



Organ Pipe Cactus and the Ajo Range, Organ Pipe Cactus National Monument, Arizona © Carr Clifton/Minden Pictures

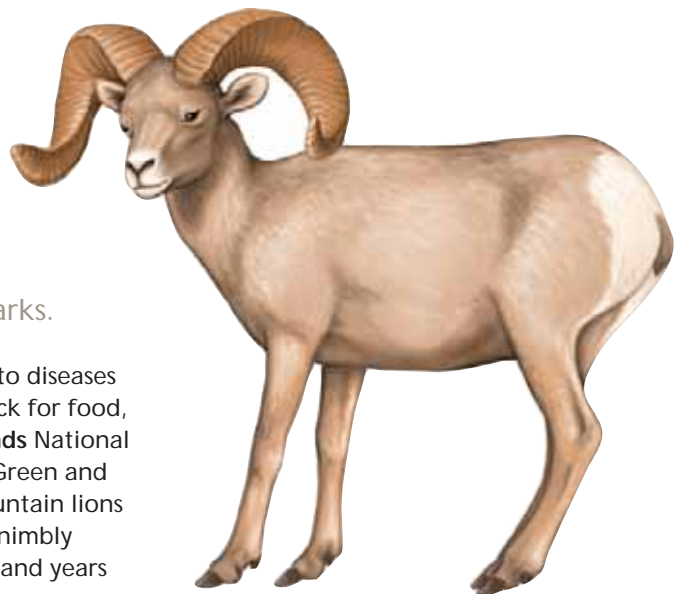
Though Canyonlands' bighorns are well adapted to endure harsh conditions, Canyonlands' arid climate offers little cushion for bad years.

Bighorn Sheep

in the Southwest

Canyonlands National Park is one of the most rugged national parks, with a harsh summer sun that bakes the dry, canyon-riddled landscape. But those deep canyons' steep rocky slopes, which offer ample grasses and shrubs, and an openness that puts predators at a disadvantage, are an optimal environment for bighorn sheep. In fact, Canyonlands' bighorn population has been so stable that Utah's wildlife biologists long relied on it for stock to re-establish herds elsewhere in the state. Bighorn sheep range throughout the southwestern U.S. and are found in nearby **Arches** and **Capitol Reef** national parks.

Though they were once feared to be headed toward extinction due to diseases introduced by domesticated livestock, from competition with livestock for food, and hunting, today more than 300 desert bighorns live in **Canyonlands** National Park. They clatter about talus slopes in remote side canyons off the Green and Colorado Rivers, managing for the most part to avoid the park's mountain lions and coyotes. But there are other threats that bighorns might not so nimbly escape: drought, hot summers that jeopardize the survival of lambs, and years



Helping Bighorn Sheep Regain a Foothold

Big Bend National Park is a partner with Texas Parks and Wildlife Department, the Texas Bighorn Society, and Mexican wildlife managers in an international Desert Bighorn recovery program. Native to the area, bighorn sheep were wiped out of the Trans-Pecos and Northern Chihuahua/Coahuila by the mid-20th century by domestic livestock diseases and hunting. Over the past 20 years, bighorn sheep have been introduced into several sites, including Big Bend's Deadhorse Mountains, the State of Texas' adjacent Black Gap Wildlife Management Area, and Mexico's Sierra del Carmen range. While still small, the populations are slowly increasing. Desert bighorn sheep depend upon sparsely vegetated desert mountain terrain, and the few water sources scattered throughout the habitat. Climate change threatens the persistence of water sources bighorn sheep depend upon, but it's not certain which areas will be most impacted, and it's likely that impacts will shift over time. Helping sheep regain a foothold in strategic places throughout their historic range could increase their chances of survival in the face of climate change uncertainties.



with poor vegetation. As a result, relatively subtle, long-term changes in the park's climate that increase those conditions could disrupt the bighorns' habitat, food sources and reproduction enough to jeopardize their future.

Perched on the Colorado Plateau of southeastern Utah, **Canyonlands** National Park encompasses 527 square miles of demanding landscape. Temperatures on hot summer days can rise to 100 degrees Fahrenheit and beyond, while temperatures on cold, wind-whipped winter days and nights can plummet to zero degrees Fahrenheit. Though the park's bighorns are well adapted to endure these conditions, Canyonlands' arid climate offers little cushion for bad

years. The park's relatively high elevation offers a shorter growing season than lower areas such as the Mojave Desert in California. As a result, how and when precipitation arrives is critically important to the bighorns.

In canyon country, water is vital to life. **Canyonlands** National Park's bighorns have adapted to the 8 inches or so of moisture that fall on the park each year. The park's two rivers are ever-flowing sources of water, while "potholes" — natural bowls in sandstone that capture rain — provide another source of water for the sheep. Moisture also is critical for the vegetation that nourishes the bighorns, particularly during the ewes' gestation and birthing periods. Changes in precipitation patterns — even relatively

minor ones — affect the bighorns' reproductive success. Proof of this relationship stands out when reviewing the park's long-term bighorn population data. Between 1976 and 1998 the park's ewes produced, on average, 44 lambs per 100 ewes each year. But during the dry year of 1984, only 15 lambs per 100 ewes were spotted, while the wet year of 1982 was notably bountiful, producing 77 lambs per 100 ewes.

Fortunately, ewes are capable of slightly altering their breeding timetables to coincide with weather conditions that produce the most nutritious forage during the last stage of gestation and on through the weaning of lambs. But sometimes conditions are beyond their adaptation.

Cold, late winters can produce a ground so frozen that spring rains don't adequately soak in to fully nourish vegetation. Droughts, late springs that are unusually wet and cold, and unusually hot springs that affect the nutritional value of forage also can adversely affect population growth. Beyond those immediate conditions, studies have shown that forage conditions two years *before* a ewe becomes pregnant can impact her productivity by depriving her of needed nutrition.

Since ewes in Canyonlands typically give birth in April and May, and since the moisture content in the park's soils usually begins to dwindle in April, a change in climate that results in fewer or less potent winter storms or hotter May weather could jeopardize the bighorns by depriving them of nutritious vegetation when they most need it.

An overall climate change that produces higher temperatures and lower precipitation in general, as is forecast for much of the West, also poses a threat to other bighorn sheep habitat in mountain ranges. During the 20th century, a noted rise in temperature that coincided with a drop in precipitation led to the extinction of 26 bighorn sheep populations in California.

SOLUTIONS

In light of these threats, providing and protecting undeveloped land between existing bighorn habitats will help bighorns cope with the impacts of climate change. Land managers will need to create safe ways for bighorns to cross barriers, such as highways, to access those areas. Finally, bighorn sheep transplant programs should consider potential climate change impacts when deciding where the sheep are introduced and how many the main herd can stand to lose.

We Can Safeguard Bighorn Sheep from Climate Change

Stop contributing to climate change

Bighorn sheep could decline if we fail to reduce carbon dioxide pollution and global warming that is altering precipitation patterns and increasing drought in the Southwest.

Give bighorn sheep freedom to roam

Bighorn sheep need to roam freely so they can access food and water in new areas if changing precipitation patterns and rising heat make food and water scarce in their traditional habitat.

Adopt "climate smart" management practices

By coordinating bighorn sheep reintroduction efforts, identifying potential shifts in migration corridors, and working to keep these corridors open, resource managers from national parks, forests, wildlife refuges, and state conservation areas can help bighorn sheep overcome some of the climate challenges they face.

