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A scoping review on measures of farmer well-being

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32 **Abstract:**

33 Determinants of farmer well-being can be derived from objective and subjective measures of
34 social components, environmental sustainability indicators, and quality of life indices, as well as
35 the multiple scales that farms and farmers operate. Yet, despite multiple frameworks on farmer
36 well-being, the extent to which farmer-expressed values are used in the development of farmer
37 well-being indicators is unclear. Challenges can arise from extracting indicators that are
38 insufficiently grounded in place, or that inadequately incorporate context and biocultural
39 relations and practices. Here in this scoping review, we synthesize the methodologies in the
40 literature on assessing farmer well-being and identify the extent to which farmer well-being
41 domains are derived from values expressed directly by farmers. We consolidated and coded 92
42 papers to respond to the following questions: 1) What are the most frequent farmer well-being
43 domains in published studies? 2) What methods are used to elicit multidimensional farmer well-
44 being domains? And 3) Do well-being domains used in the literature adequately reflect a
45 biocultural context, including place-based influences on well-being? Our results show that
46 economics and social relationships are pervasive domains of how farmer well-being is identified
47 and assessed. These domains tend to be measured simultaneously, while less common domains,
48 such as governance and place, are rather isolated. A suite of methods was used to assess well-
49 being domains, ranging from basic surveys to in-depth participant observation. Yet, we identify
50 gaps in the methods for deriving farmer well-being indicators. Specifically, methods that refer to
51 farmer-expressed values were rare and domains identified through a place-based approach were
52 often not recorded, but, arguably, critical in developing multidimensionality of farmer well-
53 being. We show that while the translocal approach is well represented in established well-being
54 frameworks, farmer expression is not foundational in well-being assessments but is needed in
55 order to center farmer values when generating indicators of well-being.

56

57 **Keywords:**

58 Biocultural approach; farmer values; place-based; sustainable agriculture; well-being
59 dimensions; well-being indicators

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63	Contents:
64	1. Introduction
65	2. Search strategy, screening protocol, and analysis
66	3. Farmer well-being definitions and frameworks
67	4. Farmer well-being domains
68	4.1 Domain frequency
69	4.2 Domain interrelationships
70	5. Assessment of domains
71	5.1 Methods to collect domain
72	5.2 Scale and implementation of domains
73	6. Discussion: Biocultural approaches to farmer well-being multidimensionality
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94 **1. Introduction**

95
96 Farmer well-being is influenced by a multitude of factors. These include environmental, social,
97 political, and economic factors, such as soil health, social capital, and material living conditions
98 (Schirmer et al. 2013; Brigance et al. 2018; Sabillon et al. 2021), which can be either objective
99 (e.g. physical health, economical welfare) or subjective (e.g. satisfaction of one’s own existence)
100 (Dasgupta 2001). Farmers can derive well-being from processes that operate at and across
101 multiple spatial scales including farm, landscape, community, national and international
102 (Latruffe et al. 2016; Hammersley et al. 2022). Yet, many factors also have a negative impact on
103 the well-being of farmers, *i.e.* ill-being, including climatic hazards (e.g. floods, droughts) and
104 change, economic pressure (e.g. increase in the cost of inputs, price volatility), public policies
105 and regulations (administrative work) and social isolation (Isakson 2015; Mills et al. 2021;
106 Talukder et al. 2021). The definition of well-being spans mental and physical health, social,
107 cultural, spiritual, economic, and political elements (see King et al., 2014; Barrington-Leigh and
108 Escande, 2018), all of which are strongly multidimensional and context-dependent. The
109 appropriate assessment of farmer well-being underpins the accurate development of
110 sustainability indicators in agriculture (Brown et al. 2021), and is the basis of well-being
111 frameworks that inform policy (Betley et al. 2022). Including elements of farmer well-being has
112 become a priority for many emerging agriculture programs, such as crop credit and insurance
113 programs (DeLay et al. 2020), or pesticide-free agriculture (Jacquet et al. 2022). Notably,
114 assessments of well-being are critical as farmers are increasingly suffering from depression and
115 burnout (see Brew et al. 2016; Jones-Bitton et al. 2020).

