

Social reproduction strategies and climate change in communal lands in the Sierra Nevada of Puebla, Mexico

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ABSTRACT

Objectives: To understand the socio-demographics of *ejido* communities in the Sierra Nevada region of Puebla, Mexico, their social reproduction strategies within domestic units, their perception of climate change and its impact, and their interest in training on the subject.

Methodology: A questionnaire was administered to a probabilistic sample of 334 *ejidatarios* from ten *ejidos* in the municipalities of Calpan, Chiautzingo, San Nicolás de los Ranchos, and San Salvador El Verde; 16.2% of the *ejidatarios* in the sample were women and 83.8% were men.

Results: Of the 334 *ejidatarios* in the sample, 70% were between 46 and 75 years old and 97% declared they knew how to read and write. Their social reproduction strategies are agriculture (55.7%), selling labor force (23.7%), housewifery (9.3%), commerce (4.5%), and other activities (6.8%). Such diversification is associated with the impacts of climate change on agricultural production. In terms of land, 71% is owned by the *ejidatarios*, themselves, with 65% having a working area of 1-2 ha. A percentage as high as 89.8% of *ejidatarios* have heard about climate change, with 93.4% indicating personal and domestic unit affectations; 99.4% identified climate transformations, and 88.6% declared interest in training on the subject.

Study implications: Participants in the study showed motivation to learn about five thematic axes of climate change, fostering a commitment to continue producing collaborative knowledge and designing strategies to enhance the adaptation strategies of *ejidos* in the region.

Conclusions: There was consensus among participants on the perception of climate change and its effects. Climate change requires them to strengthen and develop adaptation strategies applicable to reproduction strategies. To do so, they need access to training and participation in the production of collaborative knowledge on the subject in the region.

Keywords: Climatic variability, Pluriactivity, Ejidos, Environmental training.

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INTRODUCTION

Global transformations linked to climate change have been widely recognized. Climate change is a deviation from historical climate patterns at different scales—global, regional, and local—due to natural and human causes, with activities in the agricultural sector being particularly significant. The increase in greenhouse gas emissions (GHG) has led to atmospheric alterations, affecting climate variability over time. Reports on the

impact of climate change on agriculture highlight the need to produce knowledge that aims at promoting adaptation strategies in rural environments. Mexican climate change legislation, the *Ley General de Cambio Climático*—enacted in 2012 and revised in November 2023—outlines its main objectives in Article 2: “... to guarantee the right to a healthy environment and to establish the concurrent jurisdiction of the Federation, federal entities, and municipalities in developing and implementing public policies to adapt to climate change and mitigate greenhouse gas emissions” (DOF 11-15-2023, p. 1).

This legislation emphasizes the shared responsibility of government and society in reducing greenhouse gas emissions and calls for continued research on how rural communities—such as the ejidos or communal lands in the municipalities of the Sierra Nevada region of Puebla, Mexico—perceive and experience climate change in the context of agricultural practices and social reproduction strategies (Batista-Fonseca, 2021). Studying social reproduction strategies helps us understand the everyday practices of social subjects in their environment. The concept, developed by De Oliveira *et al.* (1989) among others, provides a framework to analyze how farmer households adapt to socio-environmental challenges such as climate change and its effects on agricultural practices, as well as structural issues such as the endurance of poverty (Alcazar-Sánchez *et al.*, 2022). Understanding the characteristics of ejidal groups is critical to examining the socio-demographic factors that influence the creation of social reproduction strategies, particularly those aimed at adaptation to and mitigation of climate change.

Social context informs the configuration of reality among social groups. Thus, environmental perceptions are governed by culture and the socio-historical moment in which people live. Everything we think, believe, and build is part of such a construct. Gender, age, and education, among other socio-demographic factors, can influence how groups perceive specific environmental phenomena and their effects (Flores *et al.*, 2014). Hence the importance of understanding these perceptions to develop capacities and actions aimed at adapting to, mitigating, or remediating the causes and effects of climate change.

