Colegio de Postgraduados

Sembrando Vida Program: Analysis of Food Security and Social Organization in Communities of the Central Veracruz Agroecosystem

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ABSTRACT

Objective: To compare the Sembrando Vida Program with respect to food self-sufficiency, adoption of the Milpa Intercalada en Árboles Frutales (MIAF; Intercropped Milpa with Fruit Trees), and social organization across three communities situated along a contrasting altitudinal gradient within the central Veracruz agroecosystem.

Design: The methodology relied on a survey approach using a structured questionnaire. We interviewed 90 registered participants ("sowers") from peasant learning communities in three localities in the state of Veracruz, complemented by semi-structured interviews with 15 sowers.

Results: The Sembrando Vida Program showed 100% recognition and acceptance among formal members. All participants (100%) reported that the program transformed and made more visible gender relations both within the broader community and within the peasant learning community. Participants also reported improvements in household and community-wide economic conditions and food security.

Limitations of the study/Implications: The significance of this study is limited to participants in the Sembrando Vida Program. Nonetheless, it offers a grounded account of current realities and of the program's impacts on the lives of those involved.

Findings/conclusions: The evidence presented supports the program's positive contributions to the transformation and development of rural communities and their principal actors, particularly women. The Sembrando Vida Program is associated with increased women's participation across activities, advances in gender equity, enhanced food security, biodiversity conservation within agroecosystems, improvements in household economies, and strengthened social cohesion, alongside more structured planning and allocation of tasks in both agricultural and domestic spheres.

Keywords: Poverty, agroecosystems, social well-being, reforestation

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INTRODUCTION

Agriculture is a strategic sector for society at large, as it underpins the global food supply and contributes to the development of rural communities. Nevertheless, agriculture faces multiple local and global challenges that constrain rural community development.

These challenges are increasingly complex and include climate change, degradation of natural resources, rural outmigration, and the persistent impoverishment of rural communities. In Mexico, the National Population Council (CONAPO, 2006) estimates that by 2050 the population will increase by 17% relative to the current figure of 129.7 million inhabitants (INEGI, 2024). In response to these dynamics and to pervasive poverty in Mexico, the federal government implemented the Sembrando Vida Program (Programa Sembrando Vida; PSV) in 2019, with the aim of reversing negative trends attributed to neoliberal policies. PSV seeks to promote the social well-being of rights-holders, mitigate environmental degradation, reduce rural poverty, foster and strengthen a sense of belonging to rural life and land, and reinforce food sovereignty. In addition, the program is designed to reduce social vulnerability through food self-sufficiency, employment generation, and the equitable participation of women and men (Secretaría de Bienestar, 2020a). The main pillars of PSV are the Peasant Learning Communities (Comunidades de Aprendizaje Campesino; CAC), Agroforestry Systems (Sistemas Agroforestales; SAF), the Milpa Intercalada en Árboles Frutales (MIAF; Intercropped Milpa with Fruit Trees), agroecological practices, biofactories (biofábricas), and the living pharmacy (farmacia viviente) (DOF, 2020b). In recent years, multiple studies have assessed the impacts of PSV, yielding mixed perspectives within both the scientific and journalistic spheres. The scientific literature identified to date comprises 24 publications one indexed in Scopus and the remainder in SciELO. Overall, these studies report moderate yet encouraging assessments across several indicators, including agroecology, food production, training, and the production and use of bioproducts. The knowledge gap addressed by this study is to examine PSV performance from the perspective of the sowers themselves, using a comparative and territorial approach (altitudinal gradient), and to assess whether program implementation has been able to meet objectives related to food sovereignty, social fabric regeneration, and deforestation. Accordingly, the research question guiding this study was: What is the level of effectiveness of the Sembrando Vida Program in reducing rural poverty, environmental degradation, and in reactivating the local economy, strengthening food sovereignty, and regenerating the social fabric in rural communities along an altitudinal gradient in the central region of Veracruz State, Mexico? Therefore, the aim was to compare the impact of the Sembrando Vida Program (PSV) in terms of food self-sufficiency, adoption of Agroforestry Systems (SAF), and social organization, with particular emphasis on gender inclusion and empowerment, across communities in the central Veracruz agroecosystem situated along an altitudinal gradient.

MATERIALS AND METHODS

This study employed a survey-based approach grounded in a structured questionnaire technique.

