

Domestic dog (*Canis lupus familiaris*) conflicts with sheep (*Ovis orientalis aries*) production: use of camera traps to inform mitigation actions

Conflictos de perros domésticos (*Canis lupus familiaris*) con la producción ovina (*Ovis orientalis aries*): uso de cámaras trampa para informar acciones de mitigación

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The issue of damage caused by dogs (*Canis lupus familiaris* Linnaeus, 1758) to other animals is becoming increasingly alarming. This study aims to demonstrate the attack by domestic canids on a flock of sheep belonging to a farmer in the north-central region of Argentina, using non-invasive technologies. Two field visits were made, one on October 23, 2023, and another on November 10, 2023, to photograph the damaged sheep. Then, 2 generic trail cameras were installed on the fence posts. The flock of sheep was attacked on November 18, 2023, so we immediately traveled to the ranch and examined footprints and/or signs in the vicinity and inside the sheep pen. After installing the trap cameras, during the early hours of November 29, 2023, a new attack on 2 sheep from the same ranch was recorded. The recorded images confirmed that the attacks were not from native animals but from 2 of the farmer's domestic dogs: a Doberman, assisted by a Border Collie. Initially, the blame for the damage to the flock was attributed to native wildlife, particularly the puma, and a plan for its hunting and death was being set up. This case study reinforces the conclusion that the first fundamental step in mitigating fauna-human conflicts is to listen to those affected and seek solutions together with them that do not involve the use of lethal tools against wild carnivores.

Key words: Attack by dog; camera traps; human-wildlife conflict; sheep production.

El problema del daño causado por perros (*Canis lupus familiaris* Linnaeus, 1758) sobre otros animales es cada vez más alarmante. Este estudio tiene como objetivo demostrar el ataque de cánidos domésticos a un rebaño de ovejas perteneciente a un agricultor en la región centro-norte de Argentina, utilizando tecnologías no invasivas. Se realizaron 2 visitas en el campo, una el 23 de octubre 2023 y otra el 10 de noviembre 2023 para fotografiar las ovejas dañadas. Luego se instalaron 2 cámaras trampa genéricas sobre los postes de los alambrados. El rebaño de ovejas tuvo un ataque el 18 de noviembre de 2023, por lo que viajamos inmediatamente al rancho y se examinaron huellas y/o señales en las cercanías y dentro del corral de las ovejas. Luego de instalar las cámaras trampa, durante la madrugada del 29 de noviembre de 2023, se registró un nuevo ataque a 2 ovejas del mismo rancho. Las imágenes grabadas confirmaron que los ataques no eran de animales nativos sino por 2 de los perros domésticos del agricultor: un Doberman, asistido por un Border Collie. Inicialmente, se atribuyó la culpa del daño al rebaño a la fauna silvestre nativa, particularmente al puma, y se planeó su caza y muerte. Este estudio de caso refuerza la conclusión de que el primer paso fundamental para mitigar los conflictos fauna-humano, es escuchar a los afectados y buscar soluciones junto con ellos que no impliquen el uso de herramientas letales contra los carnívoros silvestres.

Palabras claves: Ataque por perro; cámaras trampa; conflicto humano-fauna silvestre; producción ovina.

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The conflicts between humans and carnivores are among the main threats affecting wildlife populations (Quiroga *et al.* 2016; Lucherini *et al.* 2018; Conover and Conover 2022; Davoli *et al.* 2022). Additionally, they have been identified as a problem by livestock producers worldwide, including most of Argentina (De Lucca and Nigro 2013; Doherty *et al.* 2017; Weise *et al.* 2018; Smith *et al.* 2019; Llanos *et al.* 2020). Livestock mortality can become

particularly significant in small herds, where a single attack can end the entire animal stock of a property (Wierzbowska *et al.* 2016; Guerisoli *et al.* 2017; Lucherini *et al.* 2018). This phenomenon involves environmental and socio-cultural factors, and resolving it requires reconciling the interests of livestock producers with wildlife conservation (Carter and Linnell 2016; Gordon 2018; Lozano *et al.* 2019; Cravino *et al.* 2024).

