

# **The ecology and history of livestock and wildlife grazing in and around Grand Canyon National Park**

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## **Introduction**

On the Colorado Plateau and in the Grand Canyon, mammalian grazers impact ecosystems by altering vegetation composition, water quality, and soil quality. The Grand Canyon is home to both native and domesticated grazers including the native Mule Deer (*Odocoileus hemionus*) and the Desert Bighorn Sheep (*Ovis canadensis*), as well as cattle, sheep, goats, horses, and bison. Today, livestock grazing in the Grand Canyon itself has ceased, but its legacy remains. In addition, much of the surrounding area is still maintained as rangelands. The Grand Canyon ecosystem is held and maintained by a diverse set of stakeholders ranging from state and federal agencies to Native American communities to private landowners and conservation organizations. These stakeholders often disagree about how to manage native and domesticated grazers. This paper explores the ecological impacts of livestock and wildlife in and around the canyon, as well as the influence and impact of a few key grazing management strategies.

## **Ecological impacts of livestock**

In general, livestock grazing is often linked to environmental degradation, water shortages, and forage scarcity (Beck and Peek, 2005; Namgail et al., 2007; Voeten and Prins, 1999). Livestock grazing also presents a number of threats to wildlife. Livestock grazing can increase competition with wildlife for food and water (Beck and Peek, 2005). Moreover, livestock grazing can decrease nutrient availability in soil (Hiernaux et al., 1999). In the Grand Canyon, grazing has been shown to reduce soil crusts (Anderson et al., 1982).

Competition between wild herbivores and livestock is likely context-dependent. For example, in one grassland system in Kenya, wild herbivores and cattle compete for food during the dry season when resources are scarce, but facilitate each other's diet quality during the wet season when resources are high (Odadi et al., 2011). However, the effects of livestock need not even be negative. In some cases, livestock may provide unexpected benefits to an ecosystem by promoting seed dispersal (Brown and Archer, 1988) and increasing plant diversity (Hickman et al., 2004).

## **Livestock grazing in the Canyon: A Brief History**

Even though grazing may have both positive and negative effects on ecosystem health, the legacy of livestock grazing around the Grand Canyon is largely negative. This is likely due to widespread overgrazing at the end of the 1800s century and the beginning of the 1900s.

The Spanish brought livestock to the Colorado Plateau as early as the 1500s, but livestock grazing was not important in this area until the late 1800s. The arrival of railroads to the Colorado plateau also meant the arrival of hundreds of thousands of sheep and cattle (Abruzzi, 1995). Although estimates of the exact number of sheep and cattle in and around the Grand Canyon at the end of the 1800s vary, it is largely agreed that stocking rates were much too high. For example, in 1881 alone, 20,000 head of cattle and 22,000

arrived to the Colorado Plateau via railroad (Abruzzi, 1995) Grazing on the Colorado Plateau was believed to be approximately 2-3 times carrying capacity (Abruzzi, 1995).