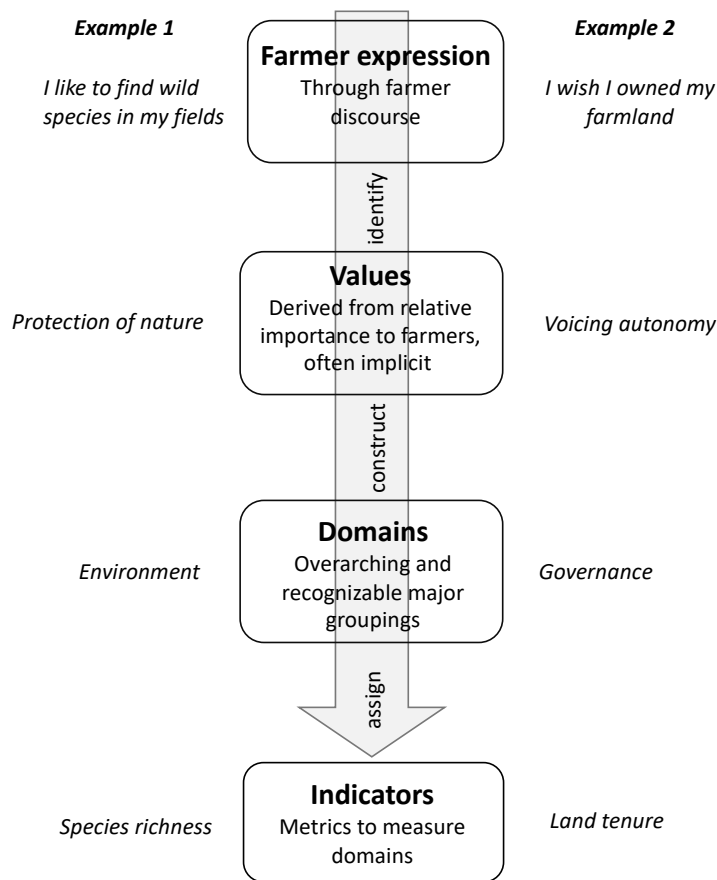
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117 While there is much scholarship on the development of sustainability indicators in agriculture
118 (Latruffe et al. 2016) and on well-being indicators for farmers (Brown et al. 2021; Mills et al.
119 2021; Sabillon et al. 2021), there remains many and sometimes opposing ways in which farmer
120 well-being is assessed (for instance, including explicit consideration of ill-being). King et al.
121 (2014) describe the assessment of well-being in a social-ecological context, and highlight the
122 evolution of ways to assess well-being, from a narrow focus on objective measures of economic
123 conditions to a more complex and holistic concept through including subjective and objective
124 measures of social components, environmental sustainability indicators, quality of life indices,

125 and theories of multidimensional well-being. Breslow et al. (2017) present a framework for
126 determining indicators of well-being specifically for ecosystem based management, and advance
127 previous frameworks by including multi-directional relationships among well-being indicators,
128 and identify comparable categories based on context specific factors. Specific to agriculture,
129 Brown et al. (2021) argue that most agricultural sustainability indicator frameworks do not
130 include farmer well-being, but provide evidence that the inclusion of subjective well-being
131 measures contribute more fully to what constitutes farmer well-being. In fact, Sabillon et al.
132 (2021) conclude from their large scale assessment of farm level factors on farmer well-being that
133 it is essential to integrate measures of farmers' point of view of social issues to achieve true
134 multi-dimensional indicators. Yet, despite multiple frameworks on well-being, the extent to
135 which farmer-expressed values are used in the development of farmer well-being indicators
136 remains unclear.

137

138 The values that underpin these frameworks are not always explicitly formulated but rather
139 implicit in the methods used to measure well-being (Brown et al. 2021). Processes to filter a
140 large array of *values* into *domains* of well-being are common (Breslow et al. 2016), leading to
141 diverse steps of aggregation or decomposition to determine well-being indicators. In Figure 1,
142 we conceptualize this process moving from farmer values to well-being indicators through
143 various domains. Values, or expressed individual motivations, are aggregated to generate
144 significant domains of what constitutes well-being. These well-being domains are constructed as
145 overarching and recognizable major groupings, similar to the Sustainable Development Goals
146 (SDGs) biosphere, economics and social domains. Domains of well-being can be assessed by the
147 assignment of indicators that are measured in order to compare well-being among farmers and
148 across locations and time (albeit not without limitations). For instance, *protection of nature* may
149 be a farmer value, which, amongst other related values such as *landscape beauty*, are aggregated
150 into a domain "environment" and can be measured by indicators such as "species richness". Or
151 *voicing autonomy* may be a farmer value, which amongst other related values such as *freedom* is
152 aggregated into a domain "governance" and can be measured by the indicator "land tenure".
153 However, in addition to these values, we add farmers' expression of their well-being or ill-being
154 in terms of specific forms of attachment and practices, and specifically as articulated by the
155 respondent in the process of indicator identification. For instance, farmers may express "*I like to*

156 *find wild species in my fields*” or “*I wish I owned my farmland*”. While capturing farmer
 157 expression occurs as part of a discourse during interview processes, this inclusion of farmer
 158 narratives responds to the long-standing call for place-based and biocultural approaches in
 159 sustainability assessments (Merçon et al. 2019; Hanspach et al. 2020). This pathway to the
 160 identification and development of well-being values, domains and indicators includes what
 161 constitutes well-being for the farmer through self-expressed, locally informed descriptions,
 162 which are in turn key to embracing equity and representation in well-being assessments (Bentley
 163 et al. 2022).
 164