The pumas (*Puma concolor*) and foxes (*Lycalopex culpaeus* and *L. gymnocercus*) are the species of wild carnivores considered most harmful to livestock production in Argentina (Travaini *et al.* 2000; Llanos *et al.* 2020; Nanni *et al.* 2020; Ballejo *et al.* 2022). However, the problem of damage caused by dogs (*Canis lupus familiaris*) is becoming increasingly alarming (Cravino *et al.* 2024), suggesting that the attacks of dogs on wildlife affect many species and all ecoregions in Argentina (Zamora-Nasca *et al.* 2021). Untrained dogs tend to behave instinctively like their ancestor, the wolf (*Canis lupus*). Specifically, domestic dogs have contributed to the extinction of at least 11 vertebrates and are a known risk to 188 threatened species (Doherty *et al.* 2017). Free-ranging dogs mainly attack goats, sheep, and poultry, but in packs, they can kill almost any medium or large-sized mammal (Ritchie *et al.* 2013; Wierzbowska *et al.* 2016). In the Argentine and Chilean Patagonia, free-ranging dog predation causes significant livestock losses (Zanini and Pérez 2005; Plaza *et al.* 2019; Rodríguez *et al.* 2019; Cortés *et al.* 2021; Arona and Schiavini 2023). While sheep killing is common, cases of mutilation and severe trauma leading to bleeding and infectious processes resulting in animal deaths have also been reported (Gáspero *et al.* 2019; Rodríguez *et al.* 2019; Smith *et al.* 2019; Arona and Schiavini 2023; Díaz *et al.* 2023; Gonzaga *et al.* 2024).

Carnivore species have different ways of hunting and consuming their prey. Although some carnivores exhibit high behavioral plasticity, there have repetitive patterns that often allow identification of the predator responsible for an animal's death based on the shape and distribution of wounds, as well as the method of consumption (Arilla *et al.* 2023; Khorozyan and Heurich 2023). However, in some cases, identifying the predator can be ambiguous or lead to disagreements among different stakeholders. In such cases, confirming the perpetrator of the attacks is important to identify the most appropriate measures and ultimately, mitigate conflicts (Treves *et al.* 2016; van Eeden *et al.* 2018; Fletcher and Toncheva 2021; Lambertucci *et al.* 2024).

Recent technological advancements have enabled significant progress in monitoring animal behavior, particularly through the use of camera traps that capture photos and videos (e.g., O'Connell *et al.* 2011; McCallum 2012; Meek *et al.* 2014; Apps and McNutt 2018; Lizcano 2018; Akcali *et al.* 2019). These cameras have proven to be an essential and highly effective non-invasive tool for species identification (Steenweg *et al.* 2017; Sparkes and Fleming 2022; Paton *et al.* 2024).

This study aims to demonstrate the importance of using non-invasive technologies (camera traps) to correctly assess a case of carnivore-livestock conflict, identify the species responsible for an attack on a flock of sheep belonging to a producer in the north-central region of Entre Ríos, Argentina, and how this was instrumental to properly managing the conflict. We also provide new details regarding the behavior of a breed of domestic dogs that can be useful for practitioners involved in the evaluation and mitigation of conflicts concerning livestock production.

The study area corresponds to a fragmented landscape of native forests, typical of the central-northern region of Entre Ríos province in Argentina, along with cereal and oil-seed crops (such as, soybean, corn, wheat, sorghum, another's), where the main activity is small and medium-scale cattle. A sheep rancher from the Las Garzas city (Entre Ríos province, Argentina; Figure 1) contacted the authors in early October 2023. Field visits were carried out on 2 occasions (October 23, 2023 and November 11, 2023 corresponding to spring season) to photograph the damaged sheep. On this occasion, the authors of this report suggested the immediate installation of trail cameras inside and outside the pen. Since the producer agree to follow this suggestion but mentioned that he did not have the means to do it by himself, on November 25, 2023, we set up 2 camera traps in the enclosure pen following another attack on sheep occurred 2 days earlier. Two trap cameras (Marca Gadnic, Model 4k Lumix) were installed on the fence posts. Both were configured to capture 3 photographs and 20-sec videos when detecting movement. They were equipped with a 32 GB memory card. During the early hours of November 29, 2023, the authors received a report of a new attack on 2 sheep from the same ranch, prompting a new visit to the affected estate to retrieve the memory cards from the camera traps.

