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Exploring Subjective Well-being of Smallholder Farmers in an Agriculture-Conservation Interface in Costa Rica

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Abstract

Sustainable small-scale production systems are vital for addressing long-standing socio-ecological challenges and for advancing transformative change. Beyond their significant contribution to global food security, these systems may enhance ecological integrity and support the livelihoods of millions. However, critical knowledge gaps remain regarding the determinants of smallholder well-being and its context-specific conceptualizations that can help guide decision-making. Utilizing a mixed-methods approach combining statistical and qualitative analysis, this research helps address these gaps by exploring influencing factors behind subjective well-being (SWB) and its distinct conceptions among smallholders in the Alexander Skutch Biological Corridor (ASBC) in Costa Rica, a microcosm of socioecological tensions common across Latin America. Results indicate that smallholders who perceive higher pro-environmental performance on their farms report significantly higher SWB. Age also emerged as a significant factor in explaining SWB variations. Moreover, ASBC smallholders conceive well-being as primarily related to good overall health, tranquility, and good social relations. Food self-provisioning was the most significant livelihood dimension contributing to smallholder well-being, followed by being in nature and having tranquility. Finally, respondents identified the amelioration of rural extension programs and increased institutional support as key for well-being improvement. This study contributes to a more nuanced understanding of rural well-being, which is essential for the realization of the Sustainable Development Goals (SDGs) and for informing development strategies that increasingly use well-being as a core principle.

Keywords: peasant studies, Costa Rica, happiness, rural geography, socio-ecological systems

Exploration du bien-être subjectif des petits exploitants agricoles dans une zone du Costa-Rica où agriculture et conservation se côtoient

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Résumé

Les systèmes de production durables à petite échelle sont essentiels pour relever les défis socioécologiques de longue date et favoriser une transformation en profondeur. Outre leur contribution significative à la sécurité alimentaire mondiale, ces systèmes peuvent renforcer l'intégrité écologique et soutenir les moyens de subsistance de millions de personnes. Cependant, d'importantes lacunes persistent quant aux déterminants du bien-être des petits exploitants et à leurs conceptualisations contextuelles susceptibles d'éclairer la prise de décision. Cette recherche, s'appuyant sur une approche mixte combinant analyses statistiques et qualitatives, vise à combler ces lacunes en explorant les facteurs influençant le bien-être subjectif (BES) et ses différentes conceptions chez les petits exploitants du corridor biologique Alexander Skutch (CBAS) au Costa Rica, microcosme des tensions socioécologiques courantes en Amérique latine. Les résultats indiquent que les petits exploitants qui estiment une meilleure performance environnementale de leurs exploitations font état d'un BES significativement plus élevé. L'âge s'avère aussi un facteur important pour expliquer les variations du BES. De plus, les petits exploitants agricoles du CBAS conçoivent le bien-être comme étant principalement lié à une bonne santé générale, à la tranquillité et à de bonnes relations sociales. L'autosuffisance alimentaire est le facteur le plus important des moyens de subsistance contribuant au bien-être des petits exploitants, suivi par le contact avec la nature et la tranquillité. Finalement, les répondants ont identifié l'amélioration des programmes de vulgarisation rurale et le renforcement du soutien institutionnel comme des facteurs clés de l'amélioration du bien-être. Cette étude contribue à une compréhension plus nuancée du bien-être rural, ce qui essentiel à la réalisation des objectifs de développement durable (ODD) et à l'élaboration de stratégies de développement qui intègrent de plus en plus le bien-être comme principe fondamental.

Mots-clés : études paysannes, Costa Rica, bonheur, géographie rurale, systèmes socioécologiques

1.0 Introduction

Considering current pressing global sustainability challenges associated with food production, water availability, biodiversity loss, climate change, and environmental pollution, attention has been redirected at smallholder production systems as a potential alternative approach to mitigating these challenges (Arulingam et al., 2022; Nicholls et al., 2020). Given its significant contribution to total world crop production (Ricciardi et al., 2018), the vast number of livelihoods it supports, and its lower ecological footprint compared to intensive systems, smallholder production is recognized as a key strategy for transformative change (IPBES, 2024).

Smallholder systems have been widely studied from geographical and anthropological perspectives, especially in the fields of cultural and political ecology and land systems science (Turner & Robbins, 2008; Zimmerer, 2007). While indeed these and other human-environment fields have contributed to significant advances in the understanding of smallholder systems, there is a need to better comprehend the behavioral and cognitive dimensions of agents in land systems (le Polain de Waroux et al., 2021; Meyfroidt, 2013; Rindfuss et al., 2007). More specifically, there are knowledge gaps regarding how smallholder livelihoods relate to well-being, as part of more multifaceted understandings of sustainability that include well-being as a core component. Exploring the life satisfaction of these producers through such holistic lenses is vital, given both the global prevalence of smallholder systems and their potential to yield significant well-being benefits. This is especially relevant under development paradigms that prioritize qualitative outcomes over traditional quantitative metrics.