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 166
 167 **Figure 1.** Pathway to determine and assess farmer well-being. Farmers express narratives about
 168 their lives from which values are identified. These values are then constructed into well-being
 169 domains, from which indicators to measure are assigned. Two examples of each step are
 170 provided.
 171

172 Challenges can arise from extracting indicators that are insufficiently grounded in place, or that
173 inadequately incorporate context and biocultural relations and practices (Sterling et al. 2017;
174 McCarter et al. 2018; Sebastien 2020). Determinants of well-being are not only dependent on the
175 intrinsic characteristics of individuals but also on context, including that which is constituted by
176 the relations and practices that link individuals to other people and elements of the non-human
177 world within a local, holistic, social-ecological landscape. For instance, environment can be
178 considered as a ‘constituent’ (internal) element of well-being, rather than a ‘determinant’
179 (external) one (Dasgupta, 2001). To address these overlooked aspects of indicator development,
180 biocultural approaches embed the shared experiences, behaviours, and beliefs of local
181 communities through a place-based approach that informs our understanding of the relationships
182 between farmers and their environment (Gavin et al. 2015; Caillon et al. 2017; McCarter et al.
183 2018). Such approaches offer the promise of embracing both biological and social-cultural-
184 aspects of well-being, and of addressing the complex relationships and feedbacks between
185 human and non-human entities in situ (Rose et al. 2017; Hanspach et al. 2020; Betley et al.
186 2022). A biocultural framing of well-being also allows for embracing multiple forms of
187 knowledge (Raymond et al. 2019) and has been recently highlighted as critical to effective
188 environmental policy-making (Merçon et al. 2019). The development of farmer well-being
189 indicators often overlooks such social-cultural dimensions, even though these factors of well-
190 being are recognized as critical to achieve sustainability in agriculture (Brennan et al. 2020).

191
192 In order to better understand how the dimensionality of farmer well-being is being assessed,
193 particularly what and how well-being is being measured, we conducted a scoping review of the
194 peer-reviewed literature. The objective of this paper is to identify farmer well-being domains and
195 the extent to which well-being domains are derived from subjective values expressed directly by
196 farmers within published studies. We ask the following research questions: 1) What are the most
197 frequent farmer well-being domains in published studies? 2) What methods are used to elicit
198 multidimensional farmer well-being domains? 3) Do well-being domains used in the literature
199 adequately reflect a biocultural context, including place-based influences on well-being? and
200 finally, 4) Are recommendations derived from well-being indicators reported as implemented in
201 the published literature?

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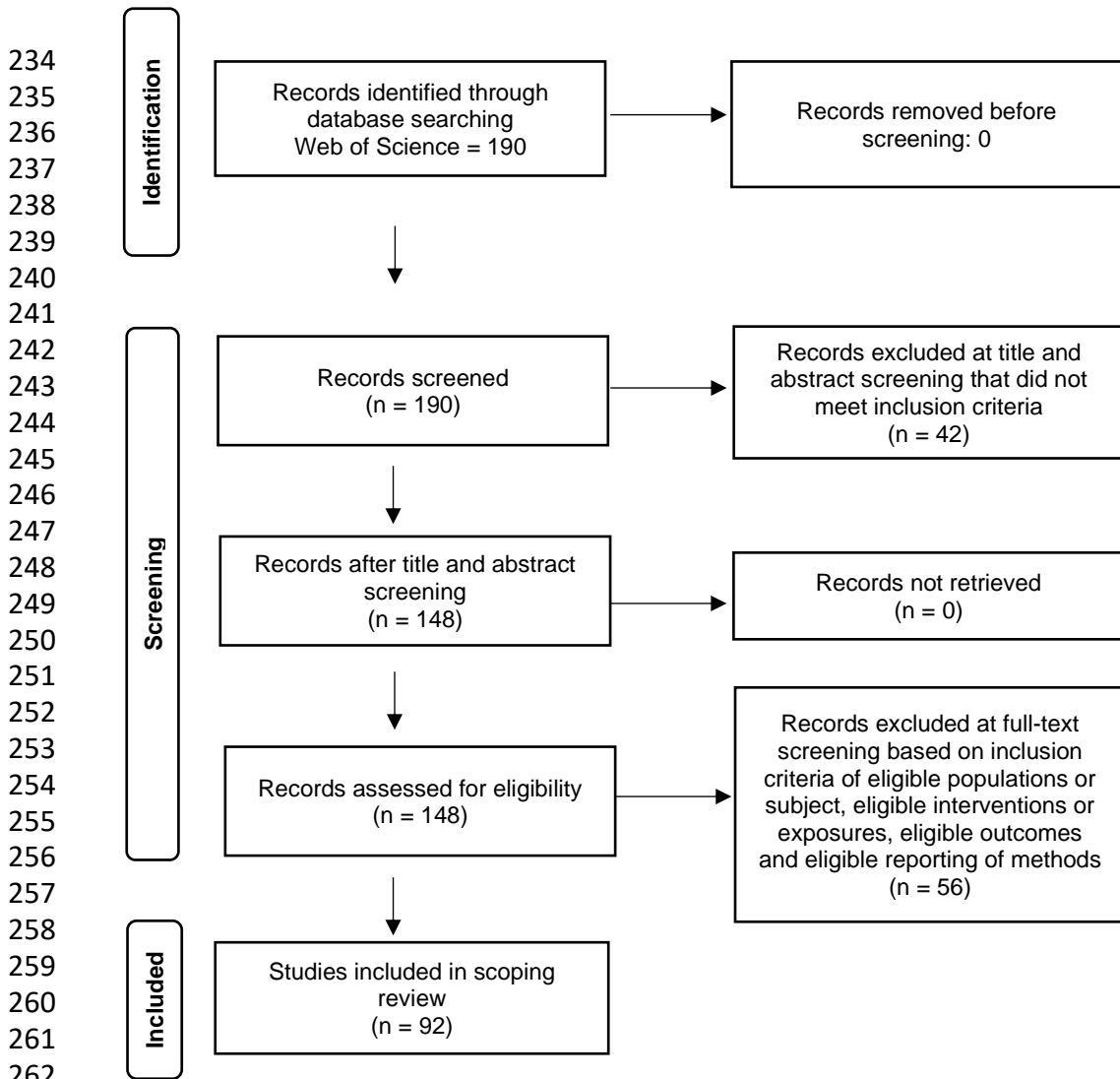
2. Search strategy, screening protocol, and analysis

