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Article

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POTENTIAL CONTRIBUTIONS OF MAMMALS TO HUMAN WELL-BEING IN ARGENTINA

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ABSTRACT. Mammals are key components of biodiversity mediating ecosystem functions, mainly because of the diversity of forms and functions of this group. Understanding and making explicit the role of mammals underpinning Nature's Contributions to People (NCP) or directly contributing to human well-being would help to influence policy formulation towards sustainable development and nature conservation. Through a workshop held at the XXXII Jornadas Argentinas de Mastozoología and subsequent collaborative work, we compiled information related to Mammal's Contributions to People in Argentina (MCP-Arg) based on participants' interpretation of the available literature and their field experience. Argentinian mammals contribute to 12 of the 18 defined NCPs. We derived numerous MCP-Arg from studies that focused mainly on ecological processes and conservation, revealing an information gap in MCP-Arg description, quantification, and mapping. All taxa contribute similarly to the overall contributions, highlighting the importance of preserving mammal diversity. Conservation should also be framed at the local community rather than regional scales, aiming to preserve ecological functioning and contributions to human well-being, especially within regulation contributions. Our results show destructive feedback between threats and habitat-related contributions, with habitat degradation being the greatest threat to mammalian contributions and habitat maintenance the most threatened one. Our research indicates that a substantial amount of knowledge about MCP-Arg is available through narratives and interpretations. Considering the NCP approach to mammalian

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research, we can make significant contributions to both mammal conservation and human well-being.

RESUMEN. CONTRIBUCIONES POTENCIALES AL BIENESTAR HUMANO DE LOS MAMÍFEROS EN ARGENTINA. Debido a su diversidad de formas y funciones, los mamíferos son componentes clave de la biodiversidad y cumplen importantes funciones ecosistémicas. Para formular políticas que permitan un desarrollo sostenible y la conservación de la naturaleza, es fundamental comprender y explicitar el papel de los mamíferos en sustentar las Contribuciones de la Naturaleza a las Personas (CNP). Durante un taller realizado en las XXXII Jornadas Argentinas de Mastozoología y un posterior estudio colaborativo, hemos recopilado información relacionada con las CNP de mamíferos en Argentina (CMP-Arg) en base a la interpretación de la literatura disponible y la experiencia de campo. En la Argentina, los mamíferos contribuyen en 12 de las 18 CNP definidas. Deducimos numerosas CMP-Arg de estudios centrados principalmente en procesos ecológicos y de conservación, que muestran un vacío de información en cuanto a descripción, cuantificación y mapeo de CMP-Arg. Todos los taxones realizan aportes similares a las contribuciones totales, lo que destaca la importancia de preservar la diversidad de mamíferos. Los esfuerzos de conservación deben enmarcarse no solo a escala regional, sino también a escala local, con el objetivo de preservar las CNP. Nuestros resultados han mostrado una asociación entre amenazas y contribuciones relacionadas con el hábitat: la degradación de este ha sido la principal amenaza para las contribuciones y su mantenimiento la contribución más amenazada. Nuestra investigación muestra que una cantidad importante de conocimiento sobre CMP-Arg está disponible a través de narrativas y representaciones sociales. Mediante la implementación del enfoque del CNP en la investigación mastozoológica, podemos hacer aportes significativos tanto para la conservación de los mamíferos como para el bienestar humano.

Key words: Biodiversity, conservation, ecosystem functions, ecosystem services, Nature's Contributions to People.

Palabras clave: Biodiversidad, conservación, Contribuciones de la Naturaleza a las Personas, funciones ecosistémicas, servicios ecosistémicos.

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INTRODUCTION

The ability of the planet to continue to provide beneficial contributions from nature to human well-being is limited and declining due to demographic and socioeconomic development pressures at different scales (MEA 2005; IPBES 2019). There is consensus on the increasingly urgent need to align conservation and development through global policies, such as the Sustainable Development Goals (SDGs; United Nations 2015). To assess the knowledge to inform policy formulation towards sustainable development, the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) recently proposed the Nature's Contributions to People (NCP) approach.

According to IPBES, "NCP are all the contributions, both positive and negative, of living nature (diversity of organisms, ecosystems, and their associated ecological and evolutionary processes) to people's quality of life" (Díaz et al. 2018). The NCP approach includes direct and indirect effects of nature on the quality of life, and it involves narratives of actors in the definition and assessment of different contributions (Díaz et al. 2018). In this way, the approach can be more easily applied to compile and reframe the knowledge of ecologists and other actors within the systems in which they work, and to analyze different perceptions of the species or groups whose contributions are recognized as benefits or detriments depending on the actor's perspective. This holistic assessment supports decision-making and conservation actions, including diverse perceptions and multiple contributions to human well-being (and ecosystem functioning underpinning those contributions) (Takahashi et al. 2022). In particular, this approach can contribute to participatory processes to resolve conflicts between wildlife and productive activities (Williams et al. 2018; Vilá & Arzamendia

2020; Takahashi et al. 2022). Implementing integrated valuation to open a new perspective on conservation requires an understanding of the relationship between biodiversity and human well-being, which still need to be disentangled (Mastrángelo et al. 2019).

Mammals are key components of biodiversity that mediate ecosystem functions, mainly because of their diversity of forms and functions (Lacher et al. 2019). Therefore, understanding and making explicit the role of mammals underpinning NCP or directly contributing to human well-being would contribute significantly to informing policy formulation toward sustainable development and nature conservation. This understanding of the role of mammals is mainly contained in the relationship of Nature and NCP within the IPBES conceptual framework. However, ecological knowledge of processes and threats affecting mammals could inform policy identifying some direct drivers (**Fig.** 1).

The role of mammals in ecosystems and their relationship with other components, including human populations, have been recently reviewed by Lacher et al. (2019). Although this review was not in terms of Mammals' Contributions to People (MCP) approach, the authors acknowledge an information gap about the relationship between mammals' ecosystem functions and human well-being (Lacher et al. 2019). However, previous studies have documented the contributions of some species to human well-being in terms of ecosystem services (Kunz et al. 2011; Valentine 2014; Rodrigues et al. 2020). For example, digging mammals contribute to soil fertility and seed dispersal, through foraging activities, and habitat creation, through seed capture, seedling germination, recruitment and plant diversity in some foraging pits (Valentine 2014). Armadillos, in addition to their contributions as digging mammals, act as sentinel species for contaminants, disease surveillance and pest control, provide meat and medicine, and as non-material contributions, they are conservation flagship species (Rodrigues et al. 2020). Bats contribute to ecosystem regulation through arthropod suppression, seed dispersal, and pollination of a wide variety of ecologically and economically important plants, provide food, guano as fertilizer and medicine, and contribute to culture (Kunz et al. 2011). Overall, important contributions of these mammals to people have been described, but gaps in understanding some ecological processes or the measurement of positive consequences for human well-being have also been identified. In addition, the assessment of these contributions was based primarily on ecological studies rather than a direct compilation of studies on the contributions themselves. Therefore, the narrative of ecologists is crucial for understanding and making explicit MCP to foster the new dimension of mammal conservation.

In Argentina, 98 out of 400 mammal species assessed are threatened (SAyDS & SAREM 2019), and threats related to habitat transformation and climate change are expected to increase in the near future (IPBES 2019). An assessment of the known contributions to people provided by mammals in Argentina (MCP-Arg) helps ecologists visualize information that is already available but may be lost in studies focused on other subjects, such as seed dispersal of a species instead of habitat maintenance. By acknowledging the contributions to people provided by mammals in Argentina (hereafter MCP-Arg), policy and conservation efforts can focus on conserving these processes and mitigating the current environmental crisis (**Fig.** 1).

To our knowledge, no article focused on compiling available ecological and ethnozoological information to highlight known MCP-Arg. Therefore, our study is the first approach to understanding the available information and gaps related to MCP-Arg. First, we aimed to develop a baseline for MCP-Arg, by identifying contributions to people that mammals may provide in Argentina according to species and ecological processes involved. To achieve this goal, we worked with expert elicitation to gather available information in their fields. Our second objective was to record the gaps in the baseline to contribute to future research for assessing the perspectives for the maintenance of MCP-Arg. To meet these goals, we focused mainly on the role of mammals underpinning MCP, and only discussing some other elements and relationships of the IPBES framework (**Fig.** 1).

Our article is structured as follows. First, we present the methodological approach and then the results, which are divided into (1) a general qualitative-quantitative description of MCP-Arg and the compiled information, and (2) the understanding of MCP-Arg and the ecological processes involved according to the classification proposed by IPBES to facilitate the localization and comparison of information among contributions. Finally, we discuss the implications of the general finding about MCP-Arg and the information gaps for both mammalian conservation and human well-being.

METHODS

This article arose from a workshop developed during the XXXII Jornadas Argentinas de Mastozoología (JAM,

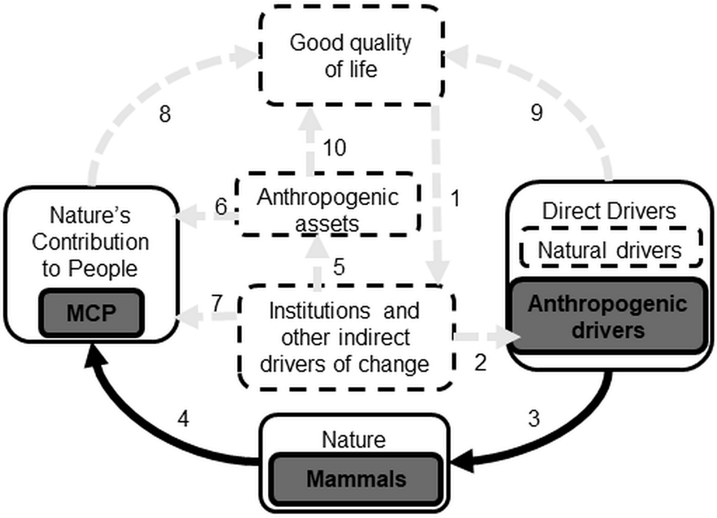

Fig. 1. Focus on the role of mammals underpinning the NCP and the effects of drivers threatening mammalian populations within the IPBES conceptual framework (Díaz et al. 2015). Boxes denote the basic components of nature and society that are the focus of IPBES, and dark grey boxes with non-dotted lines indicate those components that are the focus of this research: mammals within nature, Mammal's Contributions to People (MCP) within nature's contributions to people (after Díaz et al. 2018), and direct drivers of change with particular emphasis on anthropogenic drivers. The arrows between the elements represent influences and interactions between IPBES components, and the solid black arrows are the ones researched in this study (arrow numbers are the same as in Díaz et al. 2015).

Argentine Mammalogy Meeting) attended by 44 experts. Considering that: 1) the JAM is an annual scientific meeting organized by the Argentine Society of Mammalogists and the gathering place par excellence for mammalogy specialists working on different sub-disciplines; and 2) an expert is someone who holds information about a given topic through training, research, and skills, but could also through personal experience (Martin et al. 2012); the only criterion for participation as an expert in the workshop was attendance at the XXXII JAM. Therefore, the group of experts participating in this study represents a sample of mammalogists from various subdisciplines, who have information about the role of mammals in the ecosystems and the relationships between mammals and humans. Because this sample was biased toward ecologists, to develop the baseline for MCP-Arg assessment, we focused on identifying the species and ecological processes involved in underpinning MCP-Arg and threats over species and processes (**Fig**. 1).

During the workshop, experts shared their experiences to identify the contributions to human well-being by different mammal species or taxa and the associated processes, considering the 18 NCP identified by IPBES as a reference, and providing literature references when possible (see sup. mat. 1 for the workshop dynamics description). The workshop was the first of four steps in the expert elicitation process adapted from the IDEA protocol (Investigate-Discuss-Estimate-Aggregate, Hemming et al. 2018; **Fig**. 2). However, to develop an MCP-Arg baseline, the elicitation was primarily qualitative.

Following the elicitation process after the workshop (investigation step), most participants kept in contact and collaborated remotely to 1) discuss the results of the workshop (discussion step); 2) identify MCP-Arg (estimation step) in a more detailed way answering an online form, and; 3) compile the information related to MCP-Arg (aggregation step) obtained via the online form (**Fig**. 2). By responding the form, participants contributed with information on four main topics: MCP-Arg narratives, mammalian processes and functions underpinning MCP-Arg, the conservation status of populations and their main threats, and evidence supporting the former three topics (scientific published articles, technical reports, unpublished field observations; the complete list of literature compiled during expert elicitation process is in sup. mat 1). The online form was designed to guide and compile input from all participants (see sup. mat. 2). It is important to note that the baseline of MCP-Arg developed by participants from the available literature and their own experiences in the field is not intended to be exhaustive. However, we consider that the compilation of expert knowledge was sufficient to fulfill the objectives of the article.

To evaluate possible regional bias due to the composition of the expert group, a Pearson's correlation test was performed between the number of MCPs and the number of experts in each particular ecoregion (Burkart et al. 1999). To visualize the information gaps in MCP-Arg, we also used a word cloud analysis using the keywords, titles and abstract of the literature referenced in the compiled contributions. A word cloud is a visual representation of word frequency in which the more frequently a term

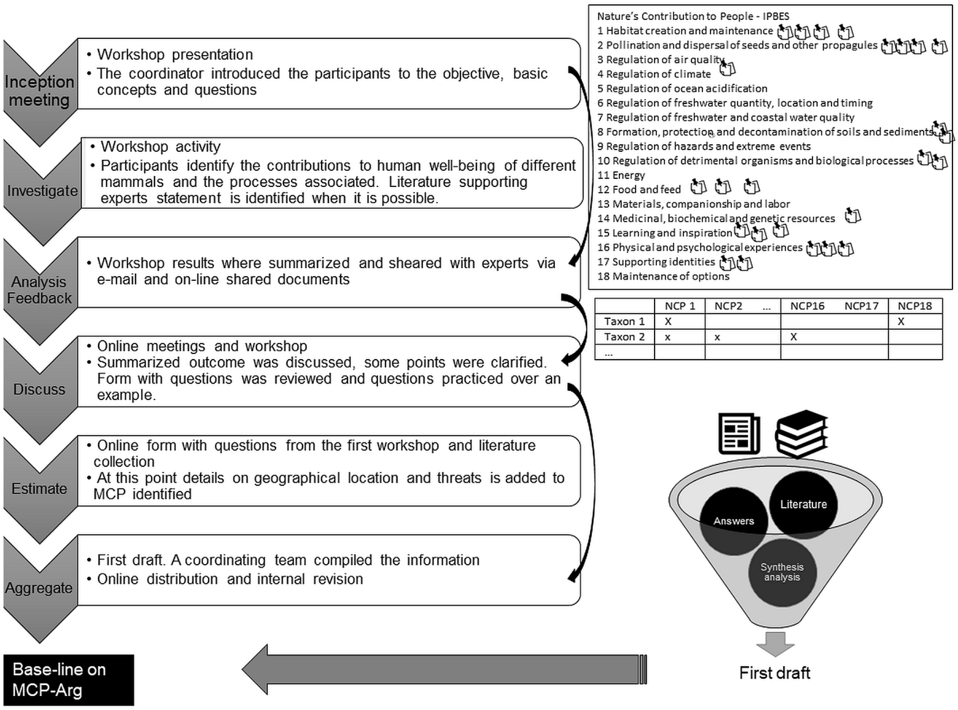

Fig. 2. Workflow diagram for the expert elicitation process adapted from the IDEA protocol (Investigate-Discuss-Estimate-Aggregate, Hemming et al. 2018).

occurs in the analyzed text, the larger the word appears in the generated image (Padmanandam et al. 2021). Word clouds are increasingly used as a simple tool to identify the focus of written material (Flaherty et al. 2017; Vlami et al. 2020; Choudhury et al. 2021). Finally, to summarize information about the most important threats, we summed the importance that experts placed on each threat for all taxa, and for each contribution. We used a scale of one to five, indicating the most and less important threat, respectively, affecting the taxa or its contribution to people. All analyzes were performed using R (Feinerer et al. 2008; Neuwirth 2014; Silge & Robinson 2016; Wickham 2016; Fellows 2018; Feinerer & Hornik 2019; Wickham 2019; R Core Team 2020; Wickham 2021b,a; Wickham et al. 2021).

During the compilation (aggregation step of the protocol), it became clear that some MCPs are tightly related. When a taxon contributes with two related MCPs, the one more directly or strongly related to human benefits was registered as the contribution for the compilation, and the other was considered as the ecological process underpinning the contribution. For example, habitat creation and seed dispersal are often provided by the same species that contribute to the maintenance of a shrubland habitat through shrub seeds dispersal. Another example is the activity of digging mammals that contribute to soil formation and maintenance, but also habitat creation.

RESULTS

Argentine mammals contribute to at least 12 of the 18 NCPs defined by IPBES (**Table** 1, Table S1). Most of the contributions described were regulatory contributions (39.5%, **Table** 1). From most to less described contributions, we found: habitat creation and maintenance (16.3%); pollination and dispersal of seeds and other propagules (15.1%); formation, protection, and decontamination of soils and sediments (3.5%); regulation of climate, and regulation of detrimental organisms and biological processes (2.3% each). Material contributions accounted for 36% (**Table** 1) and were described in three types: food and feed, materials, companionship, and labor and medicinal, biochemical, and genetic resources. Non-material contributions represented 24.4% (all types were described, **Table** 1). In addition, one example of maintenance of options was described (Table S1), that is regulation, material, and no material contribution at the same time (Díaz et al. 2018).

Mammalian contributions to people are differentially present in all Argentinian ecoregions (**Fig.** 3). Monte and Chaco were the ecoregions where more

Table 1

Taxa contributing to each MCP. Reference to MCP within the table in column header: Regulation MCP: 1, habitat creation and maintenance; 2, pollination and dispersal of seeds and other propagules; 4, regulation of climate; 8, formation, protection and decontamination of soils and sediments; 10, regulation of detrimental organisms and biological processes. Material MCP: 12, food and feed; 13, materials, companionship and labor; 14, medicinal, biochemical and genetic resources. Non-material MCP: 15, learning and inspiration; 16, physical and psychological experiences; 17, supporting identities; 18, maintenance of options.

