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Towards Biocultural Conservation of Chilean Palm Landscapes: Expanding Perspectives from Historical Ecology

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Abstract: The Chilean palm (*Jubaea chilensis*) is an endangered and culturally important species from central Chile. We studied the Ocoa palm landscape (OPL), which is currently part of a protected area that harbors the largest Chilean palm population where local peasant practices have been excluded and conflict with biodiversity conservation strategies. We explored how human–landscape relationships over time have shaped present conditions and the implications for biocultural conservation. Methods included a review of archaeobotanical and historical records, and a qualitative study focused on local peasants' perspectives. We reported the uses of *J. chilensis* and the OPL since pre-Hispanic times. For the last 400 years, these uses have involved important differences between landowners and local peasants in terms of power dynamics, access to the land, and intensity of use. The current palm landscape structure directly responds to past human activities, such as palm felling and agriculture. Also, we explain peasant practices linked to the OPL as ways of resisting cultural homogenization and marginalization associated with reductive conservation approaches and other presses and pulses. Chilean palm conservation can be improved by considering ecological legacies to inform future conservation strategies and adding a biocultural approach that respectfully integrates local peasant knowledge systems and worldviews.

Keywords: biocultural conservation; local knowledge; *Jubaea chilensis*; ecological legacies; historical ecology; central Chile

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1. Introduction

The Chilean palm (*Jubaea chilensis* (Molina) Baill.) is an endemic species of the Mediterranean-type ecosystems of central Chile (31°–37° S) [1,2]. At present, *J. chilensis* is considered endangered in the IUCN's Red List [3], and the main populations of this species are restricted to three locations: Ocoa (32° S), Cocalán (34° S), and El Salto (33° S) palm forests [4,5].

J. chilensis is one of the largest palm species in the world [6]. Its fruits are ovoid–spherical drupes with a green to yellow exocarp (depending on the maturation stage) and a fleshy fibrous mesocarp. The hard endocarp containing the seed inside is edible, and it is commonly known throughout South America as *coco chileno* or *coquito* in Spanish (Chilean coconut or small coconut) [6–8]. The best-known uses of Chilean palms are the production of syrup made from the sap, commonly known as *miel de palma* (palm honey), and coconut consumption as food.

Palm forests (locally known as *palmares*) are described as mixed sclerophyllous forests with abundant populations of *J. chilensis*. These evergreen forests occur mainly on slopes and valleys of the Coastal Cordillera of central Chile [1], and they are currently under threat due to several reasons, such as land-use changes, deforestation, fires, invasive species, and various pressures associated with the unsustainable use of *J. chilensis* [9,10].

Previous studies on the Chilean palm show the need to further understand this species' reproductive dynamics, ecological interactions, and conservation problems [2,7,9,11,12]. However, despite being considered an endangered and culturally important species, the human dimensions of Chilean palm conservation have barely been studied. Most previous research has set humans aside or reduced human presence to a mere threat, except for a few works that have explored human–Chilean palm relationships (e.g., [13,14]). Moreover, the perspectives of local peasant communities on Chilean palm conservation and forest management are in conflict with those of Western science and Chilean state institutions [13,15], which accentuates the need to explore the epistemological and ontological dimensions of conservation challenges of this endangered and culturally important species [16–19].

In addition, as many scholars have pointed out, historical perspectives bring helpful and necessary insights for environmental research, conservation, and ecological restoration [20–23]. Furthermore, ecological legacies, as persistent signatures of past human activities on a landscape, are crucial to understanding the modern composition, structure, and function of ecosystems [24,25], and they are essential for biocultural heritage conservation [26,27]. From this perspective, it is impossible to gain a deep understanding of the biophysical landscape, and the relationships humans create and recreate over time as part of landscape transformation without looking at the past. Studies involving a long time span (for example, millennia) are important for understanding disturbance histories, landscape connectivity, and responses to climatic change and for informing better conservation strategies [20]. Thus, the integration of several sources, including archeological and historical records, can significantly improve our understanding of landscape dynamics [28,29].

In this study, we analyzed the Ocoa palm landscape (OPL) (see Figure 1) as a case study. In this adaptive socio-ecological system or palmscape, a long history of human presence and several land uses has been followed by the creation of a protected area, La Campana National Park (LCNP). The establishment and subsequent implementation of LCNP between 1968 and 1985 involved the exclusion of local inhabitants, prohibition of productive activities [13], and some conflicts over land property rights [30], which led to tensions between local rural communities [15] that persist to the present.

Thus, in this study, we explored the relationships between humans and *J. chilensis* over time, focusing on the case of OPL, where ecological legacies have been commonly overlooked in LCNP management, and local peasant practices conflict with biodiversity conservation strategies developed by the Chilean state. We aimed to answer the main research question: How have the relationships between humans and the OPL over time shaped present conditions? Our main goal was to contribute information about past and present human–palmscape relationships to inform future conservation and ecological restoration strategies, overcoming reductive conservation approaches that have commonly excluded local peasant communities and ignored past landscape trajectories.

There are several approaches for landscape-level studies that aim to provide a holistic understanding of human–environment relationships [31–37]. In this study, we took the framework of historical ecology, which is an integrative research program that seeks to understand interactions between humans and other agents active in a landscape by paying attention to changes over time [38–41]. From this perspThis information is in the simbology. The lines are actually the outer boundary of polygons. In this case, the green solid line is the outer boundary of La Campana National Park and the brown dash line is the outer boundary of La Campana-El Roble Mountain Rangeective, landscapes are more than mere spaces where human–environment relationships occur. Rather, landscapes are seen as constantly changing over time and encompassing several active agents and their relationships: humans shape the landscape and, simultaneously, the landscape and its components actively shape human lives [42]. Historical ecology is a collaborative and transdisciplinary research framework that draws on a broad spectrum of concepts, methods, theories, and evidence taken from biological, physical, and social sciences, as well as from the humanities [43]. Furthermore, aligned with other transdisciplinary approaches for studying human–environment interactions [44–46], historical ecology creates space for both

Western scientific knowledge and local knowledge to provide a holistic understanding of human–environment relationships over time and in a particular locale [31]. Moreover, historical ecology provides an integrative framework for the construction of an evidence-validated, open-ended narrative of landscape evolution and transformation in which the landscape is understood to be a complex system [41]. This perspective considers not only those human actions that have caused environmental degradation but also reciprocal contributions between people and nature [47,48].

Figure 1. Map of the study area. The main locations named in the text are labeled.

Study Area

The study area is La Campana El Roble Mountain Range (CRMR), which is part of the Coastal Cordillera of central Chile. Within this zone, the OPL currently harbors the largest Chilean palm population, with an estimated 70,000 palms, which represents more than 50% of the total surviving palms of this species [5]. Most of the OPL is protected inside the LCNP, which is administered by the National Forestry Corporation (CONAF) as part of the Chilean National System of State Protected Areas.

On the flanks of CRMR and around LCNP are several villages where rural communities live (Figure 1). The conservation model applied by CONAF for the LCNP, and

more broadly for Chilean national parks, is based on mainstream biodiversity conservation approaches rooted in European and North American 19th Century conservation movements [49–52] described by some authors as the "Yellowstone model" [53,54]. These conservation perspectives see humans as separate from nature [55] and tend to obscure vital links between biological and cultural diversity [56,57]. This preservationist model also has had consequences for those communities inside or around protected areas worldwide, in some regrettable cases producing local displacement, dispossession, and marginalization in the name of biodiversity conservation [51,58–61].

The OPL was part of a large single estate (Ocoa estate) in the 17th century. Later, in 1822, the property was subdivided into five holdings; the area where the palm landscape is located at present became the Las Palmas de Ocoa estate [62] (see Figure 2). These properties were structured under the logic of the Chilean land tenure system prevailing from colonial times until the second half of the 20th century, which concentrated land and agricultural production in a few landowner families [63]. In 1967, the LCNP was created to support an idea that had been promoted by conservation scientists concerned about the ecological degradation of CRMR and the Ocoa palm forest [30,64]. Additionally, the Chilean Agrarian Reform was initiated in 1962 and involved expropriations of estates and land distribution to laborers. In the midst of this sociopolitical context, the landowners donated most parts of the OPL to the Chilean state for conservation purposes in 1968 [13,62]. However, the LCNP was progressively implemented as a new protected area, and its administration as a national park by CONAF began only in the 1980s when its boundaries were defined and park rangers were introduced.

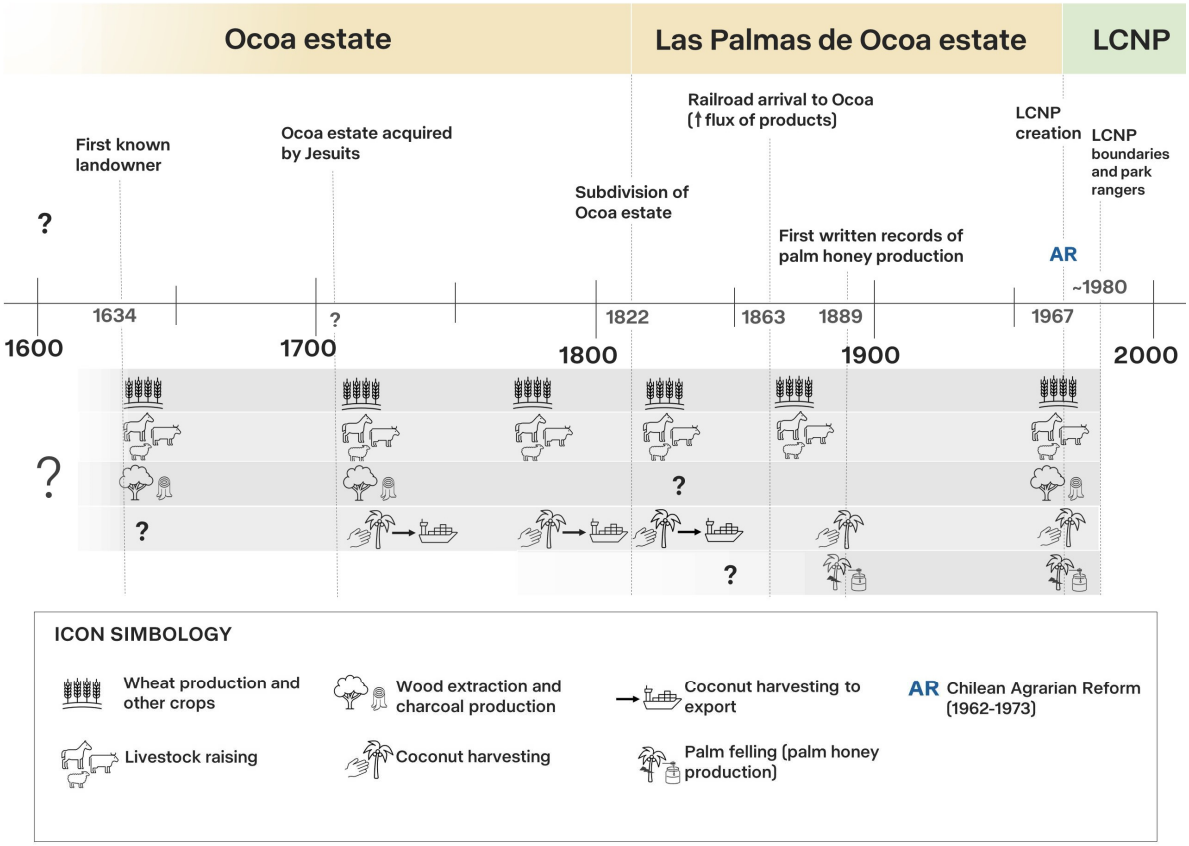

Figure 2. Summary of the uses of the Ocoa palm landscape by landowners over time, according to historical records. Icons representing productive activities are depicted only when the historical records specifically mention that activity. Related historical events are also shown; local peasant livelihoods are not included. Note that productive estate activities continued after LCNP creation. See Section 3.2.1 and Appendix B for details and references. Figure by C. U.