To gather studies related to farmer well-being, we conducted a scoping review of peer-reviewed literature. Similar to reviews conducted on well-being and equity (Betley et al. 2022), we followed the “Guidelines and Standards for Evidence Synthesis in Environmental Management” (Bangor University, Collaboration for Environmental Evidence, 2018). Our scoping review had five steps: (1) querying academic literature databases for relevant studies; (2) screening titles and abstracts to determine if a study meets our inclusion criteria; (3) screening the full text of studies that passed our screening; (4) extracting relevant data outlined in our code book; and (5) summarizing results.

We used Web of Science 12.1.20, all databases, all languages, January 2000 to November 2021, run with Columbia University Scholar access. Our research query was:

indicator OR metric OR index OR indices AND evaluat* OR assess* OR monitor* OR measur* OR impact OR framework OR outcome AND wellbeing OR well-being OR "farmer well-being" OR “farmer wellbeing” OR “farmer well being” OR dissatisfaction OR unhapp* AND agriculture OR agroeco* OR agronom* OR agrofor* OR biodynamic OR "organic agriculture.

These search terms were used to gather all studies related to farmer well-being. A flow diagram (Page et al. 2021) illustrating our study screening for our scoping review is shown in Figure 2.



266 **Figure 2.** Scoping review search method including identification of articles, screening with
267 inclusion criteria and the number of included studies.

268
269 Our search resulted in 190 articles. We screened the abstract and titles of all citations from our
270 search with Colandr (Cheng et al. 2018). Our inclusion criteria were based on eligible
271 populations or subjects - farmers/ farm employees producing food or drink, include links to
272 health, but has to have one or more elements of well-being, include labour if there is a direct link
273 to farm activity/ practice; eligible intervention(s) or exposure(s) - types of farming, including
274 organic, regenerative, conventional, subsistence and commercial including industrial, needs to be
275 about food/drink, single family or collectives/ cooperatives; eligible outcomes - must include

276 measures of well-being for farmers; eligible types of study design - must include methods, ideal
277 if includes well-being indicators. Using our inclusion criteria, we excluded 42 articles that were
278 not relevant to our criteria during screening. Therefore, 148 articles passed initial screening.
279 After a full assessment for eligibility, 56 articles did not meet our inclusion criteria after a full
280 text review. In the end, our review included 92 papers (Supplementary File 1).

281

282 A codebook was developed to extract information from each study. Our multidisciplinary coding
283 team created the codebook through an iterative process including blind test coding rounds,
284 involving assigning a pair of coders to code the same paper and thus enable comparison of
285 results. Improvements were made through discussion of discrepancies in coder agreement
286 between coders. We coded for five aspects: i) descriptive, including geographic location, type of
287 agriculture and well-being definitions, ii) well-being domains, described below, iii) method of
288 data collection, such as interviews, focus groups, surveys, landscape/transect walks , iv) presence
289 of biocultural context, including a discussion of place and place-attachment beyond the location
290 of data collection, and v) implementation of recommendations, either clearly stated or inferred.
291 We surveyed articles for 14 domains. Domains included: economic, social, environment,
292 agricultural management, general health, physical health, mental health, governance, education,
293 human-nature relationships, affect, culture, place and ill-being. This list of domains was
294 compiled through an interactive discussion amongst the research team, based on field work,
295 existing knowledge of the indicators literature and preconceived categories (Sterling et al. 2017;
296 Breslow et al. 2017; Betley et al. 2022), noting that affect, culture and place domains were
297 specifically added to respond to our objective of assessing studies for methods to capture place-
298 based and bio-cultural context of indicators. In Table 1, we define each domain and provide
299 indicator examples for each from the literature. The co-occurrence network of well-being domain
300 relationships measured within studies was made with an adjacency matrix to generate a network
301 of nodes (domain) and ties (in the same study).