A sheep rancher mentioned a conflict with his flock due to the attack of an animal causing severe injuries and even sheep mortality. Initially, based on his perspective and previous experiences, he considered a large animal like a puma responsible for the attacks. Following several phone calls by the producer, personnel from the Natural Protected Area 'La Esmeralda' (NPA La Esmeralda, hereinafter) visited the sheep farm and took note of the farmer's family members accounts regarding the timings and method of attack, as well as the reaction of their domestic dogs during those events. Photographs of the injuries on the animals were also taken (Figure 2).

According to the NPA 'La Esmeralda' staff, most of the wounds did not seem consistent with a puma due to their location on the flanks, sides, ears, and when wounds were on the neck, they did not break it. This seemed an atypical behavior for a puma, and could possibly occur only if the individual had been disturbed before being able to kill its prey, which was not in line with the producer's accounts. Figure 1 details the position of the enclosure pen (where most of the attacks occurred), the owner's house, and the shed. We observed that the distance between the pen and the house (where the farmer kept his dogs at night) is less than 40 m, which made us even more doubtful that the attack had been executed by a puma, and human influence is limited, as would be the case in our study area where relatively abundant populations of axis deer, wild boars, hares, and gray brocket exist. On the other hand, some of the sheep showed only marks from canines on the neck, which could be consistent with the affected producer's hypothesis.