LCNP has also been part of a UNESCO Biosphere Reserve (La Campana–Peñuelas Biosphere Reserve), whose framework aims to reconcile biodiversity conservation with socioeconomic development and the protection of cultural values, since 1984 [65]. However, as in other Chilean biosphere reserves, the model has not been effectively implemented; indeed, the main threats to biodiversity persist in La Campana–Peñuelas' transition and buffer zones and state institutions have not improved the inclusiveness of local communities in conservation strategies [66–68].

2. Methods

The methods involved a review of previous archaeobotanical records and historical documents and a qualitative study using ethnographic techniques, which were conducted as follows:

2.1. Review of Previous Archaeobotanical Data

Information on micro- and macro-remains of *Jubaea chilensis* in archeological contexts is very scarce. Hence, our review focused on both indexed publications and grey literature, attempting to include as many sources as possible, which were critically analyzed. We considered peer-reviewed articles, books, conference proceedings, theses, and unpublished reports (see Appendix A for details). We found a total of 16 publications and documents reporting micro- or macro-remains associated with *J. chilensis* in archeological contexts. For the analysis of the data, we organized the information according to the type of palm remains (e.g., phytolith or carbonized coconuts) and their sources (e.g., bedrock mortars, dental calculus, etc.). We also added a summary of each document, highlighting the context, purpose of the research, and the methods used by each author.

2.2. Review of Historical Records

We searched documents and archival materials produced before 1960 containing information about geographical or botanical descriptions of South America and the environmental history of central Chile. These sources were obtained mainly from online and physical archives and from local libraries such as the National Library of Chile, the Chilean Historical Museum, and other local libraries from towns surrounding LCNP (e.g., Limache and Quillota public libraries). Within these archives, we searched for keywords in Spanish such as "*palma chilena*" (Chilean palm), "*Jubaea*", "*coco chileno*" (Chilean cococonut), "Ocoa", etc. Through this search, we aimed to include historical information about *J. chilensis* not commonly found in peer-reviewed articles. We found a total of 33 written historical documents containing information about Chilean palm populations and uses of the species, ranging from 1558 to 1958 (see Appendix B for details). We also reviewed 65 non-written visual historical documents containing information about the Chilean palm (photographs archived in the Chilean Historical Museum and illustrations associated with the written documents). Documents or information containing data after 1960 were not considered historic but were included as part of the literature review. For analysis of these data, we focused on information on past uses of *J. chilensis,* which were classified according to 8 categories of uses and the part of the plant utilized.

2.3. Qualitative Study Using Ethnographic Techniques

We used this approach to incorporate local knowledge, memories, and perspectives of local peasant inhabitants. During two months of fieldwork in the villages surrounding LCNP and within the protected area, the first author carried out twelve semi-structured interviews and participant observation in the villages surrounding LCNP following the guidelines by Guber [69] and Patton [70]. The first author also participated in two guided tours [39] to CRMR led by one of the research participants, where we combined techniques for ethnoecological research applied to historical ecology and guidelines for walking interviews [39,71]. These guided tours were focused on recording information about activities carried out at the OPL before LCNP creation and current peasants' practices

linked to palms. Informal interviews were also relevant to delve into local peasant–palm landscape relationships; these were conducted following the guidelines by Guber [69] and Kemp & Ellen [72].

For participant selection, we employed purposive sampling (i.e., snowball or chain sampling) [70,73], as appropriate for small populations and recommended when looking for information-rich cases for in-depth studies [74,75]. In this case, we had specific selection criteria, i.e., people from villages surrounding the LCNP whose livelihoods were or are connected to the OPL, in addition to people who have lived or worked there in the past, or whose family members did so. All research participants were adult local inhabitants who have lived in the villages surrounding LCNP (or within the former Las Palmas de Ocoa estate) for their entire lives or since childhood.

This research was approved by the University of Georgia Institutional Review Board (IRB). Free, prior, and informed consent was obtained from all research participants. Regarding confidentiality, participants agreed to the publication of the results of this research project and quotes from the interviews; however, their names and other information enabling personal identification are not disclosed.

Interviews were conducted, transcribed, and analyzed in Spanish. Transcribed data were coded and analyzed using an abductive approach [76]. According to the coding methods described by Skjott Linneberg & Korsgaard [76] and Saldaña [77], we conducted a descriptive first coding cycle, followed by a second cycle of categorization. The software ATLAS.ti 24 was used to facilitate this process of analysis and to integrate data from interviews with data from historical documents and archival materials (e.g., historical photographs). Selected quotes from interview fragments were translated into English for inclusion as part of this article.

3. Results

3.1. Humans and the Chilean Palm in Archeological Contexts

The presence of plant remains attributed to *J. chilensis* is very uncommon in archeological contexts [78]. Additionally, the data available from previous works have been generated and analyzed from different perspectives and with diverse purposes to answer broader archaeological or paleoenvironmental questions rather than directly focusing on the Chilean palm or on the relationships between humans and this species.

The archeological data reviewed for this work are summarized in Table 1 and presented in more detail in Appendix A. The evidence corresponds to micro- and macro-remains associated with the Chilean palm, or in some cases at the family level (i.e., Arecaceae), which all authors interpret as *J. chilensis* since this is the only native palm species found in continental Chile. These records show evidence of pre-Hispanic uses of the species in particular sites of what today is Chile, ranging from La Serena (29°49′ S) to the Maule River (35°25′ S). Micro-remains correspond to phytoliths associated with leaves, while macro-remains are carbonized coconuts (see Table 1). The time spans from the Late Archaic period (ca. 3000 to ca. 300 years BCE) to the Late Intermediate period (1000/1200 years CE to 1450 years CE) (cultural periods *sensu* Falabella et al. [79]).

Particularly for LCNP, Inostroza [80] has reported at least sixteen archaeological sites in the area; however, at present, there are no subsequent publications about these sites nor available dating or archaeobotanical studies.

The available archaeobotanical data presented below shed some light on the uses of the Chilean palm in archeological contexts and on locations where these plant materials were processed or directly used. However, there is still an important research gap, and more data are required to better understand how this plant was used by pre-Hispanic populations, where provision sites were located, and the role of humans in shaping *J. chilensis* palmscapes in pre-Hispanic times.

Table 1. Evidence of *Jubaea chilensis* remains in archaeological contexts.

Latitude	Type of Evidence	Source of Remains	Reference
29° S	Phytoliths	Remains adhered to bedrock mortars and from dental calculus of human individuals	[81]
30° S	Phytoliths	Remains adhered to bedrock mortars	[82,83]
31° S	Phytolith	Sediments present inside smoking pipes	[84]
32° S	Phytoliths	Sediment inside a ceramic vessel	[85]
32° S	Phytoliths	Remains adhered to mortars	[86,87]
33° S	Phytoliths	Remains adhered to pestle and mortars	[78]
33° S	Phytolith	Remains adhered to lithic instruments	[88]
33° S	Phytoliths	Remains adhered to ceramic vessels	[89]
33° S	Carbonized coconuts	No information	[90]
33° S	Carbonized coconuts	Burning area	[91]
34° S	Phytoliths	Lake sediment cores	[92]
35° S	Carbonized coconuts	Burning area and sediments	[93]

3.2. Uses of Palm Landscapes over Time

From our historical ecology perspective, our interest is not only in the relationships between humans and *J. chilensis* but also in the landscape on which Chilean palm and humans have continuously interacted in the last millennia. Although information about pre-Hispanic times is scarce for the OPL, for central Chile, evidence showing human occupation during the last 12,000 years exists [94]. Furthermore, according to Inostroza [80], 70% of the archeological sites reported in the CRMR also presented evidence of occupation during colonial times.

OPL and CRMR have had several uses over time. Most of them have to do with *J. chilensis*, but there are several other uses associated broadly with the sclerophyllous forests and, more broadly, with the multiple dimensions of the mountainscape [95]. Since colonial times, these uses have involved significant differences among actors in terms of power and access to the land and resources. In the last 400 years, the OPL has been exploited in several ways by its landowners, being a source of wealth for a few proprietor families. At the same time, this landscape has also supported local subsistence economies for peasants living in the OPL or in the surrounding rural areas (see below).

Most of the information about the relationships between humans and Chilean palm landscapes in historical records was produced from a utilitarian perspective, with a focus on the uses of *J. chilensis*. The best known of these uses are coconut consumption as food and the production of syrup (*miel de palma*), whose extraction at OPL in the past involved cutting the palms down, resulting in their subsequent death. In Appendix B, we present the results of the review of historical documents, showing a description of Chilean palm uses reported. In addition, a synthesis of Chilean palm uses integrating several sources of information is presented in Table 2 (also see Figure 3) according to the part of the plant utilized and categories of use. We also added details on the time, reasons, and actors engaged [96,97].

In the next subsections, we analyze palmscape uses *over time*, distinguishing between landowners and local peasants. We made this distinction because there are important differences in terms of power dynamics, access to the land, intensity of the use of resources, and local social impacts of conservation measures.