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307 **Table 1.** The 14 domain categories coded in the 92 studies included in our analysis. Domains
 308 represent the grouping of values, leading to the aggregation or decomposition of well-being
 309 indicators. The general definitions and indicator examples with citations of each are provided.
 310

Domain	Definition	Indicator examples (source)
Economics	Studies that measure farm yield, profit or reduced costs.	<ul style="list-style-type: none"> - Household farm income (Paracchini et al. 2015; Perrin et al. 2020) - Crop yield (Antunes et al. 2017) -Off farm activities (Kallas et al. 2010) -Working hours (Witt et al. 2020)
Social (human relationships)	Studies that measure aspects related to social activities or social networks.	<ul style="list-style-type: none"> - Trust in others, and the government (Bartl 2019) - Community connectedness (Peel et al. 2015; Brown et al. 2021; Boncinelli and Casini 2014) -Time for family (Koesling et al. 2008)
Agricultural management	Studies that include elements of farm management, specifically practices that affect entities involved in agricultural landscapes by transforming soil processes and functions, crops and landraces diversity, surrounding flora and fauna.	<ul style="list-style-type: none"> - Irrigated farmland (Lauer and Sanderson 2020) - Weed control (Rigby et al. 2001) - Intercropping (Templer et al. 2018)
Environment	Studies that measure the state (ecology) or conservation of natural resources associated with agriculture.	<ul style="list-style-type: none"> - Natural capital /Natural resource stocks (Siepmann et al. 2018) - Crop diversity (Zahm 2008)
Physical health	Studies that include a measure of health of the individual.	<ul style="list-style-type: none"> - Food security (Vilei 2011; Whitehead 2017) - Water quality for household (Vilei 2011)

Human-nature relationships	Studies that include a measure of material and immaterial (spiritual, cultural) links between humans and biotic and abiotic elements of the agricultural system.	<ul style="list-style-type: none"> - Value of traditional farming practices (Brennan et al. 2021) - Aesthetic enjoyment (Bruley et al. 2021)
General health	Studies that include a comprehensive measure of the state of complete emotional, mental, and physical health.	<ul style="list-style-type: none"> - Physical well-being of the farming community (Van Cauwenbergh et al. 2007) - Access to healthcare (Whitehead 2017)
Education and knowledge	Studies that included a measure of education level or knowledge (awareness, understanding, or information that has been obtained by experience or study and transmitted formally or informally).	<ul style="list-style-type: none"> - Level of education (Vilei 2011) - Access to market information (Martey et al. 2020)
Mental health	Studies that include an aspect of mental health that enables people to cope with the stresses of life, realize their abilities, learn well and work well, and contribute to their community.	<ul style="list-style-type: none"> - Substance abuse; deliberate self-harm and suicide (Kannuri & Jadhav 2018)
Affect	Studies that include concepts of underlying experience of feeling, emotion, attachment, or mood when describing well-being.	<ul style="list-style-type: none"> - Optimism about the future (Hansen et al. 2019) - Level of happiness (Bartl 2019)
Ill-being	Studies that deliberately measure ill-being (condition of being deficient in health, happiness, or prosperity) and not just the lack of well-being.	<ul style="list-style-type: none"> - Farmer stress/feeling of loneliness (Hansen et al. 2019)
Governance	Studies that include aspects related to the process of making and enforcing decisions within an organization or society.	<ul style="list-style-type: none"> - Land tenure (Torralba et al. 2018) - Production control quota (Meuwissen et al. 2019) - Policy support from government (Shakya et al. 2019)

Culture	Studies that measure arts, belief, customs, and other products of human work and thought.	- Member of a religion and adherence to religious principles (O'Brien et al. 2012; Kaufman et al. 2014)
Place	Studies that examine relations to land using concepts such as: place attachment, sense of place, place meaning, place identity.	- Sense of place (Bruley et al. 2021) - Pleasurable working environment (Crimes and Enticott 2019)

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312

313 Of the 92 studies included in our review, the largest portion focused on Western Europe with
314 Oceania and South Asia also highly represented (Supplementary File 2). African sub-regions
315 (North, East, West and South) make up the next largest proportion of the studies' geographies.
316 By country, studies were concentrated in Australia (n = 9), France (n = 9), and India (n = 7).
317 Across all geographic regions, the types of agricultural systems included annual (13%), perennial
318 (6%), or both (33%) production systems. Other agricultural systems represented in the studies
319 were dairy farming, crop-livestock integration, urban gardening, and vineyards. Both
320 conventional and organic/ecological agriculture were represented within these studies.