Subjective well-being (SWB) is a construct that has been widely used in social science research (Camfield et al., 2009; Cook et al., 2022; Diener et al., 2018) and increasingly in national reporting on development and social progress (OECD, 2013). The OECD, for instance, has prioritized measuring and understanding well-being (including SWB) to improve policies and strategies striving for social progress. The establishment of its Center on Well-being, Inclusion, Sustainability and Equal Opportunity (WISE) is an important step toward that goal. Broadly, SWB is a measure of people's quality of life and life satisfaction as perceived by each individual. In its essence, it seeks to capture how people evaluate and experience their own lives (Diener et al., 1998, 1999), considering affective reactions and "eudaimonic" aspects associated to meaning, engagement, purpose and a flourishing life (OECD, 2013). It is part of the set of components usually associated with overall well-being (Diener et al., 1998). As such, it can significantly complement the use of more objective measures (Camfield et al., 2009; Diener et al., 1998), providing a more holistic and comprehensive understanding.

Because well-being is an individually centered construct, SWB is important because it considers self-perceived evaluations of life satisfaction that transcends materiality to capture more diffuse and intimate components of well-being. This is germane because relying exclusively on objective measures of well-being may miss key aspects when trying to understand life satisfaction and quality of life (Diener et al., 2018). For instance, having similar access to resources and/or material goods does not necessarily translate into similar levels of well-being for two individuals. Thus, as mentioned, SWB can be a helpful complement to more standard measures of quality of life and life satisfaction (OECD, 2013).

More practically, measures of SWB can be key input for assessing the impact of policies or strategies aimed at societal well-being (Diener, 2006; Diener et al., 2018). It can also be useful for a more in-depth understanding of the drivers of well-being in particular contexts (Aslam & Corrado, 2012; OECD, 2013) and for using that information to design more socially-sensitive policies and strategies for promoting societal progress in general and sustainable land management in particular (Santillán-Carvantes et al., 2025). This is especially relevant in Global South countries, where there is a need for more detailed research on SWB (Cox, 2012; Santillán-Carvantes et al., 2025), particularly on how people conceive well-being and what people engage in to pursue it (Camfield et al., 2009). Utilizing a mixed-methods approach, this research addresses these gaps by exploring SWB and its context-specific determinants. Furthermore, it investigates the distinct conceptions of well-being held by smallholders within a socio-ecologically significant biological corridor in Costa Rica.

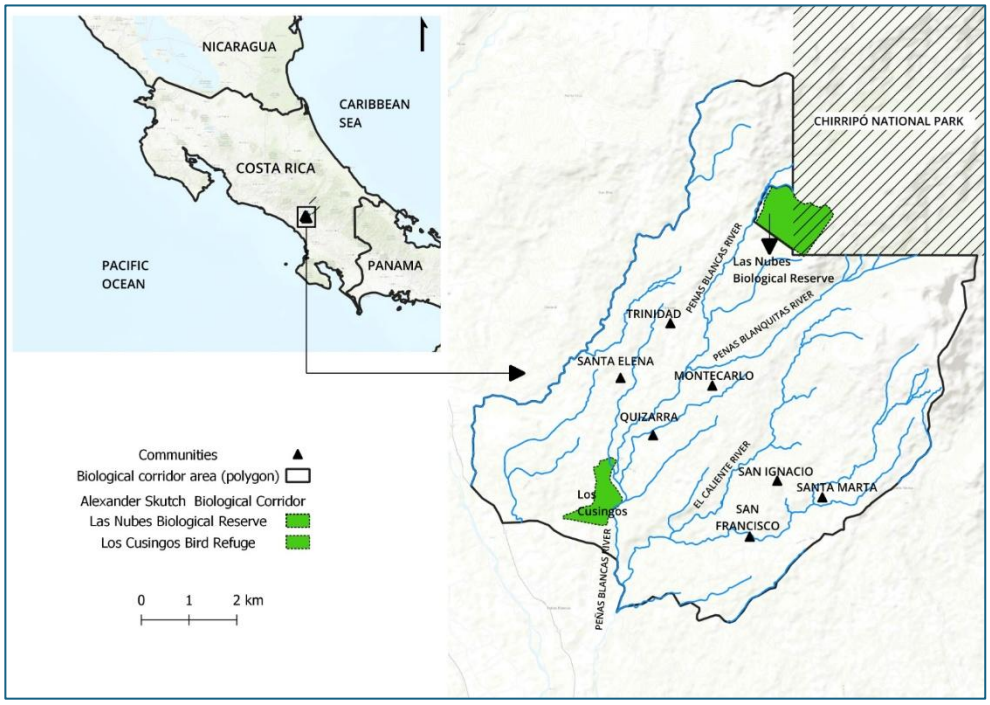
2.0 Methods

2.1 Study Area

Formally established in 2005, the Alexander Skutch Biological Corridor (ASBC) is located in the south-central part of Costa Rica. It extends a little over 6,000 ha and buffers Chirripó National Park, one of the most iconic protected areas in the country (see Figure 1). On a broader scale, the ASBC is situated within the Brunca Region, where significant biological and cultural diversity contrast sharply with socioeconomic vulnerabilities that lag behind national averages (Morales Aguilar & Fernández Montero, 2022). More locally, the ASBC is part of a series of corridors that buffer the southern portion of the country's largest terrestrial protected area: La Amistad International Park. Also, the ASBC connects two private protected areas: the Las Nubes Biological Reserve to the north with Los Cusingos Bird Refuge to the south, mostly through the Peñas Blancas River.