Taxa	Common name	MCP												Total MCP
		Regulation					Material			Non-material				
		1	2	4	8	10	12	13	14	15	16	17	18	
Dromiciops gliroides	Monito de monte	0	1	0	0	0	0	0	0	0	0	0	0	1
Myrmecophaga tridactyla	Oso hormiguero	0	0	0	0	0	1	1	1	0	0	0	0	3
Armadillos		0	0	0	0	0	1	0	1	0	0	0	0	2
Chiroptera	Murciélagos	0	0	0	1	0	0	0	0	1	0	0	0	2
Frugivorous bats		0	1	0	0	0	0	0	0	0	0	0	0	1
Hematophagous bats		0	0	0	0	0	0	0	1	0	0	0	0	1
Insectivorous bats		0	0	0	0	1	0	0	0	0	0	0	0	1
Noctarivorous bats		0	1	0	0	0	0	0	0	0	0	0	0	1
Aotus azarai	Mirikiná	1	0	0	0	0	0	0	0	0	0	0	0	1
Alouatta caraya	Carayá negro y dorado	0	1	0	0	0	0	0	0	0	0	0	0	1
Native predators		0	1	0	0	1	1	0	0	1	1	1	0	6
Lycalopex gymnocercus	Zorro gris pampeano	0	1	0	0	0	0	0	0	0	0	0	0	1
Otaria flavescens	Lobo marino de un pelo	0	0	0	0	0	0	0	0	1	1	0	0	2
Mirounga leonina	Elefante marino del sur	1	0	1	0	0	1	0	0	1	1	1	1	7
Puma concolor	Puma	0	0	0	0	0	0	0	1	0	0	0	0	1
Panthera onca	Yaguareté	0	0	0	0	0	0	0	0	0	0	1	0	1
Tapirus terrestris	Tapir	1	0	0	0	0	1	1	0	0	0	0	0	3
Catagonus wagneri (*Parachoerus wagneri*)	Pecarí quimilero	1	0	0	0	0	1	0	0	0	0	0	0	2
Pecari tajacu	Pecarí de collar	1	0	0	0	0	1	0	0	0	0	0	0	2
Tayassu pecari	Pecarí labiado	2	0	0	0	0	1	0	0	0	0	1	0	4
Lama guanicoe	Guanaco	0	1	0	1	0	1	1	1	0	1	1	0	7
Vicugna vicugna	Vicuña	0	0	0	0	0	1	1	1	0	0	1	0	4
Mazama gouazoubira	Corzuela parda	1	0	0	0	0	1	0	1	0	0	0	0	3
Eubalaena australis	Ballena franca austral	1	0	1	0	0	0	0	0	1	1	1	0	5
Delphinidae: *D. delphis* and *L. obscurus*	Delfín común and Delfín oscuro	1	0	0	0	0	0	0	0	1	1	0	0	3
Small rodents		0	3	0	0	0	0	0	1	0	0	0	0	4
Microcavia maenas	Cuis chico mayor	0	1	0	0	0	0	0	0	0	0	0	0	1
Dolichotis patagonum	Mara	1	1	0	0	0	1	1	0	0	0	1	0	5
Dolichotis salinicola	Conejo de los palos	0	0	0	0	0	1	0	0	0	0	0	0	1
Hydrochoerus hydrochaeris	Carpincho	0	0	0	0	0	1	1	0	0	0	0	0	2
Lagostomus maximus	Vizcacha	0	0	0	0	0	1	0	0	0	0	0	0	1
Ctenomys mendocinus	Tuco-tuco mendocino	1	0	0	0	0	0	0	0	0	0	0	0	1
Ctenomys spp.	Tuco-tuco	1	0	0	0	0	0	0	0	0	0	0	0	1
Myocastor coypus	Coipo	0	0	0	0	0	0	1	0	0	0	0	0	1
Exotic predators		1	1	0	1	0	1	0	0	0	0	0	0	4
Total taxa		14	13	2	3	2	16	7	8	6	6	8	1	86

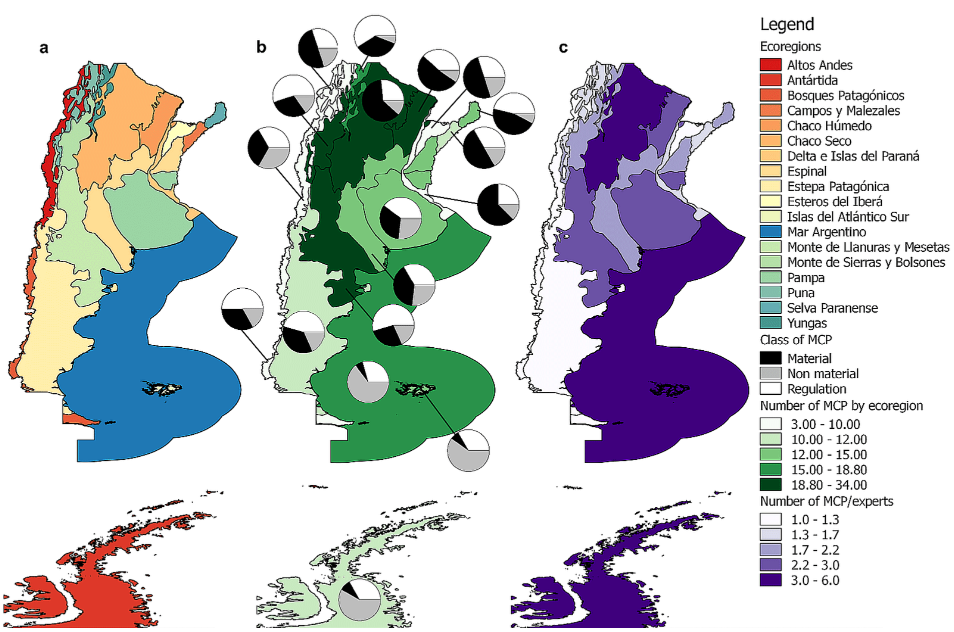

Fig. 3. Maps of the ecoregions in Argentina (a) show the number of MCP (b), the proportion of the three classes of MCP (b), and the weighted number of MCP by experts (c).

contributions were registered. The ecoregions across the Andes, Esteros del Iberá, and Delta e Islas del Paraná registered the fewest contributions (**Fig.** 3 b). However, the number of contributions and the number of experts by ecoregion were weakly correlated (Pearson's r = 0.52, p = 0.028). The weighted number of contributions identified by experts was lower in Monte and Patagonia, while Mar Argentino, Antártida e Islas del Atlántico showed a higher weighted number of contributions (**Fig.** 3 c). Material contributions were identified predominantly in the northeastern ecoregions and Puna, while regulating contributions were more detected in the southern continental ecoregions, Monte and Yungas. Non-material contributions were predominantly identified in Mar Argentino, Antártida e Islas del Atlántico (**Fig.** 3 b).

Habitat creation and maintenance, pollination and dispersal of seeds, and food and feed showed relatively high redundancy with more than ten groups or taxa involved in each contribution (**Table** 1). The other regulation contributions showed low redundancy (two or three taxa). Each taxon was involved in an average of 2.45 contributions, standing out guanaco (*Lama guanicoe*) and elephant seal (*Mirounga leonina*) that were involved in seven contributions (**Fig.** 4).

Word cloud analysis revealed information gaps in contributions that contrast with the rich literature on ecological processes (**Fig.** 5) involving the taxa summarized in **Table** 1. Words such as "services", "contributions", "assessment", "mapping", "regulation", "food", "material", "medicine", "inspiration", "identity" or "culture", as some examples of possible MCP keywords, are not present.

Habitat degradation was a threat to all MCP-Arg. In contrast, contamination of habitat, alteration due to climate change, and other impacts related to human presence threatened most contributions (**Fig.** 6). Habitat creation and maintenance and food and feed were the most threatened contributions.

In the following three sections, we present a synthesis of the compiled information on the process and groups/species intervening in MCP-Arg.

1. Regulation

Habitat creation and maintenance

Fossorial mammals facilitate water infiltration and reduce surface runoff by capturing plant seeds, promoting plant germination and growth, transporting nutrients from deep soil layers to the surface, and capturing organic matter (Kinlaw 1999; Fleming et al. 2014). Thus, they can impact vegetation structure

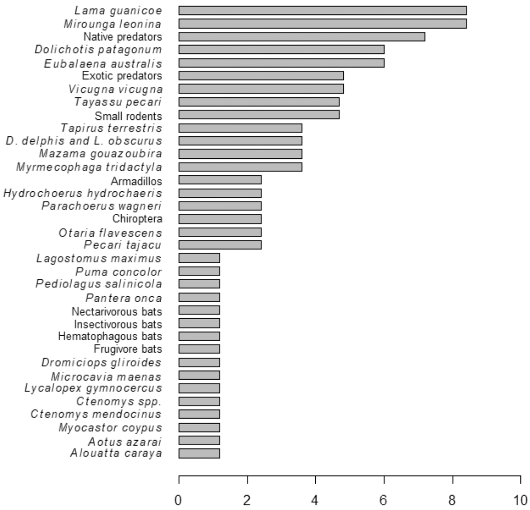

Fig. 4. Percentage of contributions of each taxon across all MCP registered.

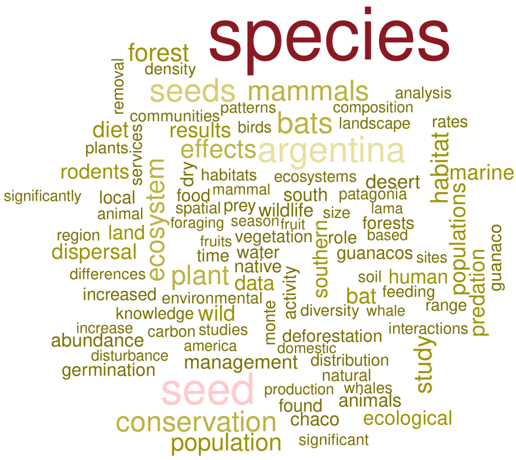

Fig. 5. Word cloud based on title, keywords, and abstract of publications referenced to back up the compiled information on MCP-Arg.

directly through their foraging activities, affecting plant species structure and composition, and their distribution and dispersal (Galil 1967; Borghi & Giannoni 1997; Gómez-García et al. 2009). Indirectly, fossorial mammals through their digging activity modify the physical and chemical properties of the soil, disperse arbuscular mycorrhizae and dark septate endophytic fungi and facilitate sexual or asexual reproduction (Contreras & Gutiérrez 1991; Whitford & Kay 1999; Lara et al. 2007; Fracchia et al. 2011). They also store food, feces, and seeds in their burrows, creating patches rich in organic content and influencing dispersal of different plant species (Borghi & Giannoni 1997; Gómez-García et al. 2009).

Many burrowing small mammals are identified as ecosystem engineers, including species of *Ctenomys* spp. (Andino & Borghi 2017; Borghi et al. 2020). *Ctenomys mendoncinus* plays a dual role, acting both as an herbivorous and a facilitator of reproduction and propagation of numerous plant species. Herbivory by medium-sized rodents is important in the Monte communities, where *Ctenomys* species produce changes in plant cover, composition, and diversity (Borruel et al. 1998; Campos et al. 2001; Tort et al. 2004). Herbivory by *C. mendocinus* reduced herbaceous (*Aristida* sp., *Pappophorum caespitosum*, and *Digitaria* sp.), and shrub (*Larrea cuneifolia* and *L. divaricata*) cover in the Central Monte (Borruel et al. 1998; Campos et al. 2001). At the upper limit of Monte, the foraging impacted *L. divaricata*, *Lycium chilensis*, *Junellia seriphioides*, and *Menodora decemfida* (Tort et al. 2004).

In the Puna ecoregion, research has shown that *C. mendocinus* increases the dominance of shrub cover, especially the unpalatable shrub *Artemisia mendozana* (sagebrush), in plant communities (Andino & Borghi 2017). However, it decreases the cover of herbs, grasses, and palatable shrubs (Lara et al. 2007). At sites inhabited by this rodent, sagebrush plants also increase their seed production and size (Andino & Borghi 2017), as well as sexual and asexual propagation (Borghi et al. 2020). Reproduction of several plant species improved in areas disturbed by *Ctenomys* species, especially sexual reproduction (Borghi et al. 2020). Facilitated plant reproduction and propagation in the Puna could be produced by a more efficiently capturing wind-dispersed seeds in burrows, mounds, and feeding holes (Borghi et al. 2020). *Ctenomys* modifies emerging vegetation patterns in the Puna, and acts as a keystone species because its activities are one of the factors that influence plant reproduction and, consequently, the successional development of vegetation communities (Borghi et al. 2020).

The mara (*Dolichotis patagonum*) is another rodent species that contributes to habitat creation and maintenance. This species digs warrens that provide habitat and refuge for other species (Alonso Roldán & Udrizar Sauthier 2016; Gatica et al. 2020). Among the species recorded using the mara warrens are *Athene cunicularia*, which may contribute to pest control, *Lepus europaeus*, and *Chaetophractus*

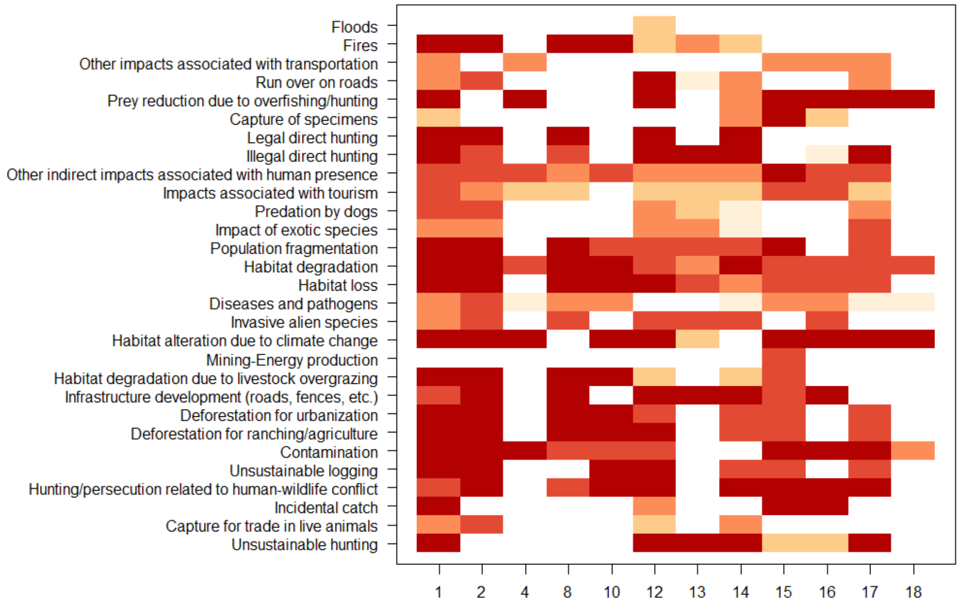

Fig. 6. Threats to MCP. On a scale of 1 to 5, the more important threats for each MCP are in darker red, while white indicates no threat. Numbers refer to MCP: 1 Habitat creation and maintenance; 2 Pollination and dispersal of seeds and other propagules; 4 Regulation of climate; 8 Formation, protection and decontamination of soils and sediments; 10 Regulation of detrimental organisms and biological processes; 12 Food and feed; 13 Materials, companionship and labor; 14 Medicinal, biochemical and genetic resources; 15 Learning and inspiration; 16 Physical and psychological experiences; 17 Supporting identities; 18 Maintenance of options.

villosus, which are occasionally hunted for food. There have been no studies to determine if the use of burrows is opportunistic or if the species that use them depend on them. To know their function in the system, there are no available studies about the effect of warrens on species richness and physical and chemical abiotic variables. Warrens increase landscape heterogeneity and promote species richness (Root-Bernstein & Ebensperger 2013). Therefore, a facilitation process may be involved (Machicote et al. 2004). Other processes involved may be related to nutrient cycling, water infiltration, and soil formation (Martínez-Estévez et al. 2013) due to digging and burying organic material.

Pecari tajacu and *Tayassu pecari* generally predate on seedlings and seeds, and largely determine the demography of seedlings and the composition and dominance of vegetation species in the ecosystem (Beck et al. 2005; Beck 2006; Beck et al. 2013). Thus they create and maintain habitats that allow the presence and survival of various amphibians and reptile species (Beck et al. 2010, 2013; Reider et al. 2013). In this way, the species contribute to maintaining forest cover and, thus, forest services, such as regulation of climate (Gasparri et al. 2008; Baumann et al. 2017), prevention of soil erosion and desertification (Rojas 2012), or water salinization (Jobbagy et al. 2008). They also maintain fodder for cattle of rural communities of the forest and their traditional medicine and food resources (Camino et al. 2016, 2018). It is highly probable that *Catagonus wagneri* (*Catagonus wagneri*) also disperses and predates seeds and performs the same ecosystem functions. Similarly, the lowland tapir (*Tapirus terrestris*) has been mentioned as an ecosystem engineer (Bodmer 1991; Fragoso 1997; Taber et al. 2008; Chalukian et al. 2013; De Bustos et al. 2019) because it can predate on and disperse seeds, it predates on seedlings, and its behavior defines ecosystems structure, modifying light penetration and soil properties, among other things. By defining the plant species present and dominant in an ecosystem and the vegetation structure, *T. terrestris* helps maintain the integrity and functionality of the ecosystem (Bodmer 1991; Fragoso 1997; Taber et al. 2008; Chalukian et al. 2009; De Bustos et al. 2019).

The diet of *Mazama gouazoubira* includes seeds of several species, contributing to defining the composition of plants in the area (Richard & Juliá 2001; Periago et al. 2017). By maintaining forest vegetation, the species indirectly contributes to providing fodder to the cattle of rural extensive ranchers (Camino, Pers. Com.). It may also contribute to dispersing plant species used by indigenous and criollo people of the forest (Periago et al. 2015).

