

Cricket

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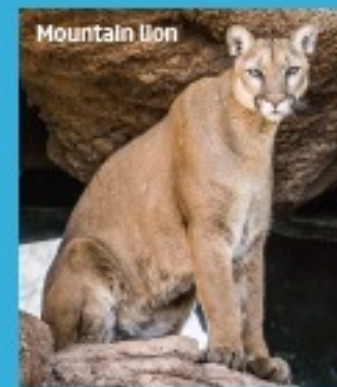
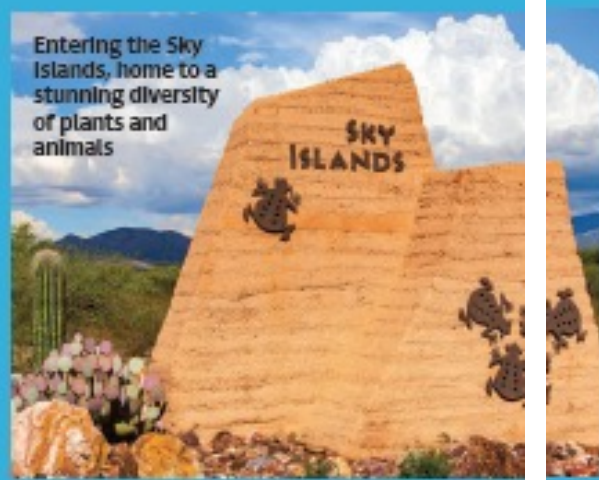
**Spellbinding
ISLANDS**



Islands in the Sky

by Charles C. Hofer

In Western North America, two massive mountain ranges dominate the region. To the north are the Rocky Mountains that extend from Alaska to New Mexico. To the south are the Sierra Madre Occidental, a towering range that makes up the backbone of Mexico. Connecting these two different worlds is a scattered network of small mountain peaks that rise from vast oceans of desert and grasslands. These are the Sky Islands, one of the most biodiverse regions on the planet.



Mountain lion



Jaguar



Mount Lemmon, which some call Frog Mountain, reaches about 9,160 feet (2,790 m). The habitats at the summit are often about 20 degrees cooler than those at the base.



White-nosed coati



Gila monster



Desert bighorn sheep



Thick-billed parrot



Harris's hawk



Rufous hummingbird



A flowering yellow prickly pear cactus



Gray hawk



A male wild turkey



Black-tailed rattlesnake



Ridge-nosed rattlesnake

Spanning southern Arizona and northern Mexico, the Sky Islands are home to 450 bird species—nearly half of North America's bird species—along with more than 3,500 species of plants. More than 100 species of reptiles and amphibians and a similar number of species of mammals live in the Sky Islands. These mountains are also a global hotspot for bee and ant diversity.

The Sky Islands are important for more than their stunning biodiversity. These isolated mountains are also a living laboratory for scientists. The Sky Islands are helping scientists understand how plants and animals will adapt to climate change—and how we can help.

Two Worlds

The Sky Islands region is a biodiversity hotspot because it connects the cooler

temperate ecosystems of North America to the lush subtropical ecosystems of Central America. The result is a mesmerizing blend of plant and animal life. Here in the Sky Islands, mountain lions and bobcats from the Rocky Mountains live alongside jaguars and ocelots from the jungle. Gila monsters, rattlesnakes, and pronghorn of the desert lowlands live near bighorn sheep, black bears, and peregrine falcons from the cooler mountain peaks.

The Sky Islands are also home to "biome stacking," where different habitats are stacked vertically on top of each other moving up a mountain slope. Near the mountain base are sprawling deserts and grasslands where temperatures can soar to 120 degrees Fahrenheit (49 degrees C) during the

summer months. Going upslope, the temperatures gradually drop, leading to chaparral and oak woodlands. At the highest elevations sit conifer forests and tundra in the cold mountain peaks. With some Sky Islands reaching 10,000 feet (3,048 m) above sea level, a single mountain can be home to eight different biomes. It's like traveling from hot, arid Mexico to cold, rainy Canada in a little over a mile (1.5 km).

Climate change is transforming the Sky Islands, though. A warming climate is leading to rapid ecosystem changes, or conversion. As a result, the Sky Island ecosystems are creeping upwards: Deserts are overtaking grassland areas. Shrubs are encroaching into woodlands and the delicate conifer forests on top of the mountains are shrinking and

disappearing altogether. These rapid changes are telling scientists how—and if—plants and animals will adapt to a warming climate.

A Changing World

Ecosystems are always changing, of course. What's troubling in the Sky Islands today, however, is the rate at which this change is happening. A rapidly warming climate is increasing how quickly ecosystems are shifting.