Population in the ASBC is estimated to be around 2,000, although no official number exists. Smallholder systems predominate within the ASBC, albeit interspersed with tourism activities ranging from five-star hotels to small cabins and homestay programs (Espinoza-Cisneros & Montoya-Greenheck, 2024). Smallholder production systems here are family-run land units that rely on coffee and sugar cane as main cash crops, although some focus primarily on cattle husbandry as their main productive activity. As mixed systems, most also include subsistence crops, including banana, plantain, cassava, beans and maize. ASBC smallholders face important challenges, including being "doubly exposed" (O'Brien & Leichenko, 2000) to crop vulnerability due to climate change impacts as well as to economic downturns. Some of these challenges are analyzed and described in Espinoza-Cisneros and Montoya-Greenheck (2024), Martínez and Montoya-Greenheck (2021) and Montoya (2022).

Figure 1. General reference map of the Alexander Skutch Biological Corridor (ASBC).



Source: Author. Data layers facilitated by York University and Costa Rica's National System of Territorial Information (SNIT for its Spanish acronym).

2.2 Survey Design, Sampling and Data Collection

Data for this research was collected through 43 face-to-face surveys applied to smallholders producing within ASBC, between June 2021 and November 2023. This number is estimated to represent at least one quarter of the total smallholder farm units in ASBC based on unofficial, informal estimates[1]. A smallholder was understood here as a land manager running a small-scale, family-operated and diversified land use system producing for both market and subsistence, in either agricultural and/or cattle-raising activities. Either agriculture or cattle raising was a requisite for being considered a smallholder; however, these could be accompanied by other *in situ* production strategies such as beekeeping or tourism-related activities.

Broadly, these surveys captured data on smallholder sociodemographics, land-use practices/strategies, and perceptions regarding ecosystem services and well-being. The instrument included closed-ended items predominantly used for quantitative analysis and open-ended questions used more for qualitative examination. For input on survey design, four interviews with community leaders and local producer group representatives were carried out. Furthermore, 10 pilot surveys were applied to test and improve the survey instrument.

[1] These estimates are based on informal information provided by community leaders and members of producer groups. To the knowledge of the researcher, as of 2023 there were no official registries of total producer farms within the ASBC.

A list of smallholder producers within ASBC was created after consultation with Local Development Associations (LDAs). As state-recognized community groups coordinating and overseeing socioeconomic, environmental and cultural development matters at the local level, LDAs commonly manage detailed information about producers within the community, hence were considered an appropriate source of information. The lists of smallholder producer farms provided by the LDAs were therefore used as the sampling frame. The final sample of smallholders considered in this research was obtained using a combination of probability and nonprobability methods.

Initially, smallholder farms were selected through simple random sampling using the lists provided for each of the ASBC's communities. However, a considerable number of farms initially selected using this sampling method were either difficult to access, had modified their productive nature in some way, or, for various reasons, it was not possible to recruit their land manager. Thus, to obtain an acceptable sample size, when it was not possible to access the randomly selected farm or recruit its land manager, convenience sampling was applied by selecting the closest farm to the initial random point that met the established criteria. This was mostly done for logistical reasons, as it was time- and resource-intensive to move to another randomly selected point in a different area of the corridor. Of the total sample, 60% (25 farms) corresponded to the farms initially randomly selected; the remaining 40% were chosen conveniently after the original randomly selected farm could not be accessed. To partly counteract this issue, stratified sampling was applied, wherein all major communities within the corridor were considered. This prevented the exclusion of small communities or areas with differences. From this stratification, the initial random selection was conducted, matching the proportional size in the sampling frame. While stratification does not reduce sampling bias on average compared with simple random sampling, it does reduce bias on the stratification variable, which in this case corresponds to all communities within the corridor. In total, the sample covered approximately 25% of all smallholders within the corridor.

2.3 Data Processing and Analysis

The SWB variable was statistically tested against three broad categories of independent variables: (1) sociodemographic, (2) farm management and external influences, and (3) perceptions of farm pro-environmental performance. Each of these categories of variables has been empirically related to SWB or was hypothesized to have some relationship with SWB based on insights from previous anthropological studies in the ASBC (Espinoza-Cisneros & Montoya-Greenheck, 2024). The specific variables for each category are listed in Table 1.

To capture SWB, the Cantril scale's "ladder" analogy was used, as it was considered more easily interpretable. In this case, endpoints of the ladder were indicated, with 10 being "*best possible life/full life satisfaction*" and 1 being "*worst possible life/no life satisfaction.*" Also, since Cantril's scale has been more closely correlated with income and social status, it was considered appropriate in this research given that those are relevant socioeconomic factors in the study area (Espinoza-Cisneros & Montoya-Greenheck, 2024). Also, according to a recent study by Nilsson et al. (2024), the Cantril scale may be interpreted with greater emphasis on power and wealth than on broader well-being in certain cases. To circumvent these potential orientations away from overall well-being, open-ended questions were used to better capture smallholders' understanding of well-being.

