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Chasseur mesurant la patte d'une proie. Crédit: Paul Quintero / *Hunter measuring the hand of a prey. Credit: Paul Quintero.*

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# Human-puma (*Puma concolor* (Linnaeus, 1771)) relations in the Dry Chaco of Córdoba, Argentina

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**ABSTRACT**
Peasant and puma (*Puma concolor* (Linnaeus, 1771)) relations in the Argentinian Chaco (Córdoba) are assessed through interviews, participant observation and a zooarchaeological approach. Thus, we present information concerning human perceptions surrounding this carnivore and an analysis of the remains of a puma that had been hunted, prepared as pickles and consumed by local dwellers. Despite the negative perceptions (N = 61 interviewees) associated with the threat that pumas represent to the subsistence of the rural populations, it has been possible to record consumption practices (as food and medicine) of the animal. The zooarchaeological analysis of 19 elements selected for the consumption of the carnivore has also provided information about modes of preparation and practices that do not appear in the narratives. Finally, we note that local perceptions in relation to pumas are being subjected to changes associated with socioeconomic pressures and ecological transformations, thus we highlight the role of transdisciplinary approaches in supporting biocultural conservation in the area.

**KEY WORDS**
Hunting, consumption, zooarchaeology.

**RÉSUMÉ**
*Relations homme-puma (*Puma concolor *(Linnaeus, 1771)) dans le Chaco sec de Córdoba, Argentine.*
Par le biais d'entretiens, d'observation de participants et d'une approche zooarchéologique, nous avons évalué les relations entre les paysans et le puma (*Puma concolor* (Linnaeus, 1771)) dans le Chaco argentin (Córdoba). Nous présentons des informations sur les perceptions humaines de ces carnivores ainsi qu'une analyse des restes d'un puma qui a été chassé, sa viande marinée puis consommée par les habitants locaux. Malgré les perceptions négatives (N = 61 personnes interrogées) associées à la menace que représente les pumas pour les populations rurales, il a été possible d'enregistrer les pratiques de consommation de l'animal en tant que nourriture et médecine traditionnelle. L'analyse zooarchéologique de 19 éléments sélectionnés pour la consommation du carnivore a également permis d'obtenir des informations sur des modes de préparation et des pratiques qui ne sont pas présents dans les récits des paysans. On constate, enfin, que les perceptions locales relatives aux pumas sont soumises à des changements liés aux pressions socio-économiques et aux transformations écologiques. Pour cela, nous soulignons l'importance des approches interdisciplinaires pour soutenir la conservation bioculturelle de l'espèce dans la région.

**MOTS CLÉS**
Chasse, consommation, archéozoologie.

## INTRODUCTION

The relationship between humans and felids is complex and under constant transformation. Felids, as Kruuk (2002: 75) once wrote, are the "most carnivorous of carnivores" and also the most famously known human eaters. Thus, big cats can compete, spread fear, hunt and be hunted by humans. Felines can be companions to people and whereas the smaller ones have been fully domesticated, bigger cats are tamed by different human groups. Faure & Kitchener (2009) suggested that more than 38% of the felid species have been tamed by humans. Moreover, they can be symbols, trophies, medicine, food, provide warmth as clothes or be ornaments and tools for humans (Kruuk 2002; Faure & Kitchener 2009). But how do these different sorts of relations transform whilst human societies change? In this paper we aim to address this question through a particular case study, the puma (*Puma concolor* (Linnaeus, 1771))-peasant relations in the dry Chaco of Córdoba province, Argentina.

## HUMAN-FELID ENTANGLEMENTS IN THE GRAN CHACO

In South America, many wild cats have been tamed as pets, a practice that can be traced back to at least 500 years ago (Faure & Kitchener 2009). Even though taming has been initiated by indigenous people, the praxis still occurs among many of the current peasant community of the Gran Chaco (Manzano-García 2019); a familiarizing sort of relationship that also included –and still includes– pumas (Faure & Kitchener 2009; Manzano-García 2019).

Despite the previous, the relation with the most widespread predator in the continent is now under new forms of transformation (Nanni *et al.* 2020). The farming-based communities that have their livelihoods in Chaco are currently seeing pumas as a threat to their subsistence (Manzano-García 2019; Nanni *et al.* 2020). Therefore –in the anthropocenic era–, the ever-expanding farming environment is presenting new challenges to the cohabitation of humans and pumas in the ecoregion. The sometimes alleged predation on livestock is frequently the reason of conflicts between pumas and cattle ranchers (Manzano-García 2019; Nanni *et al.* 2020). Consequently, in the arid saline depressions of Northwestern Córdoba, this felid is now perceived as harmful –almost as a plague– that threatens the livelihoods of goat farmers (Manzano-García 2019).

As asserted earlier, the relations between humans and felids are complex and are always transforming. These carnivores were the most frequent images in art and mythology prior to European colonization (Saunders 1998). The first inhabitants of Córdoba also depicted felines in their rock art sites and pumas were portrayed in different artistic styles, from the North (Serrano 1945; Uribe & Ochoa 2008) to the South (Rocchietti 2013) of the province. Many of these scenes have been interpreted as hunting practices, a sort of relationship that also underwent transformations through time, although deeply accentuated when the first European settlers arrived in the area (Manzano-García *et al.* 2019; Costa *et al.* 2022).

Jerónimo Luis de Cabrera, the founder of Córdoba, once wrote that the region was "good land" to make farms and raise European cattle (Cabrera [1573] in Montes & Freytag 2008: 47). Cabrera's quote displays the beginnings of the capitalist transformations that arrived in the continent with the European settlers, altering livelihoods and the way people perceived and related to many local animals, such as pumas (Costa 2022). These changes were so profound that between 1750 and the first half of the 19th century the province was divided into small independent agrarian units, and was completely inserted in a mercantile network formed by an indigenous or mestizo peasantry (Tell 2008). This new form of economic organization certainly affected the ways humans perceived pumas.