The wild boar, *Sus scrofa,* can directly or indirectly affect the habitat of numerous plant and animal species (Cushman et al. 2004; Barrios-Garcia & Ballari 2012; Cuevas et al. 2012), and in turn, may directly affect humans. For example, the presence of plants can mitigate the process of desertification. In NE Patagonia, large areas of disturbed soil and many plant species can be found with exposed roots and large areas of bare soil (D. Birochio, Pers. Com.). This type of impact has not been typified or quantified in this region. The presence of wild boar and its particular behavior of rooting the ground in search of food can reduce the vegetation cover and the composition of plant species (Cuevas et al. 2012); which in turn affects animal species that use them for shelter or food.

Primate droppings contribute to habitat creation allowing forest species to germinate due to the increased availability of nitrogen and phosphorus in the forest ground. For example, populations of *Alouatta caraya* contribute to forest maintenance by dispersing large numbers of seeds and providing suitable sites for natural germination, thereby accelerating the seed germination process of native forest species (Bravo 2003; Fergnani et al. 2020).

In the marine ecosystem, marine mammals are also reported as contributors to habitat creation and maintenance and ecosystem engineers (Riisager-Simonsen et al. 2020), with representative species in the Argentinean jurisdiction. Marine mammals directly (or indirectly) modify their environment by altering local food availability, providing habitat structure, and supporting diverse biotic assemblages on the deep sea and the seafloor through their sinking and floating carcasses after death, as well as in terrestrial environments when they strand on coastlines (Lundsten et al. 2010; Roman et al. 2014). They also act as vectors for material flux and nutrient redistribution within the marine environment (through vertical mixing, horizontal transfer and recycling of C, and other limiting nutrients), enhancing primary productivity and biodiversity and causing physical changes in their environment (Pershing et al. 2010; Roman et al. 2014).

The nutrient-rich wastes (Fe in fecal and N in fecal and urine) of whales (*Eubalaena australis*) would play an important role in increasing C fixation and improving primary productivity in the oceans (Roman et al. 2014). Carbon is also sequestered in whale carcasses (Pershing et al. 2010). For example, a 40-ton whale contains approximately 2 million g C, equivalent to > 2000 years of background C flux into the area underlying the carcass (Smith 2006). Whales contribute to mixing up the water column by distributing nutrients and microorganisms across different marine zones, and they can exert strong pressure on marine communities through direct predation and indirect food web interactions (Roman et al. 2014). Southern elephant seals (*M. leonina*) have a principal function for trophic relationships as a top marine predator, facilitating the transfer of nutrients (Roman et al. 2014) and their redistribution at sea between different marine regimes.

Pollination and dispersal of seeds and other propagules

Terrestrial mammals are among the most important groups of vertebrates that contribute to seed dispersal and predation. Depending on the role mammals play in seed dispersal, the plant species involved, and human activities, animals could be offering a benefit or prejudice to humans. Animal-mediated seed dispersal is a mutualism in which the animal gets benefits by feeding on the fruits and the plant gets benefits by moving its seeds to new locations where they can become established. In this way, mammals can contribute to the maintenance of vegetation structure and habitat connectivity, which in turn can have a positive impact on people (e.g., maintaining native vegetation can prevent soil erosion or desertification process, provide many benefits to people, or help restore habitats after fires). Furthermore, it can be significant for local communities due to their use of the forest, like wood, crafts, and food (Díaz et al. 2005). In contrast to the above examples, the dispersal of seeds or propagules by some mammalian species can be considered as a negative contribution by ranchers, who regularly take action to control the growth of native vegetation not suitable for agro-livestock activities (e.g., seed dispersal by carnivore species in agroecosystems).

Although small rodents are widely represented in all mammalian communities, knowledge of their contribution to seed dispersal and predation in Argentina is limited. While most small rodents include seeds in their diet, those belonging to the genus *Calomys* are classified as granivorous and consume mainly weed seeds in agroecosystems (Dellafiore & Polop 1994, 1998; Castellarini et al.

2003). In the Monte ecoregion, removing *Neltuma flexuosa* seeds by rodents is an important ecological interaction (Campos et al. 2016; Miguel et al. 2017, 2018). In this ecosystem, *Graomys griseoflavus* stores *N. flexuosa* fruits and seeds inside the burrows and consumes the propagules for a long time. Therefore, its contribution is considered negative for the native forest (Giannoni et al. 2013). Seeds are also removed by *Microcavia maenas* (Campos et al. 2016) and *Eligmodontia typus* (Giannoni et al. 2013), which move fruits away to consume them and disperse seeds by scatter-hoarding. All seeds transported by *M. maenas* are left in fruit segments or are covered only by the endocarp, never as predated seeds (Campos et al. 2016). Thus, *M. maenas* and *E. typus*, unlike *G. griseoflavus*, contribute to the seed dispersal of *N. flexuosa* in the Monte Desert.

Dromiciops gliroides is a known case of animal-mediated seed dispersal that plays an essential role in the dispersion of numerous plant species with fleshy fruits in Patagonian Andean forests (Amico et al. 2009; Mora & Soto-Gamboa 2011). The quintral (*Tristerix corymbosus*) is among these plants, whose flowers are the only food for the ruby hummingbird (*Sephanoides sephaniodes*; Balazote Oliver 2017) during the winter season. This hummingbird pollinates 20% of forest woody plant genera (Aizen et al. 2002). This situation makes the interaction of the Monito del Monte-Quintral-Hummingbird system become a key element for the conservation of Patagonian forests (Rodriguez-Cabal et al. 2007). Balazote Oliver (2017) observed that *D. gliroides* lays seeds at suitable sites for quintral seedling settlement. At these sites, the seeds will have a high probability of survival compared to random dispersal sites.

Bats are also important contributors to the pollination and dispersal of seeds and other propagules. In terms of pollination, they are efficient pollinators visiting the flowers of relatively few species (Tschapka & Dressler 2002) and transporting large amounts of pollen (Muchhala & Thomson 2010) over long distances (Dick et al. 2008). For this contribution, in Argentina, there is evidence only for the Yungas. *Anoura caudifer* pollinates *Nicotiana otophora* (Nattero et al. 2003), *Cleome viridiflora*, *Abutilon niveum* and *Pseudobombax argentinum* (Boero et al. 2016). *Sturnira lilium* pollinates *Callianthe nivea* (Giannini 1999). *Glossophaga soricina* pollinates *C. viridiflora*, *A. niveum*, and *P. argentinum*, among others (Boero et al. 2016).

Regarding seed dispersal in Campos y Malezales, Selva Paranaense, and Yungas ecoregions, there is evidence that *S. lilium* feeds on plants of families Moracea, Piperacea, and Solanaceae and *G. soricina* disperses seeds of *Muntingia calabura* (Autino & Barquez 1994; Iudica & Bonaccorso 1997; Giannini 1999; Sánchez et al. 2012a; Boero et al. 2016; Argoitia, Pers. Com). In the Yungas, the diet of *S. erythromos* and *S. oporophilum* has a lower diversity of plant families Moracea, Piperacea, and Solanaceae (Giannini 1999; Sánchez et al. 2012b). Sánchez et al. (2012b) reported preferences of species of *Piper* spp. by *Carollia perspicillata*, Cecropiaceae and Moraceae by *Artibeus lituratus* and *A. fiambriatus*, Celtidacea for *A. planirostris* and *Ficus* spp. by *Vampyressa pusilla* in the Yungas and Selva Paranaense ecoregions.

In addition to small mammals, carnivores may directly or indirectly affect the dispersal of seeds or propagules (Manfredi et al. 2004; Raíces & Bergallo 2010; Castillo et al. 2011; Sarasola et al. 2016). For example, the Pampas fox (*Lycalopex gymnocercus*) plays an important role as a legitimate seed disperser, both for native species dominant in the native forest and for exotic species in varied environments such as agroecosystems, mountain forests, and *Neltuma* forests (Campos & Ojeda 1997; Periago et al. 2017; Dellafiore 2018; Duarte & Dellafiore 2020; Campos et al. 2021). In addition, top predators can strongly influence the structure and dynamics of herbivore-prey communities via predator-prey interactions. Thus, they can prey on birds or other herbivores and act as secondary dispensers (Sarasola et al. 2016).

Medium and large-sized herbivores are also seed dispersers. For example, *Lama guanicoe* and *D. patagonum* are involved in the seed dispersal of at least three *Neltuma* species in the Monte ecoregion, and they have different effects on germination (Campos et al. 2008, 2021). It has also been observed that the guanaco consumes these species in the arid Chaco, although their dispersive potential has not been assessed (Geisa et al. 2018). Peccaries and tapirs are also involved in seed dispersion in northern Argentina (Beck et al. 2010; De Bustos et al. 2019).

Some arboreal species can play an important role as seed and fruit dispersers. For example, *A. caraya* is a tree-living species that inhabit the rainforests of northeastern Argentina and has been mentioned as an important consumer of fruit. Even though this species is mainly arboreal, it can cross open areas between patches of vegetation in drier regions, which may contribute to the dispersal of plant species (Bravo 2003; Fernandez 2014). Thus, this species can directly influence the conservation of native forests and accelerate the regeneration process. Another tree-living species that inhabits most of northeastern Argentina is *Aotus azarai.* This small-sized primate feeds on the treetops and rarely goes down to collect food. It consumes different plant parts (fruits of 25 species, flowers of 13 species, and leaves of 8 species; Van Der Heide et al. 2012) and disperses the seeds of various species. This feeding behavior contributes to creating and maintaining the habitat in which they live. For example, *A. azarai* has been observed that helps to maintain the structure of the gallery forest in the Chaco Húmedo ecoregion in Formosa (Juárez 2014).

Regulation of the climate

Marine mammals in Argentine ecoregions contribute to ecosystems climate regulation by reducing greenhouse gas concentrations in the atmosphere or oceans as they increase primary productivity by recycling macro and micronutrients, thus affecting carbon fluxes. Carbon is retained in marine mammal's biomass, exported to deep waters (fecal matter and carcasses), and fixed as a consequence of primary production stimulated by feces from marine mammals (Smith 2006; Lavery et al. 2010; Pershing et al. 2010; Roman & Mccarthy 2010; Roman et al. 2016; Riisager-Simonsen et al. 2020).

Formation, protection and decontamination of soils and sediments

Among small mammals, bats contribute to nutrient cycling and energy flow through guano production. They play an important ecological role in soil fertility and nutrient distribution due to their relatively high mobility and use different habitats for roosting and foraging, which facilitates nutrient transfer within ecosystems. They also contribute to the redistribution of nutrients from nutrient-rich sources to nutrient-poor regions (Kasso & Balakrishnan 2013). A colony of one million *T. brasiliensis* in Texas can contribute 22 kg of nitrogen in the form of guano (Kunz et al. 2011). Bat guano supports a great diversity of organisms, including arthropods, fungi, bacteria, and lichens, representing different trophic levels (Kasso & Balakrishnan 2013; Castillo-Figueroa 2020). The species *Eptesicus fuscus* and *Desmodus rotundus* are those with the most studies on guano analysis. Other species included in this type of study are insectivores such as *T. brasiliensis* and *Myotis velifer*, frugivorous from the genus *Carollia*, *Platyrrhinus*, *Uroderma*, *Sturnira* and omnivorous from the genus *Phyllostomus* and *Tonatia* (Castillo-Figueroa 2020). Although these taxa are represented in Argentina (except *E. fuscus*, *M. velifer*, *Phyllostomus*, and *Uroderma*), no studies have been conducted to demonstrate the contributions of guano to the ecosystem.

Large terrestrial mammals that contribute positively to habitat creation and maintenance and soil formation and conservation include camelids such as the guanaco (*L. guanicoe*) and vicuña (*Vicugna vicugna*). These species have pads on their legs which help to prevent the soil from becoming compacted by their trampling, and when they feed, they do not uproot vegetation like cattle (Flores et al. 2012). These aspects help to ensure that the soil does not increase its erosion rate. On the other hand, these ungulates also contribute organic matter with their feces which increases soil nutrients (Henríquez 2004). The main ecological processes involving these species are herbivory, nutrient cycling, and seed dispersal. Therefore, the presence of guanacos in different areas contributes to the healthy status of habitats. In Tierra del Fuego, for example, the guanaco defecations have a positive effect on vegetation richness and diversity (Henríquez 2004).

Unlike camelids, wild boar negatively affect soil structure and function by removing and eliminating vegetation cover (Cuevas et al. 2012). In an arid zone such as NE Patagonia, this could contribute to intensifying the degradation process due to wind erosion. Although there are no data in this region, it is possible to appreciate important zones of soil removed by the behavior of rooting the soil in its search for food (D. Birochio, Pers. Com.). In Argentina, the population size of the species is unknown, with only point estimates (Merino & Carpinetti 2003; Pescador et al. 2009). However, the local perception by inhabitants of NE Patagonia is that this population is increasing, so it could be assumed an increase in the negative impact of the species on the environment (D. Birochio, Pers. Com).

Marine mammals that breed and molt on land, such as pinnipeds (sea lions and seals), are vectors for material flux and nutrient redistribution between marine and terrestrial sites, importing limiting nutrients and affecting biota dynamics (Panagis 1985; Smith 2006; Campagna et al. 2007; Smith 2008; Pershing et al. 2010; Roman et al. 2014). Southern elephant seals (*M. leonina*) can import up to 74 tons of N and 4 tons of P from the ocean, enhancing soil nutrient status (total forms of N, Ca, K, Mg, and the available forms of Ca, Na, Mg, and NH4) through their excreta, placenta, molted skin, and carcasses, stimulating ecological processes and directly affecting plant and invertebrate dynamics (Panagis 1985; Smith 2008). In addition, the species has a principal function in trophic relationships as a top marine predator by facilitating the transfer of nutrients (Roman et al. 2014) and their redistribution at land sites where they occur (Campagna et al. 2007).

Regulation of detrimental organisms and biological processes

Mammals can be important in controlling pests and disease vectors and regulating their abundance or distribution. Representative groups of mammals within Argentine ecoregions, especially bats and native carnivores, have been reported to contribute to regulating different detrimental organisms, mainly through predator-prey interactions.

Insectivorous bats within Argentina are mainly represented by the families Emballonuridae, Molossidae, and Vespertilionidae. Bat activity and diversity are strongly correlated with the abundance of arthropods (Kunz et al. 2011). Bats prey on a wide variety of insects (consuming up to 70% of their body mass), including devastating agricultural pests and human disease vectors in different ecosystems (Kalka et al. 2008; Williams-Guillén et al. 2008; Kunz et al. 2011; Ghanem & Voigt 2012). In the northwestern Yungas, *Tadarida brasiliensis* and some vespertilionidae consume various orders of arthropods, being the Lepidoptera, Hymenoptera, and Coleoptera the most recurrent (Bracamonte 2013; Gamboa Alurralde et al. 2019). In the Pampa ecoregion, *T. brasiliensis* preys mainly on Diptera (Olmedo et al. 2021).

Top predators, such as native carnivores, can strongly affect the structure and dynamics of herbivore-prey communities. The ecological role of carnivores in natural communities is mainly associated with predation and competition. The former includes predatory interactions that can affect the behavior, demography, and population dynamics of their prey, which may sometimes include other predators (i.e., intra-guild predation), while competition encompasses inter-specific interactions with other top predators at the same trophic level (Ripple et al. 2014; Winnie Jr. & Creel 2017). Rodents are among the most important species that carnivores can help to control. In this way, they reduce the transmission of rodent-borne pathogens (Ostfeld & Holt 2004). Carnivores can also help control other species that negatively impact agricultural activities (e.g., plains vizcacha [*Lagostomus maximus*] and rhea [*Rhea americana*]).

2. Materials

Food and feed

Traditionally, wild animals are an important food source for indigenous and criollo people in Argentina. One of the native mammals most commonly consumed in the Monte region is *D. patagonum*, and their meat is preferred over *L. europaeus* because of its larger size (Vilela et al. 2009; Campos et al. 2021). Other species, such as *C. wagneri*, *L. maximus*, *M. gouazoubira*, *Myrmecophaga tridactyla, P. tajacu, D. salinicola, T. terrestris, T. pecari,* and *L. europaeus,* usually are considered a source of protein in the Chaco and Yungas regions (Arenas 2003; Altrichter 2005, 2006; Martínez 2013; Camino et al. 2016, 2018; Camino & Torres 2019; Wajner et al. 2019)). Also, the diversity of armadillos of the Monte and humid and dry Chaco regions are highly valued as food (Arenas 2003; Altrichter 2006; Camino et al. 2018; Campos et al. 2021). On the other hand, the exotic mammal *S. scrofa* is commonly consumed and associated with informal commerce in northeastern Patagonia (Winter 2020).

Mammals are known for their ancestral uses, such as the case of *L. guanicoe* meat, which has been part of the human diet since the Pleistocene (Vilá 2014; Moscardi et al. 2020). Although their hunting is prohibited in the province of San Juan, they are still used for consumption (Campos et al. 2007; Hernández et al. 2015; Campos et al. 2021). *Vicugna vicugna* has been hunted by the Incas civilization (Vilá 2006) and is now used as food in different areas of the Puna and Altos Andes regions (Campos et al. 2007; Vilá 2014).

Often, the management of these animals is based on different techniques of subsistence hunting in the natural environment. However, in the case of *Hydrochoerus hydrochaeris* and *Myocastor coypus*, in addition to their local consumption, their meat can come from breeding sites and be commercialized in exclusive restaurants or from the wild (Taylor & Dunstone 1996). Another case is the opportunistic consumption of *Puma concolor*, where people can eat their meat but it is the consequence of killing conflictive individuals (Camino et al. 2018).

Materials, companionship and labor

Camelid textiles are the most relevant because they have one of the finest fibers in the animal kingdom being its fur used for these purposes (Campos et al. 2007; McGregor 2014; Vilá 2014; Hernández et al. 2015). In the beginning, humans hunted *V. vicugna* to take their fiber; however, these practices changed by a wild management technique known as "chaku" (see Vilá et al. 2010). In the case of *L. guanicoe*, it was included in Appendix II of CITES in 1978 due to its excessive use and is currently carried out live shearing for the exploitation of its fiber by the local population in the Monte and Patagonia regions (Montes et al. 2006; Carmanchahi et al. 2011, 2014).

