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ORIGINAL

Perceived environmental risk and community attachment in agricultural communities of the Culiacán Valley

Riesgo ambiental percibido y apego a la comunidad en comunidades agrícolas del valle de Culiacán

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ABSTRACT

Agricultural communities in the Culiacán Valley live next to intensively farmed fields, which raises questions about how residents perceive environmental risk and how they relate to their community. Using the preliminary data cut from the pilot survey of project FZ-HAB-0032 on the Factoriza UAS platform, this study described the initial behaviour of a ten-item scale with two dimensions, Environmental concern in the community and Community attachment, among residents of agricultural communities in the Culiacán Valley. With a cross-sectional design, 12 cases out of a target of 100 were analysed while data collection remained open. Descriptive statistics, Cronbach's alpha, McDonald's omega total, an exploratory factor analysis and the Spearman correlation between dimensions were estimated. Internal consistency was moderate for Environmental concern (α = .664; ω = .748) and for Community attachment (α = .665), with omega not interpretable for the latter. Sampling adequacy was very low (KMO = .383) and the two suggested factors did not reproduce the intended dimensions. The correlation between dimensions included zero (ρ = -.342). Residents expressed concern about water and air, identified with their community and took pride in its agricultural work, yet most would move elsewhere if they could. The findings do not yet provide structural validity evidence and suggest distinguishing identity from intention to stay when measuring attachment.

Keywords: environmental risk perception; place attachment; pesticides; agricultural communities

RESUMEN

Las comunidades agrícolas del valle de Culiacán viven junto a campos de cultivo intensivo, lo que plantea preguntas sobre su percepción del riesgo ambiental y su vínculo con la comunidad. Este estudio describió, en el corte preliminar del levantamiento piloto del proyecto FZ-HAB-0032 de Factoriza UAS, el comportamiento inicial de una escala de diez reactivos con dos dimensiones, Preocupación ambiental en la comunidad y Apego a la comunidad, en residentes de comunidades agrícolas del valle de Culiacán. Con diseño transversal, se analizaron 12 casos de una meta de 100, con el levantamiento abierto. Se estimaron descriptivos, alfa de Cronbach, omega total, un análisis factorial exploratorio y la correlación de Spearman entre dimensiones. La consistencia interna fue moderada en Preocupación ambiental (α = .664; ω = .748) y en Apego a la comunidad (α = .665), con omega no interpretable en esta última. La adecuación muestral fue muy baja (KMO = .383) y los dos factores sugeridos no reprodujeron las dimensiones previstas. La correlación entre dimensiones incluyó el cero (ρ = -.342). Los residentes expresaron preocupación por el agua y el aire, se identificaron con su comunidad y se enorgullecieron del trabajo agrícola, pero la mayoría se iría a vivir a otro lugar si pudiera. Los resultados no aportan todavía evidencias de validez estructural y sugieren distinguir entre identidad y permanencia en la medición del apego.

Palabras clave: percepción del riesgo ambiental; apego al lugar; plaguicidas; comunidades agrícolas

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INTRODUCTION

Culiacán Valley is an important agricultural area in northwestern Mexico(Leyva-Morales et al., 2025). Intensive agriculture not only sustains the region's economy but also shapes the territory where families in rural localities live, where housing, schools and play areas may border the fields. Culiacán has been described as an agro-city, in which agricultural activity on the periphery is part of the urban and environmental configuration(Borbolla Gaxiola et al., 2024). In this context, the habitability of agricultural communities depends not only on housing and services but also on the quality of the air, water and immediate surroundings, and on the affective relationship that their inhabitants maintain with the place.

Environmental studies conducted in Sinaloa have documented the presence of pesticides in different compartments. In Culiacán Valley itself, an environmental risk assessment based on application records and on sampling of agricultural soils identified organochlorines, organophosphates and synthetic pyrethroids that represented a high risk for aquatic biota and a low risk for terrestrial biota(Leyva-Morales et al., 2025), and in the central-northern coastal zone of the state, 18 pesticides were identified in water samples, with the maximum concentrations of cypermethrin and chlorpyrifos(Leyva-Morales et al., 2024). These studies describe the physical environment, but not how the people who live next to the fields perceive that risk or how that perception coexists with their attachment to the community.

Research on the social perception of pesticide risk in Latin America shows that this perception is not homogeneous. In a Uruguayan agro-city, two discourses in tension were identified, one that minimized the risks and another, with a health and environmental orientation, focused on diseases and the loss of fauna(Rodríguez et al., 2026). In communities in northern and central Sinaloa, the participants in a study of social perception expressed dissatisfaction with agricultural practices, particularly with the excessive use of pesticides, and reported a wide variety of symptoms associated with exposure(MasiasAmbrízet al., 2023). In the north of the state, most of the farmers surveyed in an irrigation district said they were aware of the risks of inadequate pesticide handling, although the use of protective equipment was inconsistent(Arciniega Galaviz and Fontalvo-Buelvas, 2024).

