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# Can Neo-Rural Initiatives Bolster Community Resilience in Depopulated Coupled Human and Natural System?: Insights From Stakeholder Perceptions in Central Spain

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Preindustrial era agro-sylvopastoral land uses have influenced structure, function and disturbance in Mediterranean type mountainous landscapes for millennia. In this study we analyze through semi-structured interviews, stakeholder perceptions of coupled human and natural system (CHANS) community resilience in one such landscape; the municipality of Puebla de la Sierra, Madrid. The municipality is part of the Biosphere Reserve of the Sierra del Rincon and the Natura 2000 network and as such is subject to various conservationist regulations emanating from multiple levels of governance. In the preindustrial past most municipal lands formed an oak "dehesa" or open forest CHANS that made biomass extraction through pollarding compatible with pastoralism and shifting agriculture. After a period of rapid land-use change in the early 20th century—marked by the state led plantation of coniferous forests, the final decades of the last century were characterized by rural abandonment and the collapse of traditional forms of land use as well as the gradual transformation of the municipality into an eco-touristic, exurban destination for Madrid residents. More recently, the municipality has experienced an influx of neo-rural settlers in the area wishing to connect traditional knowledge and management with modern agro-environmental practices. In our study, we identify two limiting factors to community resilience in Puebla de la Sierra; governance and financing. The current governance model is perceived by respondents to be contrary to their reality and needs, which translates into environmental, urban and health regulations that, in their views, penalizes agroecological and small-scale economic activities. In addition, respondents believe there is a dearth of material and financial resources to initiate these transformative local actions which further weakens community resilience. Stakeholders however also identified other factors that reinforce community resilience such as a collective willingness to revive key traditional ecosystem management practices such as pollarding, the networks of trust existing between the people participating in these new initiatives and the capacity for deliberating between different visions of future development pathways amongst local stakeholders.

**Keywords: command-and-control, psycho-social representation, neo-rurality, agro-silvopastoral systems, traditional management**

## 1 INTRODUCTION

The intensification of forestry and agriculture, and the abandonment of traditional agro-silvopastoral practices have led to increased landscape homogeneity throughout Europe (Van Der Plas et al., 2016), especially in the Mediterranean Basin (MB). This is a cause for concern because the mosaic of traditional landscapes contributes to maintain high biodiversity levels as well as diversity in human cultural practices, which in turn support multiple ecosystem services (Blondel 2006). Traditional landscapes in the MB are the result of mixed agrarian, pastoral (grazing, browsing) and forestry (firewood extraction, charcoal...) subsistence oriented production for local markets (Seijo et al., 2015). The "*dehesa*" is one of these traditional landscape types characterized by an open, old growth forest structure with an abundant grass understory. The decline of extensive agro-silvopastoral activities, the re-orientation of the rural economy towards intensive forestry and agricultural practices, tourism and residential uses and the increase in forest fires are convergent phenomena in the woodlands of Spain which threaten landscape resilience to global environmental change drivers (Seijo et al., 2017).

Pollarding or productive pruning is a declining traditional agro-silvopastoral practice that can maintain livestock carrying capacity and it is compatible with the production of timber for construction, firewood and charcoal collection. There is evidence that the abandonment of pollarding practices negatively influences the conservation of biodiversity (Mugarva 2012; Sebeck et al., 2013). Pruning, that is the periodic removal of the tree branches from old growth monumental pollarded trees, creates open canopy stands that allow for understory biodiversity in "*dehesa*" systems (Moreno et al., 2016). This practice may also limit wildfire risk in Mediterranean landscapes, by altering forest structure and reducing the density of flammable material (Moreira et al., 2020). Another ecologically valuable effect of pruning is the lengthening of the life of the trees, by selecting and maintaining healthy monumental specimens (Read 2000).

The oak forest of Puebla de la Sierra is included, since 2005, within the Man and Biosphere Reserve (MAB Reserve) of "Sierra del Rincon" and can be viewed as a pilot experience in the conservation and restoration of traditional coupled human and natural systems (CHANS) (Liu et al., 2007). This type of *Quercus* CHANS has been designed by human beings for centuries, demonstrating compatibility with the conservation of biodiversity (Blondel 2006; Santos and Thorne 2010). However, in the absence of rural management practices many oak savannas or "*dehesas*" are becoming overgrown with shrub encroachment and tall-oak forest sprouts (Peco et al., 2005; Tarrega et al., 2009). These developments could be in detriment of multifunctional forest management -i.e., the production of acorn and pastures is increasingly compromised -which contradicts current sustainability goals of the MAB Reserve.

The mission of MAB Reserves is 'to develop and strengthen sustainable development models", "to communicate the experiences and lessons learned" and "to support the evaluation and high quality management" of these ecosystems (UNESCO-MAB 2016). More specifically, one of the Sierra del Rincon MAB Reserve's goals is to curb rural abandonment, favor the development of local productive economic activities in the primary sector and responsibly manage the potential for tourist and recreational use of the region which is located only an hour-drive away from Madrid. Extensive pastoral systems in Mediterranean oak savannas that preserve traditional management practices currently represent an interesting opportunity for sustainable forestry management initiatives considering the environmental advantages of extensive agro-environmental livestock farming and small-scale biomass-based energy production.

One of the strategies available to reach the MAB Reserve's goals in Puebla de la Sierra is to encourage neo-rural initiatives which may be a good strategy for fostering sustainable development. Currently, the abandonment of management for the sake of "rewilding" and the evolution of these traditionally open canopy oak forests to closed canopy oak forests is not devoid of both social and ecological risks (Cronon 1996; Moreira et al., 2020). In particular, it is difficult to monetize the added value of these "rewilded" forests for local economies and the resulting new forested landscapes generate uncertainties regarding their mitigation potential to new global environmental challenges such as carbon sequestration, drought resilience, wildfire risk, hydrology, etc., overall decreasing the ecosystem services/disservices ratio (Sjölund and Jump 2013; Seijo et al., 2017; Domingo et al., 2020; Varela et al., 2020). Hence, the development of local initiatives in favor of traditional pollarding tree practices and agro-silvopastoralism constitutes an opportunity for sustainable forest management and biodiversity preservation. Moreover, financially support through governmental subsidies of "*rewilded*" CHANS is extremely expensive and requires external capital and human resource inputs. Active engagement of local communities in the management of these landscapes is therefore desirable but for this to take place these communities must feel empowered and have the necessary resources to carry out interventions in these CHANS (Ostrom 1990).

Puebla de la Sierra is particularly apt for this type of sustainability initiative, since both the local residents and the City Council are keen on restoring traditional uses of their oak forest landscapes. Local initiatives such as the neo-rural cooperative established in the 2000's have extended their activity to recovering traditional agro-silvopastoralism and pollarding in order to benefit from local wood biomass products with the idea of fostering carbon neutrality. However, permits for pruning and firewood extraction must be requested from the forestry administration of the Community of Madrid. Since 2019 no permits have been granted for pollarding in Puebla which contravenes the decision of the municipal council to support this traditional practice. This conflict between administrations may prove determinant for the persistence of the practice of pollarding. To analyze these complex dynamics and to assess the potential trajectories of the Puebla de la Sierra CHANS, we studied the "community resilience" of the human system in the face of these developments.