Other important aspects are related to use of leather, principally of rodents. The fur of *H. hydrochaeris* can be used to manufacture clothes, purses, bags, and shoes, among other objects of excellent quality (Moreira 2013). Argentina is one of the few countries that commercializes these items for local use and exports them to other countries (Secretaría de Agricultura y Pesca 2018). The use of *M. coypus* also dates back to the time when Guaraníes, among other indigenous peoples hunted them to make clothes (Bolkovic 2006). In the XX century, millions of pieces of its leather were exported annually (Bó 1999) and nowadays, it has become our country's leading wild fauna resource (Bertonatti & Corcuera 2000). In the Monte ecoregion, some species, such as *L. gymnocercus*, *Conepatus chinga*, and *Leopardus geoffroyi*, were heavily hunted in the past for the monetary value of their skins (Campos et al. 2021). The leather strips of *D. patagonum* and *M. tridactyla* were used in the Monte and Chaco ecoregions as thread for sewing cowhide or for making ropes, respectively (Camino et al. 2018; Campos et al. 2021).

Concerning companionship uses, some interactions are documented for *D. patagonum* used as a mascot by rural people in the Monte ecoregion (Campos et al. 2021). In the Central Andes, a complex mosaic of landscapes and humans, the llama (*L. glama*) caravans historically used for transportation allow the exchange of resources from different altitudes (Vilá & Arzamendia 2020).

Medicinal, biochemical and genetic resources

The saliva of *D. rotundus* contains an anticoagulant compound, a protein involved in the dissolution of blood clots. This compound is used in medicine to treat strokes since, unlike other treatments or alternatives, it can be used long after the stroke has occurred and is still effective (Schleuning 2001; Reddrop et al. 2005). In Argentina, there is still no information on the medicinal use of this compound. This species is considered of sanitary importance since it can transmit paralytic rabies to the livestock it feeds, causing economic losses (Delpietro & Russo 2011). Although rabies can be associated with a negative aspect of profit, the increase in cases and its close association with livestock is a consequence of the overexploitation activities of the natural environments of this species by humans (Argoitia, Pers. Com.).

Some records mention the healing properties of some parts of mammalian bodies, like the dry leg of *L. guanicoe* and *V. vicugna*, used in the provinces of Chaco and San Juan for respiratory diseases or muscular paralysis (Hernández et al. 2015; Manzano-García et al. 2019). Some of these animals also have a gallstone called "bezoar stone", which has curative properties against heart and stomach problems (Hernández et al. 2015).

Between 5 and 10% of the indigenous QOM of the limit between the Chaco Húmedo and Chaco Seco regions uses meat and viscera from *M. gouazoubira* to prepare an infusion or decoction beverage to treat blood disorders (purifier, Martínez 2013). The fat of *H. hydrochaeris*, *M. tridactyla*, and armadillos is extensively used for various medicinal purposes in some regions (principally in Chaco) and can be used to produce oil (Taylor & Dunstone 1996; Arenas 2003; Martínez 2013; Camino et al. 2018). In addition, the fat of *P. concolor* is used as medicine in the form of cream for the throat and bruises (Martínez 2013; Camino et al. 2018).

3. Non-materials

Physical and psychological experiences

Landscapes, seascapes, habitats, or organisms provide opportunities for physically and psychologically beneficial activities (Díaz et al. 2018). Through tourism, hiking, artistic initiatives, recreational hunting and fishing, scuba diving, and other activities, people can have close contact with nature and access to recreation, relaxation, and healing, among other benefits (Díaz et al. 2018).

According to the particular knowledge system of the community, people value species by their beauty, utility, rarity, and particular physical and behavioral characteristics. Visual attractiveness also strongly influences the opinion of people on whether a species should be protected or not (Kellert 1993). People prefer large species with symbolic value and widespread popular appeal ("loveable animals", "charismatic megafauna", "flagship species"). Thus, mammals, birds, and fishes are privileged species because they are more socially accepted than reptiles, amphibians, and invertebrates (Czech et al. 2001; Clucas et al. 2008; Leader-Williams & Dublin 2010). Children and adults like animals, especially large mammals, that are similar to humans in appearance and behavior, with considerable intelligence and the hability for social bonds, capable of making eye contact, communicating through sound, learning, and exhibiting behaviors that attract attention and are often fun to watch (Borgi & Cirulli 2016).

A clear example of charismatic animals is marine mammals. Whales, dolphins, elephant seals, and sea lions are highly valued by humans for their beauty, pleasure, entertainment, or just their existence (Martinetto et al. 2020). Southern right whales use the Patagonian shelf marine ecosystem seasonally to mate, give birth, and nurse their calves (Bastida & Rodríguez 2010). The first whales arrive in the area each year in late fall and stay throughout winter and spring, with the highest number of individuals recorded in August-September (Crespo et al. 2019). The peak in the number of whales coincides with the highest number of tourists arriving in Puerto Pirámides. The dolphins (*Delphinus delphis* and *Lagenorhynchus obscurus*), with their exceptionally high degree of sociality and acrobatic aerial displays, are very attractive species, and dolphin watching is a fascinating experience for most visitors (Degrati et al. 2008; Vicente 2018). Tourism based on dolphins and whale watching proved an aesthetic pleasure based on the generation of a noticeable emotional response due to the close contact with nature (Barney et al. 2005; Lück 2015; Vicente 2018).

Other species, such as Southern elephant seals (*M. leonina*), breed in coastal areas and travel more than 400 km to feed on fish and squids along the shelf break, and the adjacent deep ocean (Campagna et al. 2006; Bastida & Rodríguez 2010). They maintain their reproductive areas on the coasts (Lewis & Campagna 2008; Bastida & Rodríguez 2010; Le Boeuf & Campagna 2013). During the breeding season, adults predictably come ashore and aggregate in harems where they are easily observed. The fights between males for hierarchical dominance, mating, births, and nursing pups are one of the main attractions of ecotourism (González et al. 2019). Similarly, the South American sea lion (*Otaria flavescens*) has colonial habits with predictable annual attendance patterns at sites that provide a viewing spectacle (Kirkwood et al. 2003).

Tourism and activities to observe and interact with large terrestrial mammals are also present in terrestrial systems. In the Monte and Patagonia ecoregions, the guanacos (*L. guanicoe*) are valued for their aesthetic beauty (Campos et al. 2021), and people enjoy finding them free in the wild. The guanaco could be an excellent example of umbrella species: a charismatic animal with a large home range whose protection confers the same to other co-occurring species (Roberge & Angelstam 2004). The protection of this ungulate ensures trophic chains due to its role as prey (Bank et al. 2002; Donadio et al. 2010) and seed disperser (Campos et al. 2008, 2021). Esteros del Iberá, in Corrientes, has ecotourism activities based on wildlife observation, mainly marsh deer (*Blastocerus dichotomus*; Zamboni et al. 2017).

The contribution of a particular wildlife species to human well-being is perceived as beneficial or detrimental depending on cultural, socioeconomic, temporal, or spatial context (Díaz et al. 2018). In extreme terms, some people live far from wild species and attribute them high aesthetic values. Such people might have a high degree of freedom of choice concerning wildlife, and their commitment to species conservation may be high. Conversely, some people living amongst wild species sometimes lack the necessities of life and often compete with wildlife over limited resources, which may threaten their lives and livelihoods. In addition, such people usually lack the choice to share their time with wildlife, to which they may be overtly hostile. Hence, the conservation of wild species may be a low priority relative to the survival of family members (Leader-Williams & Dublin 2010). Rural people recognize some carnivores (such as foxes and cougars) as beneficial for controlling other species or as seed dispersers. However, these same species are also considered harmful because they attack domestic animals and cause significant economic losses (Wajner et al. 2019; Campos et al. 2021). In the Chaco Seco and Monte ecoregions, cougars are heavily hunted by small-scale farmers because the species prey on their cattle (Camino et al. 2018), while in other regions, local inhabitants report "happiness" when they find the species in the wild. Jaguars (*Panthera onca*) were also hunted by local Chaco Seco inhabitants, and the species is currently critically endangered (Quiroga et al. 2013; Paviolo et al. 2019). However, the same species is a flagship for conservation campaigns in urban areas, and tours are available to see the species in the wild (e.g., https://www.pantanaljaguarsafaris.com/).

Bats also suffer polarizing social values. Eastern culture has a rich array of sociocultural representations of bats (Low et al. 2021). However, in western culture with a Christian tradition, these nocturnal animals with elusive habits have often been associated with devils and witchcraft (Lunney & Moon 2011; Tuttle 2017) and vampires (Prokop et al. 2009; Rydell et al. 2018). Furthermore, the contemporary messaging in today's hyper-connected world that portrays bats as disease carriers (Tuttle 2017; López-Baucells et al. 2018) is conferring a negative value to bats as it is evident in the most recent scapegoating of bats amidst the COVID-19 pandemic (Rocha et al. 2020; Sills & Zhao 2020). An excellent example of this complex cultural assessment is the representations of the indigenous people in Mexico, who had an attitude of conservation towards bats because they were idolized, and at the same time, feared. Then, the arrival of European culture and the introduction of cattle led to the growth of vampire populations due to the large food availability; thus, the negative interactions between vampires and people increased. Since then, a predominantly negative assessment was established, fueled by stories like Dracula, which spread to bats in general (Retana-Guiascón & Navarijo-Ornelas 2012; Navarro Noriega 2015; Castilla et al. 2020).

Learning and inspiration

Biodiversity also provides opportunities for the capabilities development that allow humans to prosper through education, the acquisition of knowledge, and the development of skills for well-being, information, and inspiration for art and technological design (Díaz et al. 2018).

Southern right whales and their body parts (e.g., skeletons, baleens, and cyamids) are used for educational purposes in museums, schools, and exhibitions or depicted in visual media, such as nature documentaries, where these whales are used as ambassador species to frame larger narratives about the value of science, nature, conservation, and management (Forestell 2009; Heyning & Mead 2009; Riisager-Simonsen et al. 2020).

Dolphin tours and viewing of elephant seals and sea lions inspire educational and conservation opportunities (Campagna et al. 2007; Le Boeuf & Campagna 2013; González et al. 2019; Martinetto et al. 2020). Students and the general public can improve their knowledge of the marine environment, marine species threats, and human contribution to conservation (Riisager-Simonsen et al. 2020). In addition, responses to stranding and fisheries disentanglement promote stewardship and concern for the marine environment at large (Powell & Ham 2008; Roman et al. 2014; Vicente 2018). Another species is the Chacoan peccary (*C. wagneri*), chosen in the Chaco Seco as the focus of environmental education activities directed to native forest conservation (https://www.proyectoquimilero.com.ar). In addition, carnivore species are generally perceived as charismatic and therefore have the potential to serve as flagship species. Flagship species are selected to raise public awareness, action, and funding (Leader-Williams & Dublin 2010). Thus, carnivores can increase economic benefits by promoting ecotourism, generating revenue from direct observation of species, or advertising campaigns to encourage people to visit areas where these species occur (Caruso & Pérez 2013). They are valuable tools for promoting public awareness regarding the importance of conserving natural resources and the role of carnivores in ecosystems (Soler et al. 2015; Gorosábel et al. 2020). In Argentina, the jaguar (*P. onca*) is used as a flagship for conservation campaigns (e.g., https://twitter.com/greenpeacearg/status/1093529643267878913) and even to promote consumables (e.g., https://economis.com.ar/la-multi-danone-villavicencio-realmente-quiere-ayudar-al-yaguarete-o-solo-busca-vender-mas-botellas-de-agua-mineral/); and educational and raising awareness activities (e.g. https://www.proyectoyaguarete.com.ar, https://youtu.be/TCSvpeZpNxU, https://www.facebook.com/proyaguarete/posts/708081752624589/).

The importance of animals is evident in cultural and artistic manifestations. For example, cave paintings depicting animal figures show them as symbols capable of transmitting cultural meanings both to those who drew them and who came long after (Spears et al. 1996). An example of this could be the representations of native ungulates in rock paintings in our country (Recalde & Pastor 2011; Manzano-García et al. 2019).

Supporting identities

Extremely close connections have existed between humans and animals throughout history. Certain societies have particular animal species related to shamanic, spiritual, and healing practices, associating them with the order of the universe (Viveiros De Castro 2013; Medrano 2014). For example, it was a widespread perception among Neotropical indigenous cultures that the jaguar has a larger existence than the one conceived by Western science (Viveiros De Castro 2013). Nevertheless, the indigenous Wichí people from the Chaco Seco believe that this species has a soul and a will (Camino et al. 2016, 2018). In this cosmovision, the jaguar has more elements and dimensions of existence than the material dimension, it differs from other wildlife species, and provides shamanic, spiritual, and identity support (Camino et al. 2016, 2018). The close relationship between Wichí people of the Argentine Chaco Seco is also described in areas where the species may have disappeared from the perspective of Western society (Camino et al. 2016).

As we can see, relationships with animals go beyond simple utilitarian considerations, and there have been supernatural solid relationships between the worlds of humans and animals since remote times (Alves et al. 2012). All human cultures, with their particular cosmovision, show a close integration and connection with animals (Alves et al. 2012). One of the oldest human activities that relate humans to animals is hunting (Alves et al. 2012). Hunting has practical reasons, such as meat or medicine provision, and is a practice used by humans to defend themselves against large predators (Camino et al. 2018). Nevertheless, hunting represents an enduring relationship of dependence that has often contributed to the formation of affective bonds and cultural practices associated with certain animals (Alves et al. 2012). The southern elephant seal, for example, is related to the historical "sealing" industry that developed into unchartered territories in the southern latitudes of the world during the 19th and 20th centuries (De Bruyn et al. 2016). Today, it is portrayed in different media content and symbols (such as shields and logos) as an emblematic representation of nature heritage and conservation. The southern right whale is also an emblematic species of Península Valdés (Unesco World Heritage Site since 1999), it has been declared a National Natural Monument and has recently been included in national banknotes.

Often, hunting implies rituals and meetings of certain members of society. For example, in northern Formosa, in the Chaco Seco region, an indigenous Wichí community described a ritual involved in hunting the white-lipped peccary (*T. peccary*; Camino, Pers. Com.). This ritual is part of the identity of these communities, although it may have disappeared because of the species' conservation status (EN; De Bustos et al. 2019) and the cultural loss we face associated with deforestation and habitat loss. In addition, other cultural practices associated with the large terrestrial mammal hunting by indigenous Wichí people, such as asking shamans for permission, may also be disappearing (Camino et al. 2016).

Historically, wild and domestic camelids have been used by Andean human groups since the earliest inhabitants of the Americas over 11 000 years ago (Yacobaccio 2009). While the wild species, guanacos and vicuñas (*V. vicugna*) are Salqa ("natural", "untamed") in the indigenous and local knowledge taxonomic system, and protected by the Malkus or mountain deities, the domestic species llama (*L. glama*) and alpaca (*V. pacos*) are Uywa (Vilá & Arzamendia 2020). From a biocultural perspective, the wild vicuñas "chakus" (the capture of vicuñas for shearing their ultrafine fibers and culling some individuals) and llama caravans involve different relational values and roles within diverse worldviews, including the scientific, indigenous, and local knowledge systems (Vilá & Arzamendia 2020).

Based on archaeological data present in Argentina, human populations have valued the guanaco since the late Pleistocene and throughout the Holocene (Mengoni Goñalons 1999; Izeta et al. 2007). In prehistoric Patagonian life, the important role of the guanaco in the Selk'nam culture is expressed in multiple ways. For example, they had more than eleven terms to describe guanaco diversity. In addition, the Selk'nam identified sacred areas were hunting the guanaco was taboo to allow the species to breed freely, and they also maintained several religious and spiritual connections with the animals (Gusinde 1982; Vilá & Arzamendia 2020).

Some species support rural identities, such as *D. patagonum*, which is known as "liebre criolla" in the Monte ecoregion. This term is used in contrast to that of the "liebre europea" (*L. europaeus*) and denotes the attribute of "criolla", used by local rural people to identify themselves (Campos et al. 2021). In the Yungas ecoregion, the bat colony (*Tadarida brasiliensis*) at Escaba dam is highly valued by the local people related to identity and a sense of belonging (Castilla et al. 2020).

4. Maintenance of options

Marine mammals and biogeochemical cycles are associated with marine fronts where primary production is high. Marine mammals such as southern elephant seals are important integrants of biodiversity, particularly on marine fronts, such as the shelf break front in the Argentine Sea. This and other marine mammals make up the genetic pool of the ecosystem, increasing biodiversity, and so the chances of adapting to environmental change (Martinetto et al. 2020). The biodiversity that supports the genetic pool and option value is coupled with the primary production of marine fronts through trophic interactions (Martinetto et al. 2020). In this way, marine mammals contribute to the capacity of the ecosystem to support a good quality of life in the present and in the future, keeping options open for yet unknown discoveries and unexpected uses of particular organisms or ecosystems that already exist and others that can be foreseen from ongoing biological evolution (Díaz et al. 2018). This contribution is tightly related to regulation contributions to maintain the ecosystem healthy and support other contributions. Thus, besides the example of marine mammals, all the other species we mentioned earlier participating in diverse contributions also maintain options for human well-being.

DISCUSSION

While our work is not an extensive review of MCP-Arg, and its scope is biased towards a sample of researchers attending Argentine mammalogy meetings, it is the first work that provides a baseline of knowledge on MCP-Arg and identifies information gaps that will contribute to future research on this topic. Mammals in Argentina contribute to human well-being in at least 12 of the 18 types of NCP described by IPBES. According to our results, mammals provide regulatory contributions in all Argentine ecoregions, mainly related to habitat maintenance and seed dispersal. They also contribute with materials such as meat, fiber or fur, and medicine, and the human relationship with mammals provides opportunities for recreation, learning, and inspiration, and constitutes elements of cultural identity. In this sense, it is relevant to highlight the relational value of mammals over their instrumental value, since they are much more than a resource or a part of nature serving humanity, in accordance with the CNP approach (Díaz et al. 2018).

