CANID DIVERSITY IN THE TEXAS PANHANDLE

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ABSTRACT—Before 1500, the western Great Plains was occupied by 3 sympatric wild canid species, which is the general rule throughout most of the world. However, during the past 100 years, substantial changes to the canid community have occurred in this region. During research on canids in the panhandle of Texas from 1998 to 2001, we documented 5 canid species within 5 km of each other, although there was apparent habitat segregation among species. This is the highest reported number of canid species at a given location in North America and indicates that recent human activities have increased the biodiversity of canids throughout the western Great Plains.

RESUMEN—Antes de 1500, el oeste de las Grandes Planicies estaba ocupado por tres especies simpátricas de cánidos, algo común en otras partes del mundo. Sin embargo, durante los últimos 100 años ha habido cambios sustanciales en la comunidad cánida de esta región. Durante la investigación llevada a cabo en el ''panhandle'' de Texas entre 1998 y 2001, documentamos 5 especies de cánidos a 5 km uno del otro, aunque aparentemente había segregación dentro del hábitat entre las especies. Esta es la concentración más alta de cánidos documentada en cualquier lugar de América del Norte, e indica que las actividades humanas recientes han aumentado la biodiversidad de los cánidos a través del oeste de las Grandes Planicies.

There are 36 species of Canidae worldwide (Nowak, 1999), with the highest diversity occurring in South America and Africa (10 species each; Johnson et al., 1996). As a general rule, there are only 3 species of wild canids at any given location (Johnson et al., 1996). The trio usually consists of a large species (>20 kg), a medium species (10 to 20 kg), and a small species (<10 kg). The only known exceptions occur in Africa, where 4 to 5 species can occur in the same areas (Van Valkenburgh, 1985; Wayne et al., 1989; Johnson et al., 1996).

In North America, no more than 3 wild canid species have been reported from any given location (King, 1981; Litvaitis, 1992; Peterson, 1995; Ralls and White, 1995), although 4 canid species are sympatric in several areas of North America (Nowak, 1999). While conducting an ecological study of swift foxes (*Vulpes velox*) and coyotes (*Canis latrans*) from 1998 to 2001 in the panhandle of northern Texas, we documented 5 canid species from the same local area, which is the highest reported number of canids from a specific location in North America. In this paper, we review the historic diversity of canids in the region, document and describe the current diversity of canids, and suggest reasons for this unusually high diversity.

Before European settlement, the diversity of wild canids in the shortgrass prairie region of the Texas Panhandle included the gray wolf (*Canis lupus*), coyote, and swift fox (Davis and Schmidly, 1994). Farther south and west of the Panhandle, the swift fox was replaced by the kit fox (*V. macrotis*). This hierarchy of 3 native canid species was similar to that typically found in most regions of the world, with considerable differences in body size and niche between species (Wayne et al., 1989; Johnson et al., 1996). By 1900, however, wolves had been extirpated by humans throughout the Panhandle (Davis and Schmidly, 1994), leaving only coyotes and swift foxes.

Before 1500, red foxes (*Vulpes vulpes*) did not occur in Texas, but occurred in boreal and mountainous regions of North America (Kamler and Ballard, 2002). However, red foxes of European origin were introduced into the eastern United States as early as the 1700s (Kamler and Ballard, 2002). This population expanded westward into eastern Texas by the early 1900s (Kamler and Ballard, 2002) and into western Texas by the 1990s (Kamler et al., 2005).

Gray foxes (*Urocyon cinereoargenteus*) occurred historically in Texas, but not in the shortgrass prairie of the Panhandle, because they were not typical fauna of grasslands (Fritzell and Haroldson, 1982; Fritzell, 1987). However, gray foxes have benefited from human impacts to the environment and, consequently, have expanded their range throughout many areas of North America during the last 50 years (Fritzell and Haroldson, 1982; Fritzell, 1987). By the 1990s, gray foxes occurred throughout Texas, including the Panhandle (Davis and Schmidly, 1994).