**BOX 1 | Definition of Trasmocho Practices**
Trasmocho (pollarding in English) is the name given to the tree resulting from periodic pruning in multi-year shifts carried out for the production of firewood, charcoal and timber since ancestral times. Trasmocho trees acquire a candelabra "horca y pendón" shape with large arms from a thick trunk of moderate height. This traditional practice results in an open canopy dehesa-like forest structure maximizing the production of grass and acorns. It constitutes a cultural heritage related to pruning techniques and to the naming of tree shapes and resulting landscapes.

In the context of climate change and rural abandonment, we hypothesize that the maintenance of traditional management practices, such as pollarding (i.e., trasmocho in Spanish, **Box 1**) or agro-silvopastoralism, could increase community resilience in Puebla de la Sierra as well as strengthening the MAB Reserve's sustainable development goals. Though there is no consensus in the literature over the definition of this key concept we apply the concept to our case study here, following Patel et al. (2017) by deploying in our analysis 7 core attributes identified in their systematic review: local knowledge, community networks and relationships, communication, governance and leadership, resources, economic investment, and mental outlook. We defined "community resilience" as the capacity of the human system to recover integrity and functionality after the impact of social-environmental distrubances such as economic crisis or a wildfire (Berkes and Ross 2013; Patel et al., 2017; Faulkner et al., 2018). To address this research question, we focused on the three following study objectives:

(i) Identifying the values and representations of different types of key local stakeholders regarding pollarding "trasmocho" oak forest management practices.
(ii) Analyzing the values and perceptions of local stakeholders regarding human (economic, political, social and cultural) and natural system vulnerabilities in La Puebla community ("trasmocho" oaks and natural environment risks to drought, wildfire, etc.)
(iii) Evaluating local community capacity to maintain the pollarding oaks ecological legacy to future management challenges.

# 2 METHODOLOGY

## 2.1 Study Site Description: The Community of Puebla de la Sierra

The municipality of Puebla de la Sierra is made up of a forest landscape that was originally communal property. The municipality of Puebla de la Sierra has an area of 5,771 ha with a population density of 1.12 inhabitants/km$^2$. The municipality's population is currently 100 hab, which is a third of the population it used to have before the rural exodus of the 1960s. Puebla de la Sierra is a municipality belonging administratively to the Madrid Autonomous Community ("Comunidad de Madrid") (MAC), which is one of the seventeen Autonomous Communities conforming the Kingdom of Spain. The MAC authorities hold political prerogatives on Environmental and Conservation policies. Despite being part of the MAC (one of the most populated autonomous regions in Spain), the low population density of Puebla de la Sierra can be attributed to its sinuous, remote mountainous location.

We used historical, geographical and forestry secondary literature to contextualize the origins and nature of "*trasmocho*" management of oaks in Puebla de la Sierra. To reconstruct the regulatory framework existing in the past and its evolution we accessed technical reports and other grey literature in the websites of the MAC's forest administration and the MAB Reserve. These reports informed our question formulation regarding governance, administrative rules and strategic planning in the interviews.

The current landscape of Puebla de la Sierra was shaped since the Middle Ages mainly by grazing and the use of firewood and timber, along with agricultural activities in the flatter fields closest to the village. Extensive goat and sheep grazing, as well as firewood extraction, were the main management factors that contributed to the design of this landscape, especially in the configuration of the "dehesa" forest formed by old and heavily pruned oak trees (Martin et al., 2003).

The forests around Puebla maintained until recent times communal uses derived from the medieval property and land tenure systems of the Ancien Régime, that ended with the liberal privatizations of the 19th century known in Spain as the "Desamortizaciones". Some preindustrial era practices and traditions have in fact persisted to this day (Pardo et al., 2003). At the end of the Ancien Régime, the forest administration was left in the hands of a complex governance system, a mixture of traditional communal use and public forest administration regulations and interventions such as the pine tree plantations of the mid 20th century. After the accelerated decline of traditional uses resulting from rural abandonment in the 1960s, the management of the oak forest was progressively taken over by the state forestry administration and later by the local Forest Conservation Agency which depends from the MAC. The municipality is the owner of the woodlands, but the Forest Agency manages woodlands and exploitation uses. There is a convention between the municipality of Puebla de la Sierra and the MAC. A part of profits from the woods exploitation is donated to the municipality for afforestation program, the rest is donated to the MAC.

In 2005, the municipality of Puebla de la Sierra was included in the MAB Reserve of Sierra del Rincon. Nine years later, in 2014, Puebla de la Sierra became part of the Natura 2000 Network (DECREE 103/2014, as a Special Conservation Area "Cuenca del Rio Lozoya y Sierra Norte", and a Special Protection Area for Birds "Alto Lozoya"). This conservation interest emanates from the high flora diversity existing in the landscape resulting from traditional practices. In 2000, a bottom-up management initiative

was undertaken by a group of young neo-rural dwellers, who worked at forest fire checkpoints in Puebla de la Sierra (Cooperativa agroganadera Los Apisquillos, 2018). Currently, this activist group[1] advocates for an ago-ecological approach to the management of the land which mixes scientifically based agronomy with other more specific political and ideological beliefs. This group decided to revive declining agro-silvopastoral activities with the goal of promoting a sustainable, environmentally responsible lifestyle. This initiative yielded important services for the CHANS, including renewed local food production, conservation of biodiversity and wildfire prevention.

## 2.2 Conceptual Frameworks

### 2.2.1 Value-Based Approach and Values Typology

We used a value-based approach to identify the perceptions that different types of actors have concerning pollarded oak forests. The studies of values in human-nature interactions have increasingly attracted the attention of researchers in recent years. Numerous authors identify values as an important element in the transformation of CHANS (Liu et al., 2007), in adaptation (Folke et al., 2010) or in resilience-based management (Chapin et al., 2009; Lejano and Fernandez de Castro 2014). Many debates about management strategies for CHANS are entangled in factual or technical disagreements, but the core of the debates result more often than not from value disagreements (Gamborg et al., 2014). A better knowledge about local community values increases opportunities to implement adequate and viable management strategies and to find trade-offs between social and ecological issues (Jones et al., 2016). This approach works under the premise that values and perceptions play a crucial role in CHANS management and enhanced community resilience. In fact, values and strategies affect political strategy, lived experiences, governance decisions and local management strategy and practices (Lakoff 2010).

In this study we explore three types of values and their role in fomenting community resilience: held values, assigned values and relational values (**Table 1**). Held values are defined generically, they are universal and not-context specific (Bengston 1994; Jones et al., 2016). Among the most salient held values, we can cite "security", "conformity" or "hedonism". On the other hand, assigned values are context-specific, and are linked to feelings. The understanding of assigned values more accurately predicts behavior in specific situations (Seymour et al., 2012). Finally, relational values are expressed though the interaction between an object and a subject, for instance a natural environment and its population. Relational values may enhance involvement in management (decrease management costs) and strengthen social capital thus creating closer emotional links between the individual and the ecosystem which may last even after the individuals have left the community and settled elsewhere (Uehara et al., 2019).

Here, we decided to mainly study relational values, and, in part, assigned values (see selected values in **Table 2**), to understand local community representations and perceptions of trasmocho oak forests and other related preindustrial era ecosystem management practices. To identify values and evaluate social representations, we used semi-structured interviews (see **Section 3.3**).