Community attachment is the other side of the habitability of these localities. People who live in agricultural communities tend to have bonds with the place that are based on family history, work on the land and relationships with their neighbors(Morais and Binotto, 2024). The literature on place attachment has shown that this bond is related to the way in which people face the risks of their environment and to their willingness to remain in it or to relocate(Dang and Weiss, 2021; Qing et al., 2022). However, no instruments were identified that jointly measure environmental concern and community attachment in the agricultural communities of Culiacán Valley.

The FZ-HAB-0032 project of the Factoriza UAS platform set out to study perceived environmental risk and community attachment in agricultural communities of the Culiacán Valley. This article reports the results of the first pilot survey of the Perceived Environmental Risk and Community Attachment Scale, consisting of ten items organized into two dimensions, in a preliminary data cut of small size. Its scope is therefore the initial review of the instrument and not the estimation of population parameters or the measurement of pesticide exposure.

The general objective was to describe the initial behavior of a scale of perceived environmental risk and community attachment in the preliminary data cut of its pilot survey with residents of agricultural communities of the Culiacán Valley. The specific objectives were, first, to describe the distribution of responses to each item; second, to estimate the internal consistency of each dimension using alpha and omega coefficients; third, to explore the internal structure of the items with an exploratory factor analysis, to the extent that sample size allows; and fourth, to explore the relationship between the scores of the two dimensions. The project package does not record hypotheses, so the study has a descriptive and exploratory scope.

DEVELOPMENT

Pesticides, residential exposure and perceived risk

Exposure to pesticides in agricultural communities is not limited to those who apply them. Spray drift, volatilization and contamination of water and soil can reach people who live near the fields. In adolescents from a floriculture area of Ecuador, the distance from the home to the greenhouses was associated with urinary concentrations of some pesticide metabolites, suggesting that certain compounds reached those who lived less than 200 m away(Chronister et al., 2025). In the

Imperial Valley of California, an agricultural region adjoining the border with Mexico, about 62% of the children in a cohort lived less than 400 m from at least one pesticide application, and high exposure was associated with a higher prevalence of wheezing(Ornelas Van Horne et al., 2024).

These findings give substance to families' concern for their children's health. Item R5 of the instrument, "I worry that children play near the crop fields," captures this concern, while R1 and R2 refer to air quality during fumigations and to the quality of the water that reaches the community. R3, "The smells of agricultural products reach my home," describes a sensory signal of the proximity of applications, and R4, "I feel at ease with the environment of my community," worded in the reverse direction, expresses the overall assessment of the environment. After recoding R4, a higher score on the Environmental concern in the community dimension indicates more concern.

Risk perception is not a simple reflection of exposure. In rural areas of the Netherlands with a high concentration of fruit crops, environmental concern, perceived exposure and perceived sensitivity to pesticides were associated with a greater number of self-reported symptoms and with a longer duration of these, whereas living close to the crops was not, in general, associated with the duration of self-reported symptoms or with those recorded by the physician(Gerbeckset al., 2024). The authors concluded that perceptions of the environment should be considered in research on environmental health risks. Measuring environmental concern, therefore, is not equivalent to measuring exposure, but it does capture part of the experience of living next to the fields that physical measurements do not.

The measurement of perceived exposure to pesticides has psychometric precedents in the region. In rural schools of Maule, in Chile,Muñoz-Quezada et al. (2021)evaluated the reliability and validity of a questionnaire on knowledge and perception of exposure to organophosphate pesticides in schoolchildren, and obtained a five-factor structure that distinguished, among other aspects, perception and action regarding exposure at school and at home. That precedent shows that pesticide risk perception can be organized into distinct facets, a possibility worth keeping in mind when examining the structure of the environmental concern dimension of the present instrument.

Community attachment in rural contexts

Place attachment designates the affective bond between people and the places they inhabit. In the literature it has been measured as a single-dimension or multidimensional construct, among which place identity, place dependence, affect and social ties stand out. A systematic review of 66 quantitative studies found that most reported a relationship between place attachment and various behavioral intentions, such as risk coping, land management and civic participation, but also warned that there is no consensus on its measurement and that its dimensions do not behave in the same way(Dang and Weiss, 2021).

In rural contexts, attachment acquires its own features. A review of studies on rural landowners identified six categories of bond with the land: the environment, the community, rootedness, the family and history built in the place, economic return and the rural lifestyle(Morais and Binotto, 2024). The Community attachment dimension of the instrument captures several of these categories: feeling part of the community (R6), the importance of the community in family history (R7), the desire to continue living in it (R8), the willingness to move elsewhere if possible (R9, reverse) and pride in the community's agricultural work (R10). After recoding R9, a higher score indicates more attachment.

