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Commentary

Scarred for life: the other side of the fence debate

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Fence lines crisscross the prairies of North America and are as numerous as the cattle that they fence in. Fences continue to be erected to define property boundaries, protect drivers from collisions with wildlife, and control the distribution of domestic livestock. In 1879, the United States produced only 4.5 metric tons of barbed wire; production continued to increase on a yearly basis. By 1945 the annual production was 210,600 metric tons (Leftwich and Simpson 1978) with a concomitant increase in the erection of fence lines. For example, >51,000 km of fence lines were constructed on Bureau of Land Management administered lands between 1962 and 1997 in states that supported sage-grouse (*Centrocercus urophasianus*) populations (Connelly et al. 2000). In Alberta, Canada, I estimate there to be >67,000 km of fence lines within 630 townships in the Grassland Natural Region. The construction of new fences continues today with a growing energy sector, and it will likely match, or perhaps exceed, the growth in road networks across prairie regions with little regard to their impact on wildlife, even though much has been learned about their negative effects on wildlife.

The negative effects that fences have on wildlife generally have fallen into one of 3 categories: (1) disruption of movement patterns and associated habitat fragmentation; (2) direct mortality; and (3) indirect mortality (Hayward and Kerley 2009, Somers and Hayward 2012). Fences can disrupt daily and seasonal movement patterns of wildlife (Berger 2004, Suitor 2011). It is now understood that barriers, including fences, to migrating animals is 1 reason for the collapse of a number of migratory systems worldwide (Berger 2004, Bolger et al. 2008). Fences can be a major source of mortality for wildlife (Allen and Ramirez 1990 [birds]; Catt et al. 1994; Baines and Andrew 2003; Wolfe et al. 2007, 2009 [grouse]; Harrington and Conover 2006 [ungulates]). Typically, ungulates that snare their legs and are restrained for a prolonged period of time, results in the animal's death (Scott 1992). Wire fences in Colorado and Utah killed an annual average of 0.25 ungulates per km of wire fence (Harrington and Conover 2006). These rates of mortality consisted of 0.06 elk (*Cervus elaphus*) mortalities per km, 0.08 mule deer (*Odocoileus hemionus*) mortalities per km, and 0.11 pronghorn (*Antilocapra americana*) mortalities per km of wire fence (Harrington and Conover 2006). If these numbers are a reflection of mortalities on ungulates in other areas, then, the aggregate effect of fences on ungulates is staggering.

The third, and often overlooked, negative effect of fences is indirect mortality. For pronghorn, and likely other ungulates, such indirect mortality manifests itself as hair loss. Pronghorn are a grassland species that have adapted to fences differently from other ungulates. Instead of jumping over an obstacle, as do deer, pronghorns crawl under fences to cross to the other side. Such behavior is likely due to their evolution on the prairies where there were limited vertical barriers. If the bottom wire is too low, the fence becomes a barrier to pronghorn movement (Sheldon 2005, Suitor 2011, Gates et al. 2012). When a pronghorn does try to jump a fence and becomes entangled in the wires, direct mortality can result (Simpson and Leftwich 1978, O'Gara and McCabe 2004).

Since 2003, fieldwork associated with a collaborative study on the resource selection, movement patterns, and the effects of fences on pronghorns have revealed an alarming number of pronghorns with hair loss. Such loss of hair is due to crawling under barbed fencing where the bottom wire is so low that the pronghorn rubs hair off on the barbs as it tries to crawl under (Figure 1a–c). A pronghorn typically drops to its knees to cross under a fence, and with its chest on or near the ground and front legs bent under its body, it arches its back in a convex position to avoid the bottom wire, pushes with its hind legs until its head and shoulders are on the opposite side of the fence, and then slithers forward and begins to stand up (O'Gara 2004*a*). This approach of crawling under fences can result in significant hair loss at times, as illustrated by the hair loss on an animal captured during the telemetry study (Figure 2). Hair loss is typically along the neck, back, and hind end of the animal (Figures 1 and 3). If the hair loss is significant, the exposed skin may turn black (Figure 2), which is similar to the exposed skin on moose (*Alces alces*) that have lost hair due to infestations by winter ticks (*Dermacentor albipictus*; McLaughlin and Addison 1986).