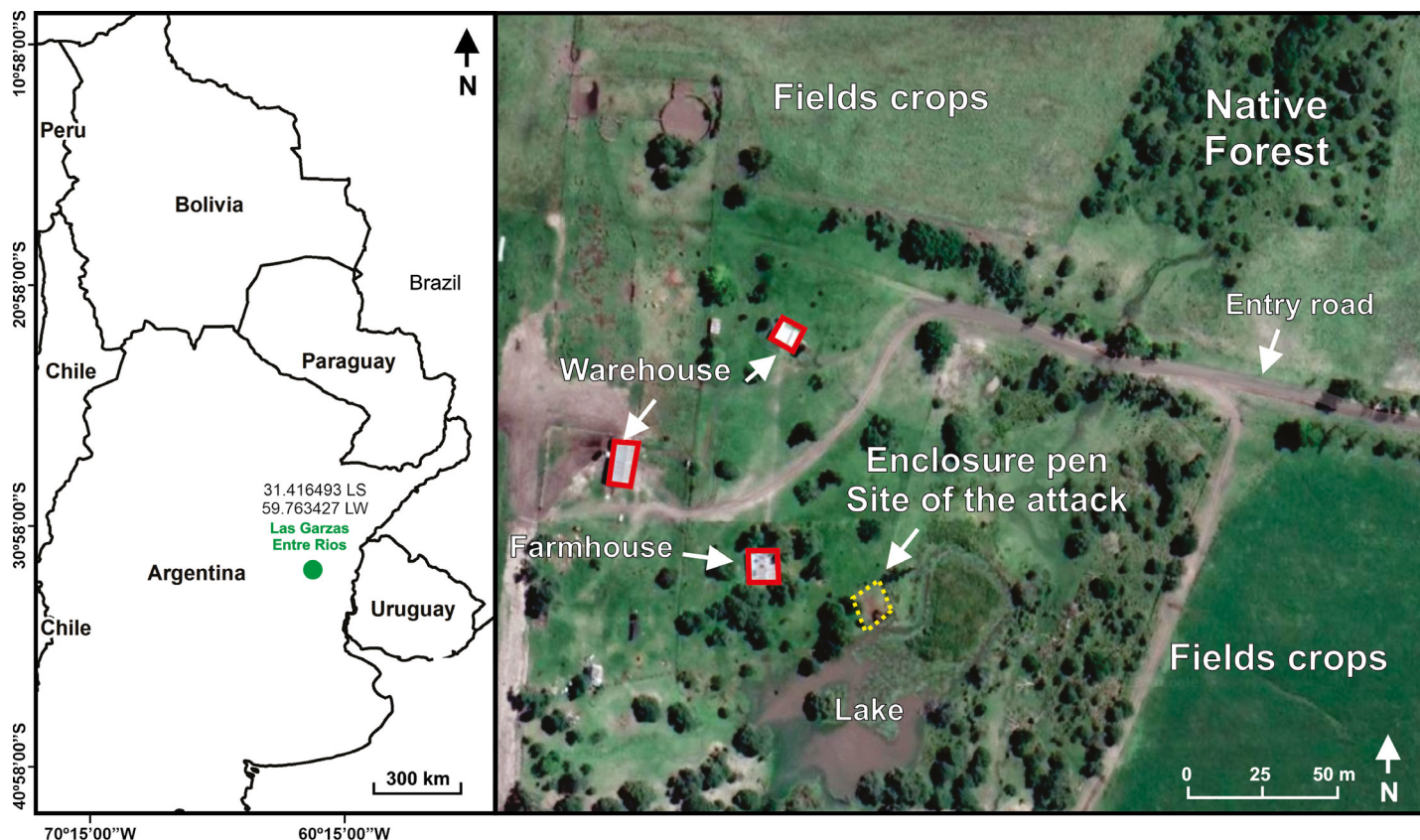


Figure 1. High-resolution satellite image locating key points of the Las Garzas city, Entre Ríos province, Argentina.

As a result of a new attack occurred on November 18, 2023, we promptly traveled to the ranch again and recorded the producer's accounts. Footprints and/or signs were examined in the vicinity and inside the sheep enclosure pen. None of them was attributable to a native feline; they belonged to large canids. Between November 25 and 28, 2023, videos and photographs were obtained depicting the normal movement of the flock inside the pen, displaying typical behaviors for their species. The images recorded by the cameras confirmed that the attacks had occurred around midnight (00:02 hr to 00:36 hr) and had been carried out by 2 of the rancher's domestic dogs: a Doberman, assisted by a Border Collie (Figure 3). The attached videos illustrate the mechanics of the attacks, consistent with the documented wounds from previous visits.

Each predator exhibits different predatory and feeding behaviors, leaving traces and signs that allow its identification, such as footprints, bite and claw mark patterns, as well as their locations on the body, and the condition of the dead prey, among others (Fonseca et al. 2015; Cristescu et al. 2022). Wild felids tend to avoid preying on livestock if the environment they live in offers abundant wild prey (Thompson et al. 2009; Veals Dutt et al. 2023). In particular, to identify the predator, bite marks should be examined in terms of their location and the distances between canine punctures (Nallar et al. 2008; Toledo González et al. 2021).

The bite force is a biomechanical parameter that indicates the amount of force applied during the mastication

(Lindner et al. 1995; Paschetta and González-José 2013). The Doberman (dolichocephalic) is capable of a bite force of up to 245 - 790 PSI (228 kg; Brassard et al. 2020), whereas a puma has a bite force of approximately 1660 PSI (426 kg). A puma attack is usually directed at the base of the throat, where it constricts to asphyxiate the victim, and frequently leaves claw marks on the prey's back or sides (Guarda et al. 2010), which were not observed on the attacked animals up to that date, or it may deliver a lethal bite to the base of the skull, severing the neck and spinal cord (Mazzoli 2013). In contrast, when attacks are by dogs, the prey typically shows various scratches and tears (Barrera 2018; Valderrama-Vásquez et al. 2018).

Dogs often inflict significant and unnecessary wounds on their prey, but some have a stronger instinct to kill, becoming efficient killers after repetition (Nallar et al. 2008). Aggression towards people or livestock are examples of behaviors that are not expected to occur in an adult dog (Caffrey et al. 2019; Baslington-Davies et al. 2023).