The items in this dimension do not address the same aspect of the bond. R6, R7 and R10 refer to belonging, history and pride, that is, to identity with the place, whereas R8 and R9 refer to the intention to stay. The distinction matters, because identification with a place does not guarantee the desire to remain in it. In rural households in seismic areas of Sichuan, place dependence was negatively associated with the intention to relocate, whereas place identity was related to evacuation intention indirectly, through the perceived efficacy of responses (Qing et al., 2022). In another area affected by secondary disasters in the same province, 45.2 % of the residents surveyed expressed a willingness to migrate, and that intention was related not only to environmental risks but also to the comfort of daily life, household income and expectations about the future (Huang et al., 2022).

Environmental risk and attachment: an ambivalent relationship

The relationship between environmental risk perception and community attachment can take opposite directions. On the one hand, the bond with the place can lead people to remain in environments they recognize as risky and to develop forms of coping; on the other, concern for the environment can erode the desire to continue living in the community, especially when the health of children is feared for. The studies reviewed suggest that the direction of this relationship

depends on the dimension of attachment considered and on factors such as perceived efficacy, the comfort of daily life and economic expectations(Huang et al., 2022; Qing et al., 2022).

In agricultural communities, this ambivalence has an additional feature: the source of the perceived risk is also the economic and symbolic basis of the community. Pride in agricultural work, captured by R10, coexists with concern about pesticide spraying, captured by R1. The literature on the social perception of pesticides in Latin America has documented precisely this tension between discourses that minimize risks and those that denounce them(Rodríguez et al., 2026). An instrument that measures both aspects can contribute to understanding how this tension is experienced, provided that its dimensions show adequate psychometric behavior. From a cross-sectional design, any relationship between environmental concern and attachment must be understood as an association and not as a relationship of dependence.

METHODOLOGY

Design

A quantitative, non-experimental, cross-sectional study was carried out with a descriptive and exploratory scope. The data correspond to the survey LEV-0037, "Culiacán valley pilot · Environmental risk and attachment", from the FZ-HAB-0032 project of the Factoriza UAS platform, and to the frozen dataset DST-0035, with a cut-off date of October 9, 2026. The survey constitutes an independent sample and is the only one of the project.

Population, sample and data cut

The population of the survey was defined as persons aged 18 years or older residing in agricultural communities of the Culiacán Valley. The communities were selected by the project lead, so the selection was not probabilistic. According to the Factoriza record, 17 persons opened the questionnaire and 12 completed it; no cases were excluded for quality control, so 12 cases were analyzed (Table 2).

The data cut analyzed is preliminary: it comprises 12 cases out of a target of 100, and the survey remained open, in the field stage, as of the date of the data cut. With 12 cases for 10 items, the ratio is 1.2 cases per item, far from what the methodological literature considers adequate for factor analysis of items, whose first condition is to verify the adequacy of the data and of the sample(Ferrando et al., 2022;Goretzkoet al., 2021).

Instrument

The Perceived Environmental Risk and Community Attachment Scale was administered, consisting of ten items with a five-point response format, from Totally disagree (1) to Totally agree(5), organized into two dimensions of five items each: Environmental concern in the community (R1 to R5) and Community attachment (R6 to R10). Two items are worded in the reverse direction, R4 ("I feel at ease with the environment of my community") and R9 ("If I could, I would move to live elsewhere"), and are recoded in the data matrix. After recoding, a higher score indicates more environmental concern and more community attachment. Table 1 presents the code, the dimension, the text and the direction of each item.

Procedure

Responses were collected through the survey questionnaire managed in Factoriza UAS, which records express online informed consent before the first item and does not collect identifying data. Factoriza froze dataset DST-0035 with a cryptographic fingerprint, generated the matrix with the reverse-scored items recoded, and produced the descriptive statistics, internal consistency and correlation analyses within each dimension (runs RUN-00201 to RUN-00205). The complementary analyses were run with the data file and the item dictionary exported by the platform.

Table 1. Structure of the instrument.

Code	Dimension	Item	Reverse
R1	Environmental concern in the community	I am concerned about the air quality in my community during field fumigations	No
R2	Environmental concern in the community	I am concerned about the quality of the water that reaches my community	No
R3	Environmental concern in the community	The smells of agricultural products reach my home	No
R4	Environmental concern in the community	I feel at ease with the environment of my community	Yes
R5	Environmental concern in the community	I am concerned about children playing near the crop fields	No
R6	Community attachment	I feel part of my community	No
R7	Community attachment	This community is important in my family's history	No
R8	Community attachment	I would like to continue living in this community	No
R9	Community attachment	If I could, I would move to live somewhere else	Yes
R10	Community attachment	I feel proud of the agricultural work of my community	No

Note. Perceived environmental risk and community attachment scale. 5-point response scale (Strongly disagree, Disagree, Neither agree nor disagree, Agree, Strongly agree). Reverse-scored items are already recoded in the delivered matrix. Source: Factoriza UAS, project FZ-HAB-0032, survey LEV-0037, dataset DST-0035.