Figure 3. Examples of uses of different parts of the Chilean palm. (**a**) Method for sap extraction involving palm felling. Image extracted from the film made in 1966 by Aguilera & Weisser [98] (with permission from TIB-Leibniz Information Centre for Science and Technology and University Library). (**b**) *J. chilensis* coconuts. (**c**) Coconuts found in a *placeta* (resting zones of cattle). (**d**,**e**) Huts in Ocoa; walls and roofs made with Chilean palm leaves. Photo (**d**) by Einar Altschwager circa 1930, Copyright© Chilean National Historical Museum Collection, authorized use [99]. Photo (**e**) by a non-identified author from a non-identified date, Copyright© Chilean National Historical Museum Collection [100], authorized use. (**f**,**g**) *Bailes chinos* (traditional dancing musician troupes from central Chile) in Las Palmas village, where Chilean palm leaves were used for decoration (April 2022). (**h**) Raceme of *J. chilensis*. (**i**) Cord made with raceme fibers following the directions of a research participant.

Table 2. Uses of the Chilean palm. AR: archeological records; HR: historical records; PA: participants' accounts from this work; ES: one or more previous ethnographic studies [13,101,102]. For references on AR and HR, see Appendices A and B.

Category of Use	Plant Part	By Whom? (for What?)	When?	Source
Food 1 (external markets or industrial production)	Sap (palm honey)	Landowners or businessmen. (From the 19th century, palm honey production became an important industrial activity controlled by landowners).	Second half of the 17th century to the 20th century	HR; PA; ES
	Coconuts	Jesuits and other landowners (for sale and export to South American cities);	From the 17th century to the 20th century	HR; PA; ES
		Sailors of ships voyaging from the port of Valparaíso, who purchased coconuts from palm forest landowners.	From the 17th century to ?	HR

Table 2. *Cont.*

Category of Use	Plant Part	By Whom? (for What?)	When?	Source
Food 2 (own consumption or local subsistence economies)	Sap (palm honey)	Laborers of Las Palmas de Ocoa estate (limited amount, as food provided by the landowner)	Second half of the 20th century	PA; ES
	Coconuts	Indigenous peoples from central Chile	At least from the Late Archaic period to the 15th century;	AR
		Peasant communities	At least from the 17th century to the present	HR; PA; ES
	Palm heart	Spaniard conquistadors (?)	16th and 17th centuries;	HR
		Landowners, "rich people"	Second half of the 20th century	ES
Recreational	Coconuts	Children from local communities and from other South American cities where coconuts were exported (for playing marbles and other games)	From the 17th (at least) to the 20th century	HR; PA
	Bracts	Children from peasant communities (as sleds)	Second half of the 20th century	PA
Home Building	Leaves	Local peasant communities (for roofs and walls of homes)	From the 18th century (at least) to the second half of the 20th century;	HR; PA; ES
		Laborers of Las Palmas de Ocoa estate (for constructing huts used for sap extraction activities)	20th century (at least).	HR; PA; ES
Domestic	Bracts	Local peasant communities (as containers for several purposes and hanging cribs for babies)	At least from the 18th century to the present	HR; PA; ES
	Other fibers, likely from leaves or racemes	Indigenous people from semi-arid north and central Chile;	At least from the Late Archaic period to the 15th century;	AR
		Local peasant communities (for making cords, brooms, baskets, mats, among other utensils)	At least from the 18th to the 20th century	HR; PA
Spiritual-Religious	Leaves (?)	Indigenous people (associated with smoking practices and as part of offerings in mortuary practices)	Early Ceramic and Late Intermediate periods	AR
	Leaves	Outsiders from Santiago (they went to La Dormida estate to obtain leaves for Palm Sunday celebrations);	18th century	HR
		Local peasant communities (As decorations for religious ceremonies and for *bailes chinos*, traditional dancing musician troupes of central Chile)	At least from the 19th century to the present	HR; PA
Ornamental	Whole tree	In several Chilean public spaces (e.g., main plazas of urban and rural settlements) and historic estates and churches.	At least from the 17th century to the present	HR; ES
		In other countries with Mediterranean climates and botanical gardens around the world	From the 19th century to the present	[6,103,104]
Other	Oil from coconuts	Jesuits? (medicine or food)	17th and 18th centuries	HR

3.2.1. Uses of the Palm Landscape by Landowners

Palm landscape uses by landowners over time in the Ocoa and Las Palmas de Ocoa estate are summarized in Figure 2. The historical records describe different agricultural activities and, in some cases, give information about the intensity of those practices and the trade markets involved.

In 1634, the landowner of the Ocoa estate developed several crops and raised livestock for carrying resources extracted from the mountains, such as minerals and firewood [62]. Later, at the beginning of the 18th century, the estate was acquired by Jesuits, who raised livestock in the forests on the property. They had 6000 cattle in the area, wheat plantations, and sheep. They also harvested coconuts, which were sent to the port of Valparaíso.

Later, in 1771, after the expulsion of the Jesuits by the Spanish monarchy, the estate was acquired by a family of the ruling class. In 1822, after the subdivision of the Ocoa estate, the area currently constituting the palm landscape became the Las Palmas de Ocoa estate, which maintained former uses [62]. Some decades later, the arrival of the railroad in Ocoa in 1863 increased the flux of products from the estate to the port of Valparaíso and, consequently, to other destinations [105]. In the 1880s, coconuts were intensively harvested, and the first records of palm honey production at OPL date back to this time. During this decade, palms were felled in Ocoa at an average rate of ca. 280 individuals per year [106].

Historical records suggest that felling for sap extraction occurred earlier at the southern flank of CRMR (where palms are scarce and scattered at present) in the second half of the 18th century [107]. However, this practice became more intensely developed from the 19th century onwards. In the second half of the 19th century, palm honey production was an activity carried out by landowners at industrial scales, as occurred in the case of OPL. Although palm felling and sap harvesting were activities carried out manually by estate laborers, the sap obtained was used for industrial production and trade, which was controlled by a few estate owners. We did not find historical records or ethnographic evidence of artisanal palm honey production for local peasant communities' consumption.

For the first decades of the 20th century, we could not find information about the activities carried out at the estate, until 1948, when Raúl Ovalle, the last landowner before the LCNP creation, acquired the property. Not only were palm honey and coconuts produced during this time, but many other agricultural activities were developed in the OPL as part of the estate's operations, which, according to participants' memories and some publications [64,108], included raising livestock, firewood extraction, charcoal production, and wheat cultivation. Research participants' memories, in addition to other sources [64,98,101,108], allow an understanding of the process of palm felling for syrup production during this time at the OPL. Participants explain that over the years, palms were cut down, mainly in the highlands of La Cortadera and El Cuarzo ravines (Figure 1). These areas were deliberately selected by the landowner, as coconut extraction was not profitable in these locations due to difficult access conditions combined with the occurrence of coconut harvesting by people coming from surrounding villages located in the southern flank of CRMR, which made palm honey production a more profitable activity for landowners in those areas. Hence, the selection of places for palm cutting in the past has had an impact on the composition and structure of the forest now. This ecological legacy must be factored in when managing the palm forest today and when researching the reproductive success and structure of the palmscape.

Although the LCNP was created in 1967, research participants recalled that palm felling continued in Ocoa as part of the estate activities at least until 1978, a fact that is supported by Rundel & Weisser [64], who reported that palm cutting had been prohibited in Ocoa at the time of their publication, with the exception of an annual quota of 150 trees.

Small and medium-scale mining has also been carried out in CRMR since at least the 18th century [109]. There are also records showing mining activities during the 1920s and later in the 1970s when LCNP had already been created [62]. These operations progressively declined until the last exploitation activities were closed in 1994.

3.2.2. Uses of the Palm Landscape by Local Peasants

The OPL has been a source of livelihood for local peasants, including those living within the estate as laborers and those living in surrounding villages. Historical records give limited information about local peasants' livelihoods, but research participants recall memories of their experiences in the palm landscape for at least the past 80 years.

Peasant families living on the Las Palmas de Ocoa estate as laborers during the 20th century carried out subsistence agriculture for their own consumption, as participants recalled (also see section 5 in Appendix C).

> "My dad made a wheat harvest every year (...). He didn't sell it, he kept it for consumption, mom for breeding, she bred all kinds of poultry. Chicken, goose, ducks (...). They planted pumpkins, onions, everything was harvested, potatoes. You almost didn't have to buy those vegetables (...). And as I told you, the harvest they made of bee honey, very pure".
>
> (Former estate laborer who lived in El Amasijo ravine for 30 years)

Wheat cultivation involved clearing some areas, which are now mostly shrublands predominantly composed of *Acacia caven*. At present, local peasants identify these sites with the name of the person or family who cultivated each of them in the past (see topic 7 in Appendix C).

In addition, historical records and participants' accounts show that homebuilding was an important use of palm leaves by peasants. This has been reported since the end of the 18th century, mainly for thatching (see Appendix B). For OPL, historical photographs from the 1920s and 1930s and other ethnographic works [13,98] show the use of leaves for homebuilding (Figure 3d,e). According to participants' accounts, the same construction technique was used until the end of the 20th century, both for local inhabitants' homes (locally called *rucos*) and for the *bodegas* (huts constructed at basecamps used in sap extraction activities in the estate).

Historical records show that coconut harvesting is one of the main peasant livelihoods linked to Chilean palm landscapes, and there are records of this practice since colonial times [107]. At present, this is still an important livelihood for local peasants, but it is in conflict with current biodiversity conservation goals defined by CONAF for LCNP [110,111]. In addition, cattle raising is also a significant, but disputed, activity historically developed by local peasants in the LCNP and broadly in the CRMR. Both practices are at the center of current tensions between local peasants and biodiversity conservation strategies defined by CONAF for OPL. Consequently, in the next sections, we delve into these practices and analyze the main controversies about coconut harvesting and cattle raising in the OPL.

3.3. Coconut Harvesting and Cattle Raising at the OPL: Linked and Controversial Historical Peasant Practices

At present, local drovers (*arrieros* in Spanish) maintain a particular mountain cattle system with free-range management [13]. Within this system, the land is considered a common-use space, while each animal has specific owners. This is a practice passed through generations; local *arrieros* recall their ancestors' raising cattle in the CRMR. Before LCNP creation, the estate's last landowner allowed the presence of outsiders' cattle in the area, but they had to pay a fee for "releasing" their animals within his property. Cattle belonged mainly to *arrieros* from the surrounding villages (for example, Las Palmas and Granizo, see Figure 1), who went across the mountain from their homes, as they still do today. A local *arriero* explains as follows:

> "In the estate, they made surround all Ocoa to be able to count the animals [cattle] that were there (...). People from the estate sent *arrieros*, and the people, the animal owners from here, from Las Palmas. We surrounded for eight days".
>
> (*Arriero* from Los Claveles village)

From the perspective of Western science and CONAF, the cow is an exotic species representing a threat to LCNP's natural ecosystems. However, none of the scientific studies

that point to cattle as one of the main threats to Chilean palm conservation have specifically studied cattle's ecological role. Several works have mentioned that cattle feed on Chilean palm seedlings, but previous work on the effects of herbivory on *Jubaea chilensis* only experimentally studied and reported the negative effect of lagomorphs [7,112]. Cattle have been present in the OPL for the last 400 years, and further research is needed to understand the ecological dynamics associated with this species at present.

