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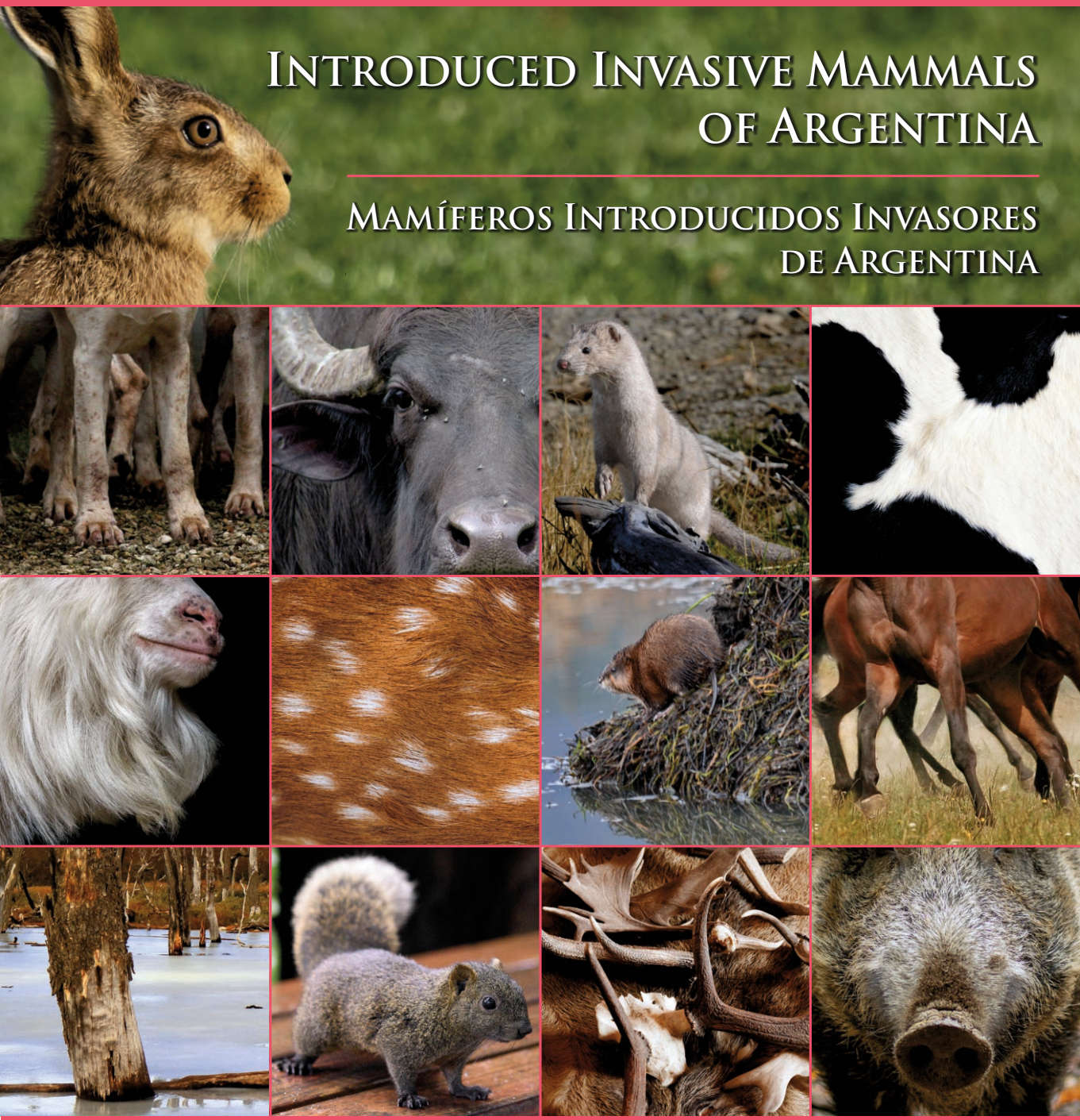
Volume 3

Introduced Invasive Mammals of Argentina

Mamíferos Introducidos Invasores de Argentina



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The Argentine Society for the Study of Mammals (Sociedad Argentina para el Estudio de los Mamíferos – SAREM) was created in 1983, and currently has about 300 members from several countries. SAREM is an interdisciplinary society of natural sciences professionals whose main goals are the promotion of scientific and technical research, the consolidation of national collections and research centers, and the publication and diffusion of research on living and/or extinct mammals. SAREM has organized scientific meetings for mammal researchers since 1994, publishes the journals *Mastozoología Neotropical* and *Notas sobre Mamíferos Sudamericanos*, and has edited books on the systematics, distribution and conservation of the mammals of southern South America, including *Libro Rojo de los mamíferos amenazados de la Argentina* (first ed. 2000, second ed. 2012) and *Mamíferos de Argentina. Sistemática y distribución* (2006), as well as contributing to the *Libro Rojo de los mamíferos y aves amenazados de la Argentina* (currently out of print).