By the beginnings of the 20th century, Río & Achával (1904: 344) wrote that pumas –or lions, as they are sometimes locally called– were still abundant and causing "serious damage to the farms by killing goats, sheep and other small livestock". The authors also described that the felines were the "object of a fierce hunt conducted by the villagers using dogs, snares, bo-

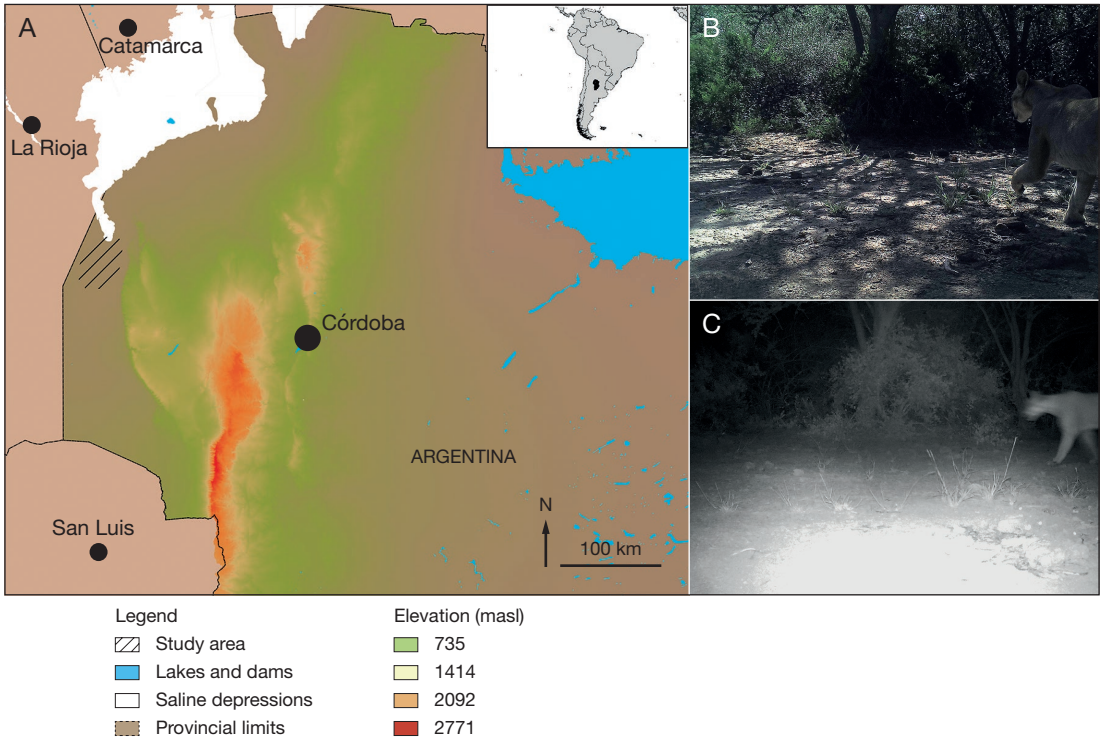


FIG. 1. — Study area, the northwest of Córdoba in Argentina, South America (insert). B, C, pumas (*Puma concolor* (Linnaeus, 1771)) captured on camera traps southward the saline depressions (31°0'23.56"S, 65°32'19.00"W). Credits: Thiago Costa.

las or simply stakes arranged as spears" (Río & Achával 1904: 344). Thus, the quote suggests that pumas were already being perceived as a menace to the peasantry also revealing that traditional techniques –such as bolas– were still in use at that time.

The intermingling of indigenous people and Europeans –that characterizes peasant (or *criollos*) communities in the Gran Chaco– appears in habits, "practices, techniques and materials" used by peasants that draw from indigenous knowledge (Gordillo 2014: 42). In this sense, Montani (2017) demonstrates that the correct disposal of many animal bones is important for the *wichí* people from the Northern Chaco of Argentina. Regarding pumas, the indigenous people say that it is important to keep the head of a hunted puma hanging, otherwise a retaliation from the entity which owns the pumas can occur (Montani 2017). The same practice has been reinterpreted by peasants but as the ethnographer described, in this case the head is kept in order to "intimidate other pumas" (Montani 2017: 395). Altrichter (2006) describes that peasant (*mestizo*) communities from the semi-arid Argentine Chaco –specifically in the *Impenetrable* area – consume pumas as food, although this would not be the most appetizing meat among these people. Therefore, the hunting of these carnivores seems to be widespread in the Chaco, although its reasons are culturally variable.

Developing a beautiful project in northwest Córdoba, the civil and cultural association *Relatos del Viento* offers us the recreation of a regional myth from *El Guanaquito* region, regarding two indigenous brothers and their encounter with a huge puma. After a first encounter with the puma in which one of the brothers –called the bad one (*malo*)– was wounded, the sibling hunters met once again with the great puma, who was seeking revenge. On that stormy day, the good (*bueno*) brother, perceiving that his sibling had been cornered by the beast, asked the god of the storm to transform him into a puma, so he could save his brother. To this day, when two pumas are seen fighting over a prey, it is said that the hostile puma is the good hunter transformed into the carnivore (Rionda & Rosalía 2015).

In accordance with this tale, the reinterpretation of indigenous myths, techniques and practices is also common among the (*criollo*) peasants that live in the arid Chaco of northwest Córdoba (Manzano-García *et al.* 2019; Costa 2022). Hence, hunting and consuming wild animals as medicine or food, taming cubs or keeping elements of their bodies as ornaments or trophies are part of the daily life in the region (Tamburini 2016; Manzano-García 2019; Costa *et al.* 2022). In this regard, here, we aim to explore the peasant-puma relations in this particular area of Córdoba –the southernmost portion of the Gran Chaco– through two lines of evidence: the ethnozoological information entangling humans and pumas as well as the study of the remains of a puma that has been hunted and consumed by current dwellers.

## STUDY AREA

The study area (Fig. 1A) is located in the central region of Argentina, in the northwest of the province of Córdoba (30°56'50.78"S 65°33'13.85"W). The area is surrounded by mountains that function as barriers restricting precipitation, thus giving special environmental characteristics to this subregion (Torrella &

TABLE 1. — *Puma concolor* (Linnaeus, 1771) skeletal elements and anthropic traces registered.

| Skeletal elements | Axial | Apendicular | | Anthropic marks | |
|---|---|---|---|---|---|
| | | Right | Left | Sawing | Cuts |
| Thoracic vertebrae | 10 | – | – | 21 | 5 |
| Rib (first) | 1 | – | – | – | – |
| Humerus | – | – | 1 | – | 31 |
| Radius | – | – | 1 | – | 2 |
| Ulna | – | – | 1 | 1 | 5 |
| Pelvis | – | – | 1 | 1 | 14 |
| Tibia | – | 1 | – | – | 29 |
| Fibula | – | 1 | – | – | 1 |
| Calcaneus | – | 1 | – | – | 2 |
| Astragalus | – | 1 | – | – | 1 |
| Total | 11 | 4 | 4 | 23 | 90 |

Adámoli 2005). Therefore, the climate is temperate with average temperatures of 25°C in summer and 12°C in winter and precipitation mainly concentrated in the warm months, with an annual average of 202.89 mm between 2012-2020 according to the particularities of a semi-arid region (data from Serrezuela weather station; 30°41'21.96"S 65°23'35.78"W).

In phytogeographic terms, the area belongs to the Gran Chaco ecoregion, one of the largest ecosystems in South America and one of the most extensive dry forest environments worldwide (Cabido *et al.* 2018). This particular sub-region has been classified as an area of white quebracho (*Aspidosperma quebracho-blanco* Schltdl., 1861) and black tree (*Prosopis nigra* (Griseb.) Hieron., 1882) forest, which is being rapidly and worryingly displaced by shrublands and (newly) anthropized landscapes (Zak *et al.* 2008). The most frequent zoological species are the rhea (*Rhea americana* (Linnaeus, 1758)), the Geoffroy's cat (*Leopardus geoffroyi salinarum* (Thomas, 1903)), the guanaco (*Lama guanicoe* (Müller, 1776)), the Patagonian mara (*Dolichotis patagonum* (Zimmermann, 1780)) and the puma, although many of them are suffering an alarming retraction process (Torres & Tamburini 2018). From a conservation standpoint, it is important to emphasize that the felid under study has been locally listed as a species of least concern (LC), due to its wide distribution and ability to inhabit areas highly modified by humans (De Angelo *et al.* 2019).