Study area. The research was conducted in three localities in the central region of the state of Veracruz, Mexico, situated along an altitudinal gradient: Tetla, in the municipality of Chocamán (1,600 m a.s.l.); Zacamilola and Ameyala, in Zongolica (>2,300 m a.s.l.); and Pachuquilla and Remudadero, in Puente Nacional (400 m a.s.l.). Each municipality was represented by two communities, corresponding to two Peasant Learning

Communities (Comunidades de Aprendizaje Campesino; CAC). These three zones differ in their edaphoclimatic characteristics particularly climate, vegetation, and soils (Figure 1). The Zongolica region is characterized by coniferous vegetation, a cold climate, and

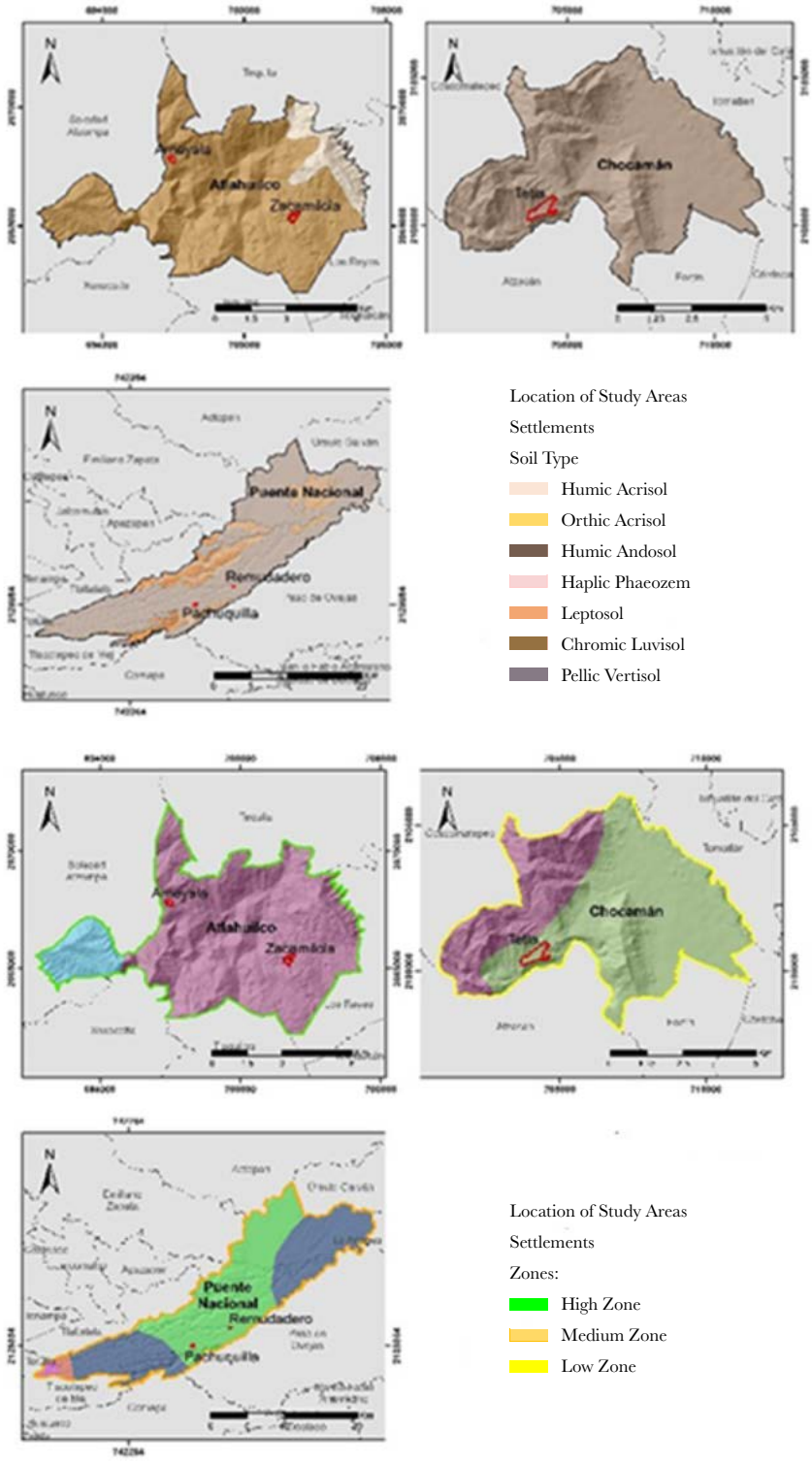


Figure 1. Location of the study areas. Authors' own elaboration based on CONABIO 2024.