Data analysis

In a first stage, Factoriza UAS calculated the mean, standard deviation, skewness, kurtosis and response percentages at the extreme values of each item; the internal consistency of each dimension using Cronbach's alpha(Cronbach, 1951), with the corrected item-total correlation and alpha if the item is deleted, and the Pearson correlations between the items of each dimension, with 95% confidence intervals via Fisher's transformation. In a second stage, the program analisis_psicometrico.py, version 1.0, was run in Python 3.13.16(Python Software Foundation, 2026), with NumPy 2.5.3(Harris et al., 2020), SciPy 1.18.1(Virtanen et al., 2020)and pandas 3.0.5. The program applies fixed, declared procedures, with no manual intervention in the calculations.

The program estimated McDonald's omega total(McDonald, 1999/2013)for each dimension from a one-factor model, without reversing items; when any item correlates or loads negatively with respect to the rest of its dimension, the program does not report omega because the coefficient ceases to be interpretable. It also performed an exploratory factor analysis of the ten items on the Pearson correlation matrix, preceded by the global Kaiser-Meyer-Olkin sampling adequacy measure(Kaiser, 1974)and by item(Lorenzo-Seva and Ferrando, 2021)and byBartlett's (1950)test of sphericity. The number of factors was determined by parallel analysis(Horn, 1965)with 100 simulations and seed 2026; extraction was by minimum residual and rotation was oblimin, which allows correlation between factors. Lastly, it estimated the relationship between the mean scores of the dimensions with Spearman's coefficient and its 95% confidence interval, via Fisher's transformation with the standard error of Bonett and Wright (2000).

The reference values for interpreting the psychometric indices are treated as guidelines and not as decision rules(Ferrando et al., 2022). No item was eliminated; the program flags items with insufficient loading, cross-loading, opposite sign or low sampling adequacy, and leaves the decision to the authors. No confirmatory factor analysis was run; this is proposed as future work.

Ethical considerations

Participation was voluntary and anonymous. Factoriza UAS records express informed consent online and does not collect names, email addresses or other identifying data.

Statement on the use of artificial intelligence

During the preparation of this manuscript, the following were used: the Factoriza UAS platform, for data management and for the descriptive statistics, internal consistency and inter-item

correlation analyses; a Python analysis program with fixed and validated procedures, for omega, the exploratory factor analysis and the correlation between dimensions; and the Claude Opus language model (Anthropic), to run that program, for assisted literature search, for drafting a preliminary version and for assembling the document from the results. The authors reviewed, corrected and approved the entire text, verified every reference and assume full responsibility for the content of the article.

RESULTS

Sample composition

Table 2 summarizes the flow of cases. Of the 17 people who opened the questionnaire, 12 completed it and were analyzed, with no exclusions due to quality control. All analyzed cases answered the ten items.

Table 2. Sample composition.

Indicator	Value
People who opened the questionnaire	17
Completed questionnaires	12
Cases excluded due to quality control	0
Cases analyzed	12
Items	10

Note. Survey "Culiacán Valley Pilot · Environmental Risk and Attachment" (LEV-0037); population: persons aged 18 years or older residing in agricultural communities of the Culiacán Valley; territory: Culiacán Valley, Sinaloa, in agricultural communities selected by the project lead. Dataset DST-0035, fingerprint f99da38b33dc94bc. Source: Factoriza UAS. Preliminary data cut: n = 12 of a target of 100, with the survey open.