Even though we detect numerous MCP-Arg, we deduce them from studies mainly focused on ecological processes and conservation. In our analysis of keywords, titles, and abstracts of the referenced literature were notoriously absent or rare terms such as "ecosystem services", commonly used referring to nature and people relationship in the last 20 years, showing a gap of information in descriptions, quantification, and mapping of MCP-Arg. These gaps are especially notorious in the Altos Andes and Patagonia ecoregions (**Fig**. 3). However, contributing experts for Patagonia are more than average (9 vs 7.05), and a book on ecosystem services in Patagonia has recently been published with several case studies (Peri et al. 2021b). So, at least in the case of Patagonia, but it could be generalized, the information gap would be precisely in MCP. The same situation is reflected in the review by Lacher et al. (2019), where much information is compiled on the ecological functions of mammals but highlights the lack of specific studies demonstrating their effects on human well-being through NCP or Ecosystem services. A similar gap is reported in reviews for other taxa (Nichols et al. 2008; Cortes-Gómez et al. 2014; Gorosábel et al. 2020; Michel et al. 2020; Rodrigues et al. 2020). Linking the ecological processes underpinned by the different components of biodiversity to NCP and their effect on human well-being is fundamental to sustainable ecosystem management and the design of trajectories to desirable futures (Fu et al. 2013). Starting from MCP-Arg baselines and reviews on ecological functions, specialists in different taxa could contribute to multidisciplinary social-ecological studies designed to unpack the role of the components of biodiversity underpinning NCP and human well-being. In this sense, we propose a research agenda based on the IPBES conceptual framework and some hypotheses that can be tested in future social-ecological studies (**Table** 2), since our results are insufficient to support statements in this regard beyond the description of some patterns. Key research topics on the agenda are: future assessment of potential MCP-Arg to complete the baseline built in this research, the underlying mechanisms (i.e., human conditions versus species conditions versus drivers), and the effects of policy and governance on MCP mediation to understand differences in type and amount of MCP among ecoregions, processes and characterization effects of NCP that enhance human capital, and how biodiversity and ecosystem functions become NCP and part of well-being via the mediation of human assets, governance, and infrastructure (coproduction process).

Making explicit the material and non-material NCP directly contributing to human well-being would help to understand better nature-society relations (Pascual et al. 2017; Mastrángelo et al. 2019). In this context, the development of scientific research could help considerably in understanding the diversity of interactions (both past and present) between human cultures and other animals (Alves et al. 2012). Currently, although the number of ethnozoological and social-ecological studies in Latin America has increased, it is still low compared to ethnobotanical studies probably because restrictions associated with wild animals' use hampers access to information (Albuquerque et al. 2013). Therefore, finding approaches that link species conservation to cultural concerns will increase the effectiveness in maintaining and restoring human and ecosystem health (Garibaldi & Turner 2004).

We also have some suggestions for policy and governance (indirect drivers) based on our assessment of threats to MCP-Arg that illustrate the effect of direct drivers on Nature and NCP (arrow 2 in **Fig**. 1). The effect of these proposed changes on indirect drivers over direct drivers and NCP (arrow 6 in **Fig**. 1)

Table 2

Research agenda based on the IPBES conceptual framework, and some hypotheses that can be tested in future social-ecological studies.

Hypotheses	Fundamentation	Future research
Taxa performing similar ecological functions underpin the same MCP (arrow 4 in **Fig**. 1).	We report MCP-Arg for functional groups as nectarivorous bats or carnivores. On the other hand, we also report MCP-Arg for some taxa that may be potential contributions for others that did not come up with the expert elicitation process. For example, we report the contribution of marine mammals to climate regulation, but this also could be true for other large herbivores such as guanaco.	Functional ecology frameworks (Lavorel & Grigulis 2012; Díaz et al. 2013; Paniccia et al. 2022; Swartz et al. 2022) could guide future assessment of potential MCP-Arg to complete the baseline built in this research.
Configuration of culture, nature, and direct drivers affects the relevance of different types of MCP (arrows 3 and 4 in **Fig**. 1) and their effect on human well-being (arrow 8 in **Fig**. 1).	We observed the dominance of regulation, material and non-material contributions in different regions, which could indicate different configurations of the nature-people relationship. Non-material contributions are predominant in Mar Argentino, Islas del Atlántico Sur y Antártida, maybe due to the eminent role of marine mammals in touristic activities and inspirational experiences. The predominance of regulation MCP in arid and rainy-hilly ecoregions could reflect the vulnerability of these environments to degradation and the consequent detrimental effects on human well-being or the minor degree of human transformation/intervention to prevent hazards in these regions. On the other hand, the predominance of material MCP in the Northeastern and Puna ecoregion may represent a more intensive use of mammals due to the influence of local and indigenous communities that use nature and mammals' diversity in a more integral way.	Underlying mechanisms (i.e., human conditions versus species conditions versus drivers, etc.) need to be explored to understand differences in the type and amount of MCP among ecoregions.
Anthropogenic assets mediate MCP and, at the same time, enhance them by increasing human, social, cultural, manufactured, and financial capital (forms of human-derived capital following Jones et al. 2016; arrow 6 **Fig**. 1).	We reported learning and identity-building from mammals that increase human and cultural capital. Also, recreation opportunities are related to tourism activities resulting in financial capital, as well as trading of some material contributions we described.	The processes and characterization of these effects of NCP on human capital need to be addressed by specific social-ecological studies.
Different types of MCP involve different coproduction processes.	Although we have focused on the ecological processes underpinning potential MCP-Arg, we acknowledge that coproduction, the socio-ecological processes requiring anthropogenic capital to provide benefits or contributions to people (Bruley et al. 2021), take part in turning potential contributions into effective contributions to human well-being. From the processes and characteristics that we described, considering the conceptual framework of Bruley and co-authors (2021), we get some general patterns that should be studied in deep: in general, the regulation contributions imply less or no coproduction; the material ones are mainly derived from type 2 coproduction (harvest; physical access) and the non-material ones are associated to the coproduction of type 2 (concerning physical access, in tourism for example) and type 3 (appreciation, social access, appropriation). In general, these patterns follow those reported for other NCPs, the big difference is that the material contributions (mainly derived from wildlife in our results) do not depend on ecosystem management such as agricultural NCPs (Bruley et al. 2021).	Further research needs to focus on how biodiversity and ecosystem functions become NCP and part of well-being via the mediation of human assets, governance, and infrastructure.
Ecoregions may differ in the mediation of MCP according to the policy will and governance efforts, such as the creation of protected areas (arrow 6 in **Fig**. 1).	The creation of protected areas implies the collection and documentation of socio-ecological narratives that summarize its benefits and values to achieve the long-term conservation of biological and cultural diversity, essential ecosystem goods and services for society and life in general (APN 2019). However, the two most important causes for establishing a protected area in Argentina are population density and distance from international borders since many protected areas of the country are close to international frontier areas (Baldi 2019). This could respond to strategic geopolitical interests at the national level, such as marking limits or being present in those territories, supporting infrastructure and equipment, delineating, and promoting studies and narratives to achieve these goals, where the contribution of mammals may or may not have a leading role. This, in turn, may promote regional gaps of information and asymmetries in the feasibility of mediating MCP and co-production. In addition, other policy and governance schemes related to different biodiversity conservation strategies than area-based options, like ecosystem-based management or restoration, may lead to a more balanced mediation of MCP across ecoregions.	The influence of local policy and governance in the mediation of MCP requires further research to understand patterns of MCP relevance in different contexts and spatial scales.

should be tested applying adaptive management frameworks.

First, conservation actions and policies should preserve mammalian diversity rather than the conservation of key taxa. This is because all taxa contribute in similar proportions to total contributions (**Fig.** 4). In addition, conservation should be framed at the local community rather than the regional scale, aiming to preserve ecological function and the contribution to human well-being. For example, the small *L. guanicoe* population (< 0.4 individuals/km^2) occurring at the hyper-arid extreme of the Monte Desert may be exposed to a high risk of local extinction (≈ 500 individuals) because of expanding tourism, road impact, and interference with exotic ungulates (Acebes et al. 2012; Cappa et al. 2019, 2020). The San Juan province considered it as a vulnerable population (Secretaría de Estado de Ambiente y Desarrollo Sustentable, Resolución N○ 0656) while, at the country scale, the species is classified as Least Concern (LC). However, this national category does not refer to the contributions to human well-being since if a local population disappears or is drastically reduced, the local people will no longer receive contributions of this species accepted for its tangible benefits and aesthetic value, which is present in narratives and oral expression shared within the community (Campos et al. 2021). Therefore, the valuable information that we have on the conservation status and threats to mammals within Argentina needs to be complemented with local information on population dynamics and perceptions of people to sustain MCP-Arg.

Second, conservation strategies and policies should also focus on preserving regulatory contributions. Our results showed destructive feedback between threats and contributions relative to habitat since the main threat for contributions is habitat degradation, and the most threatened contribution is habitat maintenance. Furthermore, this degradation process could directly affect human subsistence since the second most threatened contribution is food and feed. Therefore, the relevance of mammals and their habitat conservation to human well-being is clear, highlighting the urgency of adopting the NCP approach and how they become part of well-being via the mediation of human assets, governance, and infrastructure.

Finally, although we focus on one group of organisms, the policy should be systemic, considering multiple dimensions and elements of nature and society, committed to delivering not only conservation outcomes but also well-being outcomes (Díaz et al. 2018; Peri et al. 2021a). Policies on land use change and climate change mitigation, direct drivers threatening most MCP-ARG according to our results, should be systemically conceived and aimed at preserving regulation contributions such as habitat maintenance accounting for heterogeneity at the landscape scale, and interactions among processes, actions, and NCP. However, the climate change mitigation policy in Argentina consists of a sum of sectoral measures (SGAyDS 2019), that sometimes come into conflict, such as afforestation with exotic species for silvicultural exploitation, the generation of energy based on biofuels or the avoided native forests deforestation, failing to achieve MCP and NCP sustainability. Even regulations inspired by the ecosystem services concept, such as the Ley de Bosque Nativo (Ley 26331), need to be implemented through a participative process, including an integral valuation of the NCP by all social actors. Otherwise, it may result in altered ecosystems and access restrictions to MCP (among other NCP) by vulnerable actors leading to greater income inequality (Cabrol & Cáseres 2017; Laterra et al. 2019). Therefore, future research on the information gaps we have identified, and the inclusion of the NCP perspective could help to outline a new policy-building process toward sustainable development.

CONCLUSION

Our research shows that an important amount of knowledge on MCP-Arg is available through scientific publications, ecologist narratives, and interpretation. Furthermore, our approach allowed us to identify differences in the type of contributions by ecoregion, e.g., material contributions are mainly found in the northeastern and Puna ecoregion, which allows us to guide future studies attempting to answer whether this is due to the traits of the mammal species involved, cultural issues or both. However, we found gaps in information in the descriptions, quantification, and mapping of MCP-Arg. Future studies should take the MCP as the main focus of study, applying research designs that allow contributions to be identified and measuring their effect on human well-being. This information gap has repercussions on conservation efforts and threat assessments mainly focused on taxa rather than their contributions, especially in local contexts. By framing (or reframing) mammalian research on the NCP approach, we can make sound contributions to conservation and human well-being.

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LITERATURE CITED

Acebes, P., J. Traba, & J. E. Malo. 2012. Co-occurrence and potential for competition between wild and domestic large herbivores in a South American desert. Journal of Arid Environments 77:39-44. https://doi.org/10.1016/j.jaridenv.2011.09.003.

Aizen, M. A., D. P. Vázquez, & C. Smith-Ramírez. 2002. Historia natural y conservación de los mutualismos planta-animal del bosque templado de Sudamérica austral. Revista Chilena de Historia Natural 75:79-97. https://doi.org/10.4067/s0716-078x2002000100008

Albuquerque, U. P., J. S. Silva, J. L. A. Campos, R. S. Sousa, T. C. Silva, & R. R. N. Alves. 2013. The current status of ethnobiological research in Latin America: gaps and perspectives. Journal of Ethnobiology and Ethnomedicine 9:72. https://doi.org/10.1186/1746-4269-9-72.

Alonso Roldán, V., & D. Udrizar Sauthier. 2016. Madrigueras de *Dolichotis patagonum* como recurso para otros vertebrados en Península Valdés. Mastozoología Neotropical 23:515-520.

Altrichter, M. 2005. The sustainability of subsistence hunting of peccaries in the Argentine Chaco. Biological Conservation 126:351-362. https://doi.org/10.1016/j.biocon.2005.06.024.

Altrichter, M. 2006. Wildlife in the life of local people of the semi-arid Argentine Chaco. Biodiversity & Conservation 15:2719-2736. https://doi.org/10.1007/s10531-005-0307-5.

Alves, R. R. N., I. L. Rosa, N. A. Léo Neto, & R. Voeks. 2012. Animals for the gods: magical and religious faunal use and trade in Brazil. Human Ecology 40:751-780. https://doi.org/10.1007/s10745-012-9516-1.

Amico, G. C., M. A. Rodríguez-Cabal, & M. A. Aizen. 2009. The potential key seed-dispersing role of the arboreal marsupial *Dromiciops gliroides.* Acta Oecologica 35:8-13. https://doi.org/10.1016/j.actao.2008.07.003.

Andino, N., & C. E. Borghi. 2017. Occurrence of *Ctenomys mendocinus* in a high-altitude cold desert: effect on density, biomass, and fitness of sagebrush plants. Arctic, Antarctic, and Alpine Research 49:53-60. https://doi.org/10.1657/aaar0015-061

APN. 2019. Informe Nacional de Ambiente y Áreas Protegidas de la Argentina (2008-2018). Secretaría de Ambiente y Desarrollo Sustentable. Presidencia de la Nación. Buenos Aires, Argentina. https://doi.org/10.25085/rsea.780402

Arenas, P. 2003. Ethnography and diet of the toba-ñachilamoleek y wichí-lhuku'tas of Chaco. Authors edition, Buenos Aires, Argentina. https://doi.org/10.4000/jsa.2920

Autino, A. G., & R. Barquez. 1994. Patrones reproductivos y alimenticios de dos especies simpátricas del género *Sturnira* (Chiroptera, Phyllostomidae). Mastozoología Neotropical 1:73-80.

Balazote Oliver, A. 2017. Efectos del comportamiento de dispersores en la dinámica de plantas: selección de hábitat y patrones de movimiento del monito del monte (*Dromiciops gliroides*) y sus efectos en la dinámica poblacional de la planta parásita aérea *Tristerix corymbosus.* Tesis doctoral inédita. 131 pp. Facultad de Ciencias Exactas y Naturales, Universidad Nacional de Buenos Aires, Buenos Aires, Argentina. https://doi.org/10.24215/1850468xe006

Baldi, G. et al. 2019. Nature representation in South American protected areas: country contrasts and conservation priorities. PeerJ 7:e7155. https://doi.org/10.7717/peerj.7155

Bank, M. S., R. J. Sarno, N. K. Campbell, & W. L. Franklin. 2002. Predation of guanacos (*Lama guanicoe*) by southernmost mountain lions (*Puma concolor)* during a historically severe winter in Torres del Paine National Park, Chile. Journal of Zoology 258:215-222. https://doi.org/10.1017/S0952836902001334.

Barney, E. C., J. J. Mintzes, & C-F. Yen. 2005. Assessing knowledge, attitudes, and behavior toward charismatic megafauna: the case of dolphins. The Journal of Environmental Education 36:41-55. https://doi.org/10.3200/JOEE.36.2.41-55.

Barrios-Garcia, M. N., & S. A. Ballari. 2012. Impact of wild boar (*Sus scrofa*) in its introduced and native range: a review. Biological Invasions 14:2283-2300. https://doi.org/10.1007/s10530-012-0229-6

Bastida, R., & D. Rodríguez. 2010. Mamíferos marinos de Patagonia y Antártida. Vazquez Mazzini, Buenos Aires.

Baumann, M. et al. 2017. Carbon emissions from agricultural expansion and intensification in the Chaco. Global Change Biology 23:1902-1916. https://doi.org/10.1111/gcb.13521.

Beck, H. 2006. A review of Peccary-Palm Interactions and their ecological ramifications across the Neotropics. Journal of Mammalogy 87:519-530. https://doi.org/10.1644/05-MAMM-A-174R1.1

Beck, H., P. Forget, J. Lambert, P. Hulme, & S. Vander Wall. 2005. Seed predation and dispersal by peccaries throughout the Neotropics and its consequences: a review and synthesis. Seed fate: Predation, dispersal and seedling establishment (P. Forget, J. Lambert, P. Hulme, & S. Vander Wall). CABI Publishing, Wallingfort. 77-115. https://doi.org/10.1079/9780851998060.0000

Beck, H., J. W. Snodgrass, & P. Thebpanya. 2013. Long-term exclosure of large terrestrial vertebrates: Implications of defaunation for seedling demographics in the Amazon rainforest. Biological Conservation 163:115-121. https://doi.org/10.1016/j.biocon.2013.03.012

Beck, H., P. Thebpanya, & M. Filiaggi. 2010. Do Neotropical peccary species (Tayassuidae) function as ecosystem engineers for anurans? Journal of Tropical Ecology 26:407-414. https://doi.org/10.1017/s0266467410000106

Bertonatti, C., & J. Corcuera. 2000. Situación ambiental Argentina 2000. Fundación Vida Silvestre Argentina.

Bó, R. F. 1999. Falsa nutria, auténtico recurso. Vida Silvestre 69:2-15.

Bodmer, R. E. 1991. Strategies of seed dispersal and seed predation in Amazonian ungulates. Biotropica 23:255-261. https://doi.org/10.2307/2388202

Boero, M. L., R. M. Barquez, P. Zazú, A. Varela, & A. Cocucci. 2016. Polinización por murciélagos en las Yungas de Argentina: el desafío de registrar interacciones en un ambiente donde sus protagonistas son escasos. Libro de actas de la VI Reunión Binacional de Ecología 150-151. https://doi.org/10.31055/1851.2372.v51.n1.14420

Bolkovic, M. L. D. R. 2006. Manejo de Fauna Silvestre en la Argentina. Programas de uso sustentable.

