



A desert bighorn sheep ram captured in October 2023 and fit with a GPS collar and ear tags. This was one of 219 GPS-collared sheep studied in this project. The data set spans from 2010 to 2024 and includes multiple different capture events.

Carving Out A Niche For Desert Bighorn Sheep In Aoudad-occupied Landscapes

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Desert bighorn sheep are a unique species adapted to survive the harsh conditions of desert mountain ecosystems. The Trans-Pecos region of Texas was historically home to over 1,500 desert bighorn sheep before settlement. However, due to a combination of overhunting, habitat loss and disease, those numbers dwindled to zero by the early 1960s. Reintroduction and subsequent restoration efforts in the region were a success, with populations once again reaching 1,500 individuals by 2015. However, in recent years, managers have observed significant population declines, with only 500 to 600 individuals counted in 2024.

There are several management challenges facing West Texas desert bighorn sheep populations. The main complication is the recent outbreaks of a pathogenic respiratory bacteria called *Mycoplasma ovipneumoniae* (*M. ovi*), which causes die offs in all age groups of desert bighorn sheep populations, followed by years of low recruitment. Biologists documented the first outbreak of *M. ovi* in Texas desert bighorn sheep in 2019 and now consider pneumonia the leading cause of decline in several of the region's herds. But *M. ovi* is not the only challenge facing these sheep.

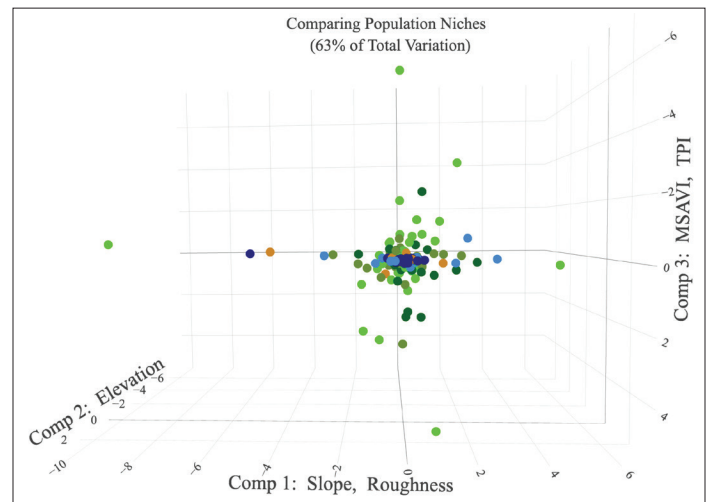
West Texas is also host to invasive aoudad, an ungulate first introduced to the United States as a game species in 1924. Aoudad are native to northern Africa, a region featuring a dry climate and rugged topography. A robust and adaptable species, aoudad populations have established in Europe and various areas of the United States, where their high population growth rates have enabled them to expand rapidly. Along with high birth rates, aoudad overlap heavily with native ungulates in habitat requirements and utilize many of the same plant species as desert bighorn sheep. Unfortunately, aoudad also carry and transmit *M. ovi*, but appear to escape the devastating effects suffered by infected desert bighorn sheep herds. These characteristics suggest that aoudad are likely to be a superior competitor to desert bighorn sheep.

To better understand competition between the species, we investigated the range of ways that aoudad, mule deer and desert bighorn sheep in the Trans-Pecos use resources, which scientists refer to as the species' niche. We found a high degree of niche overlap between desert bighorn sheep and aoudad, which indicates a concerning potential for competition. However, we also found some encouraging results that suggest, despite being habitat specialists with narrow niches, desert bighorn sheep may be able to cope with competition to at least a limited degree.

Using data from 219 GPS-collared desert bighorn sheep from four different Trans-Pecos populations, we found evidence of niche plasticity in desert bighorn sheep. This is important because most habitat specialists' niches are not very flexible, making them more sensitive to competition. The fact that desert bighorn sheep populations exhibit niche differences under different environmental conditions is promising because it indicates a degree of niche plasticity, which could help the species successfully compensate for competition with aoudad by shifting their niche and using the landscape differently than they would otherwise prefer.

However, the degree of niche plasticity in desert bighorn sheep has its limits. As individuals made more extreme tradeoffs in habitat use, moving them closer to the limits of

the desert bighorn sheep niche, they were more vulnerable to mortality. The extremity of this effect varied considerably by population. In some populations, survival probability plummeted quickly as individuals made progressively more extreme choices in habitat use, but in other populations, the effect was less pronounced. This disparity was tied to habitat quality, and populations in drier, less productive habitat had lower niche plasticity, while those in higher quality habitats had more freedom to shift their niche before their survival rates were severely impacted.



A graphic illustrating niche variation among four Trans-Pecos desert bighorn sheep populations. Each dot represents an individual sheep, color represents the population it belongs to, and color shades indicate different years.

These results are encouraging because they indicate that desert bighorn sheep have some (if limited) capacity to cope with competitive pressures from aoudad that occupy their habitats. Aoudad are here to stay in the Trans-Pecos, so that capacity is vital to bighorn persistence in the mountains of West Texas. However, it is important to remember that niche plasticity is finite and desert bighorn sheep survival suffers if an individual shifts too far. Annual survival among adult aoudad averages 94%, and human harvest accounts for the overwhelming majority of mortality. Combined with high reproductive output, this leads to rapid aoudad population growth and increased competition. Thus, aoudad populations require sustained, intensive management to mitigate competition where they coexist with desert bighorn sheep. This is particularly true in the drier parts of the desert bighorn sheep's historic range, where they have less flexibility in how they cope with competitive pressure. While this is a qualified "win" on the competition front, *M. ovi* still represents an existential threat to desert bighorn persistence in an aoudad-occupied landscape. While there are no clear management solutions yet, we continue to investigate the efficacy of aoudad population management at reducing both competition and disease risk. 🌟