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Introduced Invasive Mammals of Argentina

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Introduced invasive species are a major driver of local to global environmental change, including important negative impacts on biodiversity, ecosystem processes, economies, health and other social values. At the same time, however, different social actors can hold diverse representations of these species, particularly of introduced invasive mammals (IIMs). Such divergent values and perceptions can lead to conflicts regarding the management of IIMs, but also invite researchers and managers to be reflexive regarding their own work at a more fundamental level. Therefore, it is key that we advance towards a holistic understanding of IIMs and develop strategies to manage them based on solid technical information and plural perspectives regarding their multiple values. Despite a rich history of initiatives in Argentina to study and manage IIMs, until now there has not been an opportunity to assess the state-of-the-art knowledge in our country. This book seeks to provide rigorous, relevant and legitimate information to support research, policymaking and management decisions regarding IIMs in Argentina. With this objective in mind, the book presents a series of chapters selected to highlight priority topics concerning the conceptualization and implementation of IIM research and management. Then, fact sheets are provided for the different IIMs found in Argentina. Finally, beyond the realm of academic inquiry, the timing of this publication is ideal to re-enforce policy and decision-making, such as the recently approved National Invasive Exotic Species Strategy, which seeks to implement actions and enhance institutional capacities related to invasive species management in Argentina, and the Convention on Biological Diversity's new Global Biodiversity Framework, which also addresses biological invasions as part of broader efforts to attain the 2050 Vision for Living in Harmony with Nature.

Dr. Alejandro E.J. Valenzuela
Dr. Christopher B. Anderson
Editors, Vol. III SAREM Series A

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Foreword

Biological invasions by introduced species are one of the great changes rapidly transforming the globe today, with innumerable impacts on economics, human health, ecosystem services, and biodiversity. Mammals are among the most impactful of invasive species, transmitting diseases to humans, livestock, and native animals, trampling native grasslands, voraciously devouring vegetation from groundcover to saplings of forest trees, fouling water, causing erosion, and preying on and outcompeting native animals. They were among the first species humans introduced worldwide and in Argentina, both deliberately (*e.g.*, livestock) and inadvertently (*e.g.*, rats and mice). They have been introduced for sport (*e.g.*, deer, boar) and companionship (*e.g.*, cats, dogs), or simply as attractive ornamentals (*e.g.*, squirrels). Some that are meant to be kept in captivity, such as cats, dogs, and squirrels, escape and establish feral populations.

Argentina looms large in the history of biological invasions by introduced mammals. The earliest permanent European settlers of Buenos Aires in 1580 discovered huge herds of feral horses already on the pampas, and soon after, Vázquez de Espinoza described feral horses in Tucumán that were "in such numbers that they cover the face of the earth…". Many sheep were in Tucumán as well at that time, and of course later sheep were enormously numerous in Patagonia, effecting huge changes in the vegetation and driving land degradation and desertification to this day. When Charles Darwin visited the La Plata region in 1832 during the voyage of the Beagle, he reported that "…countless herds of horses, cattle, and sheep, not only have altered the whole aspect of the vegetation, but they have almost banished the guanaco, deer and ostrich. Numberless other changes must likewise have taken place; the wild pig in some parts probably replaces the peccari; packs of wild dogs may be heard howling on the wooded banks of the less-frequented streams; and the common cat, altered into a large and fierce animal, inhabits rocky hills."