Borghi, C. E., & S. M. Giannoni. 1997. Dispersal of Geophytes by Mole-Voles in the Spanish Pyrenees. Journal of Mammalogy 78:550-555. https://doi.org/10.2307/1382906.

Borghi, C. E., A. Rodríguez Navas, & N. Andino. 2020. A subterranean ecosystem-engineering rodent influences plant emergence and reproductive strategy in a high-altitude cold desert. Journal of Mammalogy 6:1601-1608. https://doi.org/10.1093/jmammal/gyaa118

Borgi, M., & F. Cirulli. 2016. Pet face: mechanisms underlying human-animal relationships. Frontiers in Psychology 7. https://doi.org/10.3389/fpsyg.2016.00298.

Borruel, N., C. M. Campos, S. M. Giannoni, & C. E. Borghi. 1998. Effect of herbivorous rodents (cavies and tuco-tucos) on a shrub community in the Monte Desert, Argentina. Journal of Arid Environments 39:33-37. https://doi.org/10.1006/jare.1997.0378

Bracamonte, J. C. 2013. Hábitos alimenticios de un ensamble de murciélagos insectívoros aéreos de un bosque montano en las Yungas Argentinas. Chiroptera Neotropical 19:1157-1162. https://doi.org/10.3989/graellsia.2015.v71.134

Bravo, S. 2003. Efecto de Carayá (*Alouatta caraya*) en la dinámica y regeneración de las selvas de inundación del Paraná medio.

Facultad de Ciencias Exactas y Naturales, Universidad Nacional de Buenos Aires, Buenos Aires, Argentina. https://doi.org/10.24215/1850468xe006

Bruley, E., B. Locatelli, & S. Lavorel. 2021. Nature's contributions to people: coproducing quality of life from multifunctional landscapes. Ecology and Society 26. https://doi.org/10.5751/ES-12031-260112

Burkart, R., N. O. Bárbaro, R. O. Sánchez, & D. A. Gómez. 1999. Eco-regiones de la Argentina. Presidencia de la Nación, Secretaría de Recursos Naturales y Desarrollo Sustentable, Administración de Parques Nacionales. Buenos Aires, Argentina. https://doi.org/10.24215/1850468xe006

Cabrol, D. A., & D. M. Cáseres. 2017. Las disputas por los bienes comunes y su impacto en la apropiación de servicios ecosistémicos. La Ley de Protección de Bosques Nativos en la Provincia de Córdoba, Argentina. Ecología Austral 27:134-145. https://doi.org/10.25260/ea.17.27.1.1.273

Camino, M., S. Cortez, A. Cerezo, & A. Mariana. 2016. Wildlife conservation, perceptions of different co-existing cultures. International Journal of Conservation Science 7:109-122.

Camino, M., S. De Sousa Mendes Parreira Cortez, M. Altrichter, & S. D. Matteucci. 2018. Relations with wildlife of Wichi and criollo people of the dry Chaco, a conservation perspective. Ethnobiology and Conservation 7:11. https://doi.org/10.15451/ec2018-08-7.11-1-21

Camino, M., & R. M. Torres. 2019. Quimilero (*Parachoerus wagneri*). Categorización 2019 de los mamíferos de Argentina según su riesgo de extinción. Lista Roja de los mamíferos de Argentina. (SAyDS & SAREM, eds.). http://doi.org/10.31687/SaremLR.19.202;http://cma.sarem.org.ar.

Campagna, C., A. R. Piola, M. R. Marin, M. Lewis, & T. Fernández. 2006. Southern elephant seal trajectories, fronts and eddies in the Brazil/Malvinas Confluence. Deep Sea Research Part I: Oceanographic Research Papers 53:1907-1924. https://doi.org/10.1016/j.dsr.2006.08.015

Campagna, C. et al. 2007. A species approach to marine ecosystem conservation. Aquatic Conservation. Marine and Freshwater Ecosystems 17:S122-S147. https://doi.org/10.1002/aqc.918.

Campos, C. M., C. E. Borghi, S. M. Giannoni, S. G. Ortiz, & G. Pastrán. 2007. La fauna de los desiertos de altura. Características, usos y potencialidades en la zona de influencia de San Guillermo. Zeta Editores, Argentina.

Campos, C. M., V. E. Campos, F. Miguel, & M. I. Cona. 2016. Management of protected areas and its effect on an ecosystem function: removal of *Prosopis flexuosa* seeds by mammals in Argentinian drylands. PLoS One 11:e0162551. https://doi.org/10.1371/journal.pone.0162551

Campos, C. M., S. M. Giannoni, & C. E. Borghi. 2001. Changes in Monte Desert plant communities induced by a subterranean mammal. Journal of Arid Environments 47:339-345. https://doi.org/10.1006/jare.2000.0724

Campos, C. M., M. C. Moreno, F. M. Cappa, Y. Ontiveros, M. I. Cona, & M. L. Torres. 2021. "Weaving" different knowledge systems through studying salience of wild animals in a dryland area of Argentina. Journal of Ethnobiology 41:292-306. https://doi.org/10.2993/0278-0771-41.2.292.

Campos, C. M., & R. A. Ojeda. 1997. Dispersal and germination of *Prosopis flexuosa* (Fabaceae) seeds by desert mammals in Argentina. Journal of Arid Environments 35:707-714. https://doi.org/10.1006/jare.1996.0196

Campos, C. M., B. Peco, V. E. Campos, J. E. Malo, S. M. Giannoni, & F. Suárez. 2008. Endozoochory by native and exotic herbivores in dry areas: consequences for germination and survival of Prosopis seeds. Seed Science Research 18:91-100. https://doi.org/10.1017/S0960258508940344.

Cappa, F. M., C. E. Borghi, & S. M. Giannoni. 2019. How roads affect the spatial use of the guanaco in a South American Protected area: human connectivity vs animal welfare. Diversity 11:110. https://doi.org/10.3390/d11070110.

Cappa, F. M., S. M. Giannoni, Y. Ontiveros, & C. E. Borghi. 2020. Direct and indirect effects of roads on activity patterns of the largest South American artiodactyl (*Lama guanicoe*) in a hyper-arid landscape. Mammalian Biology 100:453-461. https://doi.org/10.1007/s42991-020-00035-9.

Carmanchahi, P. D. et al. 2011. Physiological response of wild guanacos to capture for live shearing. Wildlife Research 38:61-68. https://doi.org/10.1071/WR10170.

Carmanchahi, P. D. et al. 2014. Effects of live-shearing on population parameters and movement in sedentary and migratory populations of guanacos *Lama guanicoe*. Oryx 49:51-59. https://doi.org/10.1017/S0030605314000027.

Caruso, F., & I. J. Pérez. 2013. Tourism, local pride, and attitudes towards the reintroduction of a large predator, the jaguar *Panthera onca* in Corrientes, Argentina. Endangered Species Research 21:263-272. https://doi.org/10.3354/esr00519

Castellarini, F., C. Dellafiore, & J. Polop. 2003. Feeding habits of small mammals in agroecosystems of central Argentina. Mammalian Biology 68:91-101. https://doi.org/10.1078/1616-5047-00067

Castilla, M. C., C. Campos, S. Colantonio, & M. Díaz. 2020. Perceptions and attitudes of the local people towards bats in the surroundings of the *Escaba dam* (Tucumán, Argentina). Ethnobiology and Conservation 9. https://doi.org/10.15451/ec2020-03-9.09-1-14

Castillo-Figueroa, D. 2020. Why bats matters: A critical assessment of bat-mediated ecological processes in the neotropics. European Journal of Ecology 6:77-101. https://doi.org/10.17161/eurojecol.v6i1.13824.

Castillo, D. F., D. E. Birochio, M. Lucherini, & E. B. Casanave. 2011. Diet of adults and cubs of *Lycalopex gymnocercus* in Pampas grassland: a validation of the Optimal Foraging Theory? Annales Zoologici Fennici 48:251-256. https://doi.org/10.5735/086.048.0406

Clucas, B., K. McHugh, & T. Caro. 2008. Flagship species on covers of US conservation and nature magazines. Biodiversity and Conservation 17:1517-1528. https://doi.org/10.1007/s10531-008-9361-0.

Contreras, L. C., & J. R. Gutiérrez. 1991. Effects of the subterranean herbivorous rodent *Spalacopus cyanus* on herbaceous vegetation in arid coastal Chile. Oecologia 87:106-109. https://doi.org/10.1007/BF00323787.

Cortes-Gómez, A. M., C. A. Ruiz-Agudelo, A. Valencia-Aguilar, & R. J. Ladle. 2014. Ecological functions of neotropical amphibians and reptiles: a review. Universitas Scientiarum 20:229-245. https://doi.org/10.11144/Javeriana.SC20-2.efna.

Crespo, E. A., S. N. Pedraza, S. L. Dans, G. M. Svendsen, M. Degrati, & M. A. Coscarella. 2019. The southwestern Atlantic southern right whale, *Eubalaena australis*, population is growing but at a decelerated rate. Marine Mammal Science 35:93-107. https://doi.org/10.1111/mms.12526

Cuevas, M. F., L. Mastrantonio, R. A. Ojeda, & F. M. Jaksic. 2012. Effects of wild boar disturbance on vegetation and soil properties in the Monte Desert, Argentina. Mammalian Biology 77:299-306. https://doi.org/10.1016/j.mambio.2012.02.003

Cushman, J. H., T. A. Tierney, & J. M. Hinds. 2004. Variable effects of feral pig disturbances on native and exotic plants in a California grassland. Ecological Applications 14:1746-1756. https://doi.org/10.1890/03-5142

Czech, B., P. K. Devers, & P. R. Krausman. 2001. The relationship of gender to species conservation attitudes. Wildlife Society Bulletin (1973-2006) 29:187-194.

Chalukian, S., S. De Bustos, L. Lizárraga, D. Varela, A. Paviolo, & V. Quse. 2009. Plan de acción para la conservación del tapir (*Tapirus terrestris*) en Argentina. Dirección de Fauna Silvestre de la Nación. Secretaría de Ambiente y Desarrollo Sustentable. Buenos Aires, Argentina. https://doi.org/10.1111/j.1749-4877.2012.12009.x

Chalukian, S. C., M. S. De Bustos, & R. L. Lizárraga. 2013. Diet of lowland tapir (*Tapirus terrestris*) in El Rey National Park, Salta, Argentina. Integrative Zoology 8:48-56. https://doi.org/10.1111/j.1749-4877.2012.12009.x

Choudhury, M., S. Goswami, S. Maity, & A. Chakravorty. 2021. The word cloud analysis to evaluate the impact of COVID-19 on environmental professionals and environmental degree holders: a PAN India survey. Bangladesh Journal of Medical Science 20:414-419. https://doi.org/10.3329/bjms.v20i2.51558.

De Bruyn, P. J. N., M. N. Bester, W. C. Oosthuizen, G. J. G. Hofmeyr, & P. A. Pistorius. 2016. A conservation assessment of *Mirounga leonina*. The Red List of Mammals of South Africa, Swaziland and Lesotho. (M. F. Child, L. Roxburgh, E. Do Linh San, D. Raimondo, H. T. Davies-Mostert, eds.). South African National Biodiversity Institute and Endangered Wildlife Trust, South Africa. https://doi.org/10.3957/0379-4369-38.2.133

De Bustos, S., D. Varela, L. Lizárraga, M. Camino, & V. A. Quiroga. 2019. *Tayassu pecari* Categorización 2019 de los mamíferos de Argentina según su riesgo de extinción. Lista Roja de los mamíferos de Argentina. (SAyDS-SAREM, ed.). http://cma.sarem.org.ar.https://doi.org/10.31687/saremlr.19.151

Degrati, M., S. L. Dans, S. N. Pedraza, E. A. Crespo, & G. V. Garaffo. 2008. Diurnal behavior of Dusky Dolphins, *Lagenorhynchus obscurus*, in Golfo Nuevo, Argentina. Journal of Mammalogy 89:1241-1247. https://doi.org/10.1644/07-MAMM-A-110.1.

Delpietro, H., & G. Russo. 2011. Manual de procedimientos de rabia paresiante. Senasa, Servicio Nacional de Sanidad y Calidad Agroalimentaria. Buenos Aires, Argentina.

Dellafiore, C. M. 2018. Does the pampas fox (*Lycalopex gymnocercus*) affect firethorn (*Pyracantha atalantoides*) germination? Mastozoología Neotropical 25:53-58. https://doi.org/10.31687/saremMN.18.25.1.0.06.

Dellafiore, C. M., & J. J. Polop. 1994. Feeding habits of *Calomys musculinus* in the crop fields and its borders. Mastozoología Neotropical 1:45-50.

Dellafiore, C. M., & J. J. Polop. 1998. Dieta de *Calomys laucha* (Rodentia, Muridae) en hábitats de cultivos de la provincia de Córdoba. Facena 14:25-30.

Díaz, S. et al. 2015. The IPBES conceptual framework—connecting nature and people. Current Opinion in Environmental Sustainability 14:1-16.

Díaz, S. et al. 2018. Assessing nature's contributions to people. Science 359:270. https://doi.org/10.1126/science.aap8826.

Díaz, S. et al. 2013. Functional traits, the phylogeny of function, and ecosystem service vulnerability. Ecology and Evolution 3:2958-2975. https://doi.org/10.1002/ece3.601.

Díaz, S. et al. 2005. Biodiversity regulation of ecosystem services. Ecosystems and human well-being: current state and trends: Findings of the Condition and Trends Working Group. Millennium Ecosystem Assessment 297-329.

Dick, C. W., O. J. Hardy, F. A. Jones, & R. J. Petit. 2008. Spatial scales of pollen and seed-mediated gene flow in tropical rain forest trees. Tropical Plant Biology 1:20-33. https://doi.org/10.1007/s12042-007-9006-6.

Donadio, E., A. J. Novaro, S. W. Buskirk, A. Wurstten, M. S. Vitali, & M. J. Monteverde. 2010. Evaluating a potentially strong trophic interaction: pumas and wild camelids in protected areas of Argentina. Journal of Zoology 280:33-40. https://doi.org/10.1111/j.1469-7998.2009.00638.x.

Duarte, C., & C. M. Dellafiore. 2020. Endozoocoria por el zorro gris pampeano, *Lycalopex gymnocercus*, (Carnivora: Canidae) y germinación del tala (*Celtis ehrenbergiana*) (Rosales: Cannabaceae). UNED Research Journal 12:e2615. https://doi.org/10.22458/urj.v12i1.2615.

Feinerer, I., & K. Hornik. 2019. tm: Text Mining Package. R package version 0.7-7. https://doi.org/https://CRAN.R-project.org/package=tm.

Feinerer, I., K. Hornik, & D. Meyer. 2008. Text mining infrastructure in R. Journal of Statistical Software 25:1-54. https://doi.org/10.18637/jss.v025.i05

Fellows, I. 2018. wordcloud: Word Clouds. R package version 2.6. https://CRAN.R-project.org/package=wordcloud.

Fergnani, D. M., M. M. Kowalewski, & V. A. Fernández. 2020. Germination of native and exotic seeds dispersed by wild black-and-gold howler monkeys (*Alouatta caraya*): assessing deinhibition and scarification effects. Primates 61:519-527. https://doi.org/10.1007/s10329-020-00791-9.

Fernandez, V. 2014. Ecología nutricional del mono aullador negro y dorado (*Alouatta caraya*) en el límite sur de su distribución. Facultad de Ciencias Exactas y Naturales, Universidad de Buenos Aires, Buenos Aires, Argentina. https://doi.org/10.24215/1850468xe006

Flaherty, E. A., S. M. Walker, J. H. Forrester, & M. Ben-David. 2017. Effects of course-based undergraduate research experiences (CURE) on wildlife students. Wildlife Society Bulletin 41:701-711. https://doi.org/10.1002/wsb.810.

Fleming, P. A., H. Anderson, A. S. Prendergast, M. R. Bretz, L. E. Valentine, & G. E. S. Hardy. 2014. Is the loss of Australian digging mammals contributing to a deterioration in ecosystem function? Mammal Review 44:94-108. https://doi.org/10.1111/mam.12014.

Flores, C. E., A. M. Cingolani, A. Von Müller, & F. R. Barri. 2012. Habitat selection by reintroduced guanacos (*Lama guanicoe*) in a heterogeneous mountain rangeland of central Argentina. The Rangeland Journal 34:439-445. https://doi.org/10.1071/rj12040

Forestell, P. H. 2009. Popular culture and literature. Encyclopedia of marine mammals. Academic Press, Cambridge.

Fracchia, S., L. Krapovickas, A. Aranda-Rickert, & V. S. Valentinuzzi. 2011. Dispersal of arbuscular mycorrhizal fungi and dark septate endophytes by *Ctenomys cf. knighti* (Rodentia) in the northern Monte Desert of Argentina. Journal of Arid Environments 75:1016-1023. https://doi.org/10.1016/j.jaridenv.2011.04.034.

Fragoso, J. M. 1997. Tapir-generated seed shadows: scale-dependent patchiness in the Amazon rain forest. Journal of Ecology 85:519-529. https://doi.org/10.2307/2960574

Fu B., S. Wang, C. Su, & M. Forsius. 2013. Linking ecosystem processes and ecosystem services. Current Opinion in Environmental Sustainability 5: 4-10. https://doi.org/10.1016/j.cosust.2012.12.002.

Galil, J. 1967. On the dispersal of the bulbs of *Oxalis cernua* thunb. By Mole-Rats (*Spalax ehrenbergi Nehring*). Journal of Ecology 55:787-792. https://doi.org/10.2307/2258425.