The lack of attention paid to the loss of hair caused by fences to pronghorn is surprising. Moose suffering from hair loss due to tick infestations were found to have lower body fat levels and be in poor condition (McLaughlin and Addison 1986). Though not fully understood, the hair loss in moose presumably results in increased exposure to thermal stresses, increased metabolic rates, and hypothermia during severe winters (McLaughlin and Addison 1986, Samuel 1991). Indeed, Glines and Samuel (1989) reported that moose experimentally exposed to ticks suffered from hypothermia. The effect of hair loss for pronghorn is not known, but it may be similar to that of moose. The hair of pronghorns is coarse and provides excellent protection from wind and cold (O'Gara 2004*b*). Pronghorns are able to utilize their coat (O'Gara 2004*b*) and microsites within their environment to cope with wind and cold temperatures associated with winter (Bruns 1977). Taking away one of these coping mechanisms can result in negative effects for pronghorn exposed to severe weather. Whereas hair loss and resulting mortalities in moose from winter ticks predominantly occurs between February and April (McLaughlin and Addison 1986, Samuel 1991), the loss of

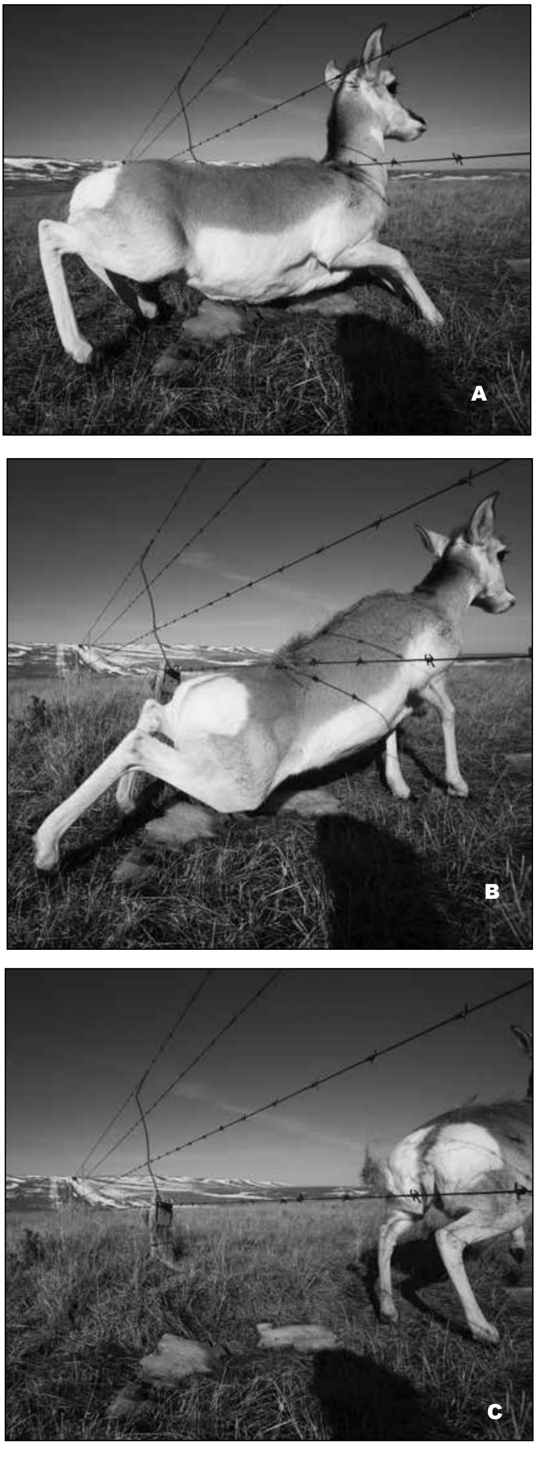

Figure 1. A female pronghorn near Medicine Hat, Alberta, crouches down (a) as it passes under the bottom barbed wire of a 4-strand fence, resulting in the barbs on the bottom wire scraping her back (b) and the eventual loss of hair (c). (*Photos courtesy J. Sartore, National Geographic*)

Figure 2. A female pronghorn captured in southern Alberta, Canada, shows significant hair loss (dark areas) along her neck, back, and rump. Notice how the areas with hair loss have turned black, particularly on her hind quarters. (*Photo courtesy Bighorn Helicopters, Alberta Conservation Association*)

Figure 3. A female pronghorn near Medicine Hat, Alberta, showing hair loss on her hind quarters as a result of crossing under barbed wire fences. (*Photo by P. F. Jones*)

hair in pronghorn occurs year-round, further exacerbating the negative effects. The loss of hair and its potential negative ramifications is likely more pronounced for pronghorns inhabiting the northern portion of their range in North America due to the severe winter temperatures that are common for this geographical area. Further, effort is required to quantify the extent of hair loss in pronghorn across their range and assess the short- and long-term negative effects.

Most jurisdictions within the range of pronghorns have developed standards for fences to make them pronghorn and wildlife friendly (Paige 2008, 2012), although it is not clear how often these guidelines are followed. Continued effort is required to inform and educate those involved with fence construction about the negative effects of fences on pronghorns and the need to upgrade to wildlife friendly standards for existing fences and for all new fence lines. Within these guides there are numerous recommendations for making fences wildlife friendly. Additional research is required to evaluate the effectiveness of the suggested fence enhancements to ensure that they do create a more wildlife friendly fence.

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