Chromic Luvisol soils; Chocamán by a temperate climate, cloud forest vegetation, and Humic Andosol soils; and Puente Nacional by tropical dry forest (selva baja caducifolia), a subhumid tropical climate, and alluvial soils.

Communities were selected purposively, using the criterion of contrasting the program along an altitudinal gradient in order to capture the cultural diversity and the range of productive systems in the central region of Veracruz. This design enabled the assessment of program management under differing biophysical constraints, ensuring that the data reflected disparities in PSV implementation across contrasting contexts.

Type of study. This was a comparative study across three communities, conducted from January to August 2023. Data collection followed a mixed-methods approach that integrated: (1) administration of a structured survey to 90 program participants ("sowers") belonging to the selected communities; and (2) semi-structured interviews with an additional 30 beneficiaries, selecting five key informants from each Peasant Learning Community (Comunidades de Aprendizaje Campesino; CAC). This methodological design enabled triangulation of information and ensured direct interaction with 100% of registered rights-holders in the study communities, thereby achieving full representativeness of the target population. The structured questionnaire was expected to standardize responses from the 90 sowers and provide a robust statistical basis for identifying general trends.

Semi-structured interviews were used to explore the underlying "why" of the observed patterns, allowing the 30 interviewees to articulate the particularities of their local contexts. By integrating both data sources, internal validation was achieved by contrasting and corroborating the survey's quantitative evidence with qualitative insights.

The questionnaire underwent a content-validation process through expert judgment by specialists in rural development and agroecology, who assessed the relevance and clarity of each item in relation to the study objectives. Subsequently, a pilot study was conducted with 10% of the sample in a community with characteristics analogous to the study area. This procedure enabled refinement of technical terminology and ensured comprehension of the different items. Finally, instrument reliability was assessed using Cronbach's alpha coefficient, yielding a value above 0.80, which indicates strong internal consistency and suitability for data collection. The unit of analysis consisted of PSV beneficiary sowers, selected according to inclusion criteria requiring a minimum of three years of participation in the program and active implementation of the MIAF and SAF systems. The data collection instrument was a structured questionnaire comprising seven components: (1) sociodemographic profile, (2) farming system, (3) agricultural practices, (4) local economy, (5) environmental degradation, (6) food security, and (7) social fabric.

After data entry in Microsoft Excel, descriptive statistics were applied along with the chi-square (χ^2) test of independence. The latter was justified by the categorical nature of the data and was used to determine whether there was a statistically significant association between the altitudinal gradient and respondents' perceptions regarding the program's effectiveness in reducing poverty, strengthening food security, promoting gender empowerment, and regenerating the social fabric.

RESULTS AND DISCUSSION

Rights-holders in Zongolica belong to Indigenous Nahuatl-speaking peoples and originate from rural communities with a predominantly agricultural vocation and high crop-species diversity. This setting differs from the other two study communities in the majority participation of women, the prevalence of Nahuatl as the primary language, and distinct economic, environmental, social, and cultural conditions (including practices, values, and beliefs). This pattern is consistent with the Economic Commission for Latin America and the Caribbean (ECLAC/CEPAL, 2021), which reports that more than 58 million people in Latin America and the Caribbean identify as Indigenous, and that a substantial share of this population experiences exclusion due to political, economic, social, environmental, health, and sanitary inequalities (ECLAC/CEPAL, 2021). In contrast, Spanish is the only language spoken in the other two communities (Table 1).

Characterization and perceptions of rights-holders

The operational structure of the Sembrando Vida Program (Programa Sembrando Vida; PSV) in central Veracruz is anchored in the Peasant Learning Communities (Comunidades de Aprendizaje Campesino; CAC) across three contrasting regions: Zacamilola and Ameyala (Sierra de Zongolica), Tetla 1 and Tetla 2 (Chocamán), and Remudadero and Pachuquilla (Puente Nacional). The demographic analysis revealed a population with extensive experiential knowledge, with mean ages ranging from 51.4 (SD=6.9) to 59.4 (SD=4.8) years. This maturity is perceived as a programmatic strength, as it facilitates the consolidation of agroecological practices grounded in traditional knowledge. In this regard, accumulated experience among older producers has been documented as a key determinant of agroecosystem resilience and the conservation of agrobiodiversity (Altieri & Nicholls, 2017). These means fall within the economically active age range (Vásquez, 2012).