At the geopolitical level, the area is located between the departments of Minas and Cruz del Eje in the province of Córdoba, both of which are predominantly composed of rural population. The Minas department, where most of our work was conducted, is characterized by scattered housing (51%), a predominance of males (6.1 for every female) and an average age of 34 between both sexes (Dirección General de Estadística y Censos de la Provincia de Córdoba 2017).

## MATERIALS AND METHOD

### IN THE COMPANY OF PEOPLE

We followed the guidelines of the International Society of Ethnobiology (2006) with regards to ethical and methodological requirements. Thus, the community was informed of the objective of the research, the exclusively academic use of the results, and verbal informed consent was obtained prior to the development of the meetings and interviews, complying with the application of the dynamic interactive cycle used in the ethnoecological methodology. The collected personal data were anonymized in the databases.

Sixty-one people between 18 and 92 years of age were interviewed (Appendix 1). Snowball sampling and intentional sampling were applied as well as techniques to find key informants for interviews (Martín-Crespo & Salamanca-Castro 2007). Some of the techniques used for the selection of key informants are observation, life stories and oral history, narrative and focus groups. Subsequently the following were done, semi-structured, open, extensive, in-depth interviews (Guber 2004; Martínez 2013; Manzano-García 2019), and participant observation were conducted (Dos Santos Rodríguez 2009).

Based on studies of the same nature (Manzano-García & Martínez 2017; Manzano-García 2019), the qualitative analysis consisted of extracting statements from the interviews, which were then classified according to consensus or plurality of perceptions in terms of puma control or elimination. Categories of ethnobiological interest (valuations, uses, frequency of mention of control/elimination by informant, causes that generate antagonism towards pumas) were systematized in a database (further information on Manzano-García 2019). In the case presented here, we used a qualitative approach.

### WITH ANIMAL BONES

We analyzed anthropic marks –sawing and cut marks produced through the use of manual metal tools– on the remains of a female puma that was trapped and slaughtered in July 2019. The carnivore was then butchered and divided among three hunters. Therefore, we present the analysis of 19 bones –mostly complete (Table 1)– that have been prepared as pickles, consumed and afterwards provided to us by one of the hunters. The elements were then boiled by one of us (TC), for approximately five hours until adhering flesh, tendons, and cartilage could easily be removed by hand. After cleansing, we followed actualistic studies guidelines in the classification of cut marks as those traces restricted to the cortical surface of the bone and sawing as cuts through the bone creating a flat fracture (Binford 1981; Nilssen 2000). Moreover, cut marks were classified into three categories:

– isolated, singular incisions perpendicular to the bone surface or with an angle;

– parallel, set of two or more cut, scrape or shave traces aligned with each other;

– superimposed, superimposition of "V" or crossed shaped cuts, scrapes and shave marks (Bunn 1981; Nilssen 2000).

For the osteological characterization of the animal, we followed the proposal of Pacheco & Zapata (2017; Zapata & Pacheco 2019). Identification and quantification of anthropic cuts and saws were performed by two of the authors (TC and JM) with the aid of a digital microscope (X4, 1000X). Subsequently, the anthropic traces were recorded on the silhouette of a puma using QGIS Desktop 3.10.0 program.

TABLE 2. — Number of interviewees according to age class and gender.

| | Age ranges (in months) | | |
|---|---|---|---|
| **Gender** | 18-30 | 31-60 | >61 |
| Female | – | 10 | 11 |
| Male | 4 | 30 | 6 |

## PERCEPTION AND ENVIRONMENT

Although it is not our intention to develop the long history of studies on human perception, it is nevertheless necessary to conceptualize it in an epistemological frame. In his book called *The Perception of the Environment. Essays on Livelihood, Dwelling and Skill*, Ingold (2000) summarizes different approaches to the understanding of human perception. Drawing inspiration mainly from the ecological psychology of Gibson (1979) and phenomenological philosophy of Merleau-Ponty (Merleau-Ponty & Smith 1962), Ingold argues that processes such as thought, perception and learning should be studied "within the ecological contexts of people's interrelations with their environments" (Ingold 2000: 171). A similar approach has been taken by the anthropologist Melgarejo (1994: 47) who understands perception as "biocultural", thus she defines it as the conformation of physical stimuli and sensations, as well as the classification (selection and organization) of these sensations. Also inspired from the work of Merleau-Ponty (Merleau-Ponty & Smith 1962), she argues that perception depends on circumstances that might change along with experiences that should be (bodily) acquired, hence it must be understood in relation to a socio-historical context, as it has a spatial and temporal location (Melgarejo 1994). In this regards, humans categorize situations or components of the environment, through references elaborated from cultural and ideological systems specific to each social group in time and territory.

Despite the similarities, Ingold's endeavor is somewhat more radical since it lies in dissolving nature/culture dualism through the development of an alternative ecological anthropology, one that is concerned with the process of mutual constitution of persons and the environment (Ingold 2000). In the case presented here, we follow these authors' proposal to understand human perception as a biocultural entanglement.

### PUMAS IN LOCAL PEASANT'S PERCEPTION

Many of the people that we interacted with, worked as loggers between the decades of 1980s and 1990s, an activity that demanded lengthy periods in the forest, where hunting was important for nourishment, thus reinforcing the practice as part of the livelihoods of the peasant community (Manzano-García *et al.* 2019; Costa *et al.* 2022). Table 2 shows gender and age class profiles of our interviewees. As depicted there, most of the stakeholders we interviewed (N = 30) were males with ages ranging from 31 to 60 years old.

The local inhabitants of the area perceive the puma as a threat to both humans and livestock. According to D. Q. (October 2018) from El Milagro, "the lions left people in the streets", because of their predation on caprine livestock. Nonetheless, people recognize pumas as a source of multiple benefits, hence the uses vary according to the body parts of the animal: meat as food, fat as medicine, and the skin or the head as ornaments (or trophies). As described by D. P. (July 2016), "When you have pain in your bones, as well as rheumatism, you massage yourself with lion's fat for several days and you heal".