Approximately 40 mammals have been introduced to South America, of which 25–30 have established populations; most of these are in the Southern Cone. In Argentina, I count 23 successfully introduced mammal species, including feral cats, dogs, and cows. Many, such as rats, rabbits, boar, and goats, are widely distributed around the world. By contrast, the hairy armadillo has been introduced nowhere else but from the mainland of Patagonia to Tierra del Fuego Island. Strikingly, except for the rats and house mouse, all these mammals were brought to Argentina deliberately; this is very different from, say, introduced insects. A few of these invasive mammals, like the squirrel, were not intended to be released, but I hesitate to term such invaders truly "accidental," because the people who brought them should have realized that escapes or later releases were almost inevitable. Of course, almost all of these mammals were introduced before the late twentieth century, which was when most scientists and the public began to recognize the extent and importance of impacts of introduced species. However, the squirrel and armadillo introductions were recent enough that potential impacts should have been foreseen. Things could be worse, of course—mammals deliberately brought to Argentina that either were released, but did not establish persistent populations or have not yet escaped from hunting preserves include reindeer, silver fox, mule deer, African buffalo, white-tailed deer, Père David's deer, thar, barbary sheep, wisent, mouflon, chamois, and ibex.

The technology of eradicating introduced invasive mammals has made enormous strides in the last thirty years—at least 31 mammal species have been eradicated from islands worldwide, including relatively large islands like South Georgia. Both Norway and ship rats have been eradicated hundreds of times, and house mice about 100 times. Most large mammals, such as deer and horses, are technologically easier eradication targets—many can simply be tracked and shot, for instance. However, mammals more than any other introduced species pose the complication that many people—especially hunters—simply do not want to eradicate them, and many animal welfare advocates, even those recognizing the damage some invaders cause, object to eradicating them by the only currently feasible means—killing them, humanely if possible. Even rat eradication has been impeded on animal rights/animal welfare grounds, and free-ranging dog and cat populations frequently are seen more as animal welfare issues than as conservation problems to broad sectors of some societies. In Argentina, the problem of implementing feasible eradication programs for invasive mammals is epitomized by the rather schizophrenic attitude taken by the National Parks Administration (Administración de Parques Nacionales – APN) towards red deer. The APN's conservation imperative is supported by the section of Law #22,351 that forbids propagating introduced animals, yet red deer, known to damage native species and ecosystems, are managed in Lanín National Park to foster ongoing hunting, and even to improve the size and quality of the deer for better hunting trophies. Additionally, there is often inconsistent and inadequate funding for managing and eradicating invasive mammals in protected areas, almost always constituting a supervening impediment even when a rational and effective goal is stated.

Argentine scientists have participated heavily in the rapid growth of modern invasion science since its inception in the 1980s, and they and overseas colleagues have conducted substantial research on the biology and impacts of many of the introduced invasive mammals in Argentina, as well as other invasive species. Some of the threats posed by these mammals have even become widely known to the general public in Argentina and beyond—the spread of the beaver from Tierra del Fuego to the mainland has been an international news story. *Introduced Invasive Mammals of Argentina* is therefore an exciting and timely addition to the literature on invasions in southern South America for both the Argentine public (and its political representatives and environmental managers) and scientists worldwide. The many authors assembled for this book explore how these biological invasions happened in the first place, how they spread, what they do to biodiversity, ecosystems, and human enterprises, what has been done about them so far, what can be done about them now, and what might be done with them in the future. The editors and authors are to be congratulated for an excellent exposition of the Argentine part of a growing global phenomenon.

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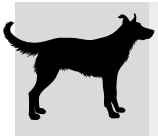

Canis lupus familiaris
domestic feral dog, perro doméstico asilvestrado

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Resumen. El perro doméstico asilvestrado tiene una gran diversidad de formas y tamaños. Tiene una flexibilidad muy alta y un nicho amplio que le permite sobrevivir y reproducirse en una enorme gama de hábitats. De hábitos terrestres, hábitat generalista y actividad catemeral, es una especie que forma jaurías en su estado en silvestría y su dieta es omnívora y generalista. El promedio de crías por camada es de 6 cachorros y excepcionalmente pueden tener hasta 15 crías. La población de perros domésticos, asilvestrados o semi-asilvestrados en Argentina ha ido aumentando en casi todas las localidades y áreas rurales del país. Su gran adaptabilidad la convierte en una de las especies invasoras más exitosas en el mundo. Proviene de los perros de caza que arribaron con los colonizadores europeos y su introducción también tuvo que ver con fines recreativos. Progresivamente se produjo una transformación hacia la silvestría a partir de escapes, abandono de ejemplares, mala gestión o tenencia no responsable de perros criados en el campo, en zonas urbanas y suburbanas. Según registros de individuos o poblaciones, los perros domésticos y asilvestrados se encuentran distribuidos en prácticamente toda Argentina. El acoso y la depredación de los perros sobre los mamíferos salvajes es el impacto más importante, afectando a varias especies. Además de provocar accidentes de tráfico y agresiones a las personas, los perros están implicados en la propagación de enfermedades zoonóticas y parásitos graves como hidatidosis, leptospirosis, toxocariasis, brucelosis, toxoplasmosis, etc. Hay algunas provincias con planes de manejo para la especie.