### 2.2.2 Community Resilience

We selected six components to analyze community resilience in La Puebla de la Sierra. Each component is defined by different indicators. All components and indicators are described in the following table (**Table 3**).

### 2.2.3 Interview Design

We used semi-structured interview methods to obtain data on local values and social representations, and perceptions of vulnerability. Interviews were conducted in two phases, because of the COVID-19 pandemic. Between July and October 2020, 30 interviews were conducted in person, and in the second phase, interviews were conducted by phone or in person between November and December 2020 to clarify issues related to perceptions of vulnerability with 10 of the first phase interviewees.

We used an inductive approach with a constructivist sampling method. The selection of respondents was conducted gradually. First, all neighbors interested in tree pruning in the "*dehesa*" were contacted. After interviews with these people, a very small group, they were asked to inform about other people interested in restoring this activity. These people were interviewed and asked for indications from other people who were also familiar with recent tree pruning history in the locality. The interviews were conducted identifying people in fortuitous encounters in the town and once contacts were established by phone. Sometimes, it was necessary to carry out a follow up interview or consultation. In some cases, the respondents did not provide data for a new contact. We followed this approach until we reached saturation, that is to say that we did not get any newer information (Denzin and Lincol 2005). Moreover, we can affirm that almost all the people interested in the maintenance of the activity were interviewed. The first phase of the interviews focused on values and social representation (questions 1 to 7, **Table 4**) and the second phase focused on vulnerability and projection in future (questions 8 to 10, **Table 4**).

Semi-structured interviews were based on a script, in order to assess different aspects of the local landscapes, and especially values and perceptions regarding "trasmochos" oak forests located in the vicinity of the Puebla de la Sierra community. During the interviews, respondents were asked to assign a numerical value to their answers using a closed Likert scale (quantitative data) followed by a reasoned explanation (qualitative data). Moreover, we asked the participants to specify some personal data at the beginning of the interview such as gender, age, professional activity, house location and education level. All questions in the interviews are detailed in **Table 4**.

[1]The Apisquillos Cooperative has maintained an interesting relationship with the authorities in recent years to develop transhumance activities, especially in the framework of a partnership in the European Project LIFE Cañadas, and with the collaboration with the shepherds' school.

**TABLE 1 |** Description of the three types of values in social-ecological studies (inspired by Jones et al., 2016).

| Value category | Definitions | Examples of values associated |
|---|---|---|
| Assigned values (context-specific values) | "Expressed relative importance or worth of an object to an individual or group in a given context". Better to predict behavior in natural resource management planning Seymour et al. (2012). | Aesthetic; Dominionistic; Scientific; Utilitarian... |
| Held values (generic values) | Represent an ideal of what is desirable "principles or ideas that are important to people" Schwartz (1992), Lockwood (1999). | Security; conformity; power; symbolic... |
| Relational values | It is the link between held values and assigned values. They are not substitutable and rooted in human-nature interactions. They are "preferences, principles and virtues associated with relationships, both interpersonal and as articulated by policies and social norms" Dos Santos and Gould (2018). | Connectedness; care; community; kindship; identity; responsibility; stewardship; ... |

### 2.2.4 Data Analysis

The analysis of the interviews was based on stakeholders' responses as transcribed and interpreted by the researchers in accordance with interpretive social science research methods (Gomm et al., 2000; Paillé 2011; Isaac 2015). We used traditional personal transcription of recording or writing interviews without any software or specific discourse analysis tool. All transcriptions have been sorted in two tables in Excel. One with the quantitative data (the answer with the Likert scale) and one with the qualitative data (the open ended question and the nuanced answers of interviewees to other questions). The analysis was made with the "transversal reading" technique. This technique consists of highlighting occurrences and dissonances in discourses, to frame main tendencies (Frisch 1999; Denzin and Lincol 2005; Creswell 2012).

To quantify indicators and evaluate community resilience, we developed methods based on the "adaptive wheel" (Gupta et al., 2010) and "adaptive capacity assessment" (Sansilvestri et al., 2020). As it is described in **Table 5**, we attributed an indicator's score according to the stakeholders' responses: +1 for a potential positive effect on resilience and +2 for a potential highly positive effect, and a score of −1 for a potential negative effect and −2 for a potential highly negative effect. If the indicator had no potential effect or was irrelevant to the forest CHANS, we attributed a score of 0. The evaluation of indicators is based on the structured interview content.

For our analysis, we took into consideration confirmation bias when interpreting information collected in the field. Interviewees can often over-rate answers that agree with their own point of view or past experiences when attributing a score. To minimize bias, we set up several methodological controls. First, we used several questions to assess one indicator, meaning that the answer of one question could serve for the assessment of different indicators. Secondly, we introduced independent scoring so as to cross-validate responses. Indicators were scored blindly by all authors. After a round of parallel scoring, the lead author evaluated discrepancies between both scores if present and provided a compromise score if necessary. The score of each component resulted from the sum of all relevant indicators and can vary from one component to the other.

# 3 RESULTS

## 3.1 Analysis of Raw Data

We interviewed 30 subjects. The respondent profile corresponds to people working in the primary sector in the region (52.63%), who live in town (75%), aged between 26 and 44 years, and mostly with professional or university studies. It was possible to interview a prominent person in the town due to his age and good memory (94 years old). In most cases the interviewees are neo-rural member of the community meaning that they have only recently settled in the town (see details in **Table 6**).

## 3.2 "The Natural Heritage"

For the interviewees, the natural heritage of Puebla de la Sierra is perceived as being more valuable (55% of answers), slightly more valuable (20%) or equally valuable (25%) as compared to other towns in the community of Madrid (see **Figure 1**).

### 3.2.1 Perception of Natural Heritage (Question 1)

The natural heritage perception is mainly driven by the ecological value ascribed to oak forests (no other natural components), and especially to the scarcity of this forest type in the MAC "There are few areas/towns with such valuable heritage" (Neo-rural residents in Puebla de la Sierra between 26 and 44 years old). Most interviewees insisted on the need to preserve the oak forest of Puebla de la Sierra from industrial uses such as logging and urban sprawl. For them, the isolation of the town gives the site exceptional characteristics. Moreover, the natural heritage is highly associated with past, traditional practices and culture "The communal uses and customs for centuries gave rise to a territory with a stable and productive cultural landscape" (Longtime resident in Puebla de la Sierra between 45 and 65 years old).