Gamboa Alurralde, S., M. D. Miotti, M. M. Díaz, R. M. Barquez, M. S. Sánchez, & M. L. Sandoval. 2019. *Sturnira lilium*. Categorización de los mamíferos de Argentina. SAyDS–SAREM. https://doi.org/10.31687/saremlr.19.061

Garibaldi, A., & N. Turner. 2004. Cultural keystone species: implications for ecological conservation and restoration. Ecology and Society 9. https://doi.org/10.5751/es-00669-090301

Gasparri, N. I., H. R. Grau, & E. Manghi. 2008. Carbon pools and emissions from deforestation in extra-tropical forests of northern Argentina between 1900 and 2005. Ecosystems 11:1247-1261. https://doi.org/10.1007/s10021-008-9190-8

Gatica, A., A. C. Ochoa, N. M. Denkiewicz, & A. M. Mangione. 2020. Wildlife associated with burrows of *Dolichotis patagonum* in central west Argentina. Neotropical Biology and Conservation 15:399. https://doi.org/10.3897/neotropical.15.e54979.figure2

Geisa, M. G., N. Dottori, & M. T. Cosa. 2018. Dieta de guanaco (*Lama guanicoe*) en el Chaco árido de Córdoba, Argentina. Mastozoología Neotropical 25:59-80. https://doi.org/10.31687/saremmn.18.25.1.0.07.

Ghanem, S. J., & C. C. Voigt. 2012. Increasing Awareness of ecosystem services provided by bats. 1 ed. Elsevier Inc., Amsterdam

Giannini, N. P. 1999. Selection of diet and elevation by sympatric species of Sturnira in an andean rainforest. Journal of Mammalogy 80:1186-1195. https://doi.org/10.2307/1383169.

Giannoni, S. M. et al. 2013. Hoarding patterns of sigmodontine rodent species in the Central Monte Desert (Argentina). Austral

Ecology 38:485-492. https://doi.org/10.1111/j.1442-9993.2012.02438.x

Gómez-García, D., J. Azorín, & A. J. Aguirre. 2009. Effects of small-scale disturbances and elevation on the morphology, phenology and reproduction of a successful geophyte. Journal of Plant Ecology 2:13-20. https://doi.org/10.1093/jpe/rtp003.

González, M. B., A. Sapoznikow, & M. N. Lewis. 2019. Sighting of southern elephant seals in Peninsula Valdes, Argentina: importance and satisfaction from the tour guide and tourist perspective. Revista Interamericana de Ambiente y Turismo 15:46-59. https://doi.org/10.4067/s0718-235x2019000100046

Gorosábel, A., L. Bernad, & J. Pedrana. 2020. Ecosystem services provided by wildlife in the Pampas region, Argentina. Ecological Indicators 117:106576. https://doi.org/10.1016/j.ecolind.2020.106576.

Gusinde, M. 1982. Los indios de Tierra del Fuego. De la vida y del mundo espiritual de un pueblo de cazadores. (Die feuerland indianer). Centro Argentino de Etnología Americana, Consejo Nacional de Investigaciones, Argentina. https://doi.org/10.46530/ecdp.v0i29.418

Hemming, V., M. A. Burgman, A. M. Hanea, M. F. McBride, & B. C. Wintle. 2018. A practical guide to structured expert elicitation using the IDEA protocol. Methods in Ecology and Evolution 9:169-180. https://doi.org/10.1111/2041-210X.12857.

Henríquez, J. M. 2004. Influencia de los defecaderos de camélidos sobre el desarrollo vegetal y riqueza de especies en morrenas glaciales, Tierra del Fuego. Revista Chilena de Historia Natural 77:501-508. https://doi.org/10.4067/s0716-078x2004000300009

Hernández, J., C. M. Campos, & C. E. Borghi. 2015. Medicinal use of wild fauna by mestizo communities living near San Guillermo Biosphere Reserve (San Juan, Argentina). Journal of Ethnobiology and Ethnomedicine 11:1-10. https://doi.org/10.1186/1746-4269-11-15.

Heyning, J. E., & J. G. Mead. 2009. Museums and Collections. Encyclopedia of Marine Mammals. Academic Press, Cambridge. https://doi.org/10.1016/b978-0-12-373553-9.00174-7

Ipbes. 2019. Summary for policymakers of the global assessment report on biodiversity and ecosystem services of the intergovernmental science-policy platform on biodiversity and ecosystem services. IPBES secretariat, Bonn, Germany. https://doi.org/10.1111/padr.12283

Iudica, C. A., & F. J. Bonaccorso. 1997. Feeding of the bat, *Sturnira lilium*, on fruits of *Solanum riparium* influences dispersal of this pioneer tree in forests of Northwestern Argentina. Studies on Neotropical Fauna and Environment 32:4-6. https://doi.org/10.1076/snfe.32.1.4.13464.

Izeta, A. D., M. Gutiérrez, L. Miotti, G. Barrientos, G. M. Goñalons, & M. Salemme. 2007. Interespecific differentiation of South American camelids from archaeofaunal assemblages in the Southern calchaquíes valleys (Argentina). Taphonomy and Zooarchaeology in Argentina (M. Gutiérrez, L. Miotti, G. Barrientos, G. Mengoni Goñalons, & M. Salemme, eds.). Oxford. https://doi.org/10.1201/9781003079323-3

Jobbagy, E. G., M. D. Nosetto, C. S. Santoni, & G. Baldi. 2008. El desafío ecohidrológico de las transiciones entre sistemas leñosos y herbáceos en la llanura Chaco-Pampeana. Ecología Austral 18:305-322.

Jones, L. et al. 2016. Stocks and flows of natural and human-derived capital in ecosystem services. Land Use Policy 52:151-162. https://doi.org/10.1016/j.landusepol.2015.12.014.

Juárez, C. 2014. Demografía e historia de vida del mono mirikiná en el Chaco húmedo de la provincia de Formosa. Tesis de doctorado. Universidad Nacional de Tucuman, San Miguel de Tucumán, Argentina. https://doi.org/10.19137/huellas-2019-2308

Kalka, M. B., A. R. Smith, & E. K. V. Kalko. 2008. Bats limit arthropods and herbivory in a tropical forest. Science 320:71-71. https://doi.org/10.1126/science.1153352.

Kasso, M., & M. Balakrishnan. 2013. Ecological and economic importance of bats (order Chiroptera). ISRN Biodiversity:1-9. https://doi.org/10.1155/2013/187415.

Kellert, S. R. 1993. The biological basis for human values of nature. The biophilia hypothesis (S. R. Kellert, & E. O. Wilson, eds.). Island Press, Washington, USA. https://doi.org/10.1126/science.263.5150.1161

Kinlaw, A. 1999. A review of burrowing by semi-fossorial vertebrates in arid environments. Journal of Arid Environments 41:127-145. https://doi.org/10.1006/jare.1998.0476.

Kirkwood, R. et al. 2003. Pinniped-focused tourism in the Southern hemisphere: a review of the industry. Marine Mammals: fisheries, tourism, and management issues. (N. Gales, M. Hindell, & R. Kirkwood, eds.) pp. 257-276. CSIRO: Collingwood, VIC, Australia. https://doi.org/10.1071/9780643090712

Kunz, T. H., E. B. De Torrez, D. Bauer, T. Lobova, & T. H. Fleming. 2011. Ecosystem services provided by bats. Annals of the New York Academy of Sciences 31:1-38. https://doi.org/10.1111/j.1749-6632.2011.06004.x.

Lacher, T. E., et al. 2019. The functional roles of mammals in ecosystems. Journal of Mammalogy 100:942-964. https://doi.org/10.1093/jmammal/gyy183.

Lara, N., P. Sassi, & C. E. Borghi. 2007. Effect of herbivory and disturbances by tuco-tucos (*Ctenomys mendocinus*) on a plant community in the southern Puna Desert. Arctic, Antarctic, and Alpine Research 39:110-116. https://doi.org/10.1657/1523-0430(2007)39[110:eohadb]2.0.co;2

Laterra, P. et al. 2019. Linking inequalities and ecosystem services in Latin America. Ecosystem Services 36:100875. https://doi.org/10.1016/j.ecoser.2018.12.001.

Lavery, T. J. et al. 2010. Iron defecation by sperm whales stimulates carbon export in the Southern Ocean. Proceedings of the Royal Society B: Biological Sciences 277:3527-3531. https://doi.org/10.1098/rspb.2010.0863

Lavorel, S., & K. Grigulis. 2012. How fundamental plant functional trait relationships scale-up to trade-offs and synergies in ecosystem services. Journal of Ecology 100:128-140. https://doi.org/10.1111/j.1365-2745.2011.01914.x

Le Boeuf, B. J., & C. Campagna. 2013. Wildlife viewing spectacles: best practices from Elephant seal (*Mirounga* sp.) colonies. Aquatic Mammals 39:132. https://doi.org/10.1578/am.39.2.2013.132

Leader-Williams, N., & H. T. Dublin. 2010. Charismatic megafauna as 'flagship species'. Has the panda had its day? Priorities for the conservation of mammalian diversity (A. Entwistle, & N. Dunstone, eds.). Cambridge University Press, Cambridge.

Lewis, M., & C. Campagna. 2008. Mamíferos Marinos. Estado de conservación del Mar Patagónico y áreas de influencia. Foro para la conservación del Mar Argentino, Puerto Madryn, Argentina. https://doi.org/10.35537/10915/56249

López-Baucells, A., R. Rocha, & Á. Fernández-Llamazares. 2018. When bats go viral: negative framings in virological research imperil bat conservation. Mammal Review 48:62-66. https://doi.org/10.1111/mam.12110.

Low, M-R. et al. 2021. Bane or blessing? Reviewing cultural values of bats across the Asia-Pacific Region. Journal of Ethnobiology 41:18-34. https://doi.org/10.2993/0278-0771-41.1.18.

Lück, M. 2015. Education on marine mammal tours – But what do tourists want to learn? Ocean & Coastal Management 103:25-33. https://doi.org/10.1016/j.ocecoaman.2014.11.002

Lundsten, L. et al. 2010. Time-series analysis of six whale-fall communities in Monterey Canyon, California, USA. Deep Sea Research Part I: Oceanographic Research Papers 57:1573-1584. https://doi.org/10.1016/j.dsr.2010.09.003

Lunney, D., & C. Moon. 2011. Blind to bats. The biology and conservation of australasian bats (B. Law, P. Eby, L. Lumsden, & D. Lunney, eds.). Royal Zoological Society of NSW, Mosman. https://doi.org/10.7882/9780980327243

MACHICOTE, M., L. C. BRANCH, & D. VILLARREAL. 2004. Burrowing owls and burrowing mammals: are ecosystem engineers interchangeable as facilitators? Oikos 106:527-535. https://doi.org/10.1111/j.0030-1299.2004.13139.x

MANFREDI, C., M. LUCHERINI, A. D. CANEPUCCIA, & E. B. CASANAVE. 2004. Geographical variation in the diet of Geoffroy's cat (*Oncifelis geoffroyi*) in Pampas grassland of Argentina. Journal of Mammalogy 85:1111-1115. https://doi.org/10.1644/bwg-133.1

MANZANO-GARCÍA, J., T. COSTA, F. BARRI, & M. P. WEIHMÜLLER. 2019. Interacciones entre el guanaco (*Lama guanicoe*) y el ser humano en el Gran Chaco: datos etnozoológicos pasados y actuales del Noreste de la Provincia de Córdoba, Argentina. Etnobiología 17:25-40. https://doi.org/10.31687/saremmn.18.25.1.0.07

MARTIN, T. G. ET AL. 2012. Eliciting expert knowledge in conservation science. Conservation Biology 26:29-38. https://doi.org/10.1111/j.1523-1739.2011.01806.x.

MARTINETTO, P. ET AL. 2020. Linking the scientific knowledge on marine frontal systems with ecosystem services. Ambio 49:541-556.

MARTÍNEZ-ESTÉVEZ, L., P. BALVANERA, J. PACHECO, & G. CEBALLOS. 2013. Prairie dog decline reduces the supply of ecosystem services and leads to desertification of semiarid grasslands. PLOS ONE 8:e75229. https://doi.org/10.1371/journal.pone.0075229.

MARTÍNEZ, G. 2013. Use of fauna in the traditional medicine of native Toba (qom) from the Argentine Gran Chaco region: an ethnozoological and conservationist approach. Ethnobiology and Conservation 2. https://doi.org/10.15451/ec2013-8-2.2-1-43.

MASTRÁNGELO, M. E. ET AL. 2019. Key knowledge gaps to achieve global sustainability goals. Nature Sustainability:1-7. https://doi.org/10.1038/s41893-019-0412-1.

MCGREGOR, B. A. 2014. Variation in the softness and fibre curvature of cashmere, alpaca, mohair and other rare animal fibres. Journal of the Textile Institute 105:597-608. https://doi.org/10.1080/00405000.2013.828448.

MEDRANO, C. 2014. Zoo-sociocosmología qom: seres humanos, animales y sus relaciones en el Gran Chaco. Journal de la Société des Américanistes 100:225-257. https://doi.org/10.4000/jsa.13777.

MENGONI GOÑALONS, G. L. 1999. Cazadores de guanacos de la estepa patagónica. Sociedad Argentina de Antropología, Buenos Aires, Argentina. https://doi.org/10.29104/phi-aqualac/2020-v12-2-07

MERINO, M. L., & B. N. CARPINETTI. 2003. Feral pig *Sus scrofa* population estimates in Bahía Samborombón conservation area, Buenos Aires province, Argentina. Mastozoología Neotropical 10:269-275. https://doi.org/10.22201/ib.20078706e.2019.90.2851

MICHEL, N. L., C. J. WHELAN, & G. M. VERUTES. 2020. Ecosystem services provided by Neotropical birds. The Condor 122:duaa022. https://doi.org/10.1093/condor/duaa022.

MIGUEL, F., M. I. CONA, & C. M. CAMPOS. 2017. Seed removal by different functional mammal groups in a protected and grazed landscape of the Monte, Argentina. Seed Science Research 27:174-182. https://doi.org/10.1017/s0960258517000101

MIGUEL, M. F., S. TABENI, M. I. CONA, & C. M. CAMPOS. 2018. Secondary seed dispersal by mammals between protected and grazed semiarid woodland. Forest Ecology and Management 422:41-48. https://doi.org/10.1016/j.foreco.2018.03.056

MILLENNIUM ECOSYSTEM ASSESSMENT. 2005. Ecosystems and human well-being: biodiversity synthesis. World Resources Institute, Washington DC, USA.

MONTES, M. C., P. D. CARMANCHAHI, A. REY, & M. C. FUNES. 2006. Live shearing free-ranging guanacos (*Lama guanicoe*) in Patagonia for sustainable use. Journal of Arid Environments 64:616-625. https://doi.org/10.1016/j.jaridenv.2005.05.008.

MORA, J. P., & M. SOTO-GAMBOA. 2011. Legítima dispersión de semillas *Ugni molinae Turcz.* (Myrtaceae), por monito del monte, *Dromiciops gliroides*. Gayana. Botánica 68:309-312. https://doi.org/10.4067/s0717-66432011000200018

MOREIRA, J. R. 2013. Capybara. Springer New York, New York, USA.

MOSCARDI, B., D. D. RINDEL, & S. I. PEREZ. 2020. Human diet evolution in Patagonia was driven by the expansion of *Lama guanicoe* after megafaunal extinctions. Journal of Archaeological Science 115:105098-105098. https://doi.org/10.1016/j.jas.2020.105098.

MUCHHALA, N., & J. D. THOMSON. 2010. Fur versus feathers: Pollen delivery by bats and hummingbirds and consequences for pollen production. American Naturalist 175:717-726. https://doi.org/10.1086/652473

NATTERO, J., M. MORÉ, A. N. SÉRSIC, & A. A. COCUCCI. 2003. Possible tobacco progenitors share long-tongued hawkmoths as pollen vectors. Plant Systematics and Evolution 241:47-54. https://doi.org/10.1007/s00606-003-0027-9.

NAVARRO NORIEGA, L. 2015. Las representaciones sociales de los murciélagos en México. Tesis Doctoral. Universidad Autónoma de Madrid, Madrid, España. https://doi.org/10.14349/sumapsi.2020.v27.n1.4

NEUWIRTH, E. 2014. RColorBrewer: ColorBrewer Palettes. R package version 1.1-2. https://CRAN.R-project.org/package=RColorBrewer.

NICHOLS, E., S. SPECTOR, J. LOUZADA, T. LARSEN, S. AMEZQUITA, & M. E. FAVILA. 2008. Ecological functions and ecosystem services provided by *Scarabaeinae dung* beetles. Biological Conservation 141:1461-1474. https://doi.org/10.1016/j.biocon.2008.04.011.

OLMEDO, M. L., C. S. GONZÁLEZ NOSCHESE, J. P. SECO PON, & D. ROMERO. 2021. Composición de la dieta de *Tadarida brasiliensis* (Chiroptera: Molossidae) en el sudeste de la provincia de Buenos Aires, Argentina. Revista del Museo Argentino de Ciencias Naturales nueva serie 23:1-13. https://doi.org/10.22179/revmacn.23.715

OSTFELD, R. S., & R. D. HOLT. 2004. Are predators good for your health? Evaluating evidence for top-down regulation of zoonotic disease reservoirs. Frontiers in Ecology and the Environment 2:13-20. https://doi.org/10.1890/1540-9295(2004)002[0013:apgfyh]2.0.co;2

PADMANANDAM, K., S. P. V. D. S. BHERI, L. VEGESNA, & K. SRUTHI. 2021. A Speech Recognized Dynamic Word Cloud Visualization for Text Summarization, Pp. 609-613. 2021 6th International Conference on Inventive Computation Technologies (ICICT). https://doi.org/10.1109/icict50816.2021.9358693

PANAGIS, K. 1985. The influence of elephant seals on the terrestrial ecosystem at Marion Island, Pp. 173-179. Antarctic Nutrient Cycles and Food Webs (W. R. Siegfried, P. R. Condy, & R. M. Laws, eds.). Springer Berlin Heidelberg, Berlin, Germany. https://doi.org/10.1007/978-3-642-82275-9_24

PANICCIA, C., M. L. CARRANZA, L. FRATE, M. DI FEBBRARO, D. ROCCHINI, & A. LOY. 2022. Distribution and functional traits of small mammals across the Mediterranean area: landscape composition and structure definitively matter. Ecological Indicators 135:108550. https://doi.org/10.1016/j.ecolind.2022.108550.