Populations of feral dogs were reported from several regions of North America, especially after the extirpation of wolves (Scott and Causey, 1973; Gipson and Sealander, 1976; Daniels and Bekoff, 1989). Most populations of feral dogs need a constant source of food from humans and infusion of additional individuals to maintain their numbers (Scott and Causey, 1973; Gipson and Sealander, 1976; Daniels and Bekoff, 1989). In the Texas Panhandle, populations of feral or free-ranging dogs occur in several localities, but only in association with large cattle feedyard operations, where cattle carrion is available on a regular basis (Kamler et al., 2004).

At 2 study sites (Sherman and Dallam counties) in the panhandle of northern Texas, we captured and radio-collared 88 swift foxes and 29 coyotes from 1998 to 2001 for an ecological study of both species (Kamler et al., 2003*a*). Study sites consisted of shortgrass prairie rangelands grazed by cattle adjacent to agricultural and Conservation Reserve Program (CRP) fields (i.e., ungrazed grasslands). During 2,838 trapnights when we used boxtraps, and 922 trapnights when we used foot-hold traps, the only canid species captured were swift foxes and coyotes.

In and near the town of Stratford, Texas (9.7 km north of our trapping site in Sherman County), we documented 3 additional canid species: red foxes, gray foxes, and feral or free-ranging dogs. During our study, we observed gray foxes on several occasions in Stratford, and in March 1999, we photographed an adult sitting in a tree (photographs deposited in The Museum, Texas Tech University, Lubbock). Similarly, we observed red foxes on several occasions in Stratford. In September 2000, we collected remains of a roadkilled red fox that were deposited in The Museum, Texas Tech University (TTU 85507). Additionally, we documented feral or free-ranging dogs near cattle feedyards adjacent to Stratford. During our study, we observed packs of dogs near large cattle feedyards in the area, and in December 2000, we collected a roadkill specimen (TTU 85505) 7.2 km north of our trapping site (Kamler et al., 2004). This dog was presumed to be feral or free-ranging because it was observed in a pack prior to being killed (Kamler et al., 2004), and these dogs occurred in agricultural fields, lacked collars, and avoided human contact (Scott and Causey, 1973; Daniels and Bekoff, 1989).

Based on locations of radio-collared swift foxes and coyotes, and the above records of red foxes, gray foxes, and feral or free-ranging dogs, all 5 canid species were documented within 5 km of each other. Of these 5 canid species, 2 were introduced by humans (red foxes and dogs) and another (gray fox) exhibited a range expansion likely facilitated by human changes to the environment. There was, however, an apparent habitat segregation among the 5 species. Coyotes and swift foxes occurred in shortgrass prairie, red and gray foxes occurred in urban areas, and feral or free-ranging dogs occurred near cattle feedyards outside of urban areas. Thus, in the interface of urban and rural habitats near Stratford, Texas, the 5 canid species occurred together.

The occurrence of feral or free-ranging dog populations in other areas within this region was unknown, but they likely are restricted to local areas with large cattle feedyards adjacent to small towns, and thus, might not be widespread. Although not normally considered a part of the wild canid community, feral or free-ranging dogs can compete or have similar niches to coyotes (Scott and Causey, 1973; Gipson and Sealander, 1976). Additionally, feral or free-ranging dogs can kill red foxes (Pils and Martin, 1974) and coyotes (Kamler et al., 2003*b*), indicating they are important members of the wild canid community in certain areas.

Both red and gray foxes are known to occupy urban environments throughout North America (Harrison, 1997; Kamler and Ballard, 2002), and urban areas might have facilitated their range expansion into this region. The extent to which red and gray foxes used non-urban habitats near our study sites was unknown, but this should be the focus of future research. Because we also observed red foxes in many neighboring towns, and collected a gray fox specimen (TTU 85506)

within our study site in Dallam County, >3 canid species likely occur in many areas of the Texas Panhandle. During the past 50 years, both red and gray foxes have expanded their ranges throughout the western Great Plains (Fritzell and Haroldson, 1982; Fritzell, 1987; Kamler and Ballard, 2002; Kamler et al., 2005), suggesting >3 canid species now occur throughout this region.

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