

## Desert Biodiversity in the Sonoran region

from Biodiversity: The Variety of Life that Sustains Our Own

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[https://www.desertmuseum.org/books/nhsd\\_biodiversity.php](https://www.desertmuseum.org/books/nhsd_biodiversity.php)

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As one spends more time in a range of Sonoran Desert habitats, one is constantly surprised by how many plants and animals are harbored here.

Travel out of Sonoran Desert vegetation into the higher mountain ranges held within the region and even more astonishing levels of biodiversity can be found. In fact, the "sky islands" of southeastern Arizona and adjacent Sonora are now recognized by the International Union for the Conservation of Nature as one of the great centers of plant diversity north of the tropics.

When we compare our desert with others, the contrast is striking. Overall, the Sonoran Desert has the greatest diversity of plant growth forms - architectural strategies for dealing with heat and drought - of any desert in the world. From giant cacti to sand-loving underground root parasites, some seventeen different growth forms coexist within the region. Often, as many as ten complementary architectural strategies will be found together, allowing many life forms to coexist in the same patch of desert.

Biodiversity in the desert is often measured on a scale that would not be used in the tropical rainforest. Desert ecologists have found twenty kinds of wildflowers growing together in a single square yard (.84 m<sup>2</sup>), while a single tropical tree might take up the same amount of space. On an acre (.4 ha) of cactus forest in the Tucson Basin, seventy-five to 100 species of native plants share the space that three mangrove shrubs might cover in swamp along a tropical coast. These levels of diversity are a far cry from the "bleak and barren" stereotype, and it may well be that the Sonoran Desert region is more diverse than other arid zones of comparable size.

Consider for example, the flora of the Tucson Mountains, which Arizona-Sonora Desert Museum research scientists recently inventoried with a number of their colleagues. In an area of less than forty square miles (100 km<sup>2</sup>), this botany team encountered over 630 plant species - as rich a local assortment of plants as any desert flora we know. This small area contains roughly one-sixth of the Sonoran Desert's entire plant diversity. It is disproportionately rich relative to its size, its paucity of surface water, and its elevational range.

Such a diversity of wildflowers and blossoming trees attracts a diversity of wildlife as well. In the Sonoran Desert area within a thirty mile radius of Tucson, you can find between 1000 and 1200 twig- and ground-nesting native bees (all of them virtually "stingless"). As the Desert

Museum's research associate Stephen Buchmann wryly notes, "this may mean that the Sonoran Desert region is the richest bee real estate anywhere in the world - the entire North American continent has only 5000 native bee species."

Desert wildflowers attract more than bees. Southern Arizona receives visits from more hummingbird species - seventeen in all - than anywhere else in the U.S. Other pollinator groups, such as butterflies and moths, are well represented in the region as well. Single canyons near the Arizona-Sonora border may harbor as many as 100 to 120 butterfly species, and moth species may number five to ten times higher than that in the same habitats. When all pollinating organisms breeding or passing through here are counted, it may be that the greater Sonoran Desert has as large a pollinator fauna as any bioregion in the world.

This region is also rich in small mammals and reptiles. Some eighty-six species of mammals have ranges centered within the San Pedro National Riparian Area alone, a record unsurpassed by any natural landscape of comparable size in the U.S.; the area contains half of all mammal species in the binational Sonoran Desert. At least ninety-six species of reptiles are endemic to the Sonoran Desert - found here and nowhere else in the world.

Why is such diversity present in a land of little rain? For starters, our bimodal rainfall pattern brings out completely different suites of wild-flowers and their attendant insects at different times of the year. In addition, we benefit from a more gradual transition between tropical nature and desert nature than does the Chihuahuan Desert on the other side of the Sierra Madre - many tropically-derived life forms reach their northernmost limits in the Sonoran Desert due to its relatively frost-free climes. Of course, tropic rainforests are much more diverse in the total number of species they have throughout their biome, in part because of their ages and their high energy budgets. However, there may be more turnover in species from place to place in the Sonoran Desert than in some tropical vegetation types. That is to say, many desert plants and insects are "micro-areal" - occurring only within 100 by 100 mile spots on the map. Particularly in Baja California, there are extremely high levels of endemism, including some 552 plants unique to the peninsula.

Nevertheless, it remains true that the highest levels of local diversity in this desert region occur where water accumulates. Some of the highest breeding bird densities recorded anywhere in the world come from riparian forests along the Verde and San Pedro river floodplains. More than 450 kinds of birds have historically nested or migrated along the Colorado, San Pedro, and Santa Cruz rivers. And yet, if riparian habitats were among our richest, what have we lost with the removal of cottonwoods from ninety percent of their former habitat in Arizona? Ornithologists cannot name a single Sonoran Desert bird that has gone extinct with riparian habitat loss, but many of the eighty species of birds dependent on these riparian forests have locally declined in abundance. A single desert riparian mammal - Merriam's mesquite mouse - is now extinct due to the loss of riparian habitat at the hand of groundwater pumping, arroyo cutting, and overgrazing. Mexican wolves and black bears that formerly frequented our river valleys are among those mammals no longer found in the Sonoran Desert proper.

Conservation International has estimated that as much as sixty percent of the entire Sonoran Desert surface is no longer covered with native vegetation but is dominated by the 380-some alien species introduced to the region by humans and their livestock. Alien plants such as buffelgrass now cover more than 1,400,000 acres of the region, at the expense of both native plants and animals. Tamarisk trees choke out native willow and cottonwood seedlings. Invasive weeds such as Johnson grass and Sahara mustard have taken over much of certain wildlife sanctuaries and parks in the desert, outcompeting rare native species. Other invasive species such as Africanized bees and cowbirds also compete with the native fauna. Biological invasions are now rated among the top ten threats to the integrity of Sonoran Desert ecosystems, whereas a half century ago they hardly concerned ecologists working in the region. These invaders somehow reach even the most remote stretches of the desert, to the point of being ubiquitous.

The wholesale replacement of natives by aliens is enough of a problem, but desert biodiversity has been even more profoundly affected by habitat fragmentation - the fracturing of large tracts of desert into pieces so small that they cannot sustain the interactions among plant, pollinator, and seed disperser. Such fragmentation does not necessarily lead to immediate extinctions, just declines - there is a time lag before a species' loss of interactions with others leads to complete reproductive failure. Fragmentation caused by urbanization is now considered the number-one threat to the biodiversity of the region and is not expected to diminish during our lifetimes. The population of Arizona's Maricopa County in the year 2025 is expected to be two and a half times what it was in 1995, and similar growth rates are anticipated along the entire desert coastline of the Sea of Cortez.

In a sense, humans are making the Sonoran Desert much more like the old (and erroneous) stereotype of a barren wasteland. As more than forty dams were constructed along rivers in this century, old-timers witnessed hundreds of miles of riparian corridors dry up. Groundwater overdraft has also impoverished desert and riparian vegetation, as farms and cities pump millions more acre-feet out of the ground than rainfall in the region can naturally recharge. The roots of plants are left high and dry above the water table. Most of the Sonoran Desert was not at all naturally barren, but our misunderstandings have impoverished one of the richest arid landscapes on the planet.