



SAREM Series A
Mammalogical Research
Investigaciones Mastozoológicas

VOLUME 3

INTRODUCED INVASIVE MAMMALS OF ARGENTINA

MAMÍFEROS INTRODUCIDOS INVASORES DE ARGENTINA



Alejandro E. J. Valenzuela, Christopher B. Anderson, Sebastián A. Ballari and Ricardo A. Ojeda, EDITORS

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» **DR. ALEJANDRO E. J. VALENZUELA**

Alejandro E. J. Valenzuela is a biologist in the Argentine National Scientific & Technical Research Council (CONICET) and professor at the National University of Tierra del Fuego (UNTDF). He works doing ecological research applied to native wildlife conservation and invasive species management, but also supporting managers and decision-makers to generate conservation strategies.

» **DR. CHRISTOPHER B. ANDERSON**

Christopher B. Anderson is an ecologist in the Argentine National Scientific & Technical Research Council (CONICET) and a professor at the National University of Tierra del Fuego (UNTDF). Originally from the USA, he has spent his professional career studying the integrated ecological and social dimensions of environmental problems in southern Patagonia.

» **DR. SEBASTIÁN A. BALLARI**

Sebastián A. Ballari is an ecologist and wildlife biologist manager in the Argentine National Scientific & Technical Research Council (CONICET). With an emphasis on the conservation of native ecosystems and their natural processes, his interests include the study of introduced invasive species, wildlife management in protected areas, and effects of global change drivers.

» **DR. RICARDO A. OJEDA**

Ricardo A. Ojeda is a biologist at the Argentine Institute of Arid Zones Research (IADIZA) and the Argentine National Scientific & Technical Research Council (CONICET). His main research interests are the ecology of small desert mammals, biogeographic patterns, integrative taxonomy and biodiversity conservation.

INTRODUCED INVASIVE MAMMALS OF ARGENTINA

EDITED BY

Alejandro E.J. Valenzuela

Instituto de Ciencias Polares, Ambiente y Recursos Humanos (ICPA), Universidad Nacional de Tierra del Fuego (UNTDF)
& Consejo Nacional de Investigaciones Científicas y Técnicas (CONICET)
avalenzuela@untdf.edu.ar

Christopher B. Anderson

Instituto de Ciencias Polares, Ambiente y Recursos Naturales (ICPA), Universidad Nacional de Tierra del Fuego (UNTDF)
& Centro Austral de Investigaciones Científicas (CADIC), Consejo Nacional de Investigaciones Científicas y Técnicas (CONICET)
canderson@untdf.edu.ar

Sebastián A. Ballari

Parque Nacional Nahuel Huapi (CENAC),
Consejo Nacional de Investigaciones Científicas y Técnicas (CONICET)
s.ballari@conicet.gov.ar

Ricardo A. Ojeda

Instituto Argentino de Investigaciones de Zonas Áridas (IADIZA),
Centro Científico Tecnológico (CCT) – Consejo Nacional de Investigaciones Científicas y Técnicas (CONICET) – Mendoza
rojeda@mendoza-conicet.gob.ar



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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.

Daniel Simberloff

Nancy Gore Hunger Professor of Environmental Studies

Department of Ecology and Evolutionary Biology

University of Tennessee

Knoxville, TN 37996



Lagomorpha

European hare and rabbit, liebre y conejo europeos

Lepus europaeus

European hare, liebre europea

Oryctolagus cuniculus

European rabbit, conejo europeo o de Castilla

Alejandro E.J. VALENZUELA¹

¹ Instituto de Ciencias Polares, Ambiente y Recursos Naturales (ICPA), Universidad Nacional de Tierra del Fuego (UNTDF), and Consejo Nacional de Investigaciones Científicas y Técnicas (CONICET), Fuego Basket 251, 9410 Ushuaia, Argentina. avalenzuela@untdf.edu.ar