321

322 **3. Farmer well-being definitions and frameworks**

323

324 Among the 92 studies, 25 provided an explicit definition of well-being, seven did not state a
325 definition, and a definition can be inferred from 60 studies. Studies with explicit definitions
326 ranged from the 'care theory' to elicit grower's well-being (Alarcon et al. 2020), to composite
327 indicators of well-being based on a suite of components including material wealth, fulfillment of
328 social needs and basic psychological needs (Bartl et al. 2019). Perrin et al. (2020) considered
329 farmer well-being as the evolution over time of farmers' perception of their satisfaction, while
330 Mourão et al. (2019) were more comprehensive in their definition, which included a person's
331 physical health, psychological state, level of independence, social relationships, personal beliefs
332 and relationships to features of their environment. TerAvest et al. (2019) were categorical in their
333 definition, proposing subjective (well-being as life satisfaction and happiness) and material
334 (quantity and quality of physical goods) as separate but interrelated groupings.

335

336 Inferred well-being definitions were typically based on aspects of sustainable agriculture. For
337 instance, many of the studies that did not clearly provide a definition used the three pillars of
338 sustainable agriculture (environment, economic, and social) or the four-pillars framework of
339 sustainability indicators (environment, social, economic, and governance). The majority of
340 studies relied on established frameworks (88 out of 92), drawing on concepts such as Nature’s
341 Contributions to People; the sustainable livelihoods approach; life satisfaction domains; or
342 achievement of the SDGs. Yet, while some studies did not directly categorize farmer well-being,
343 they drew upon well-established framings such as the functioning framework by Sen (1985) or
344 capabilities framework by Nussbaum (2000).

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346 **4. Farmer well-being domains**

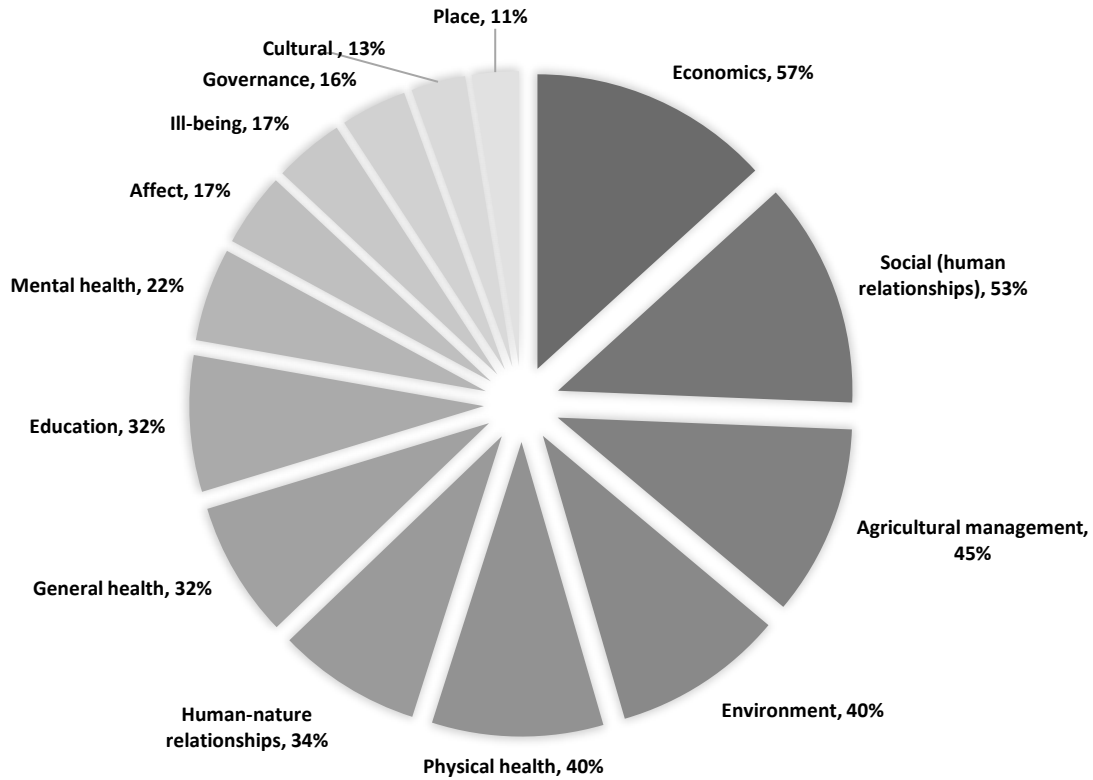
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348 **4.1 Domain frequency**

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350 Many studies focused on well-established domains such as economics (57%), social relationships
351 (53%), environment (40%), and health -including specifically, physical (40%) and mental (22%)
352 health (see Figure 3)- with domains such as education also relatively well-represented (32%).
353 Domains, such as place, culture, or affect, were much less common in the surveyed studies on
354 farmer well-being. Among all studies, 89% of studies did not focus on place as a domain, with
355 only 11% of studies mentioning place other than naming the case location as a passive backdrop.
356 Attention to concepts such as place attachment, place meaning or sense of place were not broadly
357 apparent in the reviewed studies.