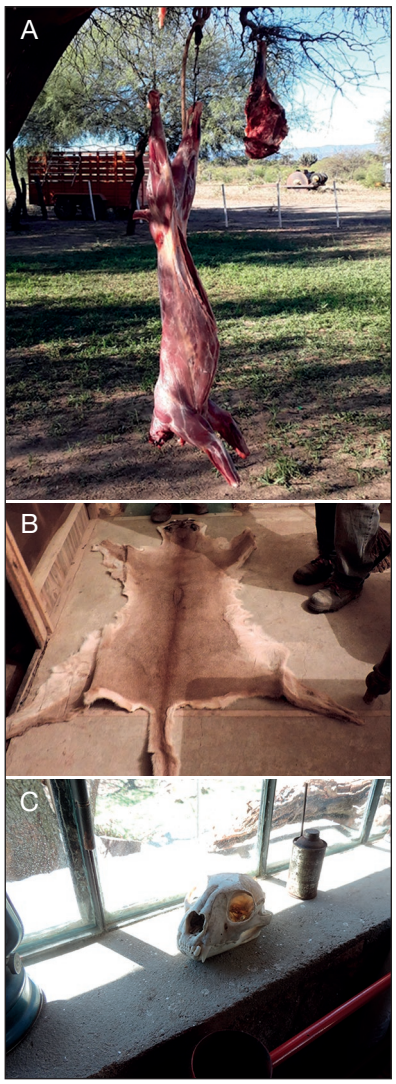


FIG. 2. — Puma's (*Puma concolor* (Linnaeus, 1771)) body parts. **A**, as nourishment waiting to be butchered; **B**, as ornamental skin for the domestic household; **C**, the skull, as ornament in a local farm cottage. Photos credits: Jessica Manzano-García.

The commercialization of leather, skins or shells from local species are illegal nowadays –during the 80s some species were still lucrative– therefore, hunting occurs only for subsistence purposes, and people usually use the entire animal: "If an animal is killed, it is used completely" (P. Q., August 2017). In addition, the forms of local consumption can be determined by collective preferences, as suggested by two of our interviewees, "The puma is better prepared in a disk (a sort of pot for preparing stews) and the hindlimbs


Fig. 3. — Depiction of a hunting sequence. **A**, puma (*Puma concolor* (Linnaeus, 1771)) track; **B**, trap used in hunting; **C**, dogs (*Canis lupus familiaris* (Linnaeus, 1758)), the nonhuman companions, after a boar (*Sus scrofa* Linnaeus, 1758) hunting party. Credits: Jessica Manzano-García.

with breadcrumbs" (R. M & G. M., June 2015). In this sense, Figure 2 exhibits local uses of puma's body parts; as nourishment or as ornaments in a local cottage.

The recognition of the felid specific behavior demonstrates a profound knowledge of the surrounding environment, also suggested by previous results (Manzano-García 2019; Manzano-García *et al.* 2019; Costa *et al.* 2022). In this sense, people usually assert that puma predation on livestock occurs in periods of drought, when the carnivore predates goats for feeding as well as for hydration. "The lion quenches its thirst in the dry season by taking the liquid from the goat's udder and breast, it has a lot of liquid there" (G. A., November 2019).

Pumas hunting generally occurs according to the following mechanical operational sequences (*chaîne opératoire, sensu* Leroi-Gourhan 1993):

– hunters –two or three– pursue the animal tracks (Fig. 3A) and install a trap (*leonera*) in an agreed location –usually a dam or a frequently used path–;
– hunters check the trap daily accompanied by their dogs;
– the feline gets trapped by a limb;
– the weakened animal is sometimes bitten by dogs;
– the felid is slaughtered by club and/or ultimately a knife stroke;
– bleeding and evisceration of the carcass is performed;
– the carcass is brought to the cottage.

Despite the reason for hunting pumas is mainly to avoid any substantial damage to livestock, once slaughtered the felid is used almost entirely (also in Tamburini 2016). Hunting mechanisms vary between peasants, nevertheless there are similarities in the use of dogs, firearms (carbine, pistol, shotgun), the use of trap (Fig. 3B) and knives as the ultimate tool in bleeding and eviscerating at the hunting ground (Tamburini 2016; Manzano-García 2019). Thus, some hunters recommend bleeding –through slitting the animal's throat– to prevent putrefaction while they transport the animal to the place where secondary butchering occurs. Regarding by-products or discarded parts after butchering, the peasant inhabitant mentions the head and hindlimbs as well as viscera, although many heads are kept as ornaments.

Nonetheless, even the viscera are used as reward for the nonhuman hunting fellows, the dogs. Evisceration, apart from lightening the weight of the animal to be carried towards the forest to the domestic unit, has a social significance on bonding through reward with the dogs, in a similar manner to that granted to the other human participants in the division of meat (Fig. 3C).

Since the government controls increased –Police and the Secretary of Environment–, transformations occurred in hunting practices. The hunting of a harmful predator used to be celebrated and the participants were rewarded with money, food or other gifts as a form of gratitude. In this sense, slaughtering a puma that attacked a neighbor's property –by feeding on goats– is considered a common benefit for the peasant community. "In the old days between 2-3 families set a hunting trap and killed it, the reward for them was a goat, a barbecue or money, whatever was gathered among the neighbors" (G. A., November 2019). Thus, this sort of social event significantly decreased because of the government restrictions.

On the other hand, puma is also important in local medicine. Rheumatic illnesses are treated using the fat extracted from the animal's thorax –adjacent to the ribs– as the mention of D. P. (July 2016) demonstrates "when you have pain in the bones, as well as rheumatism, you massage yourself with lion fat for several days and you are cured". According to A. Q. (October 2018), "lion's fat is good for articular illnesses".

As aforementioned, taming is a common practice among local inhabitants, however, in puma's case, most of the dwellers disapprove this practice since the felines are considered a potential threat to caprine livestock (Fig. 4). In this regards, the raising of a puma's cub by one of the dwellers from the locality of El Chacho, caused bewilderment among neighbors, who ended up reporting it to the local authorities (Family Albornoz, 2019).

## CONSUMING THE LION

The study of the material remains from consumed animals allows a deeper understanding of the human-animal relations in the region. Moreover, regional butchering and culinary practices provide information about the perceptions of what animals –and which parts– are edible, the best way of preparing them, as well as the social relations among people (Russell 2012). Thus, in this section we present the remains of a puma that was consumed as pickles by one of our informants.

