns are the keys to this incredible biodiversity. Much of the Sonoran Desert lies at fairly low elevation, but the region is punctuated by mountain ranges. Gradients of elevation and moisture have created an array of vegetative communities, including desert grassland, or thorny scrub vegetation, oak and piñon forests, and even tundra at the highest elevations. The ecology of the Sonoran Desert is also shaped by its two distinct rainy seasons: the monsoon season occurs from July to September and is characterized by strong thunderstorms. Another period of mostly gentle rains occurs in winter, with the intervening months almost entirely dry. Overall, the region receives less than 10 inches of rain per year, but the two rainy seasons provide enough moisture for an astonishing array of plants – wildflowers and grasses, cacti, shrubs and even trees-- to thrive here.. Saguaro and organ pipe cactus are

unique to the region, and several small trees in the bean family, the mesquite, ironwood and palo verde, are particularly important to wildlife.

### Climate Changes in the Southwest

The impacts of climate change are already being felt in the Southwestern United States, including in the Sonoran desert region. Average temperature has already risen about 1.5°F compared to the mid-twentieth century. By the end of the century, temperatures are poised to rise at least another 2.5 degrees, and possibly as much 8.5 degrees if the world fails to check emissions. Furthermore, the area is already in the grip of a major drought: much of the Sonoran Desert has seen a 25 to 40% drop in precipitation over the past 50 years. Projections indicate that the region will continue to be drier than average, and with temperatures soaring above 90°F for over half the year, prolonged water stress will be devastating to many species.

### Impacts to Plants and Animals

#### *Sonoran pronghorn*

The Sonoran pronghorn (*Antilocapra americana sonoriensis*) is an endangered subspecies of the fastest land mammal in North America, adapted to outrun the long-extinct American cheetah. They are often referred to as “antelope,” thought they are not closely related to the true antelopes of Africa. Smaller and paler in color than the other three pronghorn subspecies, the Sonoran Pronghorn shares with its cousins the distinctive white and tan neck markings and twisted, forked horns. Once ranging over a 55,000 square mile area of the Southwest, the U.S. population of Sonoran pronghorn now numbers fewer than 70 individuals, confined to the Organ Pipe National Monument, Cabeza Prieta National Wildlife Refuge and the Barry Goldwater Range. Approximately 400 remain in Mexico.

Pronghorn live in the scrub brush communities of ironwood, palo verde, mesquite, and cholla, and eat primarily herbaceous flowering plants, supplemented by cacti and shrubs during the dry months. They require

# Climate Change and the Sonoran Desert Region

large areas in which to forage, and avoid predators by remaining out in the open, using their vision and speed to their advantage.



Photo: U.S. Fish and Wildlife Service

Competition with cattle for food plants in the Sonoran region was the primary factor in the precipitous decline of the pronghorn. Livestock grazing has now been halted in the areas where pronghorn remain. The species is also sensitive to human disturbance, including military aviation activities on the Goldwater Range, and both the illegal activity in the border region and the law enforcement response to it. Roads, fences, railroad tracks and human development have reduced and fragmented the wide spaces that they need to forage successfully.

In addition to these historic and ongoing threats, climate changes already underway in the southwest are threatening to push the pronghorn over the edge to extinction. Survival of fawns is determined mainly by the amount of precipitation falling in the winter and by the length of the drought interval until the monsoon rains start in the summer. Winter precipitation governs the amount of forage available to nursing females, and summer precipitation determines the food available to the young, newly weaned fawns. Adult survival is also influenced by precipitation, probably because in dry conditions, animals are forced to forage in valleys where the vegetation is denser and predators are less visible.

The U.S. population very nearly winked out in 2002, when a 13-month drought wiped out all but 21 animals. The U.S. Fish and Wildlife Service intervened to prevent extinction by providing water and forage and initiating a captive breeding program, and is planning to establish a second population at nearby Kofa National Wildlife Refuge. These actions have helped the numbers to creep back up, however the species' chances of surviving

climate change without continued intervention may be slim. As climate change increases the length and intensity of droughts in the Sonoran desert, the pronghorn is likely to face extreme difficulty in reproducing successfully.