Regarding educational background, primary schooling predominates (63%-70%, depending on the region), a trend that remains consistent along the altitudinal gradient. Despite this educational profile, perceptions of technical outcomes in nurseries and field

Table 1. Characterization of the study areas.

Study area	Peasant Learning Community (CAC)	Indigenous-language speakers	Main forest species	Main fruit species
Sierra de Zongolica	Zacamilola and Ameyala	100% Nahuatl	Pine*, oak, walnut, ilite, ocote (pine resin)	Avocado*, guava, peach, apple, lime, coffee, Hass avocado
Chocamán	Tetla 1 and Tetla 2	1% Nahuatl	Rosewood cedar, ilite, casuarina, ocote (pine resin), poplar, oak	Macadamia, lime, coffee, orange, banana, chayote
Puente Nacional	Pachuquilla and Remudadero	0.72% Indigenous language	Cedar, oak, mahogany	Guava, lime, fig, pineapple, orange, nanche, sapodilla, soursop, passion fruit

CAC (Peasant Learning Community).

plots are strongly positive, suggesting that the CAC training model has effectively overcome barriers associated with formal education. In addition, sowers report high satisfaction with family integration, perceiving PSV not only as economic support but also as a catalyst for household improvement opportunities.

Finally, perceptions of women's empowerment differ markedly by land tenure. In the Sierra de Zongolica, 86% of female participants are landowners, in contrast to 17% in Chocamán and 35% in Puente Nacional. Across all regions, women's participation substantially exceeds the national average of 15% (SADER, 2019), indicating that program implementation in Veracruz is achieving gender inclusion above federal benchmarks, particularly in higher-altitude areas.

The implementation of the Sembrando Vida Program (Programa Sembrando Vida; PSV) in central Veracruz exhibits a high degree of consolidation and continuity. In the Sierra de Zongolica, all rights-holders (100%) joined during the foundational cycle (2019), whereas early enrollment reached 93% in Chocamán and 97% in Puente Nacional. From beneficiaries' perspective, this early incorporation translates into greater perceived technical mastery of Agroforestry Systems (Sistemas Agroforestales; SAF) and the Milpa Intercalada en Árboles Frutales (MIAF; Intercropped Milpa with Fruit Trees), given that most sowers have completed the five-year learning cycle.

This, in turn, enables a more robust agroecological transition compared with those who joined in later stages (2020 and 2021). The association between length of participation and technical mastery aligns with diffusion of innovations theory, whereby accumulated experience reduces uncertainty and facilitates the internalization of complex practices (Rogers, 2003). Likewise, the literature notes that agroforestry systems require extended maturation periods before tangible benefits become evident, reinforcing the perception of success among foundational cohorts (Pinho *et al.*, 2012). With respect to social structure, family stability predominates, with most sowers being married or in common-law unions (94% in Zongolica, 83% in Puente Nacional, and 77% in Chocamán).

These results suggest that rights-holders view PSV as a family life project rather than a purely individual endeavor. This sociodemographic configuration is pivotal for regenerating the social fabric, as conjugal cohesion facilitates task allocation on plots and participation in collective CAC activities. In this context, "bonding" social capital (internal ties) is fundamental in traditional agroecosystems, where the family unit functions as the primary labor force and as emotional support in the face of external risks (Reimer *et al.*,

Table 2. Profile of PSV rights-holders.

Municipality/ Locality	Gender (M/F)	Average schooling (%)	Cultivate coffee, maize, and beans	Mean age (years)
Sierra de Zongolica	30/20	Primary (P)* 70, Secondary (S) 24, Upper secondary (SE) 20	81%	52.6 (SE)
Chocamán	43/5	Primary (P) 63, Secondary (S) 17, Upper secondary (SE) 20	91%	59.4 (SE)
Puente Nacional	47/15	Primary (P) 68, Secondary (S) 20, Upper secondary (SE) 18	86%	51.4 (SE)

Primary education (P), secondary education (S), no formal schooling (SE).