### 3.2.2 Perception About Oaks and Woodlands (Question 2–4)

Questions 2 and 4 assess knowledge and perceptions about oaks while question 3 focuses on the woodlands around La Puebla de la Sierra. For question 2, 74% of the respondents stated that they knew of "the existence and location of the large and old oak trees that are distributed throughout the municipality" (Regular stays without ancestors in Puebla de la Sierra between 45 and 65 years old). In some cases, interviewees had difficulty understanding the

**TABLE 2 |** Definition of specific values (Kellert 2008; Dos Santos and Gould 2018).

| Nature relation values | Definitions |
|---|---|
| Aesthetic | Appreciation of the physical appeal and beauty of nature |
| Dominionistic | Mastery, physical control, dominance of nature |
| Ecologistic- scientific | Appreciation of structure, function, and relationship in nature |
| Humanistic | String emotional attachment and "love" for aspects of nature |
| Moralistic | Ethical concern for nature |
| Naturalistic | Enjoyment of immersion in nature |
| Negativistic | Fear, aversion, alienation from nature |
| Spiritual | Feelings of transcendence; reverence for nature |
| Symbolic | Inspiration from nature in language and thought |
| Utilitarian | Benefits from the practical use and material exploitation of nature |
| Connectedness | Feeling as part of nature |
| Care | Doing something to take care |
| Community | Perception that nature contribute to human community |
| Identity | Feeling/view of nature = who you are/who your community is |
| Kindship | Ecosystems are like family |
| Responsibility | Feeling that you have the moral responsibility of your environment |
| Stewardship | Willing to drive your environment, to help it in hard situation |

concept of *trasmocho* oaks. Fuzzy expressions about oaks and their management techniques abounded. The information about oak management has been transmitted mainly through "word of mouth" because oaks have become a symbol of Puebla de la Sierra "I have known it thanks to the comments of the residents of La Puebla" (Tourist between 26 and 44 years old). "These oaks are one of the unique characteristics of the landscape of La Puebla" (Regular stays with ancestors in Puebla de la Sierra between 45 and 65 years old). Oaks are mainly perceived as an identity symbol and are valued for their own sake rather than for their utilitarian or ecological value. Local people have therefore developed symbolic and identity relational values with *trasmocho* oak forests. The community's identity is inextricably linked with *trasmocho* oaks, which creates a strong bond between local peoples and woodlands. Even tourist interviewees mostly identified Puebla de la Sierra with its oaks.

**Figure 2** shows the perception of oaks' and woodlands by local people. Oak trees are generally considered to be in poor condition. Woodlands are better valued. For 34.5% the present condition of the surrounding woodlands is good or very good, while only 11% described the present conditions of oaks as being good or very good. Many interviewees insisted on the fact that oaks are very old "centenarians" (Neo-rural resident between 26 and 44 years old). Here, oak' age is not associated to the resilience capacity of the natural system or the functional or utilitarian value of forests. Oaks seem to be perceived as local monuments or historical sites with an important aesthetic value.

Most people consider that their surrounding natural environment is not being appropriately cared for "The woodlands are dirty; the roads or paths are disappearing" (Regular stays with ancestors in Puebla de la Sierra between 45 and 65 years old). These statements can be interpreted as an anthropocentric vision of nature. It also articulates the existence of a dominionistic value of nature. "Mountains are in good conditions where they have been managed for the use of firewood, and in bad conditions where not, that is, in the most inaccessible areas" (Neo-rural resident between 26 and 44 years old). In the same way, oaks' management conditions are perceived according to their degree of use and the accessibility of plots.

Moreover, the perception of woodlands' is mainly based on fears of wildfires and the re-wilding process. This re-wilding process is perceived negatively. We noted the recurrence of the word "abandoned" in different discourses to describe the natural environment. Current problems associated with woodlands and oaks, are linked to the abandonment of traditional practices. For local populations, abandonment decreases biodiversity and increases wildfire risk. The terms "old" and "abandoned" tend to get confused in the answers as there is no specific consideration of the intrinsic values of old trees such as biodiversity or resilience.

Neo-rural responders are an exception because they highlight the aesthetic value of woodlands in their responses. This perception creates a different anthropocentric vision of oaks, one not based on legacy or uses, but rather on aesthetic landscape values. Elderly people on the other hand hold strong utilitarian values of forest and woodlands resources and perceive unmanaged forest as being "degraded". We noted some disagreement amongst interviewees regarding the definition of "present conditions" and appropriate landscape management to maintain functionality of woodlands. Older community residents tend to define in terms of use-value (e.g., pruned branches may be useful as firewood or grasslands for pasture instead of scrublands). They consider that this management maintain the woodlands' functionality. Neo-rural interviewees, however, tend to include in their definition considerations about "nature and landscape preservation" and conservation of biodiversity (i.e., pruning may be ecologically functional in terms of incrementing tree resilience to heavy snowfalls or wildfires). We believe this nuance emerges from their educational experiences, since neo-rural people are mainly young people who moved from cities and some have a university level of education.

## 3.3 Perceptions of management practices (Questions 5–7)

Most respondents consider agro-silvopastoralism land uses to be very beneficial for the management and conservation of the La Puebla woodlands (**Figure 3**). The traditional management practices of woodlands and oaks such as clearing, browsing, pruning and topping, charcoal, burning, etc., are also considered as really good or good by 68% of the respondents. In contrast, it should be noted that the management carried out by the MAC in the woodlands of La Puebla is valued negatively.

### 3.3.1 Traditional Oak Management and Attitudes Towards Pastoralism

The perception of traditional management can be broken down into two representations. On the one hand, traditional practices

**TABLE 3 |** Community resilience attributes and their definitions.

| Components | Description of component | Indicators | Definition of indicator/Interests for resilience |
|---|---|---|---|
| Local knowledge | The community or group is capable of evaluating and understanding its own vulnerabilities and opportunities: 1. Information and experience acquired that allows facing challenges; 2. Training and education; and 3. Empowerment and collective capacity to act effectively in a technical way | Local practices | The presence of local practices for forestry, agriculture, fire management (. . .) creates a local capacity to act and interest from local people to attached local issues Folke et al. (2005) |
| | | Patrimonial knowledge transmission | The presence of generational transmission between actors with a transfer of local knowledge maintain a sensitization and a heritage through generation Magnan (2014) |
| | | Collective experiments | The collective experiments promote the empowerment of local community. An experiments dynamic allows the acquisition of new knowledge and increases the local learning process. Moreover, the collective characteristic reinforces knowledge transfers Folke et al. (2005), Patel et al. (2017) |
| Community networks | Links that allow people to act collectively, can be described as "social network". The network shares moral and ethical criteria and reciprocal relationships. | Collective engagement | The presence of a collective commitment testifies the existence of a collective strength with thinking, decision-making and actions Aldrich and Meyer (2015) |
| | | Connectedness (density of links) | The social network is defined by links in the community and the nature of these links Ostrom (2009), Patel et al. (2017), Dos Santos and Gould (2018) |
| Mental Outlook | Affective, cognitive and material relationship that people have with the place and the project. Understanding attitudes, feelings and points of views in the face of uncertainty. Assessment of confidence in the future and the ability to act. | Place attachment, emotional attachment, importance given to cultural heritage | A local attachment to landscapes, community, nature from actors increase the involvement and increase their capacity to act Patel et al. (2017), Uehara et al. (2019). |
| | | Perception of risks and pressures | Local actors have a good perception of current and future risks (e.g. they are not climate skeptics, they share ideas of the factors that limit local development. . .). Cox and Hamlen (2015) |
| | | Preparedness (Responsibility assumed in the face of pressure) | Local actors are concerned about the pressure of change; they are aware that a certain power is in their hands. They do not just wait for outside intervention Patel et al. (2017). They represent the ability to act in a crisis. |
| | | Collective social memory | A collective memory on one past event, or linked to common culture or legacy. Some discourses across local actors sounds the same Patel et al. (2017), Ostrom (2009). Collective memory links people for a common involvement/action/vision/goal. |
| | | Acceptance of uncertainty and confidence in the future | In an uncertain world a certain plasticity of though is needed. Actors have to accept uncertainty and the multiple forms for the future. Presence of hope despite past disaster or current crisis. Sign of a good adaptability Patel et al. (2017) |
| Governance and leadership | People, organizations, roles and actions that affect strategies. Governance and leadership determine how communities are able to handle challenges in present and for the future. It compromises 1. Infrastructures and services, 2. Participation and public support at different hierarchy levels; and 3. Trust between the different types of actors at different hierarchy levels. | Relevance of structure | Infrastructures have to respond quickly to local issues (effectiveness, efficiency, capability). The design of structure has to be relevant for the community systems and issues. |
| | | Official and non-official rules | Official norms and non-official rules (accepted by the community) creates a framework for local policy and a way to follow for all actors. This unique reference develops the local trust between actors Olsson et al. (2004), Rifkin (2011) |
| | | Trust | Trust between actors, trust with high hierarchy, trust with politics, trust in strategy... All of these trusts contribute to stronger collaborations and limit the mistrust face to new vision or management Pelling and High (2005) |