Table 1. *General Description of Variables Used in the Quantitative Analysis*

Variable category	Variable name and code	Variable type and measurement scale	Variable description and justification
Dependent variable			
Subjective well-being	Subjective well-being (SWB)	Ordinal - Generic rating scale from 1 to 10	The Cantril scale was used to capture a generic measure of SWB. This scale has been widely used in life satisfaction studies and other research on well-being (Calleja & Mason, 2020; OECD, 2013).
Independent variables			
Sociodemographic	Age (AGE)	Continuous	The relationship between age and SWB has long been debated (Hansen & Slagsvold, 2012; López Ulloa et al., 2013), so it was tested in this socio-ecological context.
	Sex (SEX)	Categorical - male/female	Sex is a common variable when assessing subjective well-being; differences in SWB between men and women smallholders can provide key insights for understanding well-being in particular contexts.
	Formal education level (FEDU)	Ordinal – seven choices	Formal education has also been widely related to levels of SWB (Witter et al., 1984), so this relationship was tested in this social-ecological context.
Farm management and external influences	Perceived influence of external factors (PIEF)	Ordinal - Likert scale from 1 to 5	Captures the level to which smallholders perceive their actions depend on external factors rather than their own agency. This variable is akin to the Perceived Behavioral Control (PBC) of the Theory of Planned Behavior (Ajzen, 1985).
	Diversification level (DIVL)	Ordinal - Generic rating scale from 1 to 10	Score reflects the diversity of crops produced and consumed within the smallholder household. It was hypothesized that the greater the diversity of subsistence crops produced, the more SWB.
	External aid (EAID)	Categorical - yes/no	Considers whether the farm receives external aid such as subsidies, government support programs, NGO financial aids, etc. It was hypothesized that smallholders receiving aid would report greater levels of SWB.
	Farm's main productive activity (MPA)	Categorical - agriculture/cattle/other	Broadly records the main productive activity within the smallholder farm. A main activity is the one on which the farm predominantly depends for income. In this sense, it is not necessarily the one that occupies the most land allocation within a productive unit.
Perceptions on farm pro-environmental performance	Perceived farm pro-environmental score (PF-PES)	Ordinal - Generic rating scale from 1 to 10	SWB may be linked to behaviors and associated perceptions of a healthy environment (Qi et al., 2022). This variable captured smallholder self-assigned score on his/her farm's broad pro-environmental performance.
	Perceived farm ecosystem service provision (PF-ESP)	Ordinal - Generic rating scale from 1 to 5	Complementing the previous variable, it captures the self-perceived overall provision of ecosystem services by the farm, including regulating, cultural, and provisioning services, through a quantitative score.

2.3.1 Statistical tests. Quantitative data were processed and analyzed statistically using IBM SPSS v.29. As a first step, One-way ANOVA tests were run to explore statistically significant differences in SWB values among the independent variables. Assumptions for ANOVA tests were met except for some outlier values detected after visual inspection of boxplots (cases #16 and #42) when evaluating SWB against the independent variables. To prevent these extreme values from exerting undue influence on the variance and inflating Type I error rates, a Winsorization procedure was applied. Specifically, these two extreme values were replaced with the next highest non-outlying values in the distribution. This approach preserves the cases within the small sample ($N = 43$) while stabilizing the variance. Following this adjustment, data met normality requirements as assessed by Shapiro-Wilk tests of normality as well as homogeneity of variances, as assessed by Levene's test for equality of variances.

To further determine the interaction effects of the independent variables on SWB in this context, a cumulative odds ordinal logistic regression with proportional odds was conducted. All underlying assumptions for the ordinal logistic framework were satisfactorily met. A likelihood-ratio test determined that the final model statistically significantly predicted the dependent variable over and above the intercept-only model, $\chi^2(11) = 22.913, p = .018$. The model demonstrated a robust overall fit to the empirical data, indicated by non-significant Pearson ($\chi^2(115) = 111.924, p = .564$) and Deviance ($\chi^2(115) = 94.157, p = .923$) goodness-of-fit statistics. Furthermore, the independent variables collectively exhibited strong explanatory power, yielding a Nagelkerke pseudo-R^2 of .442 and a McFadden pseudo-R^2 of .196.

2.3.2 Qualitative data collection, processing and analysis. Qualitative methods are especially prone to assessing SWB, given their capacity to capture the perceptions, experiences, and affective reactions of individuals in greater depth (Camfield et al., 2009). In this research, qualitative data were collected through three open-ended items. The first one asked about the person's broad understanding of what well-being entails. The second item asked for aspects of smallholder production that contributed to well-being, and the third sought to capture factors that can improve smallholder well-being within the ASBC.