Descriptive statistics

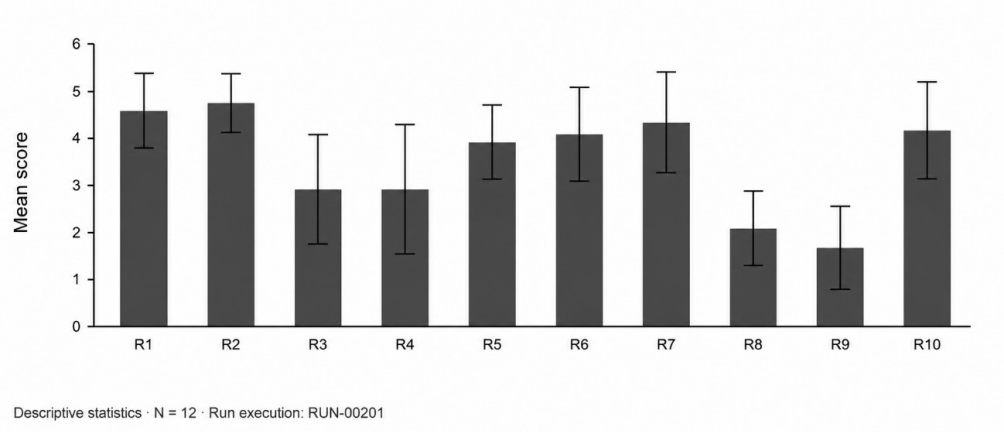
Table 3 and Figure 1 present the descriptive statistics. In Environmental concern in the community, the highest means corresponded to concern about the quality of the water reaching the community (R2: M = 4.75, SD = 0.62), with 83 % of responses at the maximum value, and to concern about air quality during fumigation (R1: M = 4.58, SD = 0.79), with 75 %. R2 showed a highly skewed distribution toward high values (skewness = -2.56) and high kurtosis (6.24). Next came concern about children playing near crop fields (R5: M = 3.92, SD = 0.79). The arrival of odors from agricultural products at the home (R3: M = 2.92, SD = 1.16) and the reverse item R4 in its recoded version (M = 2.92, SD = 1.38) obtained intermediate means and the greatest dispersion in the dimension.

Table 3. Descriptive statistics of the items.

Item	M	SD	Skewness	Kurtosis	Floor	Ceiling
R1	4.58	0.79	-1.64	1.13	17%	75%
R2	4.75	0.62	-2.56	6.24	8%	83%
R3	2.92	1.16	-0.23	0.19	17%	8%
R4	2.92	1.38	-0.32	-1.18	25%	8%
R5	3.92	0.79	0.16	-1.26	33%	25%
R6	4.08	1.00	-0.85	-0.01	8%	42%
R7	4.33	1.07	-1.33	0.43	8%	67%
R8	2.08	0.79	-0.16	-1.26	25%	33%
R9	1.67	0.89	0.80	-1.27	58%	25%
R10	4.17	1.03	-0.39	-2.26	42%	58%

Note. N = 12. Floor and ceiling indicate the percentage of responses at the minimum and maximum values. The item-total correlation column across the ten items is omitted because it combines two dimensions; the item-total correlation by dimension is presented in Table 4. Factoriza UAS run RUN-00201. Preliminary data cut: n = 12 of a target of 100, with the survey open.

Figure 1. Mean scores by item with one-standard-deviation error bars.



Note. N = 12. Scale from 1 to 5; reverse items R4 and R9 are shown recoded. Factoriza UAS run RUN-00201. Preliminary data cut: n = 12 of a target of 100, with the survey open.

In Community attachment, the identity and belonging items obtained high means: the importance of the community in family history (R7: M = 4.33, SD = 1.07), with 67 % of responses at the maximum value, pride in the community's agricultural work (R10: M = 4.17, SD = 1.03) and feeling part of the community (R6: M = 4.08, SD = 1.00). In contrast, the intention to stay items obtained low means: the desire to continue living in the community (R8: M = 2.08, SD = 0.79) and R9 in its recoded version (M = 1.67, SD = 0.89), with 58 % of responses at the minimum value, indicating that most respondents completely agreed that they would move to live elsewhere if they could. Overall, the data cut describes residents who are concerned about the air and water of their community, who identify with it and take pride in its agricultural work, but who, for the most part, would move to live elsewhere if they could.

Internal consistency

Table 4 gathers the item analysis by dimension calculated by Factoriza, and Table 5 presents the coefficients from the supplementary program. Environmental concern in the community obtained α = .664 in both calculations and ω = .748. R5, concern for children, was the item most consistent with the rest (.873), followed by R3 (.509), R2 (.345) and R4 (.319), whereas R1, air quality during fumigations, had the lowest correlation (.254). Removing R4 or R1 would raise alpha to .702 and .674, respectively. Within the dimension, two pairs of items stood out: R1 with R2 (r = .876, 95% CI [.608, .965], p < .001) and R3 with R5 (r = .779, 95% CI [.372, .935], p = .003), whereas the correlations of R1 and R2 with R3 were practically null (r = -.041 and r = -.031).

Table 4. Item analysis by dimension.