(Continued on following page)

**TABLE 3 |** (*Continued*) Community resilience attributes and their definitions.

| Components | Description of component | Indicators | Definition of indicator/Interests for resilience |
|---|---|---|---|
| Communication | Communication understood as "creating common meanings and understandings and creating opportunities for members to articulate needs, points of views, attitudes and projections". | Effective communication | A good communication is based on diversity of mode and content, and the quality of the discourse (even in crisis times). It creates common meanings to respond to common goals Patel et al. (2017), Ostrom (2009) |
| | | Access and sharing of knowledge | Local participation in knowledge diffusion. The local representation of strategy, potential response plays a crucial role in recovery Patel et al. (2017). |
| Materials and financial resources | Planning and ensuring that interventions provide a monetary return, the availability of economic resources to initiate initiatives or cushion adversities. | Infrastructures and attraction for young people | Existence of material capacity and infrastructures for activities development. An attractive sector maintains a dynamic for future generations and increase the sustainability of the community Nelson et al. (2010) |
| | | Independency from extern markets | A local economy which depends mainly from external markets and resources has less control on its local activity development. Some possibility to monetarize local activities have to exist. |
| | | Diversity of financial resources and fiscal system | The immediate availability of financial resources for strategic actions increases the efficiency of implementation process of new activities. A diversity of financial resources spread risks and uncertainty (principle of redundancy). Nelson et al. (2010), Williamson et al. (2012), Olsson et al. (2014) |

**TABLE 4 |** Questions and Likert scale associated of semi-structured interviews conducted in Puebla de la Sierra. During the data analysis, we considered the answers "Equally valuable", "Do not know", "Medium" and "Neutral" as corresponding to the same score, i.e., a neutral score (see **Table 5**).

| ID | Questions | Likert scales associated |
|---|---|---|
| 1 | What is your opinion concerning the natural heritage of the municipality comparing to other municipalities in the valley of Madrid municipality? | More valuable; slightly valuable; equally valuable; slightly less valuable; less valuable |
| 2 | Do you know the existence and the location of large and old oaks that are distributed throughout the municipality? | Know very well; know something; know a little bit; know very little; Do not know |
| 3 | What do you think of the present conditions of woodlands around the municipality? | Very good; good; medium; bad; very bad |
| 4 | What do you think of the present conditions of oaks distributed around the municipality? | Very good; good; medium; bad; very bad |
| 5 | What do you think of pastoralism as production and conservation practices for woodlands of La Puebla? | Very beneficial; somewhat beneficial; neutral; Not beneficial; Pretty bad |
| 6 | What do you think of Madrid Autonomous Community management for woodlands of La Puebla? | Very beneficial; somewhat beneficial; neutral; Not beneficial; Pretty bad |
| 7 | What is your opinion of traditional management of woodlands and oaks forest that was done in the past (e.g. clearing, browsing, pruning, charcoal, burning, etc)? | Very beneficial; somewhat beneficial; neutral; Not beneficial; Pretty bad |
| 8 | Do you feel vulnerable in La Puebla considering threats or risks for the population and/or the environment? What types of threats/risks do you perceive/identify? | Open question |
| 9 | How do you think La Puebla's natural heritage and its economy should be managed in the future? | Open question |
| 10 | For you, what is the capacity of La Puebla community to respond to threats you have mentioned? What kind of actions have been carried out, in the past and in the present, in the face of risks/threats? | Open question |

are considered a legacy from ancestors, that should be preserved by new generations. The "old" and "past" practices are perceived as the best management practices "The elderly know how to do things" (Longtime resident between 45 and 65 years old). They represent a picture of history, where people lived in connection with their environment, which contrasts with current management and contemporary lifestyles "People live more disconnected from nature. And I think this is why some big oaks are falling" (Regular stay with ancestors in Puebla de la Sierra between 66 and 75 years old). This representation of traditional management can be understood as nostalgia of past conditions, life, and practices, and this is especially true for neo-rural respondents.

On the other hand, traditional practices are also linked to what is believed to be a more sustainable path to subsistence "Has proven effective for centuries and has provided for people in these places with scarce resources" (Neo-rural residents between 45 and 65 years old), "A very sustainable way of working and at the same time taking care of the land and its resources" (Neo-rural resident between 45 and 65 years old). Regarding the traditional management of trasmocho

**TABLE 5 |** Framework for community resilience assessment based on the "adaptive wheel" and "adaptive capacity assessment" (inspired from Sansilvestri et al., 2020).

| Scores | | |
|---|---|---|
| +2 | Highly increase the transformation ability | Opportunities |
| +1 | Increase the transformation ability | |
| 0 | Neutral (data non relevant or not sufficient for scoring) | |
| −1 | Decrease the transformation ability | Weaknesses |
| −2 | Highly decrease the transformation ability | |

**TABLE 6 |** Repartition of the interviewee profile.

| General characteristics of profile | Specific characteristics | Number |
|---|---|---|
| Gender | Male | 11 |
| | Female | 11 |
| | Not pronounced | 8 |
| Age | 18–25 | 0 |
| | 26–44 | 14 |
| | 45–65 | 8 |
| | 66–75 | 2 |
| | 75+ | 1 |
| | Not pronounced | 5 |
| Education level | Never go to school | 0 |
| | Primary cycle | 1 |
| | Secondary cycle | 4 |
| | Professional diploma | 2 |
| | Graduate studies | 6 |
| | Not pronounced | 17 |
| Professional activity | Local productive activity in primary sector | 10 |
| | Local public administrative activity | 2 |
| | Other local activity | 1 |
| | Activity outside of La Puebla | 6 |
| | Not pronounced | 11 |
| House location | Longtime residents in La Puebla | 5 |
| | New residents in La Puebla | 13 |
| | Regular stay with ancestors in La Puebla | 2 |
| | Regular stay but no ancestors in La Puebla | 3 |
| | Tourism/occasional visits | 1 |
| | Not pronounced | 6 |

oaks and woodlands, positive evaluations refer to the sustainability dimension of these traditional practices. This outlook can be understood as a mistrust of intensive management practices.