2008). Nevertheless, the diversity of marital status observed in areas such as Chocamán (13% single and 7% widowed) indicates that the program also operates as a social safety net for female and male heads of household who farm independently, adapting to the distinct demographic realities along the altitudinal gradient. This protective function is critical because, in contexts of rural vulnerability, integrating single-parent households into collective learning networks (CAC) mitigates exclusion risks and strengthens community resilience (Mancini, 2013).

Farming systems and agricultural practices

PSV implementation in central Veracruz unfolds across contrasting biophysical settings that shape beneficiaries' technical perceptions. In the Sierra de Zongolica (>2,300 m a.s.l.), sowers perceive steep terrain and limited access not as constraints, but as opportunities for diversification, achieving an exceptional agrobiodiversity of 145 species.

Particularly noteworthy is the strategic perspective reported among women in this region, who have incorporated ornamental plants into their productive systems, linking biodiversity to market niches associated with local festivities thereby constituting a distinctive model of economic management. This mountain-zone diversification is consistent with the argument advanced by Toledo and Barrera-Bassols (2008), who posit that biological complexity in Indigenous agroecosystems is an adaptive response that minimizes climatic and economic risks through the use of multiple ecological niches. At the level of practices, there is unanimous recognition (100%) of the importance of agrobiodiversity for community sustainability.

An attitudinal shift toward agroecology is evident: all rights-holders have adopted the use of bioproducts and biofactories, perceiving these inputs as effective substitutes for chemical agroinputs (used by only 6.6% of the sample). This technological appropriation is reflected in universal recognition of MIAF and SAF as pillars of food sovereignty and the generation of economic surpluses. The reported low dependence on agrochemicals suggests a process of input "de-substitution," whereby technical empowerment enables producers to regain control over the productive process, aligning with the food sovereignty principles articulated by Gliessman (2015).

Chi-square (χ^2) test results confirm that the altitudinal gradient significantly influences the assessment of the program's environmental impacts (Figure 2). Soil conservation and deforestation: In the Sierra de Zongolica, perceptions are strongly positive (91% and 100% "strongly agree," respectively), suggesting that under steep-slope conditions producers assign greater value to PSV conservation techniques as critical tools for ecosystem persistence ($\chi^2=13.54$, $p=0.0011$). Water management and fauna: Puente Nacional (lowland zone) reports the highest satisfaction regarding fauna and water conservation, with 93% expressing strong agreement. In contrast, Chocamán (mid-elevation zone) exhibits more conservative and dispersed perceptions (50%-63% strong agreement), indicating variability in water-related management that may be associated with pronounced soil differences identified in that region ($\chi^2=17.89$, $p=0.0013$).

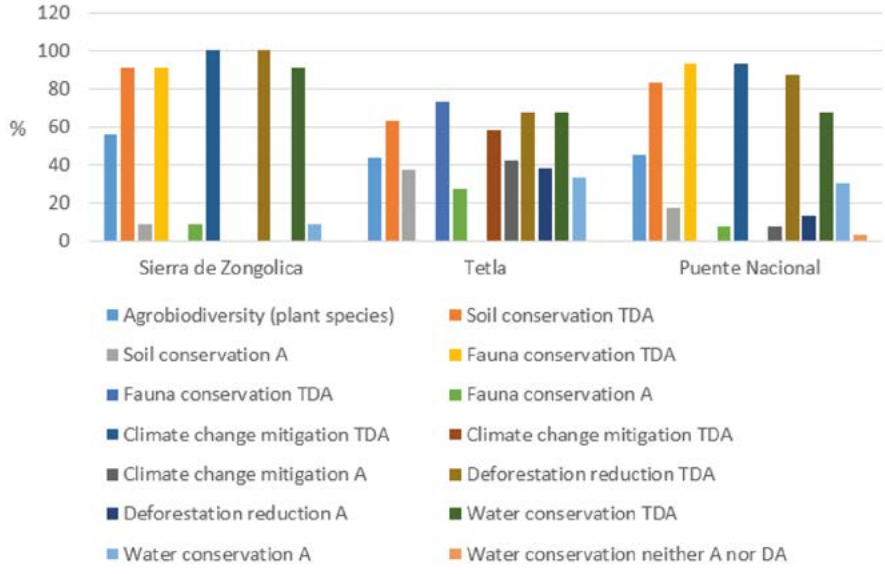
These regional differences underscore the relevance of a "biocultural landscape" approach, wherein perceptions of environmental success depend not only on the

technique applied, but also on the specific vulnerability of each thermal belt (Boege, 2008). Nevertheless, critical authors caution that positive perceptions may be influenced by the program's economic subsidy, which warrants validation through field-based biophysical indicators to confirm whether perceived conservation corresponds to genuine ecological improvement (Giraldo, 2018). Overall, rights-holders' perceptions indicate that PSV has fostered a paradigmatic shift toward the protection of natural resources. However, the statistical variability across CAC demonstrates that the success of agroecological management is not uniform; rather, it is mediated by territorial geography and by the adaptive capacity of productive systems to respond to the specific challenges of each agroecosystem.