General description of the species

Domestic dogs (*Canis lupus familiaris*), even feral ones, come in a great diversity of shapes and sizes. Its external morphological characteristics are extremely variable, with different and varied coats; individuals can range from a few kg to more than 45 kg, and even reaching up to 95 kg in some breeds (Fig. 1; Lartigau *et al.*, 2019). In general, this species relies on food supply and shelter from humans; however, feral dogs could be absolutely human independent (Butler and Du Toit, 2002).

Habitat

The dog has colonized forests, tundra, jungles, steppes and mountains. They have very high ecological flexibility and a wide niche that allows them to survive and reproduce

in a huge range of habitats. They occupy practically all environments, particularly where urban and rural human populations are established (Lartigau *et al.*, 2019). The dog is a social species that forms packs, and it has a generalist, omnivore diet and terrestrial and cathemeral activity (Long, 2003).

Figure 1. *Canis lupus familiaris* in Parque Nacional Tierra del Fuego, Argentina. (Photo: Proyecto Huillín TDF).

Reproduction

Feral dogs can display reproductive behaviors comparable to those of wolves, with the presence of well-established and organized social groups. So the rearing of pups is usually shared between members of the group (Lartigau *et al.*, 2019). The average of young per litter is 6; exceptionally, they can reach 15 offspring.

Native range distribution

The dog derived from the Eurasian wolf, but since its domestication, it has been introduced practically around the entire globe, even in polar regions (Long, 2003). Currently, the dog is the world's most abundant and widely distributed carnivore (Doherty *et al.*, 2016).

History of the invasion

Its great adaptability makes *Canis lupus familiaris* one of the world's most successful invasive species (Young et al., 2011; Paschoal, 2016; Doherty et al., 2017). Genetic studies indicate that the dog arrived to the Americas with *Homo sapiens*, around 11,000 years ago, crossing through the Bering Strait (Leonard *et al.*, 2002), and there is evidence suggesting

the existence of domestic dogs in various places in the Americas in pre-European times (Valadez *et al.*, 2003). In particular, pre-European records exist for domestic dogs in Argentina (Acosta *et al.*, 2011), but genetics indicates that today's feral dogs, which are invading the country and the continent, originated from the hunting dogs brought by early European colonizers (Cabrera, 1932). Since then, the dog's introduction has been mostly related to recreational purposes and as a pet (Lartigau *et al.*, 2019).

Patterns of expansion and current distribution

The spread of feral or semi-feral dogs is mainly associated with humans, mostly due to abandoned or mismanaged domestic individuals. Despite not having national studies, it is estimated that the population of domestic, feral or semi-feral dogs in Argentina is