This mindset is explicitly represented in the interest to revive agro-sylvopastoralist practices. There is almost a community consensus regarding agro-sylvopastoralism as the most suitable land use for this area (see **Figure 3**). Yet, this consensus is explained mainly by the perceived value of pastoralism for wildfire prevention and woodland "cleaning": "In the past, the landscape was very clean" (Regular stay with ancestors in Puebla de la Sierra over 75 years old). We note that, the explanations given by the participants regarding traditional management refer mainly to the role of grazing (assimilated to agro-sylvopastoralism in our case), and its removal of biomass which is crucial to "maintain landscape diversity and prevent fires" (Neo-rural resident between 45 and 65 years old). The recurrence of "clean" in interviewees' answer illustrates a dominionistic value of local people with a need to control their environment, especially "from fires". This fear of fire also suggests a kind of negativistic value of nature, nature can bring on disasters that must be protected from.

Traditional values dominate the community of Puebla de la Sierra. Hence, it raises the question about the capacity of local people to adapt to future CHANS changes. The attachment to past visions of oaks forests and traditional practices symbolizes a will to preserve a connection with nature, but it also represents a collective difficulty to imagine the future and how new sustainable connections with the natural environment can be established.

### 3.3.2 Madrid Autonomous Community Forest Governance

Public administration governance is highly criticized by the participants who consider it disconnected from the local community's practices and needs, and is considered an obstacle to local projects and initiatives. For local people, the MAC prioritizes tourism, urbanism and intensive forestry in detriment of traditional rural activities: "concerning the woodlands, Madrid prefers to manage pines than oaks" (New resident between 26 and 44 years old).

This conflict of values is exacerbated by the historical context. The local Forest Conservation Agency, which depends from the Ministry of the Environment, Housing and Agriculture of the MAC, has an instrumental view of nature dominated by utilitarian and aesthetic values. The local population of Puebla de la Sierra, however, ascribe also to a relational view of nature conformed by humanistic, symbolic and identity values. Both visions are irreconcilable. Puebla people totally reject the MAC strategy "There is no management, no criterion, no idea (from the MAC)" (Longtime resident between 45 and 65 years old); and the MAC is perceived to not integrate sufficiently specific local values by applying general guidelines for forests, agriculture, and economic development. Moreover, this value conflict is exacerbated by recent historical events: "Franco's tree planting program the "Repoblación": authoritarian action without consulting the population" (Neo-rural resident between 45 and 65 years old).

**Figure 4** graphically summarizes local relational values according to different stakeholders, as described in the previous sections. In this figure, we can observe four categories of relations between actors and the CHANS of Puebla de la Sierra. In quadrant 1, the local community, comprised of rural and neo-rural social groups, develop their identity and community values through the "*trasmocho*" oaks and the valley. Rural people insist more on the utilitarian value of these natural features, whereas neo-rural people have expectations of a "return to the past" lifestyle, which combines the utilitarian and connectedness values. However, both groups have a common perception that the environment contributes to the reinforcement of community identity.

In quadrant 2, the different "political" actors demonstrate a strong preference for dominionistic and stewardship values. There is a subtle gradient however with Forest Agency, being

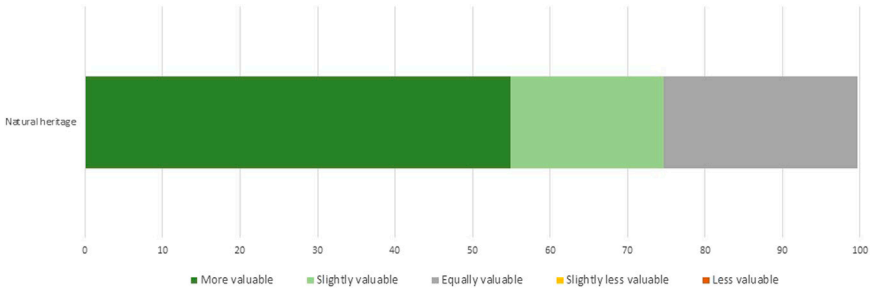


**FIGURE 1 |** Perception of natural heritage of La Puebla de la Sierra compared to other communities in the Man and Biosphere Reserve of La Sierra del Rincon.

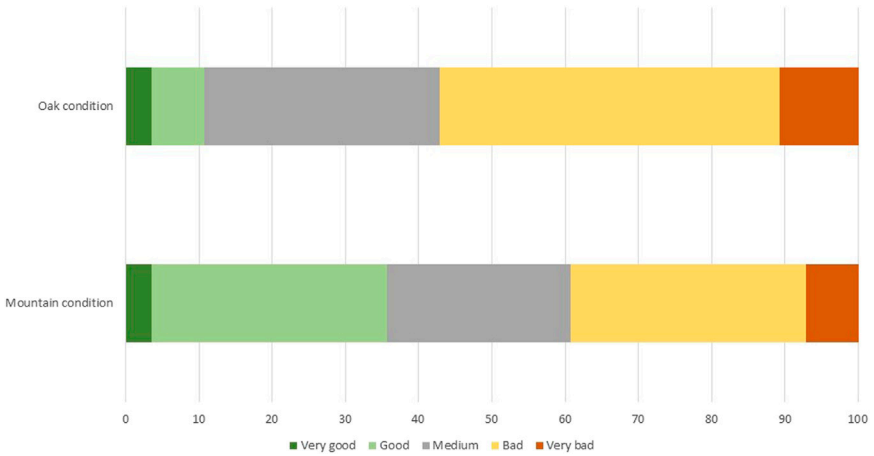


**FIGURE 2 |** Perception of oaks' and mountains' conditions of La Puebla de la Sierra.

more utilitarian, while MAB Reserve authorities prefer a more holistic management plan. The geographic disconnection existing between Puebla de la Sierra and the political decision-makers limits the development of relational values, such as identity. Moreover, the global vision of these authorities is more aligned with urban expectations and visions from nearby Madrid city, which are prioritized by the MAC's Forest Agency, and are out of step with local community needs.

As quadrant 4 shows, "local authorities" demonstrate aesthetic and recreational values. These values are mainly expressed by the management plan to preserve the forest from wildfires and the financial support provided to develop the tourism economic development model they favor.

Finally, the "tourists and visitors" category is at the limit between quadrant 3 and 4. Tourists and visitors are mainly urban city dwellers from Madrid or foreign tourists. Thus they mainly hold aesthetic and recreational expectations from Puebla de la Sierra, because of their lack of a long term endurable connection to the territory. Some tourists may also be looking for spiritual or symbolic connections with nature. However, most tourists do not stay long enough to develop strong relational values with Puebla de la Sierra, and thus, express different expectations towards the environment than its local inhabitants.

## 3.4 Perceptions of Vulnerability and Projection in Future (Questions 8–10)

We analyzed perceptions of vulnerability and the projection in future through answers to the questions 8, 9 and 10. A typology of interviewee answers is presented in **Table 7**. We note that "Abandonment of uses" and "Misguided or poor public management of woodlands and forest" are the most recurrent answers, followed by "Authoritarianism and arbitrariness of decision-makers".

The greatest feeling of vulnerability among those involved in the management of oaks refers, on the one hand, to the loss and abandonment of the traditional uses of the territory and, secondly to a feeling of vulnerability regarding administrative actions that are considered arbitrary and non-participatory: "The decisions that are made about forests do not take into account the local population" (Longtime resident between 45 and 65 years old); "The few people wanting to do things clash with an administration that limits their initiatives without criteria" (Neo-rural resident between 26 and 44 years old).