Food security

Perceptions of food security under PSV are not homogeneous; rather, they adjust to the logistical and productive realities of each thermal belt. The χ^2 test revealed statistically significant differences across all evaluated dimensions, indicating heterogeneous program management and impacts:

Availability and access: In Puente Nacional (lowland zone), perceptions of increased food availability predominate (57% "strongly agree"; $\chi^2=15.28$, $p=0.0005$), possibly favored by flatter terrain that facilitates the flow of inputs. In contrast, in the Sierra de Zongolica, although the consensus regarding improvement is high (100%), only 47% reported the highest level of agreement, suggesting that difficult physical access continues to filter perceptions of availability. This regional disparity is consistent with Bacon *et al.* (2014), who note that in mountainous areas "hungry months" may persist despite support programs due to precarious transport infrastructure and distance to markets.



TDA (Strongly Agree). A (Agree). ni A ni DA (Neither Agree nor Disagree)

Figure 2. Perceptions of improvements in agricultural practices across PSV agroecosystems.

Utilization and stability: The Sierra de Zongolica stands out in biological utilization of foods (100% agreement), whereas Tetla and Zongolica report greater stability (40% "strongly agree") relative to the lowland zone (χ^2=6.14, p=0.05). Taken together, these findings indicate that, at the local level, PSV addresses the FAO (2016) pillars of food security and aligns with Mexico's reported improvement in the Global Food Security Index (GFSI), which reached 69.1% in 2022. The high valuation of biological utilization in Indigenous settings suggests that productive diversification within agroforestry systems contributes directly to more balanced, higher-quality diets (Altieri & Nicholls, 2017).

Local economy: diversification and interdependence

In terms of economic management, PSV functions as a catalyst for rural investment. All rights-holders (100%) perceive the support not merely as a subsidy, but as investment capital for their plots, housing improvements, and the hiring of day labor, thereby energizing intra-community employment. This economic dynamic is reinforced by a multi-income strategy:

Complementarity: Beneficiaries combine PSV support with other social programs (*e.g.*, 60 y Más, Bienestar para Niños), particularly in Tetla (67%).

Pluriactivity: All sowers (100%) supplement their income through off-farm activities (construction, handicrafts, petty trade), strengthening perceived economic resilience in the face of rural poverty. As Ellis (2000) argues, pluriactivity should not be interpreted as a lack of specialization, but as a rational livelihood strategy that reduces rural household vulnerability to climatic or market shocks.

Regeneration of the social fabric and empowerment

The program has contributed to a revalorization of identity and social capital, albeit with significant regional nuances (χ^2=13.14, p=0.001). In the Sierra de Zongolica, 100% of participants perceive strengthening of cultural and linguistic identity, whereas in Puente Nacional this effect is reported with lower intensity (87%). This suggests that, in higher-altitude and predominantly Indigenous areas, PSV operates as a mechanism of cultural resistance and collective pride. However, authors such as Fox (2016) caution that the effectiveness of such programs depends on organizational structures not being imposed externally, but rather on achieving genuine dialogue with local governance forms:

Perceptions of decision-making also vary: while Zongolica and Puente Nacional report total inclusion (100%), Tetla declines to 87%, indicating opportunities to strengthen participatory management within this CAC. Notably, there is unanimous agreement (100%) on critical indicators that did not require χ^2 analysis due to complete success.

Legitimacy and gender: The program is perceived as an effective tool for narrowing gender gaps, positioning rural women as leaders with tangible access to resources. This form of perceived empowerment is crucial; however, its sustainability depends on accompanying structural shifts in the domestic workload burden (Vásquez, 2012).

Worldview and dialogue: Participants report full respect for ancestral knowledge and intergenerational dialogue, consistent with Secretaría de Bienestar (2020) guidelines on knowledge exchange.