From the perspective of *arrieros*, cattle have an ecological role. First, they perceive cattle as important for fire prevention, as they feed on grass, herbs, and other potentially flammable materials. They also see cattle as a source of food for native carnivorous [15] and a source of manure for the forest. They also argue that cattle have a crucial role in palm seed dispersion, an idea that has been previously reported in other ethnographic works [13,101]. Participants explain that cattle feed on palm fruit peels, which they ruminate and consequently transport, and then leave the coconut on the ground, which in some cases is also buried by trampling, an idea that is consistent with observations by Cabello [8]. Most research participants described some of the ecological roles of cattle from the *arriero*'s perspective (also see topic 6 in Appendix C).

> "(. . .) Then we had another meeting [with CONAF], in Olmué. I got there. And I was defending the animals [cattle], and them too, because the animal does a special job within the park, I told them. Because the animal feeds on the grass for you, and the manure, it goes manuring the land. Cows eat coconuts, they ruminate it, new palms sprout".
>
> (*Arriero* from La Peña village)

Moreover, exotic/native and domestic/wild distinctions are not relevant for local peasants. Cattle raising has a cultural significance, being part of local worldviews about the landscape and the community [13,15].

Regarding coconut harvesting, this is a peasant practice that has historically involved conflicts around access to resources and land, as it is reported to have occurred in the 17th century in the southern flank of CRMR [107,113]. This practice has been carried out at Ocoa over time, independent of the land ownership, including when it was an estate; some participants recall harvesting as estate laborers, others irregularly, not having authorization from the landowner (Appendix C, section 2). After the LCNP creation, the practice continued. Since 1986, agreements for harvesting have been made between CONAF and local communities surrounding the LCNP [15]. However, the agreements ended in 2017, and coconut harvesting was completely banned inside LCNP. This happened after a significant increase in the activity due to higher demand from international markets [111]. The higher demand caused a drastic rise in coconut prices, and more people, both locals and outsiders, came to LCNP to harvest them. This increased both the number of harvesters and the collected amounts, causing CONAF to lose its control capacity. Nonetheless, external pressures associated with international demand were not regulated at that time, and the responsibility for the conflict fell mainly on local harvesters.

At present, many local peasants go to Ocoa every fall season for coconut harvesting despite the prohibitions. The participants who maintain this practice at present see it as their livelihood and an inherited tradition that is part of their lives. They do not consider the practice as detrimental to the forest, which contrasts with CONAF's perspective; rather, some participants point to rodents as having a more significant role in palm regeneration problems due to seed predation.

> "I have always told them [to CONAF], that mice eat them [coconuts], there are mice in large amounts! (. . .) They are waiting for it, and they carry them immediately. They carry 20 and we harvest 5, because there are many mice".
>
> (Local harvester)

Many authors have stated that coconut harvesting could be one of the main causes of Chilean palm conservation problems. However, only one recent study directly focused on seed dispersal and recruitment of *J. chilensis* [9]. These authors studied the *J. chilensis*

recruitment process in the Ocoa palm forest, and their results show that within the LCNP, local harvesters remove ~1% of the fruits produced by adult palms. Although they state that these estimations based on official management reports were probably underestimated, their experiments conducted in Ocoa showed that more than 90% of palm fruits produced were predated by both exotic (*Rattus rattus*) and native (*Octodon* spp.) rodents during the dispersal stage. The local peasant perspective is consistent with these results, as local harvesters see rodents as competitors in the harvesting process. Also, they see cattle as their collaborators. As explained before, cows eat coconuts to consume their peels. This process involves rumination, after which these animals leave many peeled coconuts in specific sites. These usually are the resting zones for cows, which coconut harvesters call "*placetas*". Gatherers usually follow cows, looking for these cow resting sites where they can easily find clumps of peeled coconuts available for collection (see topic 6 in Appendix C).

Notably, in some of the areas with *placetas*, located far from the park trails, where it is evident that cattle usually pass and rest (tracks, large amounts of manure, and resting places were visible), and where coconut harvesting occurs, we observed common presence of infantile and juvenile individuals in some locations (Figure 4) (we follow Michea [114] for classifying *J. chilensis*' growth stages). Although systematic characterization of the forest structure in those areas goes beyond the scope of this study, these observations were at odds with our previous knowledge from most scientific publications on *J. chilensis* recruitment and CONAF reports. However, these observations were consistent with some participants' answers after asking about Chilean palm conservation problems. They pointed out that "small palms" are abundant in some distant areas inside LCNP, and they argued that these areas are not frequently visited by tourists, park rangers, or scientists nor considered in palm inventories.

Figure 4. Area with palm forests and abundant resting areas for cows (locally known as *placetas*) in high lands of the OPL. (**a**) General view of the area from above. The photo depicted in (**b**) was taken near the zone with denser vegetation visible towards the left of the picture. (**b**) Zoom-in on a zone with abundant infantile and juvenile palm individuals. White arrows show some of the infantile palms. (**c**) Example of a *placeta* with abundant manure and cow tracks. A juvenile palm individual is behind the brushwoods. (**d**) Ruminated coconuts found in a *placeta* during winter. Some coconuts were on the surface; others were buried.

The conflicts between Western science, CONAF, and local peasants' perspectives show the need to consider local knowledge in conservation and restoration actions, as well as in future research about Chilean palm as an endangered and culturally important species.

3.4. "One Has Ocoa in the Blood": Palms, Peasants, and Cattle as a Multidimensional Relational Assemblage

As explained above, local peasants have created and recreated utilitarian relationships with the Chilean palm and with the OPL. However, there are several more dimensions of these relationships that are uncovered through participant's narrations, local knowledge, and life experiences.

Relationships between local peasants and the palm landscape involve multiple agents. During interviews and informal conversations, local peasants described several local animal and plant species, mostly native. They also showed sophisticated knowledge about the local mountainscape, involving an intricate system of toponomy (*arrieros*' toponomy) and other related ecological knowledge (see topic 7 in Appendix C).

The relationship with the OPL is also subjective, creative, and liberating [13], which was evident in participants' accounts, who expressed feelings of liberation and wellbeing as part of their experiences in the Ocoa palm forest and in the CRMR.

> "I feel so good going to Ocoa. That's why I'll departure tomorrow at 5 am, I'll go to catch some animals that I have there, I'll go with some friends and my son-in-law. And I'll stay there. I'll spend two days. But yes, you are there. . .it is a different world. I stop thinking in things, because these days I have had bad times (. . .). So, I go there, and everything is forgotten. It is very nice, feeling the palm leaves with the breeze in the afternoon. It's something special, it's something very nice".
>
> (Arriero from La Peña village)

Participants also express that humans should have an active role in maintaining the landscape. For them, CONAF management is too passive, which they perceive as careless. From their perspective, the no-intervention approach, or letting nature self-regenerate, is not beneficial for the forest. Interestingly, for some participants, palms, similar to humans, need to be spruced up, cared for, and helped (also see Appendix C, quotes 8.1).

> "A palm is same as a person, same as a man or a woman. If the woman doesn't comb her hair, she doesn't look pretty. Same as me. And I tell them [to CONAF], there is no point in going to the hill and looking at the palms and they are being dirty and I am dirty too. It is the same as if I let my beard grow and I say—No, I will just let the hair fall by itself—. No, one doesn't let the hair fall on its own, neither does the palm. The leaves absorb all the sap until the end, when the last leaves get dry, just then the leaves fall. Then, the palm forest is getting too old (. . .) the palm gets yellow (. . .) Because the palm doesn't have a proper grooming, but they [CONAF] don't understand. They say that's nature. No, nature is very wise, but we need to help her too. . . Because we must comb ourselves, because if we don't comb our hair, tell me, if we don't take a bath, what would we do. It's the same with the palm".
>
> (Arriero from La Peña village)

Moreover, it is also evident that the OPL is socially important, as it constitutes a meeting space and sustains social relationships associated with peasant practices. Notably, these land-based social relationships encompass not only humans but also non-human agents. For the *arrieros*, palms and cattle are significant agents involved in these relationships.

Local peasants' understanding of the landscape contrasts with Western science narratives and CONAF policies not only because the latter sees humans and cattle as external and harmful agents but also because these have typically understood peasants' practices as mere economic activities. From *arrieros'* perspectives, the mountain and the palm landscape are constituted by relationships with utilitarian dimensions (livelihoods), but these

relationships are also complex networks involving ecological interactions, worldviews, and local or context-specific knowledge [46], affections among humans and non-human beings, stories, and memories of individuals, families, and communities.

> "Well, for us. . .it is important because we have cattle, we have animals there and it is like having money in the bank. Because if you have a hardship, you have someone ill, you say "ok, I'll go there to catch that cow", you catch it and sell it and you get money. On the one hand it is like business. And on the other it is something that one has like. . .one has Ocoa in the blood! You have to go to Ocoa. I mean. . .to look, to see, and every time you see something new. And walk around, I know. . .I don't want to sound like bragging, but I blindly know where I am. Because since I was a child, I have known every corner of Ocoa. There is no place I haven't been there, in the highlands, on the peaks, everywhere. I can stop going for a year, two years, and then I go there, and I know where the trail is, I know what is there. You know what. . .It is like a life history. Local people, it is like. . . how can I explain you. . .It is like a history, and everyone, my age or older, say the same".
>
> (Arriero from Los Claveles village)

We argue that "having Ocoa in the blood" and the idea that "the palm is same as a person" are not only bodily metaphors or proverbial illustrative examples. Indeed, the landscape, encompassing several active agents, both humans and non-humans, shapes human lives, at the same time the landscape is part of family and community histories, memories, livelihoods, and local identities. This relational assemblage can be understood as a place-based collective in the sense of Blaser [115], which is defined as a network of (human and non-human) persons, "who are entangled through social and even familial bonds". Blaser [115] emphasized that what modern institutions usually understand as territories composed of resources and people are, from this perspective, "complex relational assemblages of human and non-human persons".

4. Discussion

4.1. Ecological Legacies: Human Presence in the OPL

Although there is a research gap in terms of the pre-Hispanic occupation of the Ocoa valley and the CRMR, the available data do reveal that humans have been linked to *J. chilensis* and the OPL for thousands of years. Further archaeobotanical research is required to better understand how this plant was used by pre-Hispanic populations and the role of humans in shaping *J. chilensis* palmscapes from a long-term perspective (i.e., thousands of years).