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361 **Figure 3:** Distribution of frequency of the 14 domains measured within the 92 studies. The
362 percentage of studies measuring a particular domain is shown.

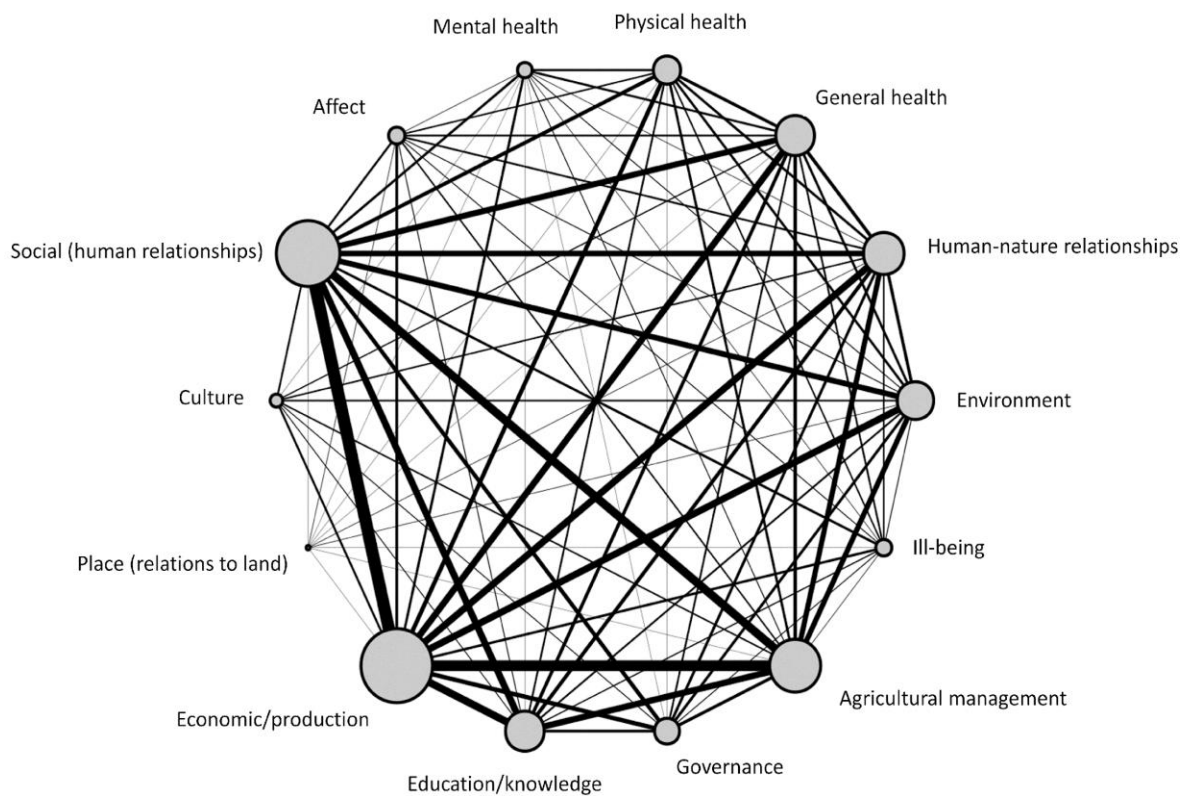
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364 **4.2 Domain interrelationships**

365

366 Of the 14 domains in our coding framework, studies on average measured five domains; two
367 studies measured none, rather covering general well-being, attitudes, and perceptions about
368 quality of life (Farnworth et al. 2009; Markussen et al. 2018). Among the suite of domains,
369 studies most often measured economic, social or environmental domains and management
370 practices and their interrelations (Figure 3). It is common to see studies operationalizing farm
371 income with an aspect of environmental protection and a specific new practice. For instance,
372 TerAvest et al. (2019) used family farm income to assess and compare the well-being of farmers
373 in Malawi across three cropping systems - continuous no-till maize, conservation agriculture
374 rotation, and conventional tillage rotation. Similarly, economic domains were often measured
375 with health domains within a study. Governance was most often measured with culture and

376 education domains. For instance, Ma et al. (2021) show that social relations between farmers in
 377 China were more harmonious under a system of self-governance, leading to higher well-being.
 378 Multiple domains were also often measured in relation to working conditions, for instance, Witt
 379 et al. (2020) examined occupational factors and health indicators with farm work satisfaction.
 380 The few studies that identified place as an aspect of farmer well-being tended to also measure the
 381 environment domain and affect domain. For instance, Bruley et al. (2019) capture quality of life
 382 as “rurality” or links to the region and an affect-oriented “attractiveness” measure, related to
 383 tourism.
 384



385
 386
 387 **Figure 4.** Relationships between the 14 domains of farmer well-being and ill-being. Nodes
 388 represent domains and ties represent co-occurrence of domains in the same study. The frequency
 389 of occurring in the same study is indicated by tie thickness. The size of the node indicates the
 390 overall rank of mentions among all studies.