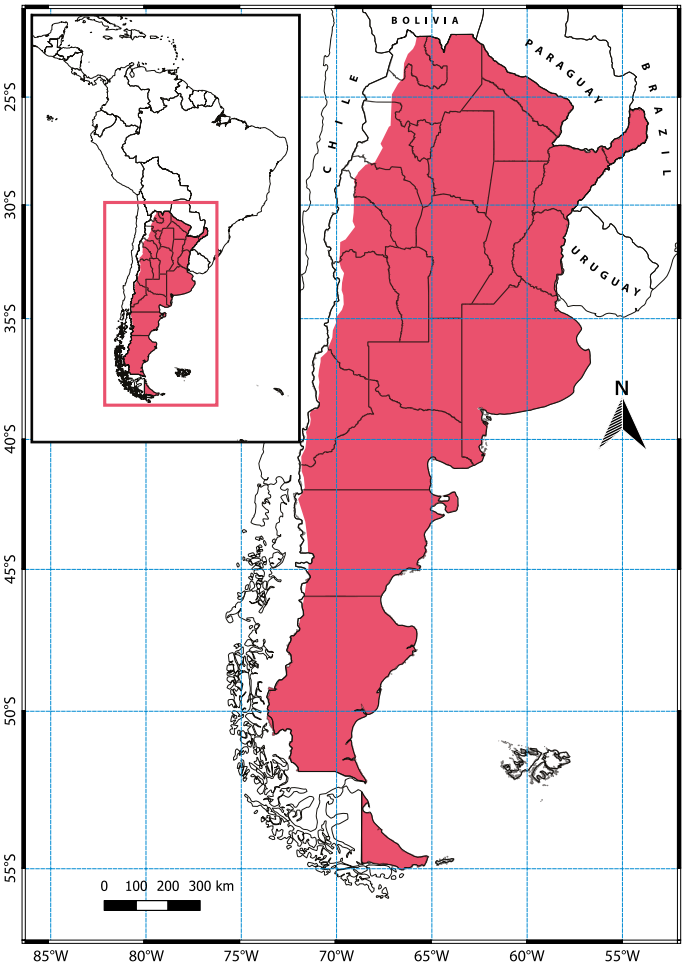

Figure 2. Distribution of *Canis lupus familiaris* in Argentina. Modified from Lartigau *et al.* (2019). (Mapping: Ian Barbe and Alfredo Claverie).

increasing, occupying the entire country, with presence in almost all protected areas (Fig. 2; Lartigau *et al.*, 2019). Additionally, urban centers often function as sources of new individuals to feral populations, or sometimes domestic or street dogs leave the cities temporarily, with potential impacts on the native fauna (Lartigau *et al.*, 2019).

Impacts

Ecological impact

The impact of dogs on native biodiversity in Argentina has not been properly evaluated (Lartigau *et al.*, 2019). Globally, this carnivore species is known to threaten native species by predation (Doherty *et al.*, 2017). In addition to predation, harassment, bird nests disturbance, competition with native predators and scavengers, and transmission or introduction of pathogens (*e.g.*, distemper, leishmaniasis, bovine neosporosis, parvovirus, rabies, hydatidosis) have been reported (Echaide, 2000; Fiorello *et al.*, 2004; Zanini *et al.*, 2009; Orozco *et al.*, 2014; Czupryna *et al.*, 2016; Feng *et al.*, 2016).

Economic impact

In Patagonia, mainly in Tierra del Fuego province, feral dogs affect livestock by attacking sheep, forcing some ranchers to change their production system to cattle (Zanini *et al.*, 2008). In Santa Cruz province, damage from dogs to sheep farming was described as even greater than that of puma (*Puma concolor*; Lartigau *et al.*, 2019). Additionally, the transmission of bovine neosporosis, caused by *Neospora caninum*, a protozoan that mainly affects cattle and dogs, is of international importance for cattle production (Echaide, 2000). As with American mink (*Neogale vison*; Claverie *et al.*, this volume), feral dogs also affect nature-based tourism economic activities (Lartigau *et al.*, 2019).

Health impact

Feral dog populations have been known to directly attack people, as well as cause traffic accidents (Zanini *et al.*, 2008). On the other hand, dogs are implicated in the spread of zoonotic diseases and serious parasites, such as hydatid disease, leptospirosis, toxocariasis, brucellosis, toxoplasmosis, etc. (Milano and Oscherov, 2002).

Management

To date, there is no national management plan for feral dogs (Lartigau *et al.*, 2019). Due to its cultural status as a pet, the perception of the species and its impacts in general does not correspond to the ecological reality, favoring the support of animal protectionist laws that prevent the application of feral dog removal measures, generating a conflict regarding the management of feral or semi-feral populations (Lartigau *et al.*, 2019). The effective management of an introduced invasive charismatic species needs social as well as political support (Guichón *et al.*, this volume), not only through responsible ownership but also by supporting ethical feral populations reduction and control actions. Since 2011,

a "National Program for Responsible Ownership and Health of Dogs and Cats" has been implemented with the dual goal of preserving native biodiversity and avoiding cruelty to these species (National Decree #1088/2011). Several feral dog management plans at local level are applied in different protected areas (mostly related to responsible ownership) and in livestock production ranches by eliminating problem individuals (Lartigau and Preliasco, 2015; Lartigau and Carminati, 2016; Lartigau and Schiaffino, 2016; Mezzabotta, 2018).

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INTRODUCED INVASIVE MAMMALS OF ARGENTINA

Introduced Invasive Mammals (IIMs) are a major driver of global and local environmental change, including negative impacts on biodiversity, ecosystem processes, economies, health and other social values. However, as complex social-ecological systems, invasive species cannot be conceived solely as "negative," nor merely as "biological" invasions. This book presents conceptual and practical perspectives from 49 authors with expertise in communication, ecology, education, genetics, history, philosophy, social sciences and veterinary medicine to better understand and manage IIMs in Argentina. It concludes by providing updated information on Argentina's IIM assemblage, which includes 23 species.

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