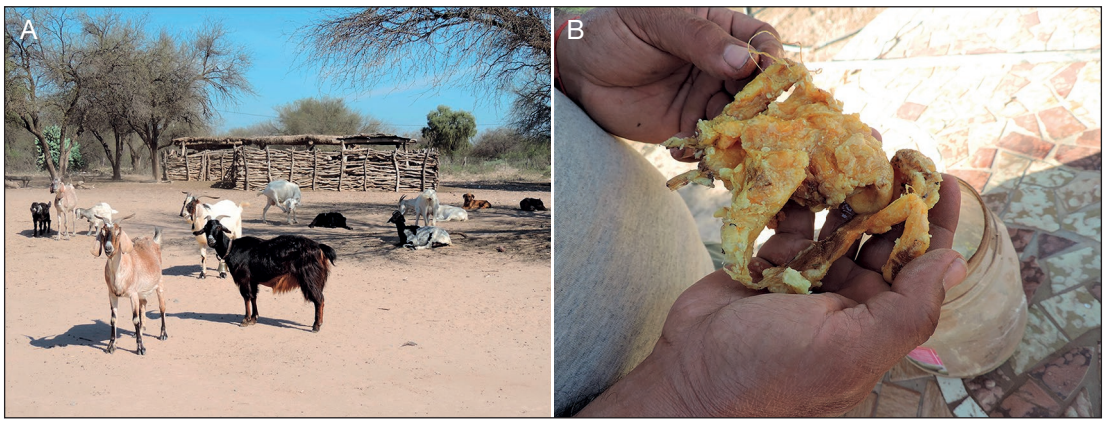


Fig. 4. — **A**, caprine livestock in local corral; **B**, the fat of the predator prepared for medicinal usage. Credits: Jessica Manzano-García.

### The preparation

According to our informant, there are mainly three ways of cooking a puma: with breadcrumbs (*milanesas*), pickled (*escabeche*) or in stews (*guisos*). In this sense, he described that the rear portions (round and shank) are better breaded, and the dorsal parts (loin and sirloin) are best suited for pickles or stews. The front limbs (chuck and brisket), this person recounted, can be cooked in all the aforementioned preparations.

Nonetheless, all the elements studied here were cooked as pickles. The preparation proceeded in the following sequence:
– the whole elements were boiled;
– meat was separated from the bones (filleting);
– bones were discarded;
– final cooking of the meat occurred along with vegetables (carrots, onions, garlic), spices (pepper and oregano), vinegar and oil;
– the preparation was preserved in a glass bottle with a metal cover;
– the food was consumed.

### Imprints on the bones

Table 1 shows the skeletal elements that have been selected for this particular preparation of the carnivore. A total of 19 elements have been prepared as pickles and consumed by our interviewee along with his family, before being delivered to us. Regarding the selection of portions, similar quantities of axial (N = 11, 10 thoracic vertebrae and a first rib) and appendicular (N = 8) elements were chosen for pickling. Concerning appendicular bones, it is noteworthy that the forelimbs belong to the left half of the skeleton while the rear limbs belong to the animal's right half. One possible explanation could be that when the felid was fractionated, the laterals were unintentionally intermingled, although intentional selection of these portions could also occur. Hunters usually divide their portions equally, however, disputes sometimes occur.

Another noticeable difference appears in the traces evidenced in thoracic vertebrae (axial), where longitudinal sawing –to separate the carcass in halves– generated 21 marks in 10 elements (Fig. 5D). On the other hand, sawing only generated two traces in appendicular elements, one longitudinal mark in pelvis ischial symphysis –also a result of the separation into halves– and one transversal cut through the end of the ulna's distal epiphysis, as a result of the forelimb separation. Therefore, the only incomplete elements were the ones that were sawed. The presence of rider bones (*sensu* Binford 1981) is also noteworthy in the assemblage – first rib, calcaneus and astragalus. In this sense, although the axial element did not present anthropic traces, both appendicular bones showed marks that might be associated with the disarticulation of the carcass (Nilssen 2000).

Regarding cut marks, the traces of these activities were far more numerous in the appendicular bones (N = 85) than in the axial remains (N = 5). Even so, there are significant differences among the distribution of marks in the limbs. In this sense, humerus presents 34% of the traces recorded in the appendicular bones, followed by tibia (32%), pelvis (16%) and ulna (6%). The remaining 12% is divided among the other elements, as shown in Figure 6.

Activities such as disarticulating body parts, skinning and filleting usually leave traces in the remains, similar to the ones depicted in Figures 5 and 6. The puma illustrated in Figure 6, displays a heatmap in terms of cut marks. The extremes of humerus and tibia are the portions that received most damage, although some alterations have been spotted in the mid sections of both bones (shafts). The pelvic girdle exhibits alterations in all its portions, thus sacrum, acetabulum, ischium, and ilium showed processing traces, as depicted in Figure 6. Furthermore, the aforementioned appendicular bones also exhibited a large amount of parallel cut marks (N = 56), and the only elements with superimposition recorded in the form of "V" shaped cuts and striations (N = 16; Table 3, Fig. 5B). On the other hand, the vertebrae, radius, fibula, calcaneus and astragalus exhibited isolated traces only, whilst the ulna showed isolated and parallel cut marks in its extremities (Table 3, Fig. 5).

In an extensive butchery study of bovids with different body sizes, Nilssen (2000) demonstrates that disarticulating and filleting activities in forelimbs produces transversal cuts in the proximal and distal ends of humerus, similar to the ones depicted in Fig. 5A. Moreover, traces that could