Dimension	Item	Corrected item-total r	α if item deleted
Environmental concern in the community	R1	.254	.674
Environmental concern in the community	R2	.345	.648
Environmental concern in the community	R3	.509	.565
Environmental concern in the community	R4	.319	.702
Environmental concern in the community	R5	.873	.434
Community attachment	R6	.632	.505
Community attachment	R7	.653	.485
Community attachment	R8	.273	.670
Community attachment	R9	-.045	.786
Community attachment	R10	.659	.486

Note. N = 12. The corrected item-total correlation excludes the item itself from its dimension total. Cronbach's α for the full dimension, with 5 items each: Environmental concern in the community = .664 (RUN-00202 run); Community attachment = .665 (RUN-00204). Source: Factoriza UAS, Tables 4 and 6 of the package, combined without modifying values. Preliminary data cut: n = 12 of a target of 100, with the survey open.

Community attachment obtained α = .665 in both calculations; omega is not reported because R8 and R9 had the opposite sign to the rest of the dimension in the one-factor model. R10 (.659), R7 (.653) and R6 (.632) were the most consistent items, R8 had a low correlation (.273) and R9 a negative correlation (-.045); removing R9 would raise alpha to .786. The correlations within the dimension outline two groups: R6 with R7 (r = .907, 95% CI [.695, .974], p < .001), R6 with R10 (r = .783, 95% CI [.379, .936], p = .003) and R7 with R10 (r = .768, 95% CI [.347, .931], p = .004), on the one hand, and R8 with R9 (r = .689, 95% CI [.190, .905], p = .013), on the other; the correlations between the two groups were low or negative, and none had an interval that excluded zero. Table 5. Internal consistency by dimension.

Dimension	Items	n	α	ω	Observation
Environmental concern in the community	5	12	.664	.748	
Community attachment	5	12	.665	n/a	Reverse-worded items: R8, R9; ω not interpretable

Note. α = Cronbach's alpha; ω = McDonald's omega total from a one-factor minimum residual model, without reversing items. Complete cases by dimension. Source: own elaboration with analisis_psicometrico.py 1.0 (Python 3.13.16), dataset DST-0035_FZ_HAB_0032. Preliminary data cut: n = 12 of a target of 100, with the survey open.

Internal structure

The data were poorly suited to factor analysis. The overall Kaiser-Meyer-Olkin measure was .383, well below the indicative reference of 0.60 used by the program(Kaiser, 1974), and R2 was the only item whose individual adequacy the program did not flag as low. Bartlett's test of sphericity was significant, $\chi^2(45) = 111.97$, $p < .001$, and parallel analysis suggested two factors (Figure 2), which together explained 74.53 % of the variance (Table 6), with a correlation between factors of .123. With 1.2 cases per item and such low adequacy, this solution is presented solely to document the behavior of the items.

Table 6. Variance explained by the factors.

Factor	Sum of squared loadings	% of variance	Cumulative %
1	3.98	39.76	39.76
2	3.48	34.77	74.53

Note. KMO = .383; Bartlett's test of sphericity: $\chi^2(45) = 111.97$, $p < .001$. Number of factors by parallel analysis: 2. Source: own elaboration with analisis_psicometrico.py 1.0 (Python 3.13.16), dataset DST-0035_FZ_HAB_0032. With a KMO far below the reference value and 1.2 cases per item, the solution is presented only to document the behavior of the items and does not constitute evidence on the dimensionality of the instrument. Preliminary data cut: n = 12 of a target of 100, with the survey open.

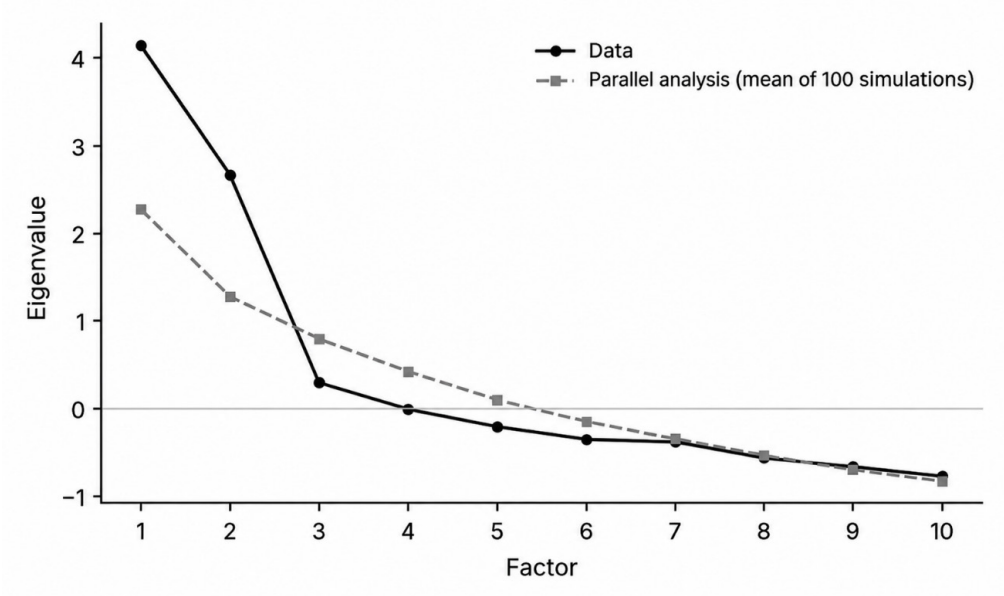
Table 7. Factor loadings of the exploratory factor analysis.