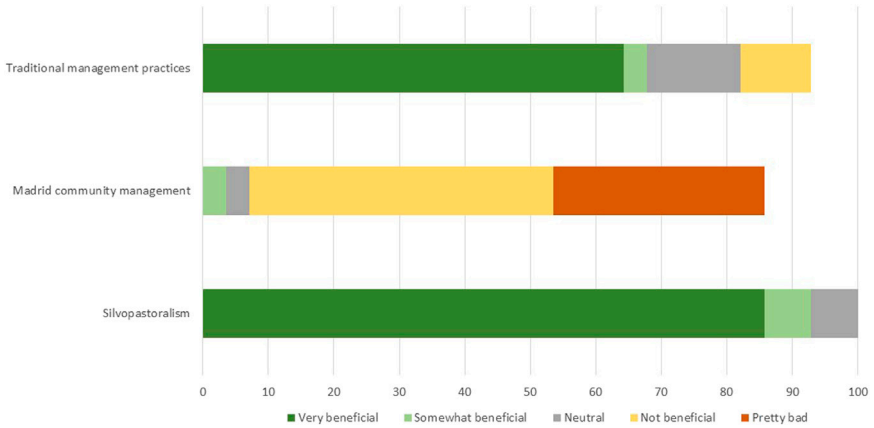


**FIGURE 3 |** Perception of different management practices' impacts on woodlands by local people from La Puebla de la Sierra. Upper graph: Perception of benefit from diverse traditional management practices as clearing, browsing, pruning etc.; Middle graph: Perception of benefit from management practices used by the Madrid Autonomous Community; Lower graph: Perception of benefit from traditional silvopastoralism management.

A second block of responses refers to the conflicting values described in the previous section confronting a local rural way of life based on the primary sector with a decoupled service sector rural economy devoted to the tourism sector. The difficulty in obtaining basic, educational, health and cultural services compounds on the feelings of vulnerability "Tourism and overcrowding, increase in the residential home population. There are conflicts of compatibility with forestry and livestock exploitation" (Neo-rural resident between 26 and 44 years old); "Very isolated, there is no elderly population due to lack of services for their needs" (Neo-rural resident between 45 and 65 years old).

Finally, the loss of productivity of the natural system due to abandonment is perceived as a vulnerability. This abandonment is related to the limitations established by regulations and administrative decision "Only pines and oaks matter. A lot of money invested in making the landscape scenic. More tourists. Environmental, urban and livestock health regulations prevent the agro-ecological model and the small scale operations" (Neo-rural resident between 45 and 65 years old). "Natural disasters such as wildfires" rank only as the fifth vulnerability identified by participants. For local people, the main vulnerability emanates from social and governance threats.

## 3.5 Analysis of Community Resilience

**Figure 5** evaluates community resilience perceptions in Puebla de la Sierra. The mental outlook and local knowledge components received the highest scores. The current mental outlook can be characterized as that of a community that values its heritage and is willing to carry out projects that include the conservation of coupled human-nature interactions.

The high scores obtained for local knowledge are driven by the neo-rural group who find inspiration in traditional pastoral and firewood gathering activities. Neo-rural residents value highly observations and comments made by older residents and value highly traditional lifestyles.

The communication component is weakly highlighted by interviewees who express contradictory views. For example, it is difficult to get the stakeholders to communicate during implementation and decision-making processes, given the geographic distance with Madrid city. Interviewees also point at the conflicts of interest and differences of vision underlying the mentalities of different territorial actors.

The greatest weaknesses pointed out by interviewees are the lack of financial capacity and the hostile governance system, which obtain slightly negative values and are considered the main obstacles to the conservation of the agro-silvopastoral use of the *dehesa*.

# 4 DISCUSSION

The CHANS of Puebla de la Sierra is of enormous cultural and ecological interest and represents an emblematic example of the challenges faced by sustainable development initiatives in Southern Europe, and in particular within MAB Biosphere Reserves, in the context of strong intergenerational cultural transformations. The preservation of this unique CHANS is a highly complex task for local people, considering existing current conflict values and the different visions of potential development strategies for the future between local and government actors. Yet, this open oak forest landscape with grazing and pollarding activities to supply domestic firewood could be an adequate adaptive ecological strategy from an economic and social point of view.

The period represented in the collective memory of the respondents starts with the heyday of rural abandonment between the 60s and 80s of the last century and concludes with the recent attempts by neo-rural residents to adapt to life in the countryside. We analyzed the case as a "real life" experiment of a transition to sustainability (Geels 2005; Grin et al., 2010). Here we consider the chances of such an experiment succeeding considering the strong contrast existing between a big city (Madrid) and a small population administratively dependent on the MAC, as well as the traditional

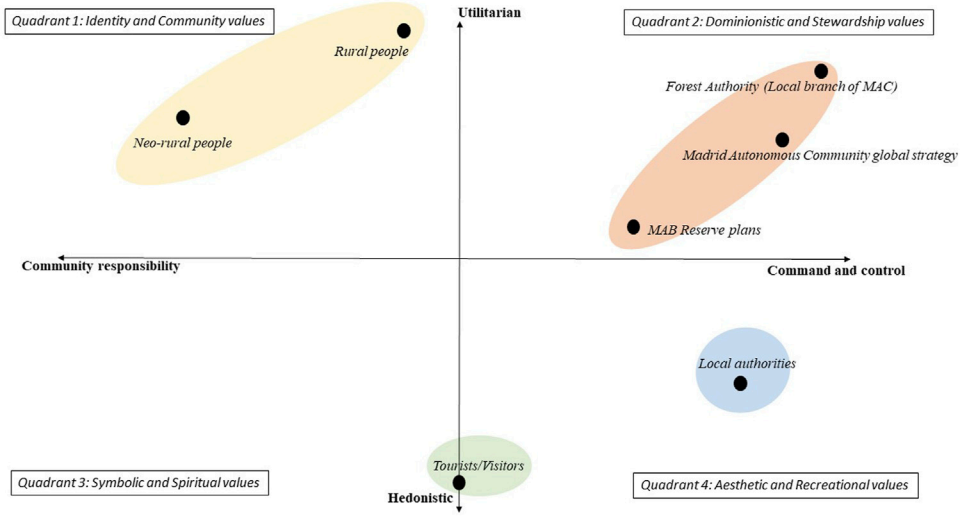


**FIGURE 4 |** Graphic representation of values developed by different stakeholders in the CHANS of La Puebla de la Sierra. Each quadrant rallied several relational values in categories as 1) Identity and Community values; 2) Dominionistic and Stewardship values; 3) Symbolic and Spiritual values; and 4) Aesthetic and Recreational values.

rural world and the neo-rural experiences partly inspired by CHANS models prevailing in the past.