The historical record shows a variety of uses of *J. chilensis* and the OPL in the last 400 years, including several intensities of uses by different actors and diverse related scales of production, consumption, and trade markets.

Humans have occupied the Ocoa for millennia, and cattle have roamed it for the last 400 years, with implications in terms of ecological legacies in the OPL. The relationships, created and transformed over time among human and non-human agents, have influenced forest composition, structure, and functionality. For instance, landowners' decisions from the past have directly shaped Ocoa palm forest structure, as palm felling for industrial palm honey production during the times of the Las Palmas de Ocoa estate was practiced in targeted areas (e.g., highlands of La Cortadera and El Cuarzo ravine basins). Current palm forest structures in these sites directly respond to past human decisions and actions, not only to biophysical factors, as previous studies assume when analyzing Chilean palm reproduction and forest structures.

Additionally, cattle have been raised in the OPL for at least 400 years, which means that bovines were present even before most current adult individuals were seedlings or infantiles. Since LCNP creation, cattle have been considered an exotic species threatening LCNP ecosystems [110]. We argue that further research is needed to understand the impact

of cattle presence in the last four centuries, not only for the Chilean palm but also for other species and for the integrity of the landscape. Moreover, not only is new scientific knowledge needed, local knowledge and peasant worldviews should be respected and considered vital in this endeavor. According to local knowledge, cattle act as *J. chilensis* seed dispersers and should be contemplated in future research on Chilean palm recruitment dynamics and in LCNP management decisions, looking for dialogue among perspectives.

Future research should aim to delve further into the ecological legacies that have been continuously overlooked since LCNP creation, which are necessary for guiding conservation and restoration strategies, overcoming the pristine myth that has implicitly guided conservation in most protected areas in the world and particularly in Chilean national parks [52,59,116,117]. Adding a biocultural perspective is particularly needed, as the OPL involves a complex socio-ecological system where relationships among landscape agents have been created, adapted, and recreated over time. This requires transdisciplinary perspectives that respect local peasant worldviews and knowledge systems in their own terms, which means encompassing epistemological pluralism and multiple ontologies [17,19].

From historical and utilitarian perspectives, we consider important not only how the species and the landscape have been used over time but also the differences among users, which involve issues of power dynamics, access to the land, use of resources, and local social impacts of conservation measures, both positive and negative.

It is important to keep in mind that the historical documents we have reviewed are frequently recorded by or centered around religious or political authorities, landowners, or businessmen. They are made from the perspective of people with certain levels of political and economic power, such as ecclesiastic authorities or renowned intellectuals of the upper classes, some of them with negative impressions of the peasantry and their ways of living, or even with colonial, hegemonic, or racist understanding of local rural contexts and the peasantry. These records do not provide much evidence of the way peasant communities experienced the transformations occurring over time in CRMR and the way they made meaning of their experiences as OPL co-inhabitants. Only some recent historical and ethnographic studies shed some light on these issues [13,30,101,118]; our qualitative study contributes in the same direction.

4.2. 'Local Peasants–Palm Landscape' Relationships

Local peasant practices, such as their mountain cattle system with free range management and coconut harvesting during fall seasons, are ways peasants deploy to (a) sustain their local economies, (b) recreate socio-ecological relationships, and (c) maintain their local knowledge systems and ways of life. These practices, involving relationships, are ways to keep co-inhabiting CRMR and be part of the OPL [119], which have been understood as common use space, independently of the ownership or legally permitted uses of the land [13].

These peasant practices have been very controversial and conflict with conventional biodiversity conservation approaches. We also understand those practices, and the relationships involved, as a process of resistance; paradoxically, these practices allow them to resist cultural homogenization and marginalization associated with reductive conservation approaches [59]. Additionally, through the constant transformation of their practices, local peasants are able to adapt and resist, in their own terms, other presses and pulses affecting the OPL and, more broadly, mountain socio-ecological systems in South America and worldwide [120]. For example, local *arrieros* made changes to their livestock-raising techniques to ensure cattle survival during the severe mega-drought that affected central Chile in the last decade [121]. They have also adapted to shifts in land property and top–down regulations imposed on the LCNP [13].

'Local peasants–palm landscape' relationships are complex and encompass multiple dimensions—utilitarian, ecological, social (inter-species), and place-based from the perspective of relational ontologies [115,122]. These relationships involve livelihoods, local worldviews, knowledge systems, memories, affections, and identities. We understand

this relational assemblage involving local peasants, palms, cattle, and other agents of the landscape as a place-based collective [115] that is highly context-specific, only existing in relation to place.

4.3. Historical Ecology Informing Biocultural Conservation

The ecological legacies of the OPL associated with dynamic 'human–palm landscape' relationships over time need to be considered in LCNP conservation to overcome static understandings of the landscape and the pristine nature myth. The ecological legacies in the OPL encompass complex combinations of temporal and spatial scales. The available archeological information sheds some light on human–palm landscape relationships at millennium time scales, but these records are still very incomplete locally. While historical records contributing to a better understanding of these relationships on centennial scales are more abundant, they are strongly mediated by power dynamics and the sociopolitical contexts in which they were created.

Moreover, our qualitative study contributes to understanding local peasants' perspectives of the palmscape, exploring their epistemological and ontological dimensions. A better understanding of local epistemologies and ontologies is an important step toward improving the relationship between conservation practitioners and local communities [16,17]. Approaches that integrate local or Indigenous communities in conservation actions and governance of protected areas have been shown to be more effective, both in terms of biodiversity conservation and the well-being of local human communities [123].

The framework of historical ecology considers a relational and historical perspective with the aim of understanding landscape changes while involving multiple temporal scales (millennia, centuries, decades). From this approach, we argue that landscape configurations in terms of structure, composition, and functionality are products of ecological legacies, which, at the OPL, involve dynamic and complex human–landscape relationships over time for at least the last millennia.

Moreover, when analyzing changes in the OPL at centennial or decadal time scales, a distinction is needed between large-scale exploitation by landowners and other uses associated with local subsistence economies by local peasant communities, some of which are still important today but mediated by political decisions and power relations. Additionally, the relationships that these local communities have created and maintained with the landscape over time are not only utilitarian but have multiple other dimensions that take part of the biocultural heritage of the landscape [26].

We posit that the conservation of the LCNP, and more broadly of Chilean palm landscapes, can be improved by adding perspectives from historical ecology and a biocultural approach. This means acknowledging ecological legacies while respectfully considering local knowledge systems and worldviews, setting 'local peasants-palm landscape' relationships as part of the landscape's biocultural heritage. We argue that this approach is needed to overcome conventional biodiversity conservation approaches that have imposed homogenizing visions of cultures while separating humans from nature or reducing access to nature only to touristic and scientific activities. This biocultural approach could be better aligned with the conservation model proposed for UNESCO biosphere reserves, which would be more appropriate for the LCNP as part of the La Campana-Peñuelas Biosphere Reserve.

5. Conclusions

Most previous studies on the Chilean palm have focused on the biophysical landscape, overlooking the long history of human presence in central Chile for at least the past 12,000 years and disregarding the multiple dimensions of human–palm landscape relationships over time. Particularly for the OPL, the available data point to human occupation since pre-Hispanic times and cattle raising over the last 400 years.

A review of archeological and historical records involving the Chilean palm, combined with our qualitative study, reveals several categories of uses of *J. chilensis* and palmscapes

over time, showing significant differences among landowners and local peasants in terms of scales of production, consumption, and trade markets for the last 400 years.

The current palm landscape structure directly responds to past human decisions and actions, as observed in those areas selected by landowners for intensive palm felling during the second half of the 20th century and in those allotments that were cleared in the past for agricultural activities, both by landowners and by peasant families living in the OPL.

At present, local peasants' understanding of the landscape contrasts with Western science narratives and CONAF policies, not only because the latter sees humans and cattle as external and harmful agents but also because they understand peasants' practices as mere economic activities. For local *arrieros*, the mountain palmscape is constituted by relationships between palms, cattle, humans, and other agents of the landscape, which we understand to be a multidimensional and complex relational assemblage.

We also understand local peasants' practices in the OPL and their involved relationships as adaptive and as processes of resistance. Through their practices, local peasants can keep co-inhabiting the CRMR and resist the cultural homogenization and marginalization associated with reductive and top–down conservation approaches.

Chilean palm conservation can be improved by looking to the past to understand present landscape conditions, which is needed to inform future conservation and ecological restoration strategies. It is also imperative to add a biocultural approach, which, in the case of the OPL, should respectfully integrate local knowledge systems and worldviews with the aim of developing more effective and equitable conservation strategies that consider not only the biophysical landscape but also the biocultural heritage of the landscape.

Furthermore, these approaches can be applied in other contexts globally, where insights from the past can improve our understanding of present landscapes to plan sustainable futures. Also, our study case contributes to understanding the human management of mountainscapes beyond utilitarian perspectives and the unidirectional flow of nature–people relationships. This also shows the need for exploring the contributions to nature by those human communities that have created long-lasting relationships with landscapes.

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Appendix A. Chilean Palm (*Jubaea chilensis*) in Archaeological Contexts

Table A1. Review of publications and documents reporting *Jubaea chilensis* remains in archaeological contexts. Dates are presented in the same format as they were presented by the authors of each referenced study. Cultural periods *sensu* Falabella et al. [79].