Item	Factor		h^2	MSA	Observation
	1	2			
R1	.845	.379	.937	.398	cross-loading; low MSA
R2	.622	.448	.657	.855	cross-loading
R3	-.313	.722	.564	.237	cross-loading; low MSA
R4	-.529	.565	.525	.401	cross-loading; low MSA
R5	.094	.954	.941	.336	low MSA
R6	.893	-.021	.794	.405	low MSA
R7	.899	-.007	.806	.357	low MSA
R8	.054	-.839	.695	.283	opposite sign; low MSA
R9	-.267	-.780	.731	.456	opposite sign; low MSA
R10	.893	-.245	.804	.402	low MSA

Note. Pattern matrix. Minimum residual extraction and oblimin rotation (γ = 0) on the Pearson correlation matrix; 12 complete cases. h^2 = communality; MSA = measure of sampling adequacy per item. All loadings are shown. Source: own elaboration with analisis_psicometrico.py 1.0 (Python 3.13.16), dataset DST-0035_FZ_HAB_0032. Correlation between the factors of the oblimin rotation = .123. Nine of the ten items show low sampling adequacy. For readability, the dimension column is omitted: R1 to R5 belong to Environmental concern in the community and R6 to R10 to Community attachment. Preliminary data cut: n = 12 of a target of 100, with the survey open.

The pattern matrix (Table 7) did not reproduce the two expected dimensions. The first factor grouped concerns about air and water (R1 = .845; R2 = .622) with the three items on identity and belonging (R6 = .893; R7 = .899; R10 = .893). The second factor grouped concern about children (R5 = .954), odors (R3 = .722) and lack of peace of mind regarding the environment (R4 = .565), with negative loadings for the two intention to stay items (R8 = -.839; R9 = -.780). That is, in this data cut, the people who perceived the most odors and were most concerned about children tended to express less desire to continue living in the community. R1, R2, R3 and R4 showed cross-loadings, and the program flagged all ten items for review by the authors.

Figure 2. Scree plot with parallel analysis.



Note. Eigenvalues of the reduced data matrix versus the mean of 100 simulated matrices of the same size (seed 2026). Source: own elaboration with analisis_psicometrico.py 1.0 (Python 3.13.16), dataset DST-0035_FZ_HAB_0032. Preliminary data cut: n = 12 of a target of 100, with the survey open.

Relationship between the dimensions

Table 8 presents the Spearman correlation between the mean scores of the two dimensions, with 12 cases. The relationship was negative, but its interval included zero, ρ = -.342, 95% CI [-.773, .306], p = .277, so the data cut does not allow asserting an association between environmental concern and community attachment. Since each dimension combines items that, according to the previous analyses, group differently, the correlation between total scores may conceal relationships of opposite sign between their components.

Table 8. Correlations between dimensions.

Pair of dimensions	n	ρ	IC 95 %	p
Environmental concern in the community and Community attachment	12	-.342	[-.773, .306]	.277

Note. Spearman's ρ between the mean scores of each dimension (cases with all items of both). Interval by Fisher transformation with the Bonett and Wright standard error. Cross-sectional design: associations, not effects. Source: own elaboration with analisis_psicometrico.py 1.0 (Python 3.13.16), dataset DST-0035_FZ_HAB_0032. Preliminary data cut: n = 12 of a target of 100, with the survey open.

Discussion of results

The purpose of this study was to describe the initial behavior of a scale of perceived environmental risk and community attachment with residents of agricultural communities in the Culia-

cán Valley. The two dimensions showed similar, moderate internal consistency, but for different reasons. In Environmental concern, omega was higher than alpha, which is consistent with items with unequal loadings; in Community attachment, omega could not be reported because two items behaved in the opposite direction to the rest. With 12 cases, all coefficients are provisional: the simulation literature on alpha and omega coefficients has been developed with much larger samples(Malkewitzet al., 2023), and the factor solution lacks a sufficient basis.

The profile of environmental concern is consistent with the regional evidence. The almost unanimous concern about water and about air during fumigations agrees with the documentation of pesticides in agricultural soils of the Culiacán Valley and in the water of the coastal zone of Sinaloa (Leyva-Morales et al., 2024, 2025) and with the dissatisfaction expressed by inhabitants of Sinaloan communities regarding the excessive use of pesticides (MasiasAmbrízet al., 2023). Concern for children is grounded in studies that document the arrival of pesticides to children and adolescents living near crops(Chronister et al., 2025; Ornelas Van Horne et al., 2024). These coincidences are descriptive in nature: the study did not measure exposure, and risk perception may diverge from it, as the results ofGerbecksetal. (2024)show.