All 43 surveyed smallholder farmers participated in this qualitative component of the study, with each participant responding to the open-ended questions. Responses to these questions were transcribed and analyzed thematically using a hybrid inductive-deductive coding approach. Coding was done by the author by first segmenting the data into cohesive units and then classifying them into thematic categories for each of the three questions. This process was done manually (i.e. not computer-automated), considering the number of explicit reports carried out and to ensure a more context-sensitive interpretation of meanings evoked by the use of slang or otherwise broad words expressed related to the topic at hand, such as "health", "social relations", "stewardship", "peace", etc. To ensure coding consistency, an iterative coding process was employed in which the transcripts were coded in multiple rounds.

3.0 Results

3.1 Quantitative Analysis

3.1.1 Variable descriptive statistics. Table 2 shows descriptive statistics for the variables analyzed. The total sample included 35 male and 8 female smallholders. Most participants (~68%) reported agriculture as their farm's main productive activity. Average SWB score was 7.47 on a 10-point scale, with a range from 3 to 10. Average age of smallholders was 61. External factors were largely perceived as important conditioning factors for adopting pro-environmental actions on the farm, with an average of almost 4 out of 5, with 5 being the most influence of external factors. Farm Diversification Level averaged 5.2, suggesting an intermediate level of diversification. The average Farm Pro-Environmental score based on smallholder perceptions was 7.77 out of 10, while the score for self-perceived farm ecosystem service provision was 4.1 out of 5. The mode for formal education level was 3 (primary education complete), while the average was 3.4, almost exactly between "primary education complete" (value 3) and "secondary education incomplete" (value 4).

Table 2. *Summary Statistics for Variables Used in Quantitative Analysis (n=43)*

Ordinal and continuous variables			
Variable	*Mean*	*Min*	*Max*
Subjective well-being (SWB)	7.47	3	10
Age (AGE)	61	41	78
Perceived influence of external factors (PIEF)	3.95	3	5
Farm diversification level (DIVL)	5.2	1	10
Perceived farm pro-environmental score (PF-PES)	7.77	5	10
Perceived farm ecosystem service provision (PF-ESP)	4.1	3	5
Formal education level (FEDU)	3.4	2	7
Categorical variables			
Variable	*Sample results*		
Sex (SEX)	35 males, 8 females		
External aid (EAID)	Yes=20, No=23		
Farm's main productive activity (MPA)	Agriculture=29 Cattle=9 Other=5		

One-way ANOVA tests showed that SWB differed significantly only within the variables of perceived farm pro-environmental score ($p < 0.01$) and age ($p < 0.05$) (see Table 3).

Table 3. *One-Way ANOVA Test Results for Determining Significant Differences in Subjective Well-being (SWB) Values Based on Independent Variables*

Variable	F statistic	p-value
Perceived influence of external factors (PIEF)	$F(2, 39) = 1.374$	.523
Age	$F(2, 40) = 4.357$	.019*
Main productive activity	$F(2, 40) = 0.896$	.416
Perceived farm pro-environmental score	$F(2, 40) = 7.658$	.002**
Sex	$F(1, 42) = 2.652$	.111
Farm diversity index (FDI)	$F(2, 37) = 0.904$	.414
External assistance	$F(1, 41) = 0.073$	.788
Perceived farm ecosystem service provision	$F(16, 26) = 0.953$	.528
Formal education level	$F(2, 40) = 2.357$	.108

Note: *significant at the 0.05 level
**significant at the 0.01 level

Ordinal logistic regression (OLR) results coincided with the ANOVA results: the perceived farm pro-environmental score had a statistically significant effect on predicting SWB (odds ratio = 2.040, $p < 0.05$) (see Table 4). However, differing with the ANOVA tests, the Age variable did not have a statistically significant effect on SWB in the OLR. All other variables did not have a statistically significant effect on SWB prediction.