## *Desert Tortoise*

The desert tortoise (*Gopherus agassizii*) is found in the Mojave Desert, where the population has been declining and is listed as federally threatened, and the Sonoran Desert, where the population is under study but appears to be more secure. Ongoing threats to the species include livestock grazing, which depletes food sources, and collisions with cars and off-road vehicles; the latter also damages fragile desert vegetation and soils and can collapse burrows where the tortoises spend much of their time.

Desert tortoises can live over 50 years in the wild, and grow to up to 15 inches long. Females do not begin to produce young until they are at least 12 years old, and sometimes not till 20 years old. They lay up to 14 eggs—though few to none in drought years—and then depart, leaving the hatchlings to fend for themselves.



Photo: Jim Rorabaugh/USFWS

Like the pronghorn, tortoises rely on the rich crop of grasses and wildflowers brought by the brief but vital rainy periods. They forage during the spring months (March through June) and early fall (September and October), and spend most the remainder of the year in underground burrows that they dig with the large claws on their front limbs. They hibernate from November to March, and may also enter a period of summer dormancy called “estivation” during particularly hot and dry conditions. Even during their active periods, they retreat to burrows during the hottest and coldest parts of the day.

# Climate Change and the Sonoran Desert Region

While the Sonoran population of desert tortoises is not currently considered to be imperiled, climate change projections indicate difficult times ahead for this species as heat and droughts expand over the region. Like all reptiles, tortoises have minimal ability to self-regulate their internal temperature, and thus must retreat to the shade of vegetation or their burrows once the air temperature reaches above 91°F in order to keep their body temperatures out of the danger zone. Droughts also force the tortoises to spend more time in their underground burrows to minimize water loss; thus both heat and drought decreasing the amount of time they are able to spend feeding. Droughts also limit the availability of nutritious forage for the tortoises.

Females also lay fewer eggs during drought years. Furthermore, the sex of the young turtles is determined by the soil temperature during incubation. Temperatures above 88.7°F produce female tortoises, so prolonged high temperatures could skew the sex distribution of future generations. Extremely high soil temperatures (above 95 degrees) are lethal to the developing young.

## *Cactus ferruginous pygmy-owl*

The cactus ferruginous pygmy-owl (*Glaucidium ridgwayi cadotum*) is a subspecies of the ferruginous pygmy-owl found in the Sonoran desert region of Arizona and in the Mexican states of Sonora and Sinaloa. Like the Sonoran pronghorn, it is critically imperiled; no more than 41 adult birds have been found in Arizona in any recent breeding season. Despite these dangerously low numbers, the U.S. Fish and Wildlife Service removed the cactus ferruginous pygmy-owl from the endangered species list in response to a lawsuit by developers (this decision is being challenged by Defenders).

Not much bigger than a sparrow, the pygmy-owl is distinguished by strong streak marks on its breast and by dark spots on the back of the neck that give it an “eyes in the back of its head” appearance. Mainly active during the day, they forage primarily in riparian zones, perching on the tallest trees available and catching birds, lizards, frogs, small mammals and insects. The owls nest in saguaro cacti or in tree cavities made by woodpeckers.



Photo: Mike Wrigley, U.S. FWS

Major threats to the cactus ferruginous pygmy-owl include loss of habitat to development, agriculture, and grazing, removal of trees from riparian zones, and the spread of invasive species and an increase in fires. One of the most important invasives in the Sonoran desert is buffel grass, which was widely planted as a forage grass. In sharp contrast to the patchy distribution of native vegetation, buffel grass forms a continuous cover, allowing fires to travel across large areas, killing saguaros and other native plant species that are not well adapted to fires. The extended droughts being wrought by climate change are increasing this fire risk and further threatening the cactus ferruginous pygmy-owl.