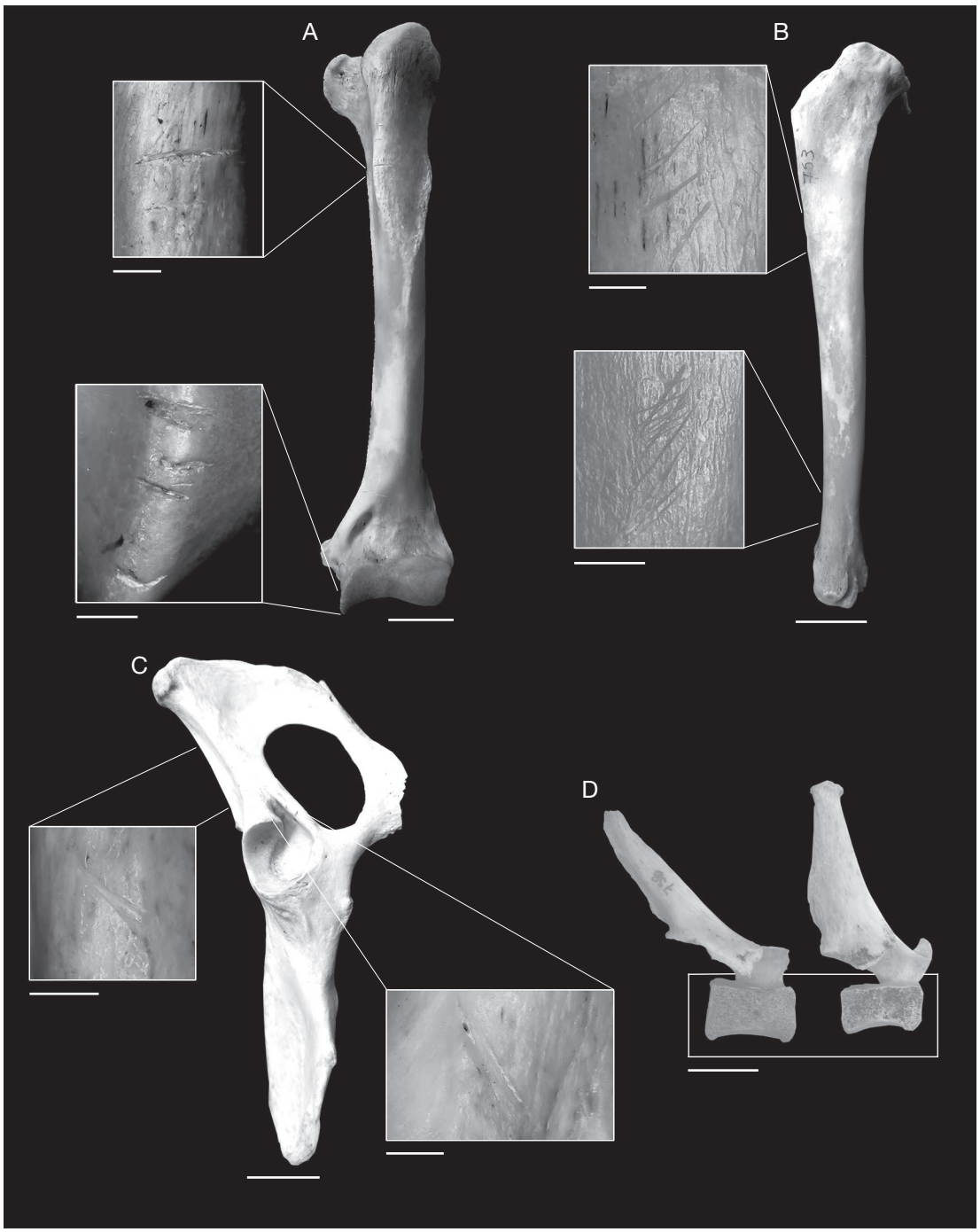


Fig. 5. — Skeletal remains of *Puma concolor* (Linnaeus, 1771) and anthropic traces. **A**, Humerus displaying cuts (anterior view); **B**, tibia exhibiting cuts (medial view); **C**, pelvis with cut marks (posterior view); **D**, thoracic vertebrae exhibiting sawing traces (lateral view). Scale bars: bones, 2 cm; anthropic traces, 2 mm (except C, left trace, 5 mm). Credits: Julian Mignino.

be associated with filleting practices can also be seen in the tibia displayed in Fig. 5B, although similar patterns can be achieved through disarticulation and skinning of the rear limbs (Nilssen 2000). On the other hand, cut marks that may be associated with activities of disarticulating and filleting of the pelvis can be seen in Figure 5C. Finally, Figure 5D illustrates the aforementioned longitudinal sawing in two of the thoracic vertebrae.

## PEASANT-PUMA ENTANGLEMENTS

### On local perceptions

The relations between people and large felids might have always been difficult the severity of the conflicts increases with the body mass of that, with the puma being among the species that stand out (Inskip & Zimmermann 2009), since these carnivores can compete, prey and thus, spread fear on

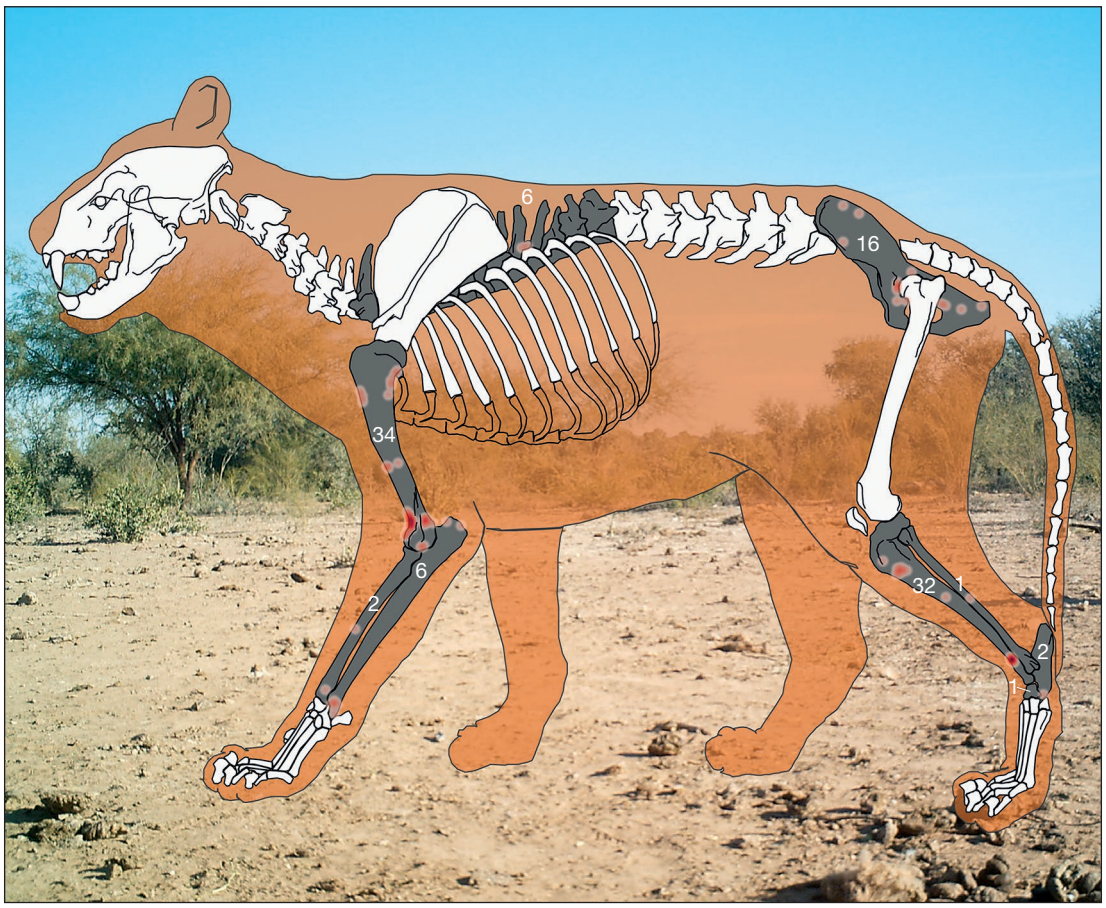


FIG. 6. — Puma (*Puma concolor* (Linnaeus, 1771)) skeleton displaying elements recovered (bones in grey) and cut marks heatmap. **Numbers** are percentages (%) of anthropic traces. Credits: Thiago Costa.

humans (Kruuk 2002). The peasant communities dwelling in the arid Chaco currently perceive pumas as a threat to their livelihoods (Manzano-García 2019; Nanni *et al.* 2020). Nonetheless, there are still myths and practices that demonstrate a profound entanglement between the northwestern communities of Córdoba and their surrounding environment, including pumas (Rionda & Rosalía 2015; Manzano-García 2019; Manzano-García *et al.* 2019; Costa 2022).