Table 4. *Synthesis of Ordinal Logistic Regression (OLR) Test Results*

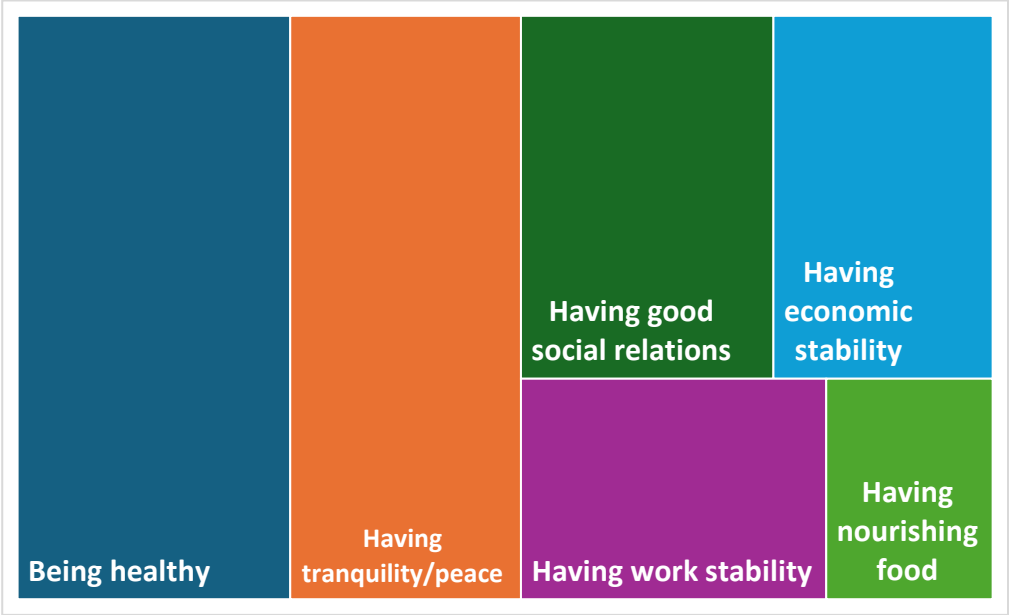
Variable	Wald χ^2	df	Sig.
Sex	.438	1	.508
Main Productive Activity (MPA)	.143	2	.931
External assistance	.619	1	.431
Formal education level	2.818	1	.093
Age	.811	1	.368
Perceived Influence of External Factors (PIEF)	.544	1	.461
Farm Diversity Index (FDI)	.411	1	.521
Perceived Farm Ecosystem Service Provision	1.388	1	.239
Perceived Farm Pro-Environmental Score	6.105	1	.013*

Note: * significant at the 0.05 level

3.2 Qualitative Analysis

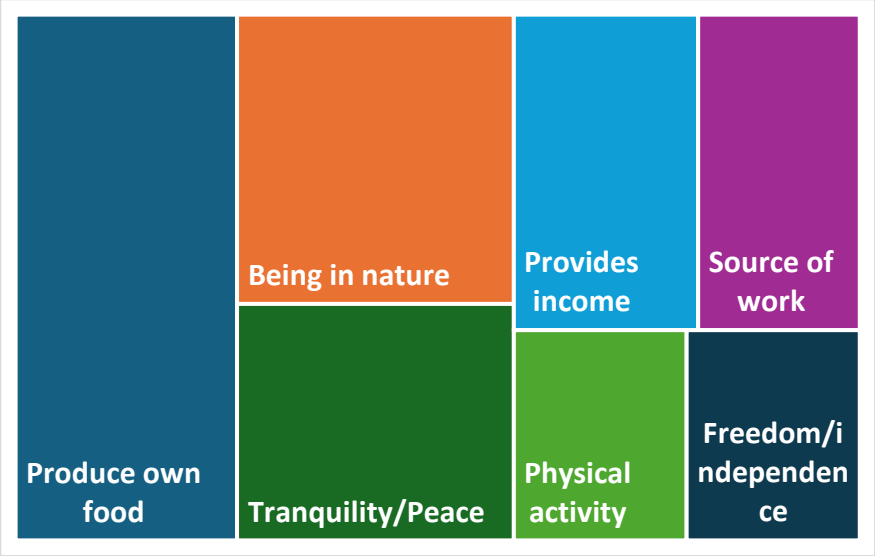
The qualitative results were synthesized as Treemap graphs in Figures 2, 3 and 4. Based on the question of what it means to have well-being (see Figure 2), smallholder farmers in the ASBC mostly associate well-being with "health" in a general sense, which includes physical, mental and emotional health. When participants were asked follow-up questions specifically about which components of health they meant, most responses alluded to an integration, to various degrees, of those three dimensions. This was followed by having peace and tranquility, which was mostly associated with living in the countryside. Good social relations were also a factor commonly linked to well-being by ASBC smallholders, which includes not only relations within the family circle but also with neighbours and community members. Economic and work stability were also seen as relevant well-being components by ASBC smallholders, as was having nourishing, own-produced food.

Figure 2. Treemap-style graph representing the most relevant categories after responses to the question, "What does it mean to have well-being?" among participating smallholders.



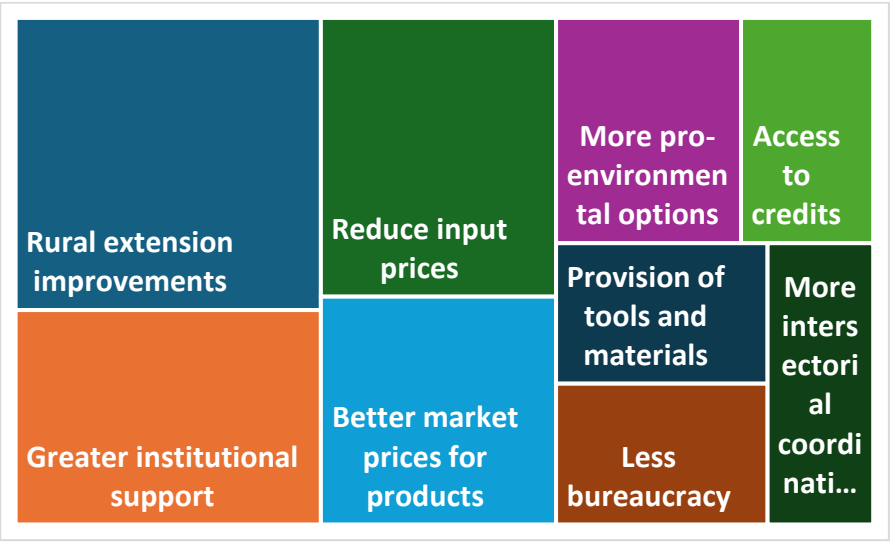
Responses to the second open-ended question (see Figure 3) identified food self-provisioning as the most significant livelihood dimension contributing to smallholder well-being in the ASBC. Participants frequently highlighted the intrinsic value of the agricultural cycle, from seeding and plant growth to harvesting and consumption. Beyond material provision, respondents emphasized the psychological benefits of the work, specifically the peace and tranquility derived from interacting with nature. These factors were followed by the role of farming as a primary source of income and employment, as well as the physical activity and sense of autonomy associated with self-employment.

