



Original Investigation

Fine-scale movements of rural free-ranging dogs in conservation areas in the temperate rainforest of the coastal range of southern Chile



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ABSTRACT

Domestic dogs can play a variety of important roles for farmers. However, when in proximity to conservation areas, the presence of rural free-ranging dogs can be problematic due to the potential for predation of, competition with, or transmission of infectious disease to local threatened fauna. We used a frequent location radio tracking technology to study rural free-ranging dog movements and habitat use into sensitive conservation habitats. To achieve a better understanding of foray behaviors in dogs we monitored dogs ($n = 14$) in rural households located in an isolated area between the Valdivian Coastal Reserve and the Alerce Costero National Park in southern Chile. Dogs were mostly located near households (<200 m) but exhibited a diurnal pattern of directed excursions (forays) away from their home locations. Dogs spent, on average, 5.3% of their time in forays with average per dog foray distances from the house ranging 0.5–1.9 km (maximum distance detected 4.3 km). Foraging behavior was positively associated with pasture habitat compared to forest habitat including protected lands. Foraging dogs rarely used forest habitat and, when entered, trails and/or roads were selected for movement. Our study provides important information about how dogs interact in a fine-scale with wildlife habitat, and, in particular, protected lands, providing insight into how dog behavior might drive wildlife interactions, and, in turn, how an understanding of dog behavior can be used to manage these interactions.

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Introduction

Despite the global trend of urbanization, in most developing countries protected lands are in remote areas, far from urban settlements (Joppa and Pfaff, 2009). The landscapes surrounding these protected lands are typically inhabited by rural human communities that are highly dependent on the use of natural resources (Baland and Platteau, 1996; Shackleton et al., 2002). In these communities, proximity to protected lands can lead to conflict with conservation efforts (e.g., hunting bushmeat) but can also provide opportunities for the community (e.g., ecotourism) (Andam et al., 2010; Naughton-Treves et al., 2005; Wittemyer et al., 2008). In addition to forest resources, small-scale agriculture is typically the primary economic driver of these communities and farm animals,

such as cattle and sheep, provide a key source of animal protein (Dovie et al., 2006; Waters-Bayer and Bayer, 1992). In these rural communities, domestic dogs (*Canis familiaris*) are common and play a variety of roles on the farm, including the guarding of livestock and the protection of households (Gehring et al., 2010; González et al., 2012; Rigg, 2001; Sepúlveda et al., 2014a).

However, dogs in rural areas can be problematic. Dogs represent an increasing problem for biodiversity conservation (Gompper, 2013; Hughes and Macdonald, 2013; Young et al., 2011). Free-ranging dogs are common in developing countries (Dalla Villa et al., 2010) and are frequently found around or inside protected areas in Africa (Atickem et al., 2009; Butler and du Toit, 2002; Butler et al., 2004), Central and South America (Fiorello et al., 2006; Koster, 2008; Lacerda et al., 2009) and Asia (Vanak and Gompper, 2009a). The occurrence of domestic carnivores in natural ecosystems can affect the local fauna through a variety of mechanisms (Hughes and Macdonald, 2013; Vanak and Gompper, 2009b). Dogs, particularly free-ranging dogs, have been responsible for declines in threatened populations due to predation in a variety of species including marine iguanas (*Amblyrhynchus cristatus*) (Kruuk and Snell, 1981),

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Galapagos giant tortoises (*Chelonoidis nigra*) (MacFarland et al., 1974), and kiwis (*Apteryx mantelli*) (Taborsky, 1988). Moreover, the transmission of infectious diseases from populations of dogs around parks also poses a significant threat to endangered wildlife (Cleaveland et al., 2000; Funk et al., 2001). For example, viruses such as canine distemper and rabies have caused population declines in African wild dogs (*Lycaon pictus*) (Alexander and Appel, 1994), lions (*Panthera leo*) (Roelke Parker et al., 1996), black footed-ferret (*Mustela nigripes*) (Williams et al., 1988) and Ethiopian wolves (*Canis simiense*) (Sillero Zubiri et al., 1996).

A critical gap in minimizing the risk to wildlife associated with interactions with dogs is an understanding of the movement patterns and habitat use of these free-ranging dogs, particularly in relation to conservation areas and threatened species' habitat. Recent telemetry studies in dogs show a clear selection for anthropogenic-dominated landscapes in rural areas (Ruiz-Izaguirre et al., 2014; Vanak and Gompper, 2010; Woodroffe and Donnelly, 2011). In particular, it is clear that dogs mostly stay close to their house of origin. Despite the apparent generality of this pattern (e.g., Vanak and Gompper 2010; Woodroffe and Donnelly, 2011; Silva-Rodríguez and Sieving 2012; Ordeñana et al., 2010), it is also clear that dogs move inside conservation-sensitive areas (Parsons et al., 2014). These events, while infrequent at the individual dog scale, are key to understanding the impacts of dogs inside protected areas. The existing studies provide little information on how dogs move on the landscape during forays. To achieve a better understanding of foray behaviors in dogs, we used a novel, radio tracking technology to study dog forays into sensitive conservation habitats in the Valdivian Temperate Forest in southern Chile. Specifically, this study focused on understanding habitat use during forays in a context of agricultural and natural environments. Our specific goals were to determine: (1) dog movements in relation to their house of origin, (2) what habitats dogs utilize during foray behavior, (3) the daily pattern of dog forays and (4) the pattern of dog movements in and around protected areas and threatened species' habitats.