In view of current perceptions on vulnerability by the local population, we argue that the most fragile component of the CHANS of the pollarded oak *dehesa* forest in Puebla de la Sierra is the human community that sustains it through traditional agro-silvopastoral practices. The proximity to the Madrid metropolis, the lack of economic recognition of the contribution of pastoral activities to ecosystem conservation and the effects of speculation on housing and land prices create great difficulties for the persistence of primary sector productive activities in this area. If this process continues, the MAB Reserve will lose its claim of promoting "sustainable development". Likewise, there is a lack of financial capacity that hinders the viability of local community projects. To a great extent, this vulnerability can be attributed to an inadequate targeting of available public resources and disparate criteria in management objectives. In particular, there is a dichotomy in manager perspectives. For some managers, there is a dominant framing of conservation as a return towards a pristine ecosystem (Cronon, 1996). Alternatively, other viewpoints emphasize the role of traditional management as a key factor for biodiversity preservation and ecosystem resilience (Zavala and Oria 1995; Domingo et al., 2020). While the former is justified by a long history of overexploitation of natural resources, which has led to the perception of humans as an inevitable destructive force, there is increasing scientific support on the need to preserve local knowledge as part of conservation global efforts (Fernandez-Llamazares et al., 2021). Hence, some forestry authorities, focus on a stereotypical model of nature conservation that does not seek to understand or empathize with alternative local attempts of land use and ecosystem management such as grazing or the productive pruning of trees. These practices are considered by managers to be outdated though this contradicts recent scientific evidence which consider some of these practices to be effective in the mitigation of "large fire" (>500 has) risks (Audefroy and Cabrera Sanchez, 2017; Nalau et al., 2018).

Abandonment of traditional uses is considered the most important vulnerability for the *dehesa* identified by local people. Policy measures enacted by the MAC reinforce community fears regarding this vulnerability and even reinforce this dominant perception ("Misguided public management" and "Arbitrariness of decision-makers"), by fomenting external economic activities (public forestry prioritizing timber production and tourism) and excluding context-specific issues, such as the procurement of health services, the circular economy, or local food supply. The tertiarization of the economy based on tourism or exurban residential development appears as the only alternative existing for economic development. While pastoralism declines, the public wildfire prevention service has become the main source of local employment making the local community increasingly dependent on external state funds and resources.

The community resilience evaluation developed here highlights that perceived weaknesses and threats are related to the governance of the system, perceived as a conflict between local aspirations and an unreceptive command and control modus operandi from higher levels of government (Cox 2016). The local community of Puebla de la Sierra, defends a way of life that is highly connected to traditional agro-silvopastoral practices and the historical landscape. The pollarded oak *dehesa* forest is as much a part of their cultural identity as the practices associated with its management. In contrast, the Forest Agency focuses on an industrial era conceptualization of economic development based on production for external timber markets and a postindustrial era valuation of ecotourism and recreational uses of the landscape. Shepherds complain about the regional authorities' hostility towards pastoralism, self-defense against wolf attacks and tree pruning and artisanal small-scale production.

A positive factor for community resilience, is that the consulted group has a clear vision of potential future challenges. The community still preserves a remarkable knowledge of the traditional ways and practices that gave rise

**TABLE 7 |** Typology of vulnerability's causes cited during interviews about vulnerability. Total of interviews 18.

| Types of threats or risks cited during the interviews about vulnerability | Occurrences of citations |
|---|---|
| Abandonment of uses | 13 |
| Misguided or poor public management of woodlands and forest | 12 |
| Authority and arbitrariness of decision-makers | 9 |
| Tourism, outsourcing (hunting, tourism, visitors) | 6 |
| Natural damages (fire, densification of forest) | 6 |
| Isolation and lack of services (school, health, culture…) | 5 |
| Loss of collective solidarity and mutual support | 4 |
| Conflict between old and new settlers | 3 |
| Rising lands and houses prices. Access to lands | 2 |
| Unfair payment for production services | 2 |
| Rejection of rural ways of life with different values between settlers | 1 |
| Nature protection figures that limit rural activities | 1 |

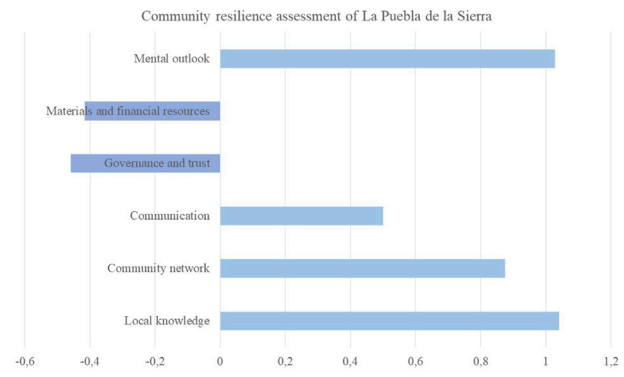


**FIGURE 5 |** Community resilience assessment of La Puebla de la Sierra (Very positive = 2; Positive = 1; Neutral = 0; Negative = −1; Very negative = −2).

to the Puebla de la Sierra CHANS in the preindustrial era, demonstrating synergistic management skills and knowledge of both traditional and modern agro-ecological methods. Likewise, a certain capacity for communication between different community actors can be observed. A promising development is the tele-coupling of local sustainable pastoral production with organized groups of consumers in the city of Madrid who value these products for their proximity and their potential for environmentally and socially responsible consumption.

## 5 CONCLUSION

The goal of this study was to assess local perceptions of community resilience by rendering the psycho-social representations of *trasmocho* oak forests and vulnerability perceptions explicit. The *trasmocho* oak management strategy could be a sound nature-based strategy to restore re-wilded landscapes in Puebla de la Sierra and promote community resilience to future challenges, such as climate change and food security.

The local community of Puebla de la Sierra is strongly connected emotionally to the traditional landscape of pollarded oaks, and to its associated agro-silvopastoral practices as demonstrated by the recurrence of the connectedness, identity and symbolic relational values expressed by local people through their interview responses. Yet, these local values are in conflict with a global vision of landscape management pursued by the Forest Agency and the MAC. These conflicting perceptions have led to a lack of communication and trust, which could threaten CHANS resilience in the long-term. A better understanding of the local relational values in Puebla de la Sierra by the MAC and its Forest Agency, and the MAB Reserve could facilitate building long-term trust between stakeholders and the implementation of vertically integrated strategies reinforcing CHANS resilience. In other words, even if the MAB Reserve defends complex interests and, the Forest Agency and the MAC plans are part of a global state strategy, it is necessary to include local realities and specificities, especially in economic and social terms, so as not to threaten community resilience in Puebla de la Sierra, which is already fragile.

In this study, we highlighted social perceptions of traditional pollarded *trasmocho* oak forest landscapes and related socio-economic and political issues. These psycho-social representations shape both on landscape management and ecological functions, and by extension, the economic livelihood of the local population. A complementary research project is in progress to assess the ecological impacts of traditional management of pollarded oaks on long-term sustainability of the forest system. We plan in the near future to combine this data with our perceptions analysis to develop policy recommendations for the restoration of abandoned CHANS, which represent a crucial, emerging issue in the Mediterranean region.

## DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

## AUTHOR CONTRIBUTIONS

RS, JL, FS, and MZ carried out field works: observations and discussions with local people. JL developed the design of interviews, conducted all interviews, on field and by phone, and analyzed the historical archives. RS transcribed all interviews. RS and JL developed the methodological approach. RS, JL, FS, and MZ analyzed the raw data. RS and JL formatted the results. RS produced the figures and the tables. RS writed the first version of the manuscript. RS, JL, FS, and MZ reviewed several versions of the manuscript according to their expertise: JL = Ecological and environmental expertise, FS = political expertise, MZ = ecological expertise and RS = interdisciplinary expertise. RS edited the final version and proceeded to the submission.

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