Local dwellers generally have positive perceptions of animals that either provide them with direct benefits, through food or medicine, or indirect ones through aesthetic or symbolic reasons (Manzano-García 2019). In this sense, birds are usually valued for aesthetics whilst mammals are important as a source of meat (Manzano-García 2019). Hence, Tamburini (2016) suggested that peasants in the area usually have a generalist hunting strategy, although there are significant differences in their perceptions regarding meat quality of the local species (also in Altrichter 2006). In the case of puma, even if the flesh is somewhat valued for its flavor and quality, our interviewees usually describe it as dry (*seca*), not suitable for roasting.

In areas where large carnivores coexist with livestock, their predation on cattle becomes the reason for persecution (Palmeira *et al.* 2008). In fact, most of the interviewees agreed that negative perceptions of pumas are directly associated with the species predation on livestock, thus hunting is primarily a strategy of control or mitigation of perceived damage and not for edible consumption. Therefore, the natural behavior of carnivores predisposes them to conflict with the peasant community (Deustua-Aris *et al.* 2008). However, not all individuals in a population prey on livestock (Mitchell *et al.* 2004; Cavalcanti & Gese 2010) and may even vary by sex and age class, as has been seen in other studies on predators

TABLE 3. — Recorded cut marks found on *Puma concolor* (Linnaeus, 1771) skeletal remains, according to the different categories.

| | Cut marks | | |
|---|---|---|---|
| **Skeletal elements** | Isolated | Parallel | Superimposed |
| Thoracic vertebrae | 5 | – | – |
| Rib (first) | – | – | – |
| Humerus | – | 27 | 4 |
| Radius | 2 | – | – |
| Ulna | 3 | 2 | – |
| Pelvis | 2 | 10 | 2 |
| Tibia | – | 19 | 10 |
| Fibula | 1 | – | – |
| Calcaneus | 2 | – | – |
| Astragalus | 1 | – | – |
| Total | 16 | 58 | 16 |

(Drouilly *et al.* 2020). The perception of wild carnivores is part of the individual and collective social construction, based mainly on the peasants' life experiences where the coexistence with predators generally manifests itself through negative perceptions permeated by conflict. In this sense, control or mitigation hunting is part of a complex cultural heritage of the local dweller that entangles practices where the animal is perceived as a threat but also as food, medicine or ornament. Some studies even show that the aesthetic factor is one of the positive aspects of the complex human-wildlife relationship, which may encourage greater tolerance of livestock stakeholders towards predators and a possible reason for coexistence (Drouilly *et al.* 2021).

### On consumption

Many factors can condition the anthropic marks left on bone remains. Nilssen (2000) argues that bigger animals should retain more cut marks than smaller ones. Pumas can be considered as large mammals, with sizes ranging between 85-150 cm and weight around 40-100 kg (Ripple *et al.* 2014). Considering the above, in order to process these carnivores, a greater number of incisions should be necessary if compared to what would be applied to smaller animals.

On the other hand, the elements studied here have been boiled before filleting and this is another important factor to consider, since butchering patterns are related to the sorts of preparations expected to be obtained (Binford 1981; Gifford-González 1993). Gifford-González (2018: 320) recently suggested that bones cooked previously defleshed offer "fewer opportunities for a functional reading of cut mark patterning". Therefore, regional experimental and ethnographically observed studies focusing on butchering and culinary processing patterns should help to clarify this matter, as well as recent changes in the utilization of the carcasses (Pasda 2013).

The expertise in butchering is also a factor that must be considered. In this sense, Barba & Domínguez-Rodrigo (2008) suggested that experienced butchers tend to leave less traces than an apprentice. In the study area, the first butchering of large animals might be done among at least two people at the same time, thus the traces treated here are probably the doings of more than one person (also in Gifford-González 1993). Notwithstanding our perceptions surrounding the informant's expertise in butchering, they tend to think of themselves as inexperienced or in their own words "useless" (*inútiles*) in the activity. Even though a more detailed analysis should be conducted, previous studies suggest that two of these persons leave more traces when butchering a large ungulate, than other peasants in the region (Costa *et al.* 2022).

As described before, our interviewees usually described puma's meat as dry, thus boiled preparations like pickles and stews are perceived as the most suitable cooking for consuming this feline. In these sorts of cooking, more filleting activities –and in some cases fragmenting the elements– for pot sizing are usually necessary, thus possibly generating more cuts in the bones remains (also suggested by Nilssen 2000: 358).

It is noteworthy that scavenging –although rarely– is practiced by some peasants, as stated by an interviewee "if it is still warm, we will eat it" (*si está caliente, nosotros comemos*). Therefore, access to the carcass may also be secondary in the area, as occurs in hunter-gatherer societies (e.g., Nilssen 2000).

On the other hand, the usage of a hindlimb section (tibia) in the preparation, demonstrates that what is generally described as a portion consumed with breadcrumbs may also be pickled. Although this description is probably related to the upper part (femur) which yields more meat, the usage of the section as a pickle highlights disagreements between the narrative and the materiality of consumption. Therefore, the study of faunal remains can also help our understanding of practices that sometimes are not spoken –for different reasons such as the feeling of disrepute or simply because it is an unimportant part of a mechanical operational sequence (Leroi-Gourhan 1993)– hence improving the characterization of the perceptions that peasants have on pumas and its edible portions, which will ultimately help in the characterization of peasant-felid relations in the area. Finally the preparation analyzed here is significant because the animal is not particularly valued for edible consumption, as asserted earlier.

## CONCLUSIONS

The transformations that were introduced in the area by the beginnings of capitalist exploitation –in the 16th century– gradually altered local livelihoods, also changing the way people perceive and relate with pumas (Costa 2022). At the dawn of the 20th century, peasant views of these felines seemed similar to the ones described here, as the predator was already affecting livelihoods (see quotes from Río & Achával 1904). Thus, if perception is to be understood in the context of the relations between humans and their environment (Ingold 2000), local inhabitants' perceptions are becoming subject to strong contradictions as a consequence of the social, economic and ecological transformations that occurred in the recent past and continue to develop in our days (Tamburini 2016; Manzano-García 2019; Costa 2022). At the national level, Law 22.351, Article 5, paragraph f., states that "hunting and any other type of action on fauna is prohibited […]." In the province, Decree-Law 4046/C/58 presides, which is in charge of the regulation of hunting for sport or commercial purposes, without contemplating subsistence hunting, as another an alternative. Therefore, we are not only omitting a social reality that needs to be considered from a legal point of view, since the rural inhabitants have practiced hunting as a social reproduction strategy since ancient times, but the active participation of rural dwellers as possible allies in the management and conservation of nature is also being underestimated (Tamburini 2016; Manzano-García 2019).

The usage of actualistic butchering and consumption studies to understand past human practices has proven its value for zooarchaeological interpretations throughout the years (e.g., Binford 1981; Gifford-González 1993; Barba & Domínguez-Rodrigo 2008; Pasda 2013). In this sense, the data presented here can help in the reasoning of the economic practices during the conformation of the agrarian period in

Córdoba between the 18th and 19th centuries (Tell 2008) and the changes in the consuming habits of the local peasantry. Even more, the information gathered through this approach can and should be used as a tool to inform on historical and contemporary animal consumption, which should aid the understanding of human animal relations in our era. Nonetheless more historic archaeological data will be required to develop a denser knowledge of the local ecological history, the interactions between peasants, their environment and the consequences of these relations in the conformation of local fauna and current human inhabitants.