Resumen. La liebre europea (*Lepus europaeus*) y el conejo de Castilla (*Oryctolagus cuniculus*) son especies de lagomorfos nativas de Eurasia y la Península Ibérica respectivamente. Son pequeños herbívoros con una gran capacidad reproductiva. Ambas especies fueron introducidas en la Argentina hace más de un siglo, lo cual implica que en algunos casos ambas especies pueden ser consideradas por las personas como nativas, a lo cual se suma que son especies carismáticas. En ambos casos el objetivo de las introducciones fue principalmente para su utilización como alimento y también por sus pieles. La liebre ha colonizado toda la Argentina, excepto Tierra del Fuego, mientras que el conejo tiene presencia en todas las provincias patagónicas, Mendoza y San Juan. Los lagomorfos introducidos invasores pueden alterar la estructura y función de los ecosistemas, y representan una amenaza potencial a la agricultura, la horticultura, la ganadería, las plantaciones forestales y los ambientes naturales, principalmente por herbivoría. También, ambas especies pueden ser vectores de diferentes enfermedades y parásitos. Cabe destacar que tanto la liebre como el conejo sirven de alimento para depredadores nativos y exóticos, lo que implica que cualquier decisión de manejo debe tener en cuenta el potencial impacto sobre los primeros. De todos modos, no existen actualmente planes formales de manejo de estas especies.

General description of the species

The European hare (*Lepus europaeus*) is a Eurasian medium to small herbivore with a fur from yellow-gray to brown and white, that ranges in size from about 48 to 70 cm and in weight from 3 to 6 kg, with long hind limbs adapted to jump (Fig. 1). The species presents sexual dimorphism, with females bigger and heavier than males (Monteverde *et al.*, 2019). It reaches sexual maturity at approximately six to eight months of age and gives birth to a litter of two young (called leverets) on average, with two or three gestations periods per year, with two or three calvings per year (Monteverde *et al.*, 2019).



Figure 1. *Lepus europaeus* in Argentina. (Photo: Gabriel Rojo).

The European rabbit (*Oryctolagus cuniculus*) is a species native from the Iberian Peninsula. This small herbivore presents a brown-gray coloration with a size between 45 to 65 cm and a weight between 1 to 3 kg (Fig. 2; Bonino and Donadío, 2010). The species reaches sexual maturity at approximately three to six months of age, with five to seven litters per year with three to nine young (called kits) each (Cuevas *et al.*, 2019).

History of the invasion

European hares were brought from different parts of Europe (Germany and France) between 1888 and 1930 for sport hunting (Bonino *et al.*, 2010).

Rabbits were brought to southern South America in multiple introductions from Spain and France, beginning in the 1760s, to several islands of the Tierra del Fuego Archipelago (Jaksic and Yáñez, 1983; Jaksic *et al.*, 2002). The objective of these releases was for food and pelts (Camus *et al.*, 2008). Subsequent to the first introduction in Tierra del Fuego, the species was also brought and released on the mainland on several occasions, mostly in Chile (Cuevas *et al.*, 2019).

Patterns of expansion and current distribution

After the first introduction, the European hare expanded between 18–20 km/year until it occupied almost all of Argentina (Fig. 3) and different areas of Chile, Uruguay,

Paraguay, Peru, Brazil and Bolivia, including urban areas (Bonino *et al.*, 2010; Jaksic and Castro, 2014). Because the European hare shows great ecological plasticity, Bonino *et al.* (2010) predicted that this species would continue to disperse towards the northern part of South America, particularly in the west where the Andean Mountains serve as a corridor (Ballari *et al.*, 2016).

European rabbits have expanded from their original introduction points and invaded other areas, and even crossed the Andes Mountains between Chile and Argentina (Jaksic *et al.*, 2002; Novillo and Ojeda, 2008). Currently, derived from different introductions events or expansions, the species is present in all Argentine Patagonian provinces and in Mendoza and San Juan (Fig. 4). Rabbits in Neuquén province were shown to have a dispersal rate that varied between two and 15 km/year, thus indicating their potential for expanding into new ranges (Bonino and Soriguer, 2009; Cuevas *et al.*, 2019). Human intervention could favor the invasion of the European rabbit, since translocations and releases are still common (Cuevas *et al.*, 2019).