Reference and Type of Document	Publication Summary and Data About *J. chilensis*	Type of Palm Remains (n = Number of Remains)	Remain Sources	Date or Cultural Period
[81] Peer-reviewed article	Diverse types of evidence (stratigraphy; radiocarbon dating; lithic, malacological, and zooarchaeological material; microfossils; dental calculi, stable isotopes; and rock art) were recovered from residential and funerary contexts from the Punta Teatinos site (north central coast of Chile, 29°S) to assess the strategies of environmental use by past human groups. The analyses of microfossils ascribed to *J. chilensis* were obtained from remains adhered to bedrock mortars and from dental calculus of human individuals (the latter is the same database presented in [124])	phytoliths	bedrock mortars and dental calculus of human individuals	Archaic III and Late Archaic period
[92] Preprint	A high-resolution fire frequency record is presented using macro-charcoal, phytoliths, and geochemical data, which were obtained from the Vichuquén Lake (coast of south-central Chile). Their main goal was to understand how relevant cultural and climatic shifts could be related to major changes in fire regime dynamics in the basin. For phytolith analysis, they obtained samples of approximately 2 gr of sediment spaced every 30 cm on the core used, and the standard procedures for phytolith extraction were followed. From this data, in addition to the chronostratigraphic information, they report the presence of the Arecaceae family from 2500 cal yr BP. Later, its presence stands out around 1800 cal yr BP. From 500 cal yr BP onwards, phytoliths of both the Arecaceae family and maize disappear from the record. This also coincides with the beginning of an increase in lake productivity, watershed erosion, and disturbance values, a trend that intensified c. 400 cal yr BP.	phytoliths	sediment cores	550 BCE to 1450 CE
[124] Thesis for archaeology professional degree	This is an analysis of microfossil remains contained in dental calculus from 50 individuals (ascribed to the Late Archaic period) found in the Punta Teatinos archaeological site (semi-arid north of Chile). The results showed 47 samples with microfossil remains and a total of 108 silica phytoliths. Four phytoliths from two different samples were globular echinate, with the characteristics associated with the Arecaceae family, which the author attributed to *J. chilensis*, as it is the only native palm in continental Chile. Using these results in addition to bioanthropological evidence and data from the literature, the author interpreted that Chilean palm leaves were used to obtain plant fibers, which were processed using different tools, such as bone artifacts, bedrock mortars, and the teeth of the person processing the material.	phytoliths (n = 4)	dental calculus of human individuals	Late Archaic period
[88] Unpublished report	This report was part of a research project directed by Dr. L. Sanhueza (University of Chile). Authors analyzed plant microfossil remains adhered to 73 lithic instruments from four archaeological sites located in central Chile, which have been ascribed to the Early Ceramic period (ECP; 800/300 years BCE to 1000/1200 years CE). A multiple microfossil analysis was carried out using the direct remains extraction method. From the analysis, the author recovered 280 micro remains (micro charcoal, tissues, silica phytoliths, and starch grains), of which 98% were silica phytoliths. Only silica phytoliths and starch grains were considered diagnostic, both for taxonomic and anatomic affinities. One spheroid echinate phytolith [125] is reported, which was extracted from a lithic rabot from the archeological site VP-1 and is ascribed to *J. chilensis* leaves.	phytoliths (n = 1)	lithic instrument	ECP
[82] Peer-reviewed article	This work is very similar to [83], both in content, study area, and methodology, but the authors complemented the former data. In this case, they analyzed 31 archaeological sites with bedrock mortars containing 217 rock supports (mortars) with 811 depressions. They identified a globular echinate morphotype phytolith (characteristic of *J. chilensis* leaves) in two sites (Valle del Encanto and Don Wilson sites). The first was the same finding reported by Troncoso et al. [83], and the second is new evidence about the presence of *J. chilensis* phytoliths in bedrock mortars from the semi-arid north of Chile.	phytoliths (n = 2)	bedrock mortars	Late Archaic period–ECP

Table A1. *Cont.*

Reference and Type of Document	Publication Summary and Data About *J. chilensis*	Type of Palm Remains (n = Number of Remains)	Remain Sources	Date or Cultural Period
[89] Unpublished report	This report presents the results of microfossil analyses made in 57 ceramic vessels that were recovered in the archaeological site "Pique Europa" (city of Santiago, central Chile). Most of the ceramic vessels analyzed were found as offerings accompanying individuals in funerary contexts from the ECP. A total of 164 samples of remains were obtained from the vessels using direct scrapping technique. They recovered 21,055 microfossils, of which about 5% (n = 1058) were silica phytoliths. The Arecaceae family was identified in 10 vessels, and in 5 of them, the authors were able to define the taxonomic affinity at the species level (*J. chilensis*). These phytoliths were associated with the leaves. Hence, the authors interpret that palm leaves were used to make cookery artifacts, which were utilized together with the vessels for cooking.	phytoliths	ceramic vessels	ECP
[83] Book chapter	This is a multi-scale study of bedrock mortars from the Limarí River watershed (semi-arid north of Chile, 30° S). They report the existence of 22 sites with bedrock mortars, which contain 175 mortars with a total of 603 depressions. Microfossil remains were analyzed, which were present in artifacts from excavations and adhered to the inner walls of the mortars. They conducted multiple microfossil analyses, and they also made new reference collections for some species, such as *J. chilensis*. Based on the regional analysis, they suggest that the bedrock mortars are usually associated with residential camps used by communities during the Late Archaic period and the ECP, with a trend towards greater use of these spaces during the ECP. They could determine taxonomic affinity only for a few samples. This was the case for one globular echinate phytolith from the site Valle del Encanto, attributed to *J. chilensis*.	phytoliths	bedrock mortars	Late Archaic–ECP
[78] Thesis for archaeology professional degree	The author examined microfossil remains adhered to grinding tools (bedrock mortars, pestles, and mortars) and plant macro-remains present in sediments in the archaeological site Carmen Alto 6 (Chacabuco Province, central Chile) to understand the functionality and context of bedrock mortars, in addition to the social dynamics around these artifacts. From the 245 micro-remains recovered from materials adhered to mobile grinding tools (pestles and mortars), Carrasco found one globular echinate phytolith, which was assigned to the Arecaceae family, following Patterer [126]. The author assumes that it corresponds to *J. chilensis*, as this is the only native species of the Arecaceae family in continental Chile. The remains of the Arecaceae family were not found in the analysis of sediments from the 9 excavations conducted at the site.	phytoliths (n = 1)	pestle and mortars	Late Archaic–ECP
[87] Peer-reviewed article	This article focuses on cultivated plants and the changes over time in their uses by cultural groups in central Chile during pre-Hispanic times. Citing Giglio [86], the authors mention that fruits of *J. chilensis* are one of the wild fruits that have been identified through the microfossil analysis of grinding tools (mortars), which have been ascribed to the Late Intermediate period (LIP; 1000/1200 to 1450 years CE).	Data on phytoliths from Giglio [86]	Grinding tools analyzed by Giglio [86]	LIP
[84] Peer-reviewed article	The authors analyzed content samples (adhered remains and sediments) of smoking pipes from three archaeological sites in different locations in Chile. They carried out a multiple microfossil analysis, which involved the study of phytoliths, starches, pollen, and crystals, among others. For the analysis of adhered remains, they used the direct extraction method. For a pipe from the semi-arid north (Pichicaven archaeological site, with dates from 530 to 1100 AD), they reported a globular echinate phytolith recovered from the sediment, which they associate with the Arecaceae family. *J. chilensis* is likely the species with which this phytolith is associated, although the authors did not identify the genus or species for the sample	phytoliths (n = 1)	sediment inside smoking pipes	530 to 1100 AD
[86] Thesis for archaeology professional degree	This is an unpublished thesis, and the manuscript was not accessible. The work is cited by Planella et al. [87] and Charó [88], pointing out that microfossil remains of Chilean palm fruits were found in adhered materials of mortars from the LIP in central Chile (Villa Cardenal Silva Henríquez archaeological site)	phytoliths	mortars	LIP

Table A1. *Cont.*

Reference and Type of Document	Publication Summary and Data About *J. chilensis*	Type of Palm Remains (n = Number of Remains)	Remain Sources	Date or Cultural Period
[90] Book chapter	The authors studied archaeobotanical remains from 41 soil samples to understand specific archaeological contexts and generate hypotheses concerning the nature of Inka domination and Indigenous influence at the southern and farthest edge of the Inka empire. They analyzed shallow fills present inside stone foundations. These structures were classified by the authors as storage units or housing, depending on their function. The authors found one carbonized coconut remain of *J. chilensis*, although they did not discuss the details of the context and location of this specific finding further; rather, they focused on other species that were more frequently found, such as *Echinopsis chilensis* (frequency of 3253) and *Calandrinia grandiflora* (frequency of 1053).	carbonized coconut	not informed	not informed
[85] Unpublished report	The authors analyzed the remains of compacted sediment found inside a ceramic vessel, which was part of a mortuary offering associated with the LIP, at the Fundo Esmeralda archaeological site (Quillota municipality, central Chile) [127]. They identified silica phytoliths of *J. chilensis* and other starch grains and phytoliths with affinities to shapes attributed to maize (*Zea mays*), beans (*Phaseolus* sp.), and squash (Cucurbitaceae).	phytoliths	sediment inside ceramic vessel	LIP
[128] Peer-reviewed article	They analyzed present palm fruits (coconut) to determine the stable C isotope content. Additionally, the authors mention that Chilean palm coconuts have been found in the archaeological site called LEP-C [91].	not applicable	not applicable	not applicable
[91] Conference article	This article is a study of the archaeological site LEP-C, which shows evidence of occupation from the Late Archaic period to the ECP. For the ECP layers, the authors report the existence of several burning areas, where clusters of charred fruits of *peumo* (*Cryptocaria alba*) and *J. chilensis* were found.	carbonized coconut	burning area	ECP
[93] Conference article	This is a synthesis of data on settlement patterns, archaeometry, cultural history, ecology, and ethnohistory of the Maule River outlet area (35°S). Charred shells of Chilean palm fruits are reported in the excavations. One of these findings was part of a campfire in the oldest detected occupation of the site (cave 07Co24), and the charred shells were found along with an obsidian knife and fish bones. A charcoal sample from this campfire was dated 2040 +/−170 BC. Another evidence of charred palm fruit shells was found in cave 07Co25, where the sediments also contained tools, obsidian waste, a pestle, pipe fragments, and coypus (*Myocastor coypus*) teeth enamel. Ceramic fragments were present in all the layers of the excavation, and several fragments were dated using thermoluminescence, resulting in a range of dates from 295 to 1490 AD	carbonized coconut	burning area and sediments	Late Archaic period to non-informed date (1490 CE maximum)

Appendix B. The Chilean Palm in Historical Records

Table A2. Review of historical documents reporting information on the uses of Chilean palm in different locations.