Material and methods

Study area

The study area is located in the Coastal Range of Southern Chile in the Valdivian Temperate Forest (39° 58' Lat., 73° 31' Long.), an ecosystem denominated as a global conservation hotspot (Brooks

et al., 2006). Rural communities living in the lowlands of the forest ecosystem utilize cleared lands for livestock production (cattle and sheep). Dogs are present in the study area in most households and are used primarily for farm animal protection as well as house guarding (Sepúlveda et al., 2014a). These dogs can be classified following Vanak and Gompper (2009b) as 'rural free-ranging dogs', these are 'dogs that are owned or peripherally associated with human habitations but are not confined to a proscribed outdoor area. These include (but are not limited to) 'stray' dogs and owned farm and pastoral companion dogs whose daily activity pattern may involve ranging that can bring them into contact with wildlife, especially when human habitations border wildlife reserves or other natural areas'. In this area, dogs represent an important threat for the conservation of endangered species such as the southern pudu (*Pudu pudu*) (Endangered, IUCN, 2014) by predation (Silva-Rodríguez and Sieving, 2012), Southern river otters (*Lontra provocax*) (Endangered, IUCN, 2014) by disease transmission (Sepúlveda et al., 2014b) and interspecific killing (Espinosa, 2012), and the Darwin fox (*Lycalopex fulvipes*) (Critically Endangered, IUCN, 2014) by interspecific killing and disease transmission (Fariás et al., 2014). We conducted our study in Cadillal Alto, a small human settlement that includes 11 families/households located on the north bank of the Chaihuín River between two protected areas, the Valdivian Coastal Reserve (VCR) and the Alerce Costero National Park (ACNP) (Fig. 1), with 50,250 and 24,694 ha respectively. The location of small villages at the edge of protected areas is a common situation in southern Chile (Sepúlveda and Silva-Rodríguez, 2012), and therefore we assumed that the study site would be representative of other protected areas. The small number of households, and therefore of rural dogs, allowed us to monitor a representative number of all dogs. This village is accessible seasonally by road or by boat, has no electricity and is geographically isolated from other rural communities. Grazing pastures for livestock are distributed predominantly in the northern lowlands of the Chaihuín River (Fig. 1).

Dog sampling and data collection

Prior to the start of the study in December 2009, the goals and approaches for this research were presented to the community of Cadillal Alto and written permission was obtained from all participating households. All families had dogs for a total of 21 dogs in the community. We collected movement data from 14 dogs in 8 households (66.6% of total dogs). Two households did

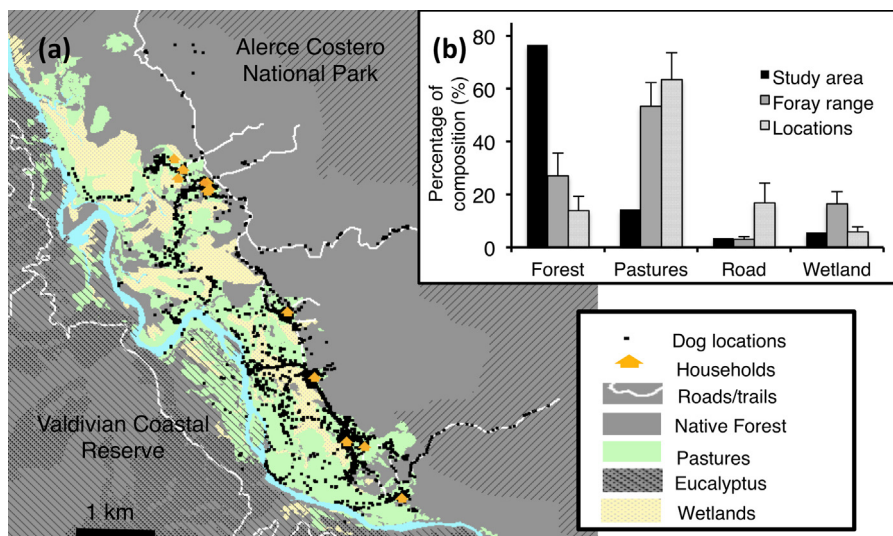


Fig. 1. Study area, GPS of 14 radiomonitored dogs and proportion of habitat composition for total study area, foray ranges and radiolocations by dogs.

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