Figure 2. *Oryctolagus cuniculus* in Tierra del Fuego, Argentina. (Photo: Nicolás Easdale).

Impacts

Introduced invasive lagomorphs could alter the structure and function of native ecosystems, representing a potentially significant threat to agriculture, horticulture, livestock, forestry and natural habitats (Novillo and Ojeda, 2008; Bonino and Soriguer, 2009). The

herbivory done by these species changes the structural complexity of herbaceous vegetation, prevents tree and shrub regeneration and could compete with native herbivores and livestock for food resources (Bonino, 1995; Vázquez, 2002; Novillo and Ojeda, 2008; Ballari *et al.*, 2016). Additionally, both species can be vectors for several diseases and parasites (Kleiman *et al.*, 2004; González-Acuña *et al.*, 2005). Furthermore, predation on both species was reported, either by native raptors and carnivores (Jaksic, 1998; Castro *et al.*, 2008; Pavez *et al.*, 2010), or by introduced invasive carnivores, such as the American mink (*Neogale vison*), which would be favored by invasional meltdown (Valenzuela *et al.*, 2013, 2014). So far there is no overall estimation regarding the economic and environmental costs of the introduced invasive lagomorphs in this region (Bonino *et al.*, 2010).

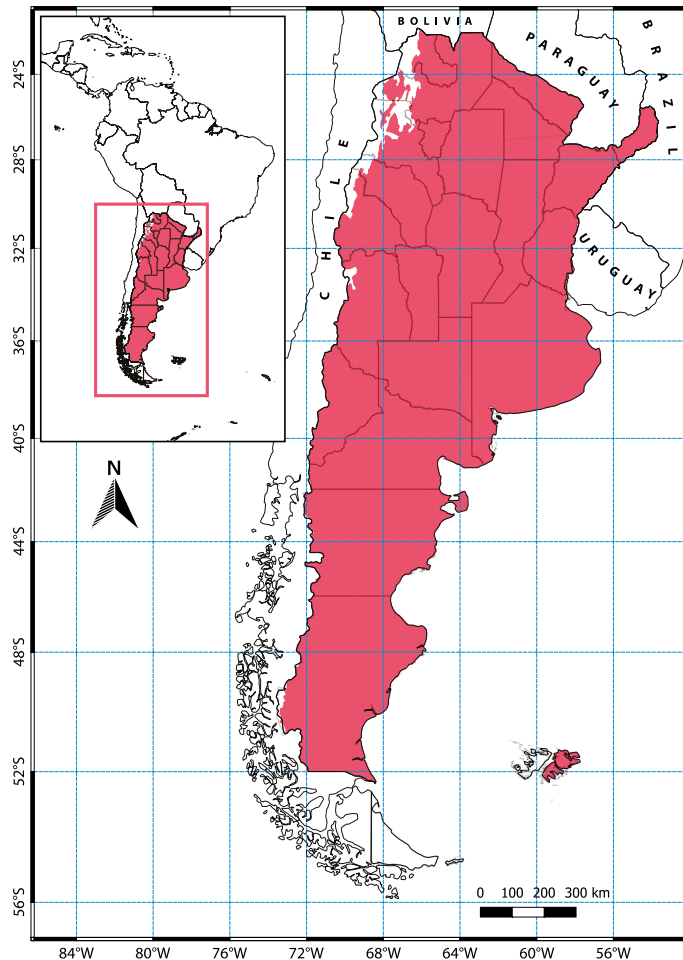


Figure 3. Distribution of *Lepus europaeus* in Argentina. Modified from Monteverde *et al.* (2019). (Mapping: Ian Barbe and Alfredo Claverie).