## *Sonora tiger salamander*

The Sonora tiger salamander (*Ambystoma tigrinum stebbinsi*) is a federally endangered subspecies of tiger salamander that is found only in the southeastern portion of the Sonoran Desert in Arizona and adjacent Mexico. Adult salamanders are terrestrial, but females lay their eggs in pond, and the young develop there, either metamorphosing as the pond dries up, or, in larger ponds, persisting in an aquatic form as an adult. Its natural habitat was the desert springs known as cienagas, found at the foot of the mountains; however, these wetlands have been extensively modified and degraded, and the salamander is now exclusively associated with livestock grazing ponds (some of which are themselves converted cienagas). Fewer than 40 of these ponds are known to support salamanders. Major threats to the salamander include predation by introduced fish and bullfrogs; hybridization with the closely related barred tiger salamander, which is used as live bait and has been released in many areas; disease, particularly viral infection,

# Climate Change and the Sonoran Desert Region

but other diseases like chytrid fungus might also impact the species; and the siltation or drying of the ponds where they are found.



Photo: Arizona Game and Fish Department

Climate change threatens the Sonora tiger salamander primarily through drought. As livestock ponds dry up, breeding habitat is lost. Moving to the large ponds that persist through drought conditions is not an option for the species, because the larger ponds tend to already be occupied by fish and bullfrogs that consume the salamander eggs and larvae, making it impossible to survive there.

## ***Border cats***

Three endangered cat species—the jaguar, jaguarundi, and ocelot—were once residents of the US portion of the Sonoran desert. These cats persist tenuously at the northern edge of their range in the northwestern edge of the Mexican state of Sonora, and continue to be sighted, although rarely, in Arizona. A male jaguar, dubbed “Macho B,” was long known to range into the area, prior to his death in early 2009. There have been sightings and a few instances of physical evidence for the presence of ocelots, as well as a few jaguarundi sightings. As climate change alters their habitats in Mexico, the northern edge of these cats’ range, in the Arizona desert and mountain areas, may become increasingly crucial to their persistence. However, the U.S.-Mexico border wall may prove to be an insurmountable obstacle that prevents these species from migrating northward in response to climate change.

## **References**

Grigione, M.M., K. Menke, C. López-González, R. List, A. Banda, J. Carrera, R. Carrera, A.J. Giordano, J. Morrison, M. Sternberg, R. Thomas and B. Van Pelt. 2009. Identifying potential conservation areas for felids in the USA and Mexico: Integrating reliable knowledge across an international border. *Oryx* 43(1):78-86.

USFWS. 2008. Desert Tortoise Status Report. Available at: [http://www.fws.gov/Nevada/desert\\_tortoise/documents/misc/20080813.Rangewide\\_Status\\_of\\_Desert\\_Tortoise.pdf](http://www.fws.gov/Nevada/desert_tortoise/documents/misc/20080813.Rangewide_Status_of_Desert_Tortoise.pdf)

USFWS. 2009. Draft Environmental Assessment for Reestablishment of Sonoran Pronghorn. Available at: [http://www.fws.gov/southwest/es/arizona/Documents/SpeciesDocs/SonoranPronghorn/SonoranPronghorn\\_dEA\\_2010.pdf](http://www.fws.gov/southwest/es/arizona/Documents/SpeciesDocs/SonoranPronghorn/SonoranPronghorn_dEA_2010.pdf)

USFWS. 2007. Sonora Tiger Salamander, Five Year Review. Available at: [http://ecos.fws.gov/docs/five\\_year\\_review/doc1154.pdf](http://ecos.fws.gov/docs/five_year_review/doc1154.pdf)

USFWS. 2002. Sonora Tiger Salamander, Recovery Plan. Available at: [http://ecos.fws.gov/docs/recovery\\_plan/020924.pdf](http://ecos.fws.gov/docs/recovery_plan/020924.pdf)

U.S. Global Change Research Program. 2009. Global Climate Change Impacts in the U.S. Available at: <http://www.globalchange.gov/publications/reports>