Regarding the particular human-felid relationship characterized here, we believe it is urgent to foster a biocultural conservation approach that recognizes local knowledge and practices. In this sense, the recent creation of reserves in the area are important for pumas' conservation, nonetheless government entities should work synergistically for the welfare of pumas and the peasant dwellers. Therefore, transdisciplinary –ethnobiological, archaeological, conservationist– and applied research approaches are needed to produce useful information that can be employed to mediate between the State and the local dwellers, and their two very dissimilar ways of perceiving the environment.

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Appendix 1. — General information of the interviewed population. Note: 56 semi-structured interviews were conducted with the occasional participation of more than one person per interview (total: 61 participants).

| N° Interview | Interviewee's initials | Gender | Age | Socio-economic profile | Date |
|---|---|---|---|---|---|
| 1 | LA | M | 79 | Native, former axe man, now retired | 01/02/2015 |
| 2 | MH | F | 71 | Native, formerly dedicated to the sale of meat products, practices healing with plants, currently retired | 13/05/2015 |
| 3 | VA | F | 70 | Native, worked for the Argentinean post office, hunted with her husband, retired | 13/05/2015 |
| 4 | RA | F | 86 | Native, raising goats and chickens | 13/05/2015 |
| 5 | MS | F | 83 | Native, pig breeding | 14/05/2015 |
| 6 | AG | F | 58 | Non-native, long-time resident, secondary school teacher | 14/05/2015 |
| 7 | FM | M | 60 | Native, self-employed in masonry activities, former axeman and hunter | 14/05/2015 |
| 8 | JT | M | 54 | Non-native, long-time resident, high school preceptor | 15/05/2015 |
| 9 | ROA | F | 82 | Native, formerly worked in salt milling, currently self-employed in various trades | 15/05/2015 |
| 10 | GL | M | 55 | Native, raises cattle and currently works in his own butcher shop | 15/05/2015 |
| 11 | RN | M | 57 | Native, hunter, currently retired | 17/06/2015 |
| 12 | GM y REM | FM | 40 | Native, works in the school kitchen/ Native, retired | 17/06/2015 |
| 13 | BR | F | 64 | Native, works in various trades, is a retired and has her own farm | 18/06/2015 |
| 14 | AL | M | 34 | Native, Provincial Secondary Education Institute (IPEM) teacher | 19/06/2015 |
| 15 | MS y MEO | FF | 58 y 52 | Native women, cooks at IPEM | 19/06/2015 |
| 16 | AM | M | 36 | Natives, various trades (domestic worker, village municipality) | 05/07/2015 |
| 17 | SHG | M | 45 | Native, hunter and axeman, currently retired | 05/07/2015 |
| 18 | PN y ROQ | FM | 87 | Natives, dedicated to raising goats and chickens, retirees | 05/07/2015 |
| 19 | RF | F | 51 | Native, self-employed (contract cook, pantry), raising chickens, pigs and goats | 06/07/2015 |
| 20 | DP | M | 58 | Native, formerly a village gardener, currently retired | 06/07/2015 |
| 21 | NF | F | 77 | Native, dedicated to raising chickens | 07/07/2015 |
| 22 | JM y DRQ | FM | 65 y 70 | Natives, currently retirees and owners of the only supermarket in town | 08/07/2015 |
| 23 | VT | F | 51 | Native, self-employed in various trades | 08/07/2015 |
| 24 | LHG | M | 49 | Native, former axeman, currently working in cattle raising as a farmhand | 10/08/2016 |
| 25 | VHS | M | 50 | Native, animal husbandry and self-employed in various trades | 10/08/2016 |
| 26 | PQ | M | 47 | Native, currently works as a rancher | 11/08/2016 |
| 27 | RF y GA | MF | 58 y 44 | Natives, engaged in animal husbandry, retirees | 12/10/2016 |
| 28 | DGR | M | 46 | Native, he raises goats and pigs | 13/10/2016 |
| 29 | GC | M | 42 | Native, dedicated to goat breeding | 13/10/2016 |
| 30 | VU | M | 44 | Non-native resident for many years, is a goat farmer | 13/10/2016 |
| 31 | IRG | M | 92 | Native, former axeman, retired | 01/08/2017 |
| 32 | NQ | M | 26 | Native, works in cattle raising as a laborer | 02/08/2017 |
| 33 | DAM | M | 39 | Native, works in cattle raising as a laborer | 01/08/2017 |
| 34 | AF | M | 18 | Native, animal husbandry, self-employed in various trades | 11/10/2018 |
| 35 | JQ, DM y AQ | MFF | 58, 55 y 29 | Native, they work in the Municipality and in the house | 11/10/2018 |
| 36 | JM | M | 32 | Native, self-employed in various trades | 02/07/2019 |
| 37 | RR | M | 54 | Native, dedicated to animal husbandry | 04/07/2019 |
| 38 | JC | M | 48 | Native, unspecified | 04/07/2019 |
| 39 | BS | F | 59 | Native, unspecified | 04/07/2019 |
| 40 | JRM | M | 58 | Native, animal husbandry, caretaker of the land where the local aqueduct system is located | 04/07/2019 |
| 41 | RA | M | 57 | non-native, long-time resident, campground owner | 04/07/2019 |
| 42 | ST | M | 49 | Native, dedicated to animal husbandry | 04/07/2019 |
| 43 | GBV | M | 60 | non-native, long-time resident, retired from the police force | 05/07/2019 |
| 44 | VF | M | 52 | Native, nurse | 05/07/2019 |
| 45 | HAL | M | 27 | non-native, long-time resident, livestock farming | 05/07/2019 |
| 46 | YS | F | 59 | Native, retired from the police | 05/07/2019 |
| 47 | NG | F | 65 | Non-native, long-time resident, animal husbandry | 04/07/2019 |
| 48 | FR | M | 65 | Non-native, long-time resident, animal husbandry | 05/07/2019 |
| 49 | MS | F | 64 | Native, domestic employee | 06/07/2019 |
| 50 | NCP | M | 60 | Native, former stallholder in Las Mesillas field | 08/07/2019 |
| 51 | PMP | M | 58 | Native, animal husbandry | 12/11/2019 |
| 52 | ST | M | 89 | Native, animal husbandry | 12/11/2019 |
| 53 | NS | M | 28 | Traslasierra National Park ranger | 07/03/2021 |
| 54 | GP | M | 56 | Non-native, sells days of pasture and firewood from her field | 17/05/2021 |
| 55 | GR | M | 42 | Native, cattle raising | 17/05/2021 |
| 56 | PC | M | 68 | Native, cattle raising | 18/05/2021 |