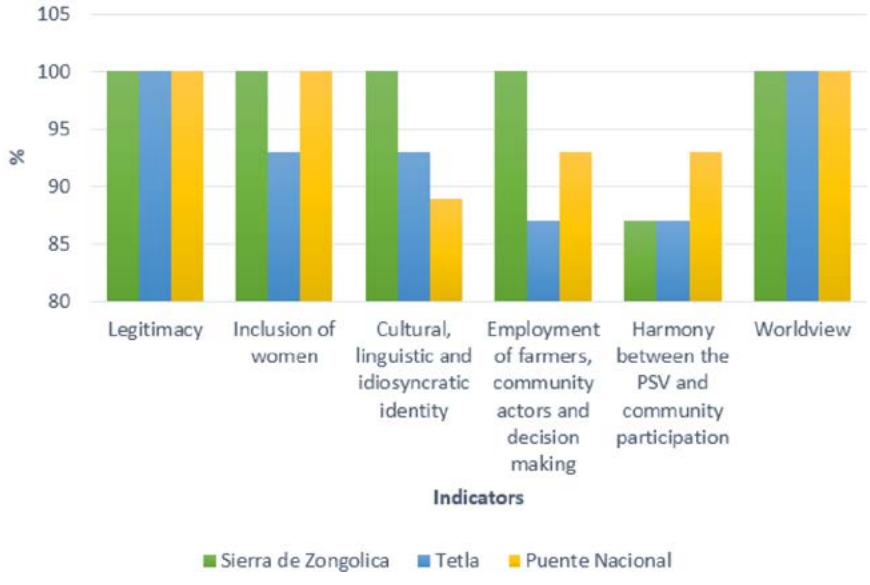
Life planning and empowerment: a unanimous consensus

Perceived structural impacts of the program on individual well-being show absolute consensus (100%) across the three regions. Rights-holders report that PSV has systematized their planning and organizational capacities, translating into tangible improvements in working conditions, housing, and control over productive processes. Given this unanimity, the chi-square (χ^2) test was not applicable for contrasting CACs, underscoring a generalized success in the social and economic recognition of sowers irrespective of geographic location. This "positive homogenization" of perceptions suggests that the program operates as a mechanism for standardizing a minimum threshold of well-being, whereby the security of a fixed income and an organizational structure reduce the uncertainty inherent to peasant livelihoods (Barkin, 2021).

Social capital and cohesion

Sowers perceive CAC management as materializing essential pillars of social cohesion:

Participation and trust: All beneficiaries (100%) recognize full alignment between program organization and community participation. Trust is expressed through unanimous perceptions of women's empowerment: women's active participation across all activities and collective learning within CACs are viewed as key drivers strengthening cooperation and trust across genders. Nonetheless, critical literature cautions that perceived empowerment should be examined alongside care burdens and the "double workday" that women may



PSV (Sembrando Vida Program). CAC (Peasant Learning Community)

Figure 3. Perceptions of improvements in the PSV social fabric.

assume when participating in intensive rural development programs (Herrera Flores, Miguel, 2022).

Identity and decision-making

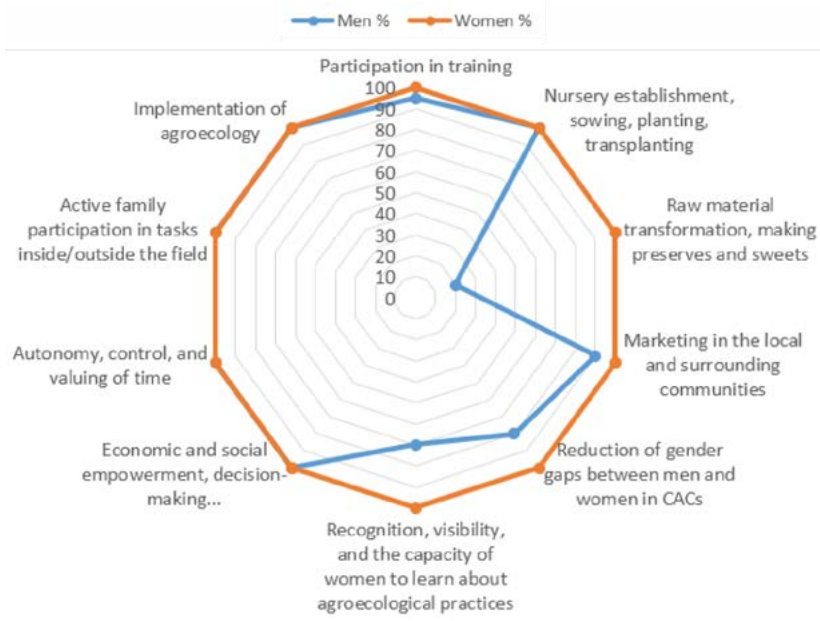
Perceptions of success in community promotion display statistically significant regional nuances ($\chi^2=13.14$, $p=0.001$). In the Sierra de Zongolica, 100% perceive that the program reflects and strengthens cultural identity and local idiosyncrasy, whereas in Puente Nacional this perception decreases to 87%. Similarly, the inclusion of local actors in decision-making is perceived with lower intensity in Tetla (87%) relative to full consensus in the other regions, suggesting that the expression of social capital varies by local context. This variation confirms that social capital is not static; rather, it depends on pre-existing networks and the degree of internal cohesion within each community (Woolcock & Narayan, 2000).