Figure 3. Treemap-style graph representing the most relevant categories after responses to the question, "What aspects of your livelihood provide the most to your well-being?" among participating smallholders.



Finally, rural extension improvements and greater institutional support were the most prominent factors mentioned in the third open-ended question (see Figure 4) about how to improve farmer well-being in the ASBC. Also mentioned were better market prices for crops produced within the ASBC, and lower costs of input prices such as fertilizers. Less prominent but still important were more incentives for pro-environmental production options, access to credits, less bureaucracy, and more intersectoral and intercommunity coordination.

Figure 4. Treemap-style graph representing the most relevant categories after responses to the question of "how can well-being be improved for smallholders?" among participating smallholders.



4.0 Discussion

Many global livelihoods depend on small-scale production systems, particularly within the Global South. Moreover, sustainable small-scale production models are vital as part of broader strategies for transformative change toward sustainability. The relevance of smallholder production systems lies in their ability to concurrently bolster livelihoods, preserve ecological functions, and enhance well-being; this multidimensional alignment is a prerequisite for systemic transformative change. Achieving this requires a deeper understanding of the multidimensional nature of well-being among smallholders, given their pivotal role in global food security and environmental stewardship.

Before discussing important points deriving from this research, it is appropriate to acknowledge some methodological limitations. As is common in human-environment geography research, it was impossible to access all subjects in the original sampling frame due to diverse reasons, such as inaccessibility, smallholder farms that had ceased operations, etc. Thus, the initial idea of applying random sampling had to be loosened to adapt to these circumstances. Part of this adaptation was implementing a convenience sampling approach in cases when the initial random strategy was not feasible due to the aforementioned reasons. This approach thus mixed an initial "randomness" with a later "convenience" given the circumstances encountered. Therefore, as a cautionary measure, inferential statistics in this study should be interpreted as descriptive of the sample only, not necessarily as generalizable to the broader population or sampling frame.

However, while sampling representativeness is ideal in many studies, it was not considered critical in this one. This is because the goal of this research was to explore SWB in smallholder populations in ASBC and, in doing so, serve as springboard for further, more in-depth studies on this relevant subject in similar socio-ecological contexts. In this sense, this study achieved its goal. Moreover, despite not being technically generalizable, it can be argued that these results likely represent the majority of the ASBC's smallholder population, partly because it did incorporate a random approach, all communities within the corridor were considered in the sampling strategy via a stratified sampling strategy, and because the sample used represents about 25% of the ASBC's entire smallholder population.

Also, it is acknowledged that the quantitative analysis is constrained by a small sample size ($N = 43$) relative to the nine independent variables evaluated in the OLR model. This low observations-per-variable ratio falls below standard recommendations for maximum likelihood estimation, which increases the risk of model overfitting and restricts statistical power. Consequently, subtle or moderate individual variable effects may not reach conventional significance thresholds within this sample constraint.

However, because the global model remains highly significant ($p = .018$) and exhibits strong overall explanatory power (Nagelkerke $R^2 = .442$), it successfully captures broader structural patterns. The fact that perceived farm pro-environmental score emerged as a statistically significant predictor despite this limited power highlights the robust nature of its relationship with SWB in this context. Nonetheless, as already stated, these inferential results should be interpreted as exploratory and specific to this tropical biological corridor framework, serving as a foundation for future, larger-scale socio-ecological modeling.

While the ANOVA tests indicated a statistically significant difference in SWB based on age group, this relationship did not persist in the OLR model. This discrepancy is likely a reflection of an underpowered regression model, as bivariate tests like ANOVA evaluate relationships in isolation whereas OLR makes all independent variables compete simultaneously for explanatory variance. Under standard sample size constraints ($N = 43$), the OLR model suffers from limited statistical power, which often undermines moderate or subtle effects—such as those of age—once other socio-ecological variables are controlled for. Consequently, while age remains a theoretically relevant factor, its lack of significance in the OLR suggests that its direct influence on SWB in the ASBC is less robust than that of more immediate, farm-level factors like perceived farm environmental performance.