On a Sky Island mountaintop high above the city of Tucson, Arizona, Damian Rawoot is tracking changes to high-elevation conifer habitats. He is an ecologist at The Nature Conservancy, where he works to protect the Sky Island ecosystems. He's seeing firsthand the changes to the region and how it affects wildlife.

"When ecosystems experience rapid changes or conversion, only the most mobile organisms have the ability to react fast enough to move to new suitable habitats," says Rawoot.

This accelerated rate of change is exceeding the "adaptive capacity" of many Sky Island plants and animals. This occurs when ecosystems change too quickly for plants and animals to adjust. They don't have enough time to move to more suitable habitats or adapt to the new conditions. The result can be local extinctions, where entire populations of plants or animals just blink out.

And things may be getting worse. Scientists predict that the desert southwest, and the Sky Islands in particular, may see greater change

than anywhere else on the continent. Temperatures may rise 4 to 10 degrees Fahrenheit (2 to 6 degrees C) by 2100. For the plants and animals of the Sky Islands, time is running out. Some will be able to adapt, to move to cooler habitats up the mountain. Others will not. They'll simply vanish.

These sudden changes will be most difficult for *endemic species*—plants and animals that are found in only one specific area. The Sky Islands are home to dozens of endemics, such as the New Mexico ridge-nosed rattlesnake, Mt. Graham red squirrel, and thick-billed parrot. If their high-elevation habitats disappear, so too will these animals. For these and many other Sky Island endemics, there is nowhere else to run—or fly or slither or swim.



Drought and wildfires, driven by climate change, are altering the landscapes of the Sky Islands. These conditions are forcing animals and plants to adapt quickly to survive.



Burned Out

Climate change is speeding up ecosystem conversion in the Sky Islands by altering the natural cycle of death and rebirth. And we're not helping. For more than a century, humans have practiced widespread fire suppression in the American West, basically eliminating small, natural fires from the landscape. As a result, mountain forests grew older and denser, building up potential fuel materials for fires. Today, we're seeing the results of a century of fire suppression. Wildfires in the Southwest have increased in size, frequency, and intensity.

Complicating matters for trees and plants are droughts, diseases, and insect infestations—which are all worsening with the warming climate. And when they die, trees and plants become fuel for devastating wildfires.

Fire was once a rejuvenator of habitats in the Sky Islands. This natural process burned away old plants and trees and allowed new, healthy generations to take their place. Today, wildfire is playing a new role in the Sky Islands. Instead of rejuvenating ecosystems, fire is now a mechanism that converts ecosystems.

It doesn't take much to find the effects of wildfire. Burn scars are scattered throughout the Sky Islands. In the charred landscapes, fast-growing shrubs and grasses now grow, soon to replace the slow-growing ponderosa pine that was burned away.

"Unfortunately, a century of

fire suppression caused our Sky Island forests and grasslands to become overgrown," says Rawoot. "[This] has contributed to larger, more catastrophic fires that result in ecosystem change, instead of maintaining the ecosystem that has evolved and adapted to the unique conditions in this area."

Connecting Habitats

Habitat loss is perhaps the single greatest threat to species worldwide. Climate change will only make this worse through rapid ecosystem conversion. Protecting larger areas of the landscape will help species adapt. Larger protected areas typically contain a greater diversity of habitats. And more diverse landscapes make it easier for plants and animals to adapt to changing conditions.

Habitat connectivity will also determine if animals can adapt. When human barriers such as fences, roads, and cities crisscross a habitat, connectivity drops. Climate change and habitat shrinkage are causing the landscapes of the Sky Islands to lose vital connections.

Animals need to move to find resources like food and water and mates. Increasing habitat connectivity allows plants and animals to find each other or to move to areas where conditions are more suitable. This movement can happen as long as there are safe pathways through the landscape. To create better pathways,

people can remove barriers like fences and build wildlife crossings over and under roadways.

More Resilient Landscapes

For places like the Sky Islands, it might be too late to turn back the tide of climate change. We can reduce the impacts of these changes, though. We can help build more resilient landscapes that allow plants and animals to adapt to changing environments. Restoring natural fire regimes, protecting larger areas, and reconnecting landscapes are a few strategies that will help preserve biodiversity and ensure healthy habitats. Making all of these changes won't be easy. Land managers, scientists, ranchers, and other citizens will need to work together to protect Sky Islands landscapes, Rawoot says.

Unfortunately, the plants and animals of the Sky Islands aren't the only ones under threat from climate change. From the Rocky Mountains to the Southern Andes, high-elevation species are feeling the heat. We might not be able to reverse climate change, but we can help prepare ecosystems for a new world. Creating more resilient landscapes will help give species the chance they need to survive.

Charles C. Hofer is a wildlife biologist and writer living in Tucson, Arizona, in the heart of the Sky Islands. When not stuck at a desk for work, he enjoys photographing the amazing plants and animals of the region.