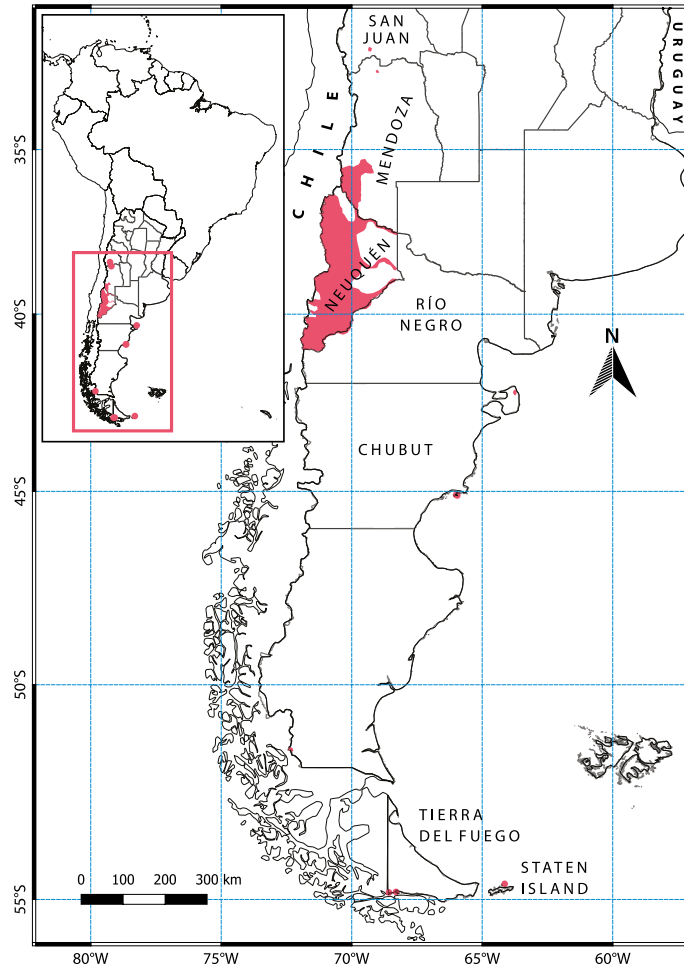


Figure 4. Distribution of *Oryctolagus cuniculus* in Argentina. Modified from Cuevas *et al.* (2019). (Mapping: Ian Barbe and Alfredo Claverie).

Management

There are currently no formal management plans or actions to reduce hare and rabbit populations in Argentina (Ballari *et al.*, 2016; Cuevas *et al.*, 2019; Monteverde *et al.*, 2019), even when, for example, millions of hares are harvested per year for export (Bonino *et al.*, 2010). Some native predators (carnivores and raptors) have included these species in their diets (Ballari *et al.*, 2016) and may contribute to the regulation of their populations. However, for this reason, management actions should consider this interaction to safeguard the welfare of native predators. Additionally, as charismatic species, both are often perceived as “native” and “familiar,” which makes further management and control actions difficult to perform (Ballari *et al.*, 2016; Guichón *et al.*, this volume).

In particular for rabbits, Pampa foxes (*Lycalopex gymnocercus*) were introduced into Tierra del Fuego Island as a biological control agent; however, no effects on the rabbits' populations were found (Valenzuela *et al.*, 2014; Ballari *et al.*, 2016). Therefore, inoculation with the myxomatosis virus was implemented and resulted in a significant decrease of rabbit populations (Jaksic and Yáñez, 1983, Jaksic and Castro, 2014), but several isolated populations survived. Myxomatosis virus was/is also used on several ranches in mainland Patagonia, but currently this approach is prohibited by law in Argentina (Ballari *et al.*, 2016; Cuevas *et al.*, 2019).

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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.

**Alejandro E. J. Valenzuela, Christopher B. Anderson, Sebastián A. Ballari
and Ricardo A. Ojeda, EDITORS**



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