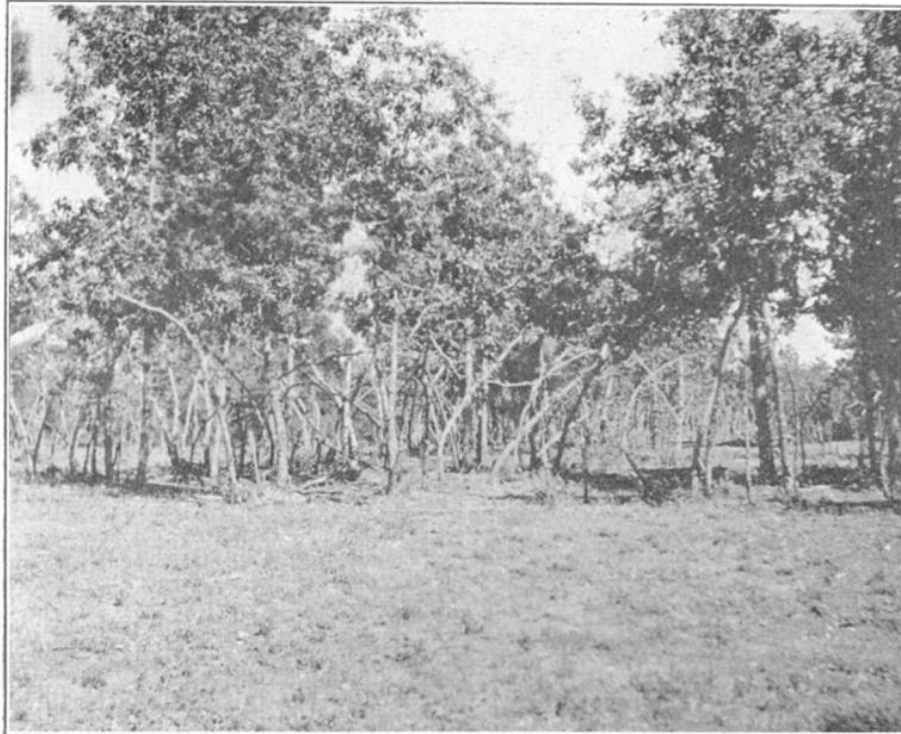
This overstocking likely had negative effects on vegetation, soil, and fire patterns in the region. In the adjacent Little Colorado Basin, also subject to extensive overgrazing, range quality deteriorated throughout the late 1800s. This deterioration is still arguably visible today, with ranges only supporting 1/2 to 1/3 the number of animals as before the arrival of large sheep and cattle herds (Abruzzi, 1995). Overstocking led to severe erosion and halted the regeneration of Ponderosa pine forests on the adjacent Kaibab Plateau (Battaglia and Shepperd, 2007). In 1906, President Theodore Roosevelt established the Grand Canyon Game Preserve. This designation as a game preserve restricted grazing in the Grand Canyon, although it was still legal. Grazing continued in the Grand Canyon until 1919, when the area was designated as a national park. However, the effects of grazing were still seen years after the Grand Canyon became a national park. For example, Adams (1925) documented the effects of grazing on vegetation in the Grand Canyon (Fig. 1). He noted that the grazing around the Grand Canyon was so severe it was still hard years later to tell apart areas that were grazed and ungrazed.

Further grazing regulation to the Grand Canyon was established with the passage of the Taylor Grazing Act of 1934. This act increased the regulation of grazing on federal lands. In short, the days of overgrazing livestock in the Grand Canyon were largely over by the 1930s (Sellars, 2009). In addition, surrounding federal lands also became more regulated. Today, the area surrounding the Grand Canyon is a patchwork of different agencies and stakeholders (Fig. 2). Land is owned and operated by state and federal agencies, Native American nations, non-profits, and private stakeholders.