The environmental concern dimension showed two pairs of items that were almost independent of each other: air and water, on the one hand, and odors and children, on the other. One possible reading is that the first pair expresses a general concern, shared by almost all respondents and with little variation, whereas the second depends on the direct experience of living near applications. This reading is compatible with the organization of exposure perception into distinct facets found byMuñoz-Quezada et al. (2021), but it cannot be tested without information on the distance of each household from the fields.

The most striking finding of the data cut is the separation between identity and intention to stay in the attachment dimension. Respondents feel part of their community, recognize it in their family history and take pride in their agricultural work, but most would leave if they could. This pattern is consistent with the warning that the dimensions of place attachment do not behave in the same way(Dang and Weiss, 2021)and with evidence that the intention to relocate is related differently to place dependence and to place identity(Qing et al., 2022). It is also compatible with the observation that the intention to migrate responds, in addition to environmental risk, to the comfort of daily life, income and expectations about the future(Huang et al., 2022), aspects that the instrument does not measure. In psychometric terms, the result suggests that the dimension combines two facets that might require separate scores, and explains why omega was not interpretable.

The two reverse items behaved differently. R4, peace of mind with the environment, maintained a positive correlation with its dimension, whereas R9, willingness to leave, correlated negatively with the rest of community attachment, although coherently with R8, which is worded in the direct direction. Scales with items in both directions require careful reading, because some people respond inconsistently to positive and negative items(Steinmann et al., 2022; García-Batista et al., 2021). However, the fact that R8 and R9 correlate with each other and separate together from the rest suggests that their behavior reflects a difference in content rather than an artifact of wording.

, which groups in the second factor the perception of odors, concern for children and the lack of desire to stay, invites exploration in the final analysis of whether direct experience of risk is associated with the intention to leave the community. The cross-sectional design would not allow establishing the direction of that relationship, and with a sampling adequacy of .383 the current solution is not evidence of it. In addition, the quality of the responses must be reviewed before the final analysis, because in small samples careless or undifferentiated response patterns can notably distort correlations(Ward and Meade, 2023).

CONCLUSIONS

The study met its objective within the scope permitted by a preliminary data cut of 12 cases. The environmental risk perception and community attachment scale of project FZ-HAB-0032 showed in its pilot survey a moderate internal consistency in Environmental concern in the community (α = .664; ω = .748) and in Community attachment (α = .665), although in the latter the omega was not interpretable. The exploratory factor analysis, with very low sampling adequacy, suggested two factors that do not reproduce the intended dimensions. The correlation between the dimensions was negative, with an interval that included zero. The results do not yet provide evidence of structural validity, but they describe residents concerned about the air and water of their community, identified with it and proud of their agricultural work, who nevertheless, for the

most part, would move to live elsewhere if they could.

The limitations are substantial. The sample of 12 cases, against a target of 100, with 1.2 cases per item, makes all statistics unstable and does not offer a sufficient basis for factor analysis; the survey was still open and not all the people who opened the questionnaire completed it. The communities were selected by the project manager, no information is available on the people surveyed, their occupation or the distance of their homes from the fields, and two cases responded almost uniformly at the midpoint of the scale. The study did not measure exposure to pesticides, so its results refer only to perception. The cross-sectional design prevents establishing dependency relationships, and no confirmatory factor analysis was performed.

These results lead to decisions for the authors. The first is to consider whether the community attachment dimension should be split into identity with the community (R6, R7 and R10) and intention to stay (R8 and R9), with additional items for each facet. The second is to review the environmental concern dimension, in which air and water behaved differently from odors and children. The third is to review the cases with uniform responses. The fourth is to verify the recoding of R4 and R9. The fifth is to record occupation, length of residence, distance from the home to the fields and the application period. None of these decisions was made in the present analysis, which retains the ten original items.

As future lines of work, we propose completing the survey up to the target set, repeating the exploratory factor analysis with a sufficient number of cases, and then evaluating the resulting structure by means of confirmatory factor analysis in an independent sample. Incorporating exposure indicators, such as the distance from the home to the crops, would make it possible to relate perception to proximity to applications, and distinguishing between identity and intention to stay would make it possible to examine whether perceived risk is associated with the desire to leave the community. An instrument with documented validity evidence would add the experience of those who live next to the fields to the information that regional studies have provided to improve the regulation of pesticides and reduce the risk of poisoning in rural communities.

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CONFLICT OF INTEREST

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