Records of dog attacks on native fauna are abundant in different parts of the world (Aliaga-Rossel et al. 2012; Doherty et al. 2017; Carrasco-Román et al. 2021; Zamora-Nasca et al. 2021; Díaz et al. 2023). However, information published regarding the negative implications of dogs on native fauna in scientific journals is still uncommon, especially in Argentina. Recently, reports of dog predation events on Magellanic penguins (*Spheniscus magellanicus*; Morgenthaler et al. 2002) and choiques (*Rhea pennata*



Figure 2. Photographs showing evidence of the attacks on both alive and dead sheep held in a ranch in the northeastern Argentine province of Entre Ríos. a) and b) damage inflicted on the animal's neck; c) and d) injuries to the base of the face and their consequence, infection; e) depth of the injury to the sheep's neck; f) sheep attacked and in medical treatment with injuries to the neck. Images available at julian.sabattini@uner.edu.ar.

pennata; [Procopio et al. 2022](#)) in the Argentine Patagonia have been published. However, this problem is frequent in neighboring countries of the region, where attacks on domestic and native vertebrates have been recorded. In

Bolivia, attacks by dogs on Andean deer (*Hippocamelus* sp.) and other wild ungulates have been reported ([Aliaga-Rossel et al. 2012](#)). In Uruguay, the killing of sheep by dogs is recurrent, and this country's Rural Code authorizes the

killing of aggressive animals if found within the property and in an attacking attitude. In Chile, farmers from different parts of the country maintain that the major conflict is with pumas, foxes, and domestic dogs, a situation similar throughout the territory (Muñoz-Pedrerros et al. 1995; Ohrens et al. 2015; Zapata-Ríos and Branch 2016; Silva-Rodríguez et al. 2023). Nevertheless, there is still some reluctance on the part of society to objectively accept cases of attack, death, or predation by pet dogs, due to natural sympathy of humans towards this species (Hare et al. 2002; Jarić et al. 2020; Sogliani et al. 2023) and there is urgent need of effective strategies to address this threat to wildlife (Degeling et al. 2021; Marshall et al. 2022; Lambertucci et al. 2024; Cravino et al. 2024).

In the analyzed case here, initially, the blame for the damage to livestock was attributed to native wildlife, namely a puma, and a plan had already been initiated by the rancher for the hunting and killing of the predator. In the region, pumas are uncommon (Muzzachiodi et al. 2020) and subject to severe hunting pressure, and the killing of another individual without any justification would have been regrettable. The use of a simple and not very expensive methodology allowed for a correct and accurate diagnosis of the conflict and avoided the hunting of native wildlife. This case study also highlights the importance of raising awareness on the need of a proper husbandry and training of the dogs used by rural residents and on the potential negative

effects of feral or poorly cared for dogs on domestic livestock and wildlife (Silva-Rodríguez et al. 2023). Finally, this case study reinforces the conclusion that the first fundamental step in convincing stakeholders to adopt no-lethal tools in mitigating conflicts with wild carnivores is to listen to them, build trust, and actively involve them in the search of alternative solutions (McQuinn et al. 2023).

Acknowledgements

The authors thank C. Madariaga, A. Madariaga, and S. Madariaga for their support. They also thank to NPA La Esmeralda and the Geoffroy's Cat Working Group for their financial support and ongoing technical assistance. To the reviewers whose comments improved this note.

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Figure 3. Captures of footages from a camera trap showing the moment when a domestic dog is attacking a sheep in a ranch in the northeastern Argentine province of Entre Ríos. a) It was the moment when the collie border is surrounding the sheep along with the attacking dog; b) the Doberman grabs the sheep with its teeth, c) and d) the Doberman settles and tightens its teeth and makes zigzag movements to paralyze the prey. Images available at julian.sabattini@uner.edu.ar.

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Associated editor: Jorge Ayala Berdón.

Submitted: July 2, 2024; Reviewed: September 18, 2024.

Accepted: September 21, 2024; Published on line: October 1, 2024.