Year of Origin of the Report	Reference	Uses
1558	[129] (pp. 132–133)	Food (coconut and palm heart)
1614	[130] (p. 28)	Food (coconut and palm heart)
1646	[131] (p. 57)	Food (coconut); recreational use of the coconut by children; coconut exported to Peru
1674	[132] (p. 223)	Oil extracted from coconut was mainly used as medicine to relieve pain caused by hemorrhoids; food (comfited coconut and palm heart). To obtain the palm heart, the tree was cut down; recreational use of coconut by children to play marbles and many other games; sap (extracted by puncturing) to make "*chicha*" and a syrup commonly called "palm honey.
1667–1670	In [107] (pp. 102–103)	Coconuts were harvested by locals and then sent to the port of Valparaíso and exported to Lima (Peru). Harvesting was a livelihood for the locals of the Limache valley

Table A2. *Cont.*

Year of Origin of the Report	Reference	Uses
1670s	In [133] (pp. 368–374)	Food: coconuts, particularly demanded by ships sailing from Valparaíso; sap extraction to make palm honey
1716	[134] (p. 104)	Food (coconut); recreational use of coconut by children; coconuts exported to Peru
1760	[135] (pp. 110–111)	Food (coconut); recreational use of coconuts by children
1763–1787	In [107] (p. 107)	Sap extraction, which involved cutting down the tree. Leaves were used for roof construction. Leaves were also used for Palm Sunday by people from Santiago who went to La Dormida estate, mandated by the city council, to harvest palm leaves for the Palm Sunday season.
1782	[136] (pp. 155–157)	Food (coconut), coconuts exported to Peru, and oil extracted from coconuts. The spathes were used by peasants to store things. Leaves were used for making brooms, baskets, and roofs. Sap extracted for making syrup ("honey")
1788	[137] (pp. 194–196)	Handicrafts using the leaves: mats, bread baskets, and brooms; a "large amount" of liquor extraction from the upper sprout to make "honey", which caused the loss of the tree; use of the spathes (bracts) by peasants to store clothes; food (coconut and oil extracted from coconuts); coconuts exported to Peru
1796	[138] (pp. 73–75)	Coconut for food and export; sap for making palm honey
1815	[139] (pp. 308–309)	Coconuts were used for food and also exported to Quito and other South American cities; Recreational use (coconuts were used for games by children)
1822	[140] (pp. 165–166; pp. 179–180; p. 234)	Roof construction using the leaves is described as a very common practice; use of the wrapper of the flowers (bracts) by peasants to store several household items; sap (extracted by cutting down the tree when the palm is older than ~150 years)
1824	[141] (pp. 50–51)	Substitute for honey (sap)
1826	[142] (p. 443)	Roof construction using the leaves
1826–1829	[143] (p. 353)	Ritual/spiritual use: for Palm Sunday, the leaves are "consecrated" in a divine place to be placed inside homes to protect against misfortunes in the next year; the woody spathes (or bracts), which he describes as 6 feet long, were utilized in multiple households uses, such as hanging cribs for children.
1830	[144] (p. 202)	The author points out that "several estates owe much of their value to the number of palms upon them". Leaves used for roof construction when thatching houses, being "considered better and more durable than any other material"; sap for making syrup as a substitute for honey; coconuts as highly esteemed and exported to Peru
1834	[109] (pp. 255–256)	Sap extraction to make "a sort of treacle".
1853	[145] (pp. 157–158)	The whole tree is useful for domestic purposes: leaves are used for making brooms and baskets and for roofing huts and rural houses; coconuts are used for food and exported to Peru; sap is used to make honey. The author mentions sap extraction as a common "industry", and many people bought trees from landowners to extract the sap.
1857	[146] (pp. 28)	Food (coconuts) and sap for making palm honey
1859	[147] (p. 96)	The whole tree was considered useful: coconut was used for food and exported to Peru; leaves were used in religious festivities and for thatching rural houses; sap was used to make honey.
1865	[148] (pp. 169–170)	Coconuts for food and export; sap for making palm syrup (honey)
1872	[149] (pp. 242–243; p. 333)	Coconuts for food, commonly used by sailors, and exported to Peru. Recreational use of coconuts (pastime for children);
1875	[150] (pp. 274–275)	Sap extraction to make syrup
1877	[105] (pp. 34–43; pp. 46–47; p. 73; pp. 77–81; pp. 107–108; pp. 151–152)	Coconut for food; sap for making palm honey and alcohol; leaves for religious celebration (Palm Sunday)
1882	[151] (p. 202)	Food (coconut)
1889	[106] (pp. 451–455; pp. 489–492; pp. 531–536; pp. 570–574; pp. 602–604)	Food (coconut and sap for making honey); fiber sources of different types, obtained from most of the tree (trunk, racemes, spathes or bracts, and the membrane that covers the spathes), except the bark and leaf stem. Several potential uses of fibers are proposed, such as raw materials for the paper industry, textile making, and brushes.

Table A2. *Cont.*

Year of Origin of the Report	Reference	Uses
1934	[152] (p. 89; p. 167; p. 272; p. 280; p. 282; pp. 297–298; pp. 476–477)	Food (coconuts, "soft parts of the palm", which involved harming the entire tree; sap to make palm honey, which involves felling the tree); material for constructing rural houses, which resulted in most palms from Petorca being in "sad conditions" because "too many leaves are pulled out"
1936	[153] (p. 182)	Ocoa and Cocalán palm forests were exploited for palm honey production
1958	[154] (p. 65–66)	The fresh coconut endocarp was highly esteemed by the youth, and there was an active trade of coconuts, especially at the stations of the Valparaíso railway branch. Dry coconuts were used for baking, and the sap was utilized for making palm honey. Leaf folioles were used as stuffing for upholstered furniture.

Appendix C. Selection of Quotes from Semi-Structured Interviews

In this appendix, a selection of quotes from semi-structured interviews is presented, organized by topic. These were translated from the original interview transcriptions in Spanish.

1. Palm honey production

Quotes 1.1: Former worker of Las Palmas de Ocoa estate.

"We started in July, they commanded us from the estate, to cut down the palms from which the juice [sap] would be extracted. So, we started in July, we were cutting palms. They cut around 200 every year. (. . .) Every worker was in charge of 25 palms. He had to do the job every day, one in the morning and another in the afternoon. . .Every worker did a round to all the palm he was in charge of. He had to cut out with the knife. . .he had to cut out like a little slice, as when you chop onions, thin, to each palm. (. . .) In each round you did to harvest the juice, to avoid stopping the drip. Otherwise, it would heal with the heat, the juice was covering slowly, like milk skin. So, the worker had to do that job, every day. In each round he harvested the juice, we had a goat leather sack, *cuero* we called it. Others named them *costal*. We carried the juice there".

"Only in the highlands, around the boundary, in the estate. . .La Cortadera, all that. . .they felled palms. Agua del Manzano, all that and a little downwards, they felled palms. . .The boss did that on those years. But below, they didn't fell. . .All the high areas, up. Until the final they cut. After we left [in 1978], two or three more years they did it. They allowed, I don't know how they got permission to keep extracting juice [sap]"

2. Coconut Harvesting

Quotes 2.1: Drover from La Peña village.

"For coconut harvesting you made an agreement with the administrator, with the estate overseer: –Ok, you give me 'x' kilos weekly–. And we harvested with my dad".

"I have gone to the coconuts my entire life, my entire life. As I told you, we went with my dad, and it is our custom. So, I keep to this day, I'm going".

Quotes 2.2: Former worker of Las Palmas de Ocoa estate.

"In '48, he [landowner] began to knock down palms, only above [on the highlands], fruit palms and new palms too. Because he said that he didn't take advantage of the fruit from those above, from the palms that were too high on the hill. (. . .) Because many people went to collect. . .in the harvesting season".

"He [landowner] harvested. Yes, it [the coconut] started getting ripe in the palm in February, and then they started, they sent crews. They paid us, but a pittance,

they paid us per kilo. . . what we harvested above [in the mountain] was carried down (. . .) Downhill he had an open ground to dry, a concrete drying space. And they took off the peel, they made it rot. (. . .) After eight days all the peel got rotten, with the heat. And then, they were dropping what was ready into a large tub, and a beast [horse] was stirring, as if running in a spin (. . .). And then there were two people collecting in a basket, it went to a rinser, it was washed and then it was emptied to be taken to the dryer".

Quotes 2.3: Drover from Los Claveles village.

"Yeah, it is something like. . .if anytime, I don't know, they say "we are going to close. . .no one else is entering". I know that I will enter somehow, and I will go, maybe stealthy, because I know. . .Because CONAF. . .when I went to the coconuts, I sometimes went to the coconuts, when it was completely banned. But one in so wise, I don't know if wise is the word, but knowledgeable, one knows where the park ranger is".

"Yes, they [outsider harvesters] came from Calera, Valparaíso. . .Ultimately they were, not the people from Granizo, but the outsider people, who don't have animals [cattle], they didn't care about throwing garbage or destroying, because business was just going to pick up coconuts for them".

3. Uses of leaves and other palm fibers.

Quotes 3.1: Former worker of Las Palmas de Ocoa estate.

"Because where we grew up, those huts were the first thing made. And there I was helping, 10 years old, helping dad. . .carrying palm leaves and making the roof. (. . .) We tied on the top, with the same thing that the palm gives, the stem, *vástago* we called it, the stalk of the raceme, we soaked it. We tied up using this".

"They always took out the one [bract] that grew well shaped. Mom used it to clean the wheat, to put it inside".

Quotes 3.2: Drover from El Llano village.

"All houses were like that [made with palm leaves], there were no houses with metal roofs up there (. . .). Those houses were warm, not as metal panel that is colder".

"They also made chairs using the leaves. They cut and wove them, they twisted them. . .it was the same as with the cattail. . .they made chairs, long couches, well woven".

Quote 3.3: Drover from La Peña village.

"Everyone made a *ruco* [hut] with palm shell [leaf]. They made their beds, with palm shell, they wove all that".

4. Recreational uses of the Chilean palm.

Quote 4.1: Interview with two drovers

Drover 1: "When we went to the rabbits [rabbit hunting], we carried them [coconuts] in our pockets, we played".

Drover 2: "Right, we didn't have marbles. In those years, there were no marbles. So, coconuts were our marbles. And we went to school, and who brought coconuts, we taken them off, and fights began! [laughing]"

Quote 4.2: Former worker of Las Palmas de Ocoa estate.

"They always used those [palm bracts], like sleds. They were going to the rock slabs. If you put them there. . .it slides fast! The children used to put this on, they would slide on the stone slabs, sitting there".

Quote 4.3: Inhabitant of Ocoa valley, descendant of former workers of Las Palmas de Ocoa estate

"Canoes [bracts], they [uncles] told me, were bigger before, maybe because of the water (. . .) They throw themselves [sitting on a bract] by that canal, they ended at the dam, almost at the bottom of the park".

5. Uses of the landscape.

Quotes 5.1: Former worker of Las Palmas de Ocoa estate.

"But after two years, dad wanted to move higher up [to the highlands], for raising, he liked raising. Cattle raising, horses. He [his father] arrived with nothing, but the boss gave him some animals and he started with that. . .and later he started to buy. After he had goats. He came to have 100 goats, the whole herd. And sheep, 50 sheep. (. . .) They were released. He corralled when the goats had kids. Mom milked them, my older sisters too. They made cheese, tasty goat milk cheese!"

"Oxen. . .to cultivate, to plow, and for the charcoal (. . .). For the kilns where they made charcoal. Because my uncle worked many years on that, we carried the wood with the oxen, to the kilns (. . .). They cut with an ax (. . .). They carried that down [the charcoal], for the estate. My uncle burned for the estate".