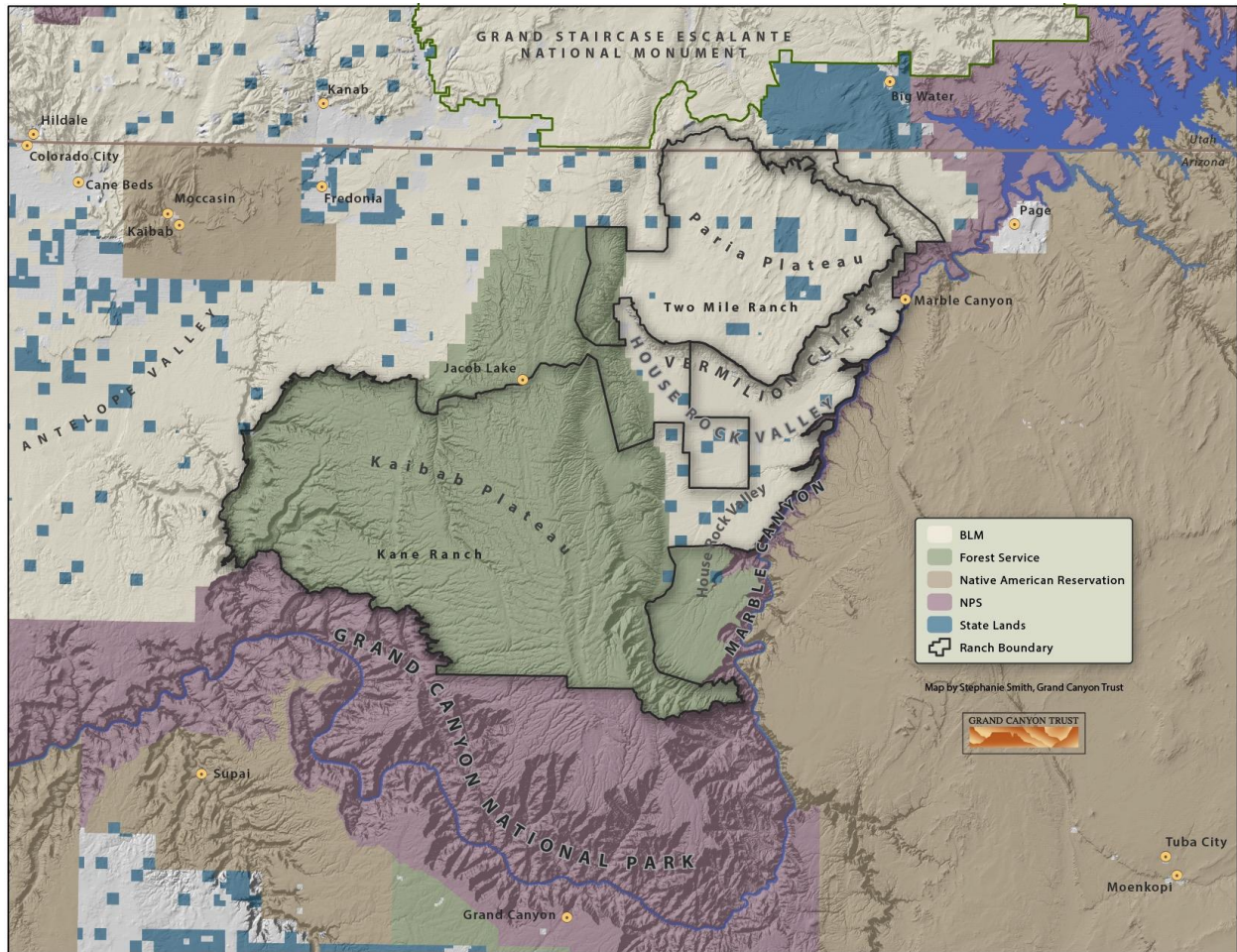
Grazing is still allowed in some areas around the Grand Canyon, including on some federal and state properties, private areas, and on Native American reservations. However, management varies. For example, management of grazing on reservations is largely the jurisdiction of the Bureau of Indian Affairs (BIA).

One important stakeholder in this region is the Grand Canyon Trust. This conservation organization works with stakeholders in the region to regulate grazing. The Grand Canyon Trust has been buying up grazing permits in the region with the intention of retiring them permanently (Matt Williamson, pers. comm.). However, in some areas, such as the North Rim of the Grand Canyon, the Grand Canyon Trust still maintains small herds of cattle. These cattle are mostly housed in two ranches, Kane Ranch and Two Mile Ranch. Together, these ranches cover approximately 850,000 acres. Williamson estimates that stocking rates on these ranches are very low. At present, there are only 540 cattle across the two ranches. Williamson estimates that this is around 1/4 the carrying capacity of cattle in this region.

It should be noted that the buying and retiring of permits has been extremely controversial. As Williamson explained, ranchers see these permit retirements as an insult to their livelihoods. To date, the effects of the retirement of grazing permits and overall reduction of livestock grazing are still largely unquantified.



**Fig. 1:** Images taken by Charles Adams in Grand Canyon National Park in 1925 showed the effects of overgrazing on vegetation. Both grasses and woody species in the park were highly browsed. *From Adams, 1925.*



**Fig. 2:** The area around Grand Canyon National Park is a patchwork of different management types. The stakeholders in this region include the Forest Service (green), BLM (white), Native Americans (tan), the National Park Service (purple), and the state of Arizona (blue). In addition, non-profit groups like the Grand Canyon Trust manage and own land including Kane Ranch and Two Mile Ranch (outlined in black). These groups manage wildlife and livestock grazing in contrasting ways. *Map by Stephanie Smith, Grand Canyon Trust.*

### **Other grazer management practices around the Grand Canyon**

The effects of grazers in and around the Grand Canyon have largely been a reflection of their stakeholders and managers. For example, before the establishment of federally protected land in this area, private stakeholders grazed as many cattle and sheep possible to draw the largest profit. In contrast, contemporary groups such as the Grand Canyon Trust try to minimize the impacts of cattle by grazing them at much lower densities than historical levels. Management decisions in this region have also impacted native species

such as the Mule Deer. Here, I use two examples to show how ecosystem management has altered grazer abundance in the Grand Canyon in the last century.