MATERIAL AND METHODS

This study used a descriptive-interpretive approach, employing quantitative tools to examine the socio-demographic characteristics of a representative sample of *ejido* members, their awareness of climate change, and the impacts they experience. According to Vizcaíno *et al.* (2023), this approach helps identify patterns and trends in data and explore causal relationships or correlations between variables. The data collection instrument was a questionnaire administered to a probabilistic sample defined through simple random sampling and including 334 *ejidatarios*, both men and women, from ten *ejidos*: Analco de Ponciano Arriaga, San Agustín Atzompa, San Andrés Calpan, San Gregorio Aztotoacan, San Lorenzo Chiautzingo, San Mateo Ozolco, San Nicolás de los Ranchos, San Pedro Yancuitlalpan, San Salvador El Verde, San Simón Atzizintla, y Tlatenco, located in the municipalities of Calpan, Chiautzingo, San Nicolás de los Ranchos and San Salvador El Verde.

RESULTS AND DISCUSSION

Participant characteristics

Of the 334 participants surveyed, 16.2% were women and 83.8% were men. Male predominance is due to the traditional allocation of *ejido* landownership to men, which limits access for women. In terms of age distribution, the 56-65-year-old group was the largest, with 86 people (25.7%), followed by the 46-55 group with 76 people (22.8%). The 66-75 group comprised 65 people (19.5%), while the 36-45 age group had 44 individuals (13.2%). At the extremes, 22 *ejidatarios* were aged 24-35 (6.6%), 31 were aged 76-85 (9.3%), and four were between 86 and 95 years old (1.2%). This distribution shows a higher concentration of people in the intermediate age range, in alignment with national trends, where most communal landowners are over 50 years old. Regarding literacy, 96.7% of participants reported being able to read and write, while 3.3% said they could not. As for educational levels, out of 45.5% who shared this information, 23.4% completed elementary school, 10.2% completed secondary school, 1.8% completed high school, 9% completed higher education, and 9.3% had incomplete elementary or secondary schooling.

In terms of marital status, we observed a remarkable diversity: 71.9% indicated they were married, 11.1% were widowed, and 8.4% lived with a partner. Moreover, 6.6% identified themselves as single, 1.2% as divorced, and 0.9% as separated. This variability reflects the heterogeneity of relationships and life experiences in these communities.

As regards the social reproduction strategies reported by *ejidatarios*, a notable 55.7% declared being occupied in agriculture, followed by 23.7% who also work in construction, 4.5% in commerce, and 9.3% in crucial activities such as the domestic and care work entailed in housewifery (9.3%). Another 4.2% performed other tasks, such as external domestic service. These figures show a variety of reproduction strategies in the respondents' domestic units and communities, highlighting the diversity of occupations and ways in which members of the *ejidos* contribute to the workforce (Hernández-Flores, 2021).

The difficulties in meeting basic needs and improving living conditions lead many residents of the region to consider migration. Indeed, 56.9% of participants reported having migrant relatives, while 42.5% denied having migrant family members. This finding underscores the importance of understanding migration dynamics. Migration is exacerbated by climate change (Baca *et al.*, 2022) and has various implications for local communities in the region, including structural issues that impact the endurance of poverty.

Information relative to landowning provided crucial findings on power dynamics, access to resources, and decision-making capacities within domestic units. Landownership impacts access to natural resources, property rights, decision-making, and the economic well-being of individuals and families. Moreover, this data allows us to identify gender, social, and economic inequalities that may exist within communities —point in case, the percentage of women included in the sample (16.2%), a trend confirmed by information in the Censo Nacional Agropecuario (INEGI, 2022), according to which 81% of agricultural producers are men and only 19% are women. Specifically, Puebla is the state with the highest percentage of women in charge of production units (12%). In the present study,

68.6% of the interviewees indicated that the ejidatarios are the landowners, 12.0% indicated that the land is owned by the parents, 3.6% said the land is owned by the children, and 15.9% did not share this information.

The area of land owned provides perspective on the distribution of natural resources in the *ejidos* of the region. To this effect, 41.0% of the respondents possess 1 hectare, 24.0% have 2 hectares, 18.9% have less than 1 hectare, 8.1% have more than 3 hectares, and 7.8% have 3 hectares. These data are crucial to understand how structural features favor the endurance of poverty in the region, prompt limitations in living conditions, and give rise to the diversification and multiplicity of reproduction strategies in the *ejido* domestic units.

Responsibility distribution within the household is also relevant to comprehending family dynamics. In this regard, 32.6% of the interviewees participate in household chores. Said chores are carried out by wives (46.4%), daughters or sons (9.0%), husbands (3.6%), and sisters, daughters or sisters-in-law (3.6%). In addition, 1.2% of participants indicated that household chores are performed by their grandchildren and only 0.3% said that they have the support of a domestic worker. These findings stress the importance of inquiring into the division of domestic labor and its implications in the configuration of gender equality and family well-being, since this type of work falls heavily on women.