Having considered the above limitations, a salient theoretical question emerging from this research is whether and how SWB is linked to how smallholders perceive their farm's environmental performance. Specifically, does higher SWB foster a more positive perception of one's own environmental performance, or conversely, do more positive perceptions of pro-environmental performance enhance SWB? These questions are not trivial, for if in fact this relationship applies, interventions designed to implement sustainable practices may yield co-benefits for producer well-being. Indeed, many confounding variables very likely influence this link (e.g. income). However, further exploring this specific relationship is important.

These considerations aside, perceived measures of environmental performance may be better predictors of SWB than purely objective measures (Schebella et al., 2019). The existing literature, it seems, has not explored this association in depth. While the relationship between environmental quality and well-being is very clear, as is the link between engagement in pro-environmental behaviors and well-being improvements (Milheiras et al., 2022; Qi et al., 2022), there are important knowledge gaps regarding how a greater sense of environmental stewardship and self-perceived sense of environmental achievement relate to SWB in particular contexts.

Meanwhile, literature exploring ageing and SWB seems to agree that there is, in fact, a relationship, albeit more conclusive claims are difficult given the differences in methodological approaches and data used (López Ulloa et al., 2013). In this case, SWB appears to differ by age group, with younger cohorts in general expressing greater SWB. This is not surprising as, by and large, this is the observed trend across empirical studies. However, in the context of the ASBC, it is still not clear why younger generations express greater SWB. A viable hypothesis is that they generally have more educational and employment opportunities than their older counterparts had. Many of these opportunities, however, are not related to agriculture, which has partly led to a gradual abandonment of peasant lifeways, something that elderly cohorts fear will disappear in the foreseeable future (Espinoza-Cisneros & Montoya-Greenheck, 2024).

Several variables initially hypothesized to influence SWB ultimately did not show a significant effect. For example, it was expected that perceptions of the farm's provision of ecosystem services would strongly influence SWB, as the relationship between ecosystem services and well-being is strongly established empirically (IPBES, 2019; McElwee et al., 2025). Also, dedication primarily to agriculture and having more diversified farms were initially thought to be more relevant in determining SWB but were not the case here. However, as with other studies of this sort, there are methodological challenges to be considered (OECD, 2013), such as differences in conceptualization of terms, variable choice, ways of measuring,

statistical tests used, among others. So, further comparable studies are needed to reach stronger theorizations regarding these relationships.

The more qualitative analysis also revealed important insights. For ASBC smallholders, well-being is primarily related to intangible factors such as "being healthy/having health," "having tranquility/peace," and "having good social relations." This aligns well with previous anthropological studies at ASBC that suggest smallholder producers in general give more priority to non-material cultural factors, as evidenced by a strong livelihood bonding and appreciation for rural lifeways (Espinoza-Cisneros & Montoya-Greenheck, 2024; Montoya, 2022). For instance, commonly mentioned by smallholders were the benefits associated with their livelihoods, particularly working in a healthy rural environment, connecting with nature and being far from the franticness of urban centers.

Similarly, non-material factors were also popular responses to the question of which livelihood aspects contribute the most to their well-being. While producing food indeed has a material component, smallholders place most value on the process of producing food itself, from the seeding to the growing stage to finally consuming the produce. In this sense, a great deal of their satisfaction seems to come from the process and not solely from the outcome of producing. Finally, responses to the final open-ended question also hint, to a certain extent, at a prioritization of non-material aspects. Most clear is the emphasis on rural extension services for implementing best management practices as the most prominent factor for improving smallholder well-being in the ASBC. Following rural extension services was greater institutional support, which included financial assistance, but was also related to policies, logistics and capacity-building. Next were more pecuniary factors such as reducing input costs and improving market prices for their products.

5.0 Conclusion

Improving individual and societal well-being is at the core of more comprehensive conceptions of development. Countries such as Bhutan, New Zealand and Iceland, to name some, have progressively incorporated considerations of happiness and well-being into their development models. These well-being-focused models are based on the premise that life satisfaction should be a central aspiration guiding political decisions. Under such connotations, a better understanding of well-being and its multiple dimensions is crucial for more effectively guiding planning and decision-making towards improving quality of life.

In this article, SWB of smallholder producers within a tropical biological corridor was analyzed. Within the ASBC, SWB appears to be greater among individuals who assign higher scores to their farm's pro-environmental performance. Age was also found to be significant in explaining differences in SWB scores, at least from the ANOVA tests. Moreover, ASBC smallholders relate well-being primarily to having good health, tranquility and peace, and good social relations. They consider that the process of producing food is the main livelihood aspect contributing to their well-being, followed by being in nature and having tranquility and peace. Finally, most smallholders consider that improving rural extension programs and institutional support, followed by better market prices and reduction in input costs, are key for improving well-being among the smallholder community in the ASBC.

This study was the first to explicitly explore the construct of SWB among the smallholder community in the ASBC, a microcosm of production and conservation

conundrums common in many Latin American socio-ecological landscapes. It sought to shed light on the context-specific determinants of SWB and the conceptions of well-being among the smallholder community. Given that small-scale production systems are pivotal in systemic sustainability transformations, a nuanced understanding of smallholder well-being is a fundamental prerequisite for achieving these urgent imperatives.

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