### **Predator Control**

As Richard Sellars notes in his book Preserving Nature in the National Parks (2009), park rangers long had a policy to remove predators from national parks. This was a widely used technique to promote more “desirable” species, as well as to promote more pastoral, peaceful landscapes. Men such as “Uncle Jimmy” Owens (Fig. 3) shot hundreds of wolves, mountain lions, coyotes, and wolves. Even President Theodore Roosevelt participated in lion hunts in the Grand Canyon.

Unfortunately, these policies likely had negative cascading effects on the grazing communities. Following the extirpation of most predators from around Grand Canyon, native grazer populations soared. In the Kaibab National Forest, for example, deer populations irrupted in the 1920s (Sellers and Despain, 1976). In areas where only 4,000 deer used to be present, scientists such as Aldo Leopold estimated that there were now 30,000 (Leopold et al., 1947). This rapid deer population growth devastated plant communities. In turn, after vegetative cover plummeted, deer without food starved in vast numbers (Binkley et al., 2006).

These deer population explosions were largely thought to be caused by a predator release following the extermination of most large predators. More recently, some scientists have pointed out that a reduction in cattle around this same time may have also decreased competition and led to the increase in deer populations (Binkley et al., 2006). Regardless of the exact reason for the sudden and dramatic increase in deer in this region, human management likely played a large role.



**Fig. 3:** Hunters like “Uncle Jimmy” Owens (left) kept predator populations at low densities in Grand Canyon in the early 1900s. Owens claims to have killed 500 mountain lions in the Grand Canyon over a twelve-year period starting in 1906. Theodore Roosevelt (right photo, center) was a participant in these hunts for predators. Their systematic extermination of predators increased grazing pressure from native browsers and led to widespread

degradation of vegetation in and around the Grand Canyon. *Left photo by Art Brown, right photo by Nicholas Roosevelt. Both photos from (Aitchison, 1996).*

### **Buffalo in Grand Canyon National Park**

In 2014, there were many news reports on the presence of a herd of buffalo inside Grand Canyon National Park. According to an article published by Science Daily (2015), buffalo are likely not native to the Grand Canyon, but have lived around the canyon for over a century. In 1906, Charles “Buffalo” Jones brought a herd of buffalo to Northern Arizona to create a hardier cattle. However, the buffalo did not succeed and were released. For years, the buffalo remained largely on the Kaibab Plateau. In recent years, however, buffalo have moved into the Grand Canyon National Park, where they are less likely to be shot. Today, there are nearly 600 buffalo in the park (pers. comm., Matt Williamson). Buffalo wreak havoc on plant life. In addition, their wallowing in water holes is fouling water sources for other species.

Buffalo present a challenging management question to various stakeholders. What should we do with the buffalo? Who should be in charge? The answers are not immediately apparent. One problem with questions like these is that multiple groups are involved in the management of buffalo. When buffalo are on the Grand Canyon National Park, they are under the jurisdiction of the Parks Service and cannot be shot. In contrast, when buffalo are outside of the park, Arizona Game and Fish manage them. Arizona Game and Fish can issue hunting licenses for buffalo, but these are unpopular because the buffalo so rarely leave the national park (Matt Williamson, pers. comm.). In the past year, various government agencies have come together to strategize on buffalo management. However, a plan has not yet been implemented.

### **Conclusions**

The fragile nature of the Grand Canyon ecosystem means that disturbance regimes such as grazing can have large effects on ecosystem health. Today, the patchwork of stakeholders in the region means that the effects of grazing vary locally. Can livestock thrive in the canyon? And if so, at what cost to the ecosystem and to other native grazers? Understanding these questions will help this region optimize ecosystem health.

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