Indigenous inclusion and cultural diversity

The chi-square test revealed an extreme cultural asymmetry in linguistic identity ($\chi^2=285.88$, $p<0.0001$). In the Sierra de Zongolica, 100% of rights-holders are Nahuatl speakers, rigorously meeting the program's Indigenous inclusion criteria. In contrast, mother-tongue speakers are nearly testimonial in Tetla (1%) and Puente Nacional (0.72%). This substantial difference indicates that PSV has adapted to markedly divergent contexts: in the highland zone it functions as a refuge for Nahuatl worldview and language, whereas in mid- and lowland zones it focuses more directly on addressing poverty and inequality through organization and economic empowerment. Across both scenarios, sowers ultimately perceive PSV as a program that facilitates intergenerational dialogue and revalorizes ancestral knowledge, consistent with Secretaría de Bienestar (2020) guidelines, while also contributing to job creation and territorial rootedness. Recognition of linguistic and cultural diversity is a critical component of food sovereignty, since language is the primary vehicle for transmitting agroecological knowledge and conserving native seeds (Guzmán Luna *et al.*, 2022) (Figure 4).

This analysis underscores the importance of considering cultural and linguistic diversity when evaluating program implementation and impacts across regions. Whereas the Sierra de Zongolica is characterized by a high concentration of Nahuatl-speaking Indigenous populations within its Peasant Learning Communities (Comunidades de Aprendizaje Campesino; CAC), Tetla and Puente Nacional exhibit linguistically distinct demographic compositions among participating groups. This heterogeneity may have implications for how program strategies are implemented, the cultural relevance of training processes, and the ways in which the revalorization of ancestral knowledge is addressed.

The comparative assessment of the Sembrando Vida Program (PSV) in central Veracruz indicates that the altitudinal gradient functions as an axis of productive and cultural differentiation, although it does not appear to influence overall perceptions of well-being. In terms of perceptual findings, an absolute consensus emerged regarding improved living conditions and women's empowerment. Nevertheless, perceptions of food security and environmental conservation displayed statistically significant variation: while lowland areas prioritize food availability, highland areas place greater value on soil protection



CACs (Peasant Learning Communities).

Figure 4. Beneficiaries' perceptions of the Sembrando Vida Program (PSV).

and ecosystem stability. This pattern suggests that beneficiaries interpret the program's utility in relation to the most pressing needs of their immediate biophysical environment. Contextual implications are substantial with respect to social capital and identity.

CONCLUSIONS

The study shows that PSV operates under two territorial logics: in the Sierra de Zongolica it consolidates as a space of Nahuatl cultural and linguistic resistance, whereas at lower elevations it manifests primarily as an organizational model fostering economic inclusion and pluriactivity. The adoption of SAF and MIAF systems, together with the transition toward bioinputs, reflects an operational plasticity that enables the convergence of ancestral and technical knowledge, facilitating intra-community job creation and legitimizing rural women in leadership roles. Regarding methodological limitations, the results are confined to the opinions of rights-holders within the selected CACs, providing an internal perspective on program management. Because purposive sampling was employed, extrapolation of findings to the regional level should be approached with caution, particularly given that uncontrolled variables such as fluctuations in local markets may shape long-term food security stability. In addition, while the chi-square test allowed identification of significant associations between altitude and perceptions, the homogeneity of responses for social-fabric indicators constrained the scope for statistical variance analysis in those specific domains.

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