PASCUAL, U. ET AL. 2017. Valuing nature's contributions to people: the IPBES approach. Current Opinion in Environmental Sustainability 26-27:7-16. https://doi.org/10.1016/j.cosust.2016.12.006.

PAVIOLO, A. ET AL. 2019. *Panthera onca*. Categorización 2019 de los mamíferos de Argentina según su riesgo de extinción. Lista Roja de los mamíferos de Argentina. (SAyDS & SAREM, eds.). http://cma.sarem.org.ar.https://doi.org/10.31687/saremlr.19.151

PERI, P. L., L. NAHUELHUAL, & G. MARTÍNEZ PASTUR. 2021a. Ecosystem services as a tool for decision-making in Patagonia. Ecosystem services in Patagonia: A multi-criteria approach for an integrated assessment (P. L. Peri, G. Martínez Pastur, & L. Nahuelhual, eds.). Springer International Publishing, Cham. https://doi.org/10.1007/978-3-030-69166-0_1

PERI, P. L., G. M. PASTUR, & L. NAHUELHUAL. 2021b. Ecosystem services in Patagonia: a multi-criteria approach for an integrated assessment. Springer International Publishing, Cham. https://doi.org/10.1007/978-3-030-69166-0

PERIAGO, M. E., V. CHILLO, & R. A. OJEDA. 2015. Loss of mammalian species from the South American Gran Chaco: empty savanna syndrome? Mammal Review 45:41-53. https://doi.org/10.1111/mam.12031.

Periago, M. E., D. M. Tamburini, R. A. Ojeda, D. M. Cáceres, & S. Díaz. 2017. Combining ecological aspects and local knowledge for the conservation of two native mammals in the Gran Chaco. Journal of Arid Environments 147:54-62. https://doi.org/10.1016/j.jaridenv.2017.07.017.

Pershing, A. J., L. B. Christensen, N. R. Record, G. D. Sherwood, & P. B. Stetson. 2010. The impact of whaling on the ocean carbon cycle: why bigger was better. PloS one 5:e12444. https://doi.org/10.1371/journal.pone.0012444

Pescador, M., J. Sanguinetti, H. Pastore, & S. Peris. 2009. Expansion of the introduced wild boar (*Sus scrofa*) in the Andean region, Argentinean Patagonia. Galemys 21:121-132.

Powell, R. B., & S. H. Ham. 2008. Can ecotourism interpretation really lead to pro-conservation knowledge, attitudes and behaviour? Evidence from the Galapagos Islands. Journal of Sustainable Tourism 16:467-489. https://doi.org/10.1080/09669580802154223.

Prokop, P., J. Fancovicová, & M. Kubiatko. 2009. Vampires Are still alive: slovakian students' attitudes toward bats. Anthrozoös 22:19-30. https://doi.org/10.2752/175303708X390446.

Quiroga, V. A., G. I. Boaglio, A. J. Noss, & M. S. Di Bitetti. 2013. Critical population status of the jaguar *Panthera onca* in the Argentine Chaco: camera-trap surveys suggest recent collapse and imminent regional extinction. Oryx 48:141-148. https://doi.org/10.1017/S0030605312000944.

R Core Team. 2020. R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. https://www.R-project.org/.

Raíces, D. S. L., & H. De Godoy Bergallo. 2010. Diet and seed dispersion of the crab-eaten fox, *Cerdocyon thous* (Linnaeus, 1766) in Restinga de Jurubatiba National Park, Rio de Janeiro State, Brazil. Neotropical Biology and Conservation 5:24-30. https://doi.org/10.4013/nbc.2010.51.04

Recalde, M. A., & S. Pastor. 2011. Variabilidad y dispersión de los diseños de camélidos en el occidente de Córdoba (Argentina). Circulación de información, reproducción social y construcciones territoriales prehispánicas. Comechingonia 15:93-114. https://doi.org/10.37603/2250.7728.v15.n1.17952

Reddrop, C. et al. 2005. Vampire bat salivary plasminogen activator (desmoteplase) inhibits tissue-type plasminogen activator-induced potentiation of excitotoxic injury. Stroke 36:1241-1246. https://doi.org/10.1161/01.STR.0000166050.84056.48.

Reider, K. E., W. P. Carson, & M. A. Donnelly. 2013. Effects of collared peccary (*Pecari tajacu*) exclusion on leaf litter amphibians and reptiles in a Neotropical wet forest, Costa Rica. Biological Conservation 163:90-98. https://doi.org/10.1016/j.biocon.2012.12.015.

Retana-Guiascón, O. G., & M. L. Navarijo-Ornelas. 2012. Los valores culturales de los murciélagos. Revista Mexicana de Mastozoología (Nueva Época) 2:18-26. https://doi.org/10.22201/ie.20074484e.2012.2.1.19

Richard, E., & J. P. Juliá. 2001. Dieta de *Mazama gouazoubira* (Mammalia, Cervidae) en un ambiente secundario de Yungas, Argentina. Iheringia. Série Zoologia:147-156. https://doi.org/10.1590/s0073-47212001000100015

Riisager-Simonsen, C., O. Rendon, A. Galatius, M. T. Olsen, & N. Beaumont. 2020. Using ecosystem-services assessments to determine trade-offs in ecosystem-based management of marine mammals. Conservation Biology 34:1152-1164. https://doi.org/10.1111/cobi.13512

Ripple, W. J. et al. 2014. Status and ecological effects of the world's largest carnivores. Science 343:1241484.

Roberge, J. M., & P. Angelstam. 2004. Usefulness of the umbrella species concept as a conservation tool. Conservation Biology 18:76-85. https://doi.org/10.1111/j.1523-1739.2004.00450.x.

Rocha, R., S. Aziz, C. Brook, W. Carvalho, & R. Cooper-Bohannon. 2020. Bat conservation and zoonotic disease risk: a research agenda to prevent misguided persecution in the aftermath of COVID-19. Animal Conservation. https://doi.org/10.1111/acv.12636

Rodrigues, T. F., A. M. B. Mantellatto, M. Superina, & A. G. Chiarello. 2020. Ecosystem services provided by armadillos. Biological Reviews 95:1-21. https://doi.org/10.1111/brv.12551.

Rojas, J. 2012. Indicadores de calidad de suelos desmontados y destinados a la producción agrícola en el área piloto de la Ecorregión chaqueña. Tesis de Maestría en Ciencias Agrarias, Orientación: Producción Sustentable. Facultad de Agronomía y Zootecnia. Universidad Nacional de Tucumán, Tucumás, Argetina. https://doi.org/10.56152/stevianafacenv13n2a2_2021

Roman, J. et al. 2014. Whales as marine ecosystem engineers. Frontiers in Ecology and the Environment 12:377-385.

Roman, J., & J. J. McCarthy. 2010. The whale pump: marine mammals enhance primary productivity in a coastal basin. PloS one 5:e13255. https://doi.org/10.1371/journal.pone.0013255

Roman, J., J. Nevins, M. Altabet, H. Koopman, & J. McCarthy. 2016. Endangered right whales enhance primary productivity in the Bay of Fundy. PLoS One 11:e0156553. https://doi.org/10.1371/journal.pone.0156553

Root-Bernstein, M., & L. A. Ebensperger. 2013. Meta-analysis of the effects of small mammal disturbances on species diversity, richness and plant biomass. Austral Ecology 38:289-299. https://doi.org/10.1111/j.1442-9993.2012.02403.x

Rydell, J., J. Eklöf, & M. Riccucci. 2018. Cimetière du Père-Lachaise. Bats and vampires in french romanticism. Journal of Bat Research & Conservation 11:1. https://doi.org/10.14709/barbj.11.1.2018.10

Sánchez, M. S., L. V. Carrizo, N. P. Giannini, & R. M. Barquez. 2012a. Seasonal patterns in the diet of frugivorous bats in the subtropical rainforests of Argentina. Mammalia 76:269-275. https://doi.org/10.1515/mammalia-2011-0059.

Sánchez, M. S., N. P. Giannini, & R. M. Barquez. 2012b. Bat frugivory in two subtropical rain forests of Northern Argentina: testing hypotheses of fruit selection in the Neotropics. Mammalian Biology 77:22-31. https://doi.org/10.1016/j.mambio.2011.06.002.

Sarasola, J. H., J. I. Zanón-Martínez, A. S. Costán, & W. J. Ripple. 2016. Hypercarnivorous apex predator could provide ecosystem services by dispersing seeds. Scientific Reports 6:19647. https://doi.org/10.1038/srep19647

Schleuning, W. D. 2001. Vampire bat plasminogen activator DSPA-alpha-1 (desmoteplase): a thrombolytic drug optimized by natural selection. Haemostasis 31:118-122. https://doi.org/10.1159/000048054.

Secretaría De Agricultura Y Pesca. 2018. Carpincho: Informe Anual de Exportación 2005-2018. Buenos Aires, Argentina.

Secretaría de Ambiente y Desarrollo Sustentable de La Nación, & Sociedad Argentina para el estudio de los mamíferos (eds.). 2019. Categorización 2019 de los mamíferos de Argentina según su riesgo de extinción. Lista Roja de los mamíferos de Argentina. Versión digital: http://cma.sarem.org.ar. https://doi.org/10.31687/saremlr.19.140

SGAyDS. 2019. Tercer Informe Bienal de Actualización de Argentina a la Convención Marco de las Naciones Unidas para el Cambio Climático (CMNUCC). https://doi.org/10.24201/fi.v59i3-4.2656

Silge, J., & D. Robinson. 2016. tidytext: Text Mining and Analysis Using Tidy Data Principles in R. Journal of Open Source Software 1:37. https://doi.org/10.21105/joss.00037.

Sills, J., & H. Zhao. 2020. COVID-19 drives new threat to bats in China. Science 367:1436-1436. https://doi.org/10.1126/science.abb3088.

Smith, C. R. 2006. Bigger is better: the role of whales as detritus in marine ecosystems. Whales, whaling and ocean ecosystems. University of California Press Berkeley, CA, USA. https://doi.org/10.1525/9780520933200-026

Smith, V. R. 2008. Energy flow and nutrient cycling in the Marion Island terrestrial ecosystem: 30 years on. Polar Record 44:211-226. https://doi.org/10.1017/S0032247407007218.

Soler, L., P. Gonzalez Ciccia, & M. Orozco. 2015. Acciones participativas para acordar prioridades y estrategias de conservación del aguará guazú (*Chrysocyon brachyurus*). El Aguará guazú, *Chrysocyon bracyurus*, en la Argentina. Lecciones aprendidas y recomendaciones para su conservación (M. Orozco, P. Gonzalez Ciccia, & L. Soler, eds.). Fundación de Historia Natural Félix de Azara, Buenos Aires. https://doi.org/10.31687/saremnms.20.0.33

Spears, N. E., J. C. Mowen, & G. Chakraborty. 1996. Symbolic role of animals in print advertising: Content analysis and conceptual development. Journal of Business Research 37:87-95. https://doi.org/10.1016/0148-2963(96)00060-4.

Swartz, T. M., J. M. Gleditsch, & J. E. Behm. 2022. A functional trait approach reveals the effects of landscape context on ecosystem services provided by urban birds. bioRxiv:2022.02.28.482331. https://doi.org/10.1101/2022.02.28.482331.

Taber, A. et al. 2008. El destino de los arquitectos de los bosques neotropicales: evaluación de la distribución y el estado de conservación de los pecaríes labiados y los tapires de tierras bajas. Wildlife Conservation Society, Wildlife Trust 181. https://doi.org/10.2307/j.ctvvnctc.13

Takahashi, Y., K. J. Park, Y. Natori, D. Dublin, R. Dasgupta, & K. Miwa. 2022. Enhancing synergies in nature's contributions to people in socio-ecological production landscapes and seascapes: lessons learnt from ten site-based projects in biodiversity hotspots. Sustainability Science 17:823-836. https://doi.org/10.1007/s11625-021-00927-w.

Taylor, V. J., & N. Dunstone. 1996. The Exploitation of Mammal Populations. Chapman and Hall, London.

Tort, J., C. M. Campos, & C. E. Borghi. 2004. Herbivory by tucotucos (*Ctenomys mendocinus*) on shrubs in the upper limit of the Monte desert (Argentina). Mammalia 68:15-21. https://doi.org/10.1515/mamm.2004.002

Tschapka, M., & S. Dressler. 2002. Chiropterophily: on bat-flowers and flower-bats. Curtis's Botanical Magazine 19:114-125. https://doi.org/10.1111/1467-8748.00340

Tuttle, M. D. 2017. Fear of bats and its consequences. Journal of Bat Research and Conservation 10:1-4.

United Nations. 2015. Transforming our world: The 2030 Agenda for Sustainable Development. UN, New York, USA.

Valentine, L. E. 2014. 7H. Ecosystem services of digging mammals. Plant Life on the Sandplains in Southwest Australia: A Global Biodiversity Hotspot (H. Lambers, ed.). University of Western Australia Publishing, Australia.

Van Der Heide, G., E. Fernandez-Duque, D. Iriart, & C. Juárez. 2012. Do forest composition and fruit availability predict demographic differences among groups of territorial owl monkeys (*Aotus azarai*)? International Journal of Primatology 33:184-207. https://doi.org/10.1007/s10764-011-9560-5.

Vicente, C. 2018. El avistaje de delfines oscuros (*Lagenorhynchus obscurus*) en el Golfo Nuevo como promovedor de conciencia ambiental. Tesis Licenciatura. Universidad Nacional de la Patagonia San Juan Bosco, Argentina. https://doi.org/10.22185/24487147.2016.90.041

Vilá, B. 2014. Una aproximación a la etnozoología de los camélido andinos. Etnoecológica 10:1-16.

Vilá, B., & Y. Arzamendia. 2020. South American Camelids: their values and contributions to people. Sustainability Science 17:707-724. https://doi.org/10.1007/s11625-020-00874-y.

Vilá, B., A. Wawrzyk, & Y. Arzamendia. 2010. El manejo de vicuñas silvestres (*Vicugna vicugna*) en Jujuy (Argentina): Un análisis de la experiencia del proyecto MACS, en Cieneguillas. Revista Latinoamericana de Conservación 1:38-52. https://doi.org/10.1007/s10164-018-0542-3

Vilá, B. 2006. Investigación, conservación y manejo de vicuñas. Proyecto MACS Argentina, Buenos Aires.

Vilela, A., M. Bolkovic, P. Carmanchahi, M. Cony, D. De Lamo, & D. Wassner. 2009. Past, present and potential uses of native flora and wildlife of the Monte Desert. Journal of Arid Environments 73:238-243. https://doi.org/10.1016/j.jaridenv.2007.10.013

Viveiros De Castro, E. 2013. La mirada del Jaguar. Tinta Limón, Buenos Aires.

Vlami, V. et al. 2020. Residents' views on landscape and ecosystem services during a wind farm proposal in an island protected area. Sustainability 12. https://doi.org/10.3390/su12062442.

Wajner, M., D. M. Tamburini, & F. Zamudio. 2019. Ethnozoology in the mountains. What does the cognitive salience of wild animals tell us? Ethnobiology and Conservation (on line). https://ethnobio-conservation.com/index.php/ebc/article/view/299.https://doi.org/10.15451/ec2019-07-8.09-1-23

Whitford, W. G., & F. R. Kay. 1999. Biopedturbation by mammals in deserts: a review. Journal of Arid Environments 41:203-230. https://doi.org/10.1006/jare.1998.0482.https://doi.org/10.1006/jare.1998.0482

Wickham, H. 2016. ggplot2: elegant graphics for data analysis. Springer-Verlag, New York, USA.

Wickham, H. 2019. stringr: simple, consistent wrappers for common string operations. R package version 1.4.0. https://CRAN.R-project.org/package=stringr.

Wickham, H. 2021a. rvest: Easily Harvest (Scrape) Web Pages. R package version 1.0.0. https://CRAN.R-project.org/package=rvest.

Wickham, H. 2021b. tidyr: Tidy Messy Data. R package version 1.1.3. https://CRAN.R-project.org/package=tidyr.

Wickham, H., R. François, L. Henry, & K. Müller. 2021. dplyr: A grammar of data manipulation. R package version 1.0.7. https://CRAN.R-project.org/package=dplyr.

Williams-Guillén, K., I. Perfecto, & J. Vandermeer. 2008. Bats limit insects in a neotropical agroforestry system. Science 320:70-70. https://doi.org/10.1126/science.1152944

Williams, S. T., N. Maree, P. Taylor, S. R. Belmain, M. Keith, & L. H. Swanepoel. 2018. Predation by small mammalian carnivores in rural agro-ecosystems: An undervalued ecosystem service? Ecosystem Services 30:362-371. https://doi.org/10.1016/j.ecoser.2017.12.006.

Winnie Jr., J., & S. Creel. 2017. The many effects of carnivores on their prey and their implications for trophic cascades, and ecosystem structure and function. Food Webs 12:88-94. https://doi.org/10.1016/j.fooweb.2016.09.002

Winter, M. 2020. Evaluación del rol de los jabalíes y roedores en el ciclo silvestre de *Trichinella* spp. en el noreste de Patagonia. Tesis Doctoral. Facultad de Ciencias Veterinarias, Universidad de Buenos Aires, Buenos Aires, Argentina. https://doi.org/10.24215/1850468xe006

Yacobaccio, H. 2009. The historical relationship between people and the Vicuña. The Vicuña (I. J. Gordon, ed.). Springer, Boston, USA. https://doi.org/10.1007/978-0-387-09476-2_2

Zamboni, T., S. Di Martino, & I. Jiménez-Pérez. 2017. A review of a multispecies reintroduction to restore a large ecosystem: The Iberá Rewilding Program (Argentina). Perspectives in Ecology and Conservation 15:248-256. https://doi.org/10.1016/j.pecon.2017.10.001.