"The wheat grew just with the rain. We started to plant in May. Before the first rain, in April, my dad left the soil for the year round, fallow, plowed to be labored. And when the planting season came, we scattered the wheat. (. . .) And after the first rain, the wheat sprouted right away. (. . .) On the flanks, it grew anyway".

"In the past, before my dad arrived [1948], there were inhabitants there, near the dam (. . .). They also planted, there were two threshing grounds. . .same as above where we grew up".

Quote 5.2: Inhabitant of Ocoa Valley, descendant of former workers of Las Palmas de Ocoa estate.

"In the Eastern flank of La Campana, if you go up there towards the viewpoint, you see some hills where there are only espinos [*Acacia caven*], and now it looks dry, only grass. In the past, they planted wheat there. . .to make bread and all that".

Quote 5.3: Inhabitant of Quebrada de Alvarado village.

"I think that's why the place is so unique. . .Because where it is, amid ravines and all that around, full of crystals. La Cristalera, the quartz mine. . . gold. . .And the monks [rock outcrops which shape seem like monks] are above, and the "Piedra del Diablo" ["Devil Stone"]. There are very strange things. . .that call your attention. Also, in these mountains it is said that the Child God was found, in the plains of Caleu. . .Between Las Palmas and Caleu. So, all of this is full of palms, and the *roblerías* [*Nothofagus macrocarpa* forests], that's also another magic thing. And the animal species living there, insects, birds. . .all that. And you know, people have lived there. As we talked about before, this is a place of livelihoods, and where the former workers of the estate lived to make the palm honey, the coconuts and make charcoal. But they also exploited the mines, and they lived in the highlands. . .So these have been mountains that in one way or another, men [humans] have been there, rooted in those places. Although it seems that is not like that".

6. Cattle as part of the landscape.

Quotes 6.1: Drover from Los Claveles village.

"The people from the park rangers, they blame on the animal [cow] that they eat the palm, and I have never seen an animal eating a palm. And if you see Ocoa, it

is full of palms and that was made by the cow. The cow, I don't know if you have seen it, eats the coconut. And then it walks, for example it can walk a distance from here to Los Claveles [referring to about 500 m] and it lays down and there it ruminates the coconut. And it eats the peel and leave the coconut (. . .). And then it gets up maybe, another and so on, it goes to another site, from there to here. And that's how the palmar was made and there are so many palms".

"If cattle are not anymore. . .the tourists. . .don't think they won't damage. . .they also damage. We have picked up bags, beer cans, many times. By myself and my uncle have seen tourists smoking and he has told them. They don't like, but they put it out. . .But no, not because we stop going to the park. . .oh the paradise, it will be very nice. Tourists damage too".

"Dialogue, nothing more than dialogue, and have a suitable local person, who understands what the park is. And a person from the park who understands who the *arrieros* are. Do you know what I mean? That they talk to each other, that they accumulate ideas and something positive can arise. But the park has always lived together with bovines".

Quote 6.2: Interview with Drover from quote 6.1 and his wife.

Husband: "The Chilean palm in Ocoa, if it would be as CONAF, the park rangers, say, that it is going to become extinct. . . but every time I see more, more small palms, and of different sizes".

Wife: "Right, I think that while cattle is there, we won't lose that, because as he says, the bovine animal is who goes like planting palms".

Quote 6.3: Ocoa valley inhabitant, descendant of former workers of Las Palmas de Ocoa estate.

"They always told me [father and uncles] that during the coconut season, they used to go after the cows. Because the cow eats coconuts. They said *rumiar* [to ruminate]. They got up at 5 am, 6 am and they went after a cow. And the cow usually stayed under a espino [*Acacia caven*], or a litre [*Lithraea caustica*]. And there they found a lot of coconuts, which were clean".

7. Local knowledge and *arrieros*' toponomy.

Quotes 7.1: Drover from La Peña village talking about various wild animal species during an interview.

"The rabbit [*Oryctolagus cuniculus*] keeps an eye on the fox [*Lycalopex* spp], the *quique* [*Galictis cuja*], it chases the rabbit. The *quique* really likes the rabbit, because the rabbit is clean and. . . the *quique* and the fox are very clean, they don't eat any meat, they like the rabbit".

"The *puma* [*Puma concolor*], it is afraid of the lasso, so if you meet a lion, you must manage the lasso. . .And they just stay looking. (. . .) And you don't have to turn your back".

"The Puerta de Rabuco [toponomy referring to a mountain pass] is there. . .and it drips to Las Cortaderas [or La Cortadera, name of a ravine]. . .there are a lot of *vizcachas* [*Lagidium viscacia*] there".

"The *chingue* [*Conepatus chinga*], is very beautiful (. . .). He pees and it is same as a flare of fire [referring to the smell of *C. chinga* secretion]. Once. . .it peed (. . .) it screwed up our minds! But it is so cute, it is like a little ball. . .like wooly".

"The Morro de la Calamidad. . .Last year I passed by there. There are a lot of buitre, the *cóndor* [*Vultur gryphus*]"

Quote 7.2: Drover from Los Claveles village.

"There is El Casino [toponomy, resting area], and towards the right side above, there are some *lajones* [rock slabs]. . .Above, it is called Morro de la China [toponomy, hill]. (. . .) From El Casino, you go to El Labrado [toponomy, hill], there is a *peumal* [*Cryptocarya alba forest*] there. From the forest, straight up, there is a high hill there. There are twisted palms there, and a lot of palms. There are *placetas*, we call them, a wide area above. You get the highlands and you see all Hualcapo [local village], La Buitrera [name of a ravine], the guard house, it looks very different".

Quotes 7.3: Former worker of Las Palmas de Ocoa estate.

"The Piedra del Finao' [toponomy, name of a big rock] (. . .) When my dad arrived. . .all the elders have a lot of faith. And as they told him, one person has died there. And he was buried right there. And an acquaintance that became my dad's friend those years we were there, he told him that he had found the bones on the trail that goes towards the slope (. . .). And he picked up them and he buried them next to the stone".

"There they call it Puerta del Sapo [toponomy, referring to a mountain pass]. . .in those years, water ran there, not now, they are all dry. (. . .) And next to it, El Penitente [toponomy, name of a mountain], you saw stones like virgin shaped".

Quote 7.4: Drover from El Llano village.

"Before, long before, we didn't know so many mice, so many creatures that. . .there weren't so many before. Of course, there were more foxes, more birds, those are catchers of mice, rabbits. (. . .) Now the monte [thicket] has grown a lot, before it was cleaner. Yes, now there are more tebo [Trevoa trinervis], more cardones [Puya spp], everything. So now the mouse comes out and hides almost immediately, before they didn't".

Quote 7.5: Drover from La Peña village, we showed them a historical photo and he explained the location where he thinks it was taken.

"From the Paso del Carbón [toponomy, name of a mountain pass] upwards. They took it from there, like the Deslizadero de Ño Marcelo [toponomy, literally meaning The Slippery Area of Mr. Marcelo], because here it is Campana [the mountain] (. . .). The Loma del Litre [toponomy literally meaning Hill of the *Litre* (*Lithraea caustica*)], the Portezuelo Hondo [toponomy literally meaning Deep Mountain Pass], the Loma del Bollén [toponomy literally meaning Hill of the *Bollén* (*Kageneckia oblonga*)], there. All of them go towards this side. You can see these are *cercos* [local concept referring to a cleared space, usually because it was used for agriculture in the past]. The Cercos de Doña Elba [Ms. Elba's Cercos], and from there, Los Hornos de Fierro [toponomy, literally meaning Iron Kilns] begins. Do you see? . . .Look, the stream is there".

Quote 7.6: Drover from quote 7.5 and his wife, looking at another historical photograph, which depicts a person in the front and a view of the CRMR in the back.

Husband: "Look, there is a fire next to Las Cortaderas [name of a ravine]. Look, the Loma de la Culebra [toponomy, literally meaning Hill of the Snake] to that side (. . .)"

Wife: "In the past, it was typical to see the old men making some smokes. A smoke, because as there were no phones, to know where other person was. . .This is how they communicated, –Ok, there is people at that site–, then they approached".

Husband: "Look, this is the location I told you. . .this is the Loma de Lorca [toponomy]. . .Las Dormideras [toponomy]. . .and falls to this hillock, this is named Morro de la Calamidad [literally meaning Calamity Hillock]. . .And here

it is the Roblería de la Arena [literally meaning Sand Oak (*Nothofagus macrocarpa*) forest], this is the stream of the Roblería de la Arena, which comes from above and goes down to the Agua del Coligüe [toponomy of a spring, literally meaning Water of the *Chusquea* spp] and to the Agua del Durazno [toponomy of a spring, literally meaning Water of the Peach], and it hits below… And here, the Paso del Maray [mountain pass], Las Cortaderas [ravine] and the Puerta de Rabuco [mountain pass] above".

8. Local peasants–palm landscape relationships.

Quotes 8.1: Drover from Los Claveles village.

"Yeah, I began to go to the palm forest, as you call it, it was Ocoa before, they took me there when I was 5, for the first time. (…) And now, I am 55 years old, so just imagine that. 50 years going there. And my grandfather, my dad told me that they took them there since they were children. Just imagine".

"For example, they [father, uncles] said: "Hey, you have to plow that piece of land…if you plow it, we will go to Ocoa tomorrow". Ocoa was the park, what people now call the Ocoa park. Wow! They told us we were going to Ocoa, it is like telling a child now that we are going to the amusement park. Right, and you plowed and plowed!"

"I think that in Ocoa, people from CONAF, just as they complain to the *arriero*, they should hire someone to clean the palm. Someone who climb and cut the all the dry material, the leaf, the dry raceme, the canoe [bract]. (…) For example, a small palm, you come and see it's full of dry leaves on the top. What does the *arriero* do? The *arriero* goes and says–I would like this palm gives coconuts in some years.–Then you go and clean it, the lower part, we always do the same, and you keep its leaves, and it looks nice! Because many years are left for that palm to bear fruits, but it's like this helps it to grow. Because this gives it strength above and the palm looks nice. An *arriero* always does that, he takes care of it, cleans it".

Quote 8.2: Inhabitant of Quebrada de Alvarado village.

"They never talked about that [referring to formal education]. As children, never. And when I began to go to the palm forest, around my fourteens, I was very impressed. Because I realized that…we usually look at very beautiful places of the world, not realizing that we had one of the most beautiful places of Chile, just crossing a mountain range. So, I felt a little sadness, actually. I felt like ignored and deceived at the same time, because I didn't know that…And when we went there, as kids, –ok, let's go to the palm forest–, but I never imagined so many palms!"

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