Care and domestic work are relevant tasks within the *ejido* domestic units because they allow for workforce reproduction and favor its members' well-being. According to the results, 48.2% of the participants oversee seniors and children care. Moreover, 6.6% provide care to sick people and accompany them in medical care, while 4.5% are in charge of dropping children at school and maintaining communication with the educational institution. On the other hand, 39.2% of participants—mainly made up of men—indicated that they are not involved in any care activities. It is crucial to stress that, in rural areas, care activities are fundamental for the well-being and social reproduction of families. However, the unequal distribution of these tasks and responsibilities reveals gender inequalities, echoing the need to continue working towards a more equitable distribution of work among members of *ejido* domestic units, since work overload among women produces physical and emotional discomfort and limits women's options for development (Ramos-Cela *et al.*, 2021).

Climate change

When asked whether they had heard of climate change, 89.8% of respondents answered affirmatively. Those unaware of the term were aged 56 to 85. This age distribution suggests that older people are less prone to identify the concept, although not the phenomenon, since 98.8% of participants acknowledged changes in weather patterns, which they perceive as series of transformations, alterations, shifts, and modifications in temperature, seasonal patterns, and rainfall patterns. Figure 1 shows the most frequently mentioned trends in the perception of climatic alterations. Mentions to weather and temperature disruptions are numerous, with participants reporting increased heat and extreme weather events (frost, hail, droughts, storms, and wind). In short, respondents mentioned changes in seasonal patterns.

the reality reported by informants, initiatives to understand, prevent, adapt to, and mitigate the effects of climate change are vital. In this context, training and knowledge exchange are necessary to enhance adaptation strategies based on local expertise and academic research with the aim to positively affect the community (Valdanha, 2024). Promoting collaborative processes to produce knowledge and alternative practices, with the participation of various social actors, is also key for addressing this global problem effectively and sustainably. As for training related to climate change, 88.3% of participants claimed to need it, outlining 295 topics of interest. Based on the latter, five main training areas were identified: 1) defining climate change (CC) and its causes; 2) understanding and analyzing the impact of CC, how it affects agriculture, how to address it, and its effects on the field and on everyday life; 3) holding back the problem and establishing measures conducive to reverse it, a topic that leads to identifying and strengthening adaptation and mitigation strategies based on local practices and knowledge; 4) demanding support to facilitate environmental awareness among younger generations, pinpointing what should be taught in schools and at home in the face of extreme phenomena associated to CC; and 5) requesting the exchange of knowledge on sustainable agricultural practices, organic alternatives in food production, efficient use of water, soil improvement, pollution reduction, use of organic fertilizers and pesticides, and conservation agriculture, among others.

CONCLUSIONS

By identifying the socio-demographic characteristics of the studied *ejidos*, as well as their social reproduction strategies and perception of climate change and its impact, we gained insight into the organization of domestic units in the face of the problems associated with this phenomenon and the training interests of *ejidatarios*. We found that agriculture remains their primary reproduction strategy. Nevertheless, adding other strategies that allow for the social and cultural reproduction of their way of life has been increasingly necessary. Selling labor—sometimes through migration—is one of their alternative strategies, although it entails the risk of identity shifts at the local level. Considering the difficulties women face in accessing land and their work overload, we found it crucial to address gender justice. The significance of agriculture requires implementing and strengthening adaptation strategies and even remediating agroecosystems in the face of climatic and socioeconomic factors. There was consensus among participants on the perception of climate change and its impacts. Interest in learning indicated a willingness to adopt new practices and develop alternatives that favor resilience in their communities.

Results underscore the urgency to address climate change through training, collective production of knowledge, and identification of adaptation, mitigation, and restoration strategies for agroecosystems. By identifying the topics of interest and grouping them into five axes, it is now possible to design educational and awareness-raising programs, as well as participatory processes for generating collective knowledge and identifying alternatives, as well as making decisions on specific adaptation and mitigation actions that may contribute to the conservation of agroecosystems through sustainable practices. This challenge, which begins on the local level and reaches the global, calls for the intervention of individuals, institutions, and policies alike.

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