391
 392

393 Ill-being domains were most often measured in studies that also measured social and economic
394 domains but no studies measured ill-being and culture or infrequently with a place-oriented
395 domain. While ill-being can certainly be measured in association with values of place and
396 culture, these were very uncommon. For example, while a farmer may engage in agricultural
397 practices that are viewed by neighbours as culturally inappropriate 'in place' even if these same
398 practices enjoy wider social sanction (e.g., if a farmer is the first in a localized context to adopt
399 an agronomic technique or crop variety), and experiences social isolation as a result, this is rarely
400 measured or captured in studies focused on farmer well-being indicators.

401

402 **5. Assessment of farmer domains**

403

404 **5.1 Methods to collect domains**

405

406 Methods used to identify and measure well-being domains, whether using one or multiple
407 methods in a study, were heavily skewed toward surveys (59 studies) and interviews (45 studies)
408 as the most common approaches to collecting data from farmers on well-being. However, studies
409 also employed more intensive ethnographic methods such as landscape walks (5 studies), focus
410 groups (18 studies) and indicator ranking with groups (10 studies). Other less frequent methods
411 used included physical health assessment tests, participant mapping and satellite observations,
412 soil sampling, and analysis of policy documents. Many studies used well-being frameworks that
413 relied substantially on mixed methods for data collection (51%), with a smaller share focused
414 solely on qualitative (27%) or quantitative (22%) methods. Multiple approaches to standardize
415 rankings of domains were used, including Likert scales, percentiles, and categorization, yet
416 comparability between studies, times, and locations was difficult as the bounds of these rankings
417 were often not described.

418

419 Use of predetermined lists of domains to elicit farmers' well-being was common among the 92
420 studies, through indicator rankings or surveys. For instance, using a scale of 0 to 10, Brown et al.
421 (2021) measured farmer well-being among regenerative agriculture farm managers with an
422 established survey using worthwhileness, life satisfaction, and multi-dimensional domain items
423 (standard of living, personal health, achieving in life, personal relationship, personal safety,

424 community connectedness, future security). Similarly, using a scoring approach, Kaufmann
425 (2015) classified the ability to achieve “good” health and dietary requirements, material needs,
426 and social and family aspirations as environmental, health, financial, social, production, and food
427 security variables. The ubiquity of using a data collection framework with pre-determined
428 domain lists could be partly driven by the need to evaluate domains, which requires a
429 quantitative and comparable component. Ahmed et al. (2019) used a total of 10 indicators across
430 three domains— education, health, and living standards—to compare smallholders’ well-being in
431 Ghana against self-reported subjective well-being measures. The subjective well-being domains
432 were also selected ahead of time, with smallholders providing their responses to four questions
433 on a 4-level Likert scale. Establishing subjective well-being domains prior to data collection was
434 also used by others (Garrett et al. 2017; Ma et al. 2021; Perrin et al. 2020), with some revision of
435 domain lists occurring during the interview process.

436

437 In contrast, Alarcon et al. (2020) explore how French winegrowers relate to and care for non-
438 humans and the environment without a predetermined list of domains. Rather, the authors
439 conducted training with winegrowers and discussed their relationships with nature to identify
440 domains through a more grounded approach. Likewise, Bailey and Kingsley (2020) posed open-
441 ended questions to understand the relationship between individual well-being and community
442 gardens in Australia. Through these discussions, the authors found salient domains: personal
443 well-being benefits, community connections and well-being, and environment connections and
444 well-being.

445

446 **5.2 Scale and implementation of domain assessment**

447

448 Studies most frequently collected data at the local and municipal scale (65%), followed by
449 subnational (13%) and national (11%). Fewer studies captured data at multiple scales (9%).
450 Notably, however, Rivera et al. (2018) conducted interviews and workshops with farmers,
451 research and development experts and advisors, agricultural companies, and representatives of
452 farmers’ associations across seven countries to investigate rural prosperity and well-being.
453 Likewise, Antunes et al. (2017) integrated national measures such as domestic water supply and

454 tariff structure, regional measures such as average salary, and local measures such as technical
455 and financial capacity of farmers for their sustainability assessment of irrigated areas.

456
457 Among the studies, 67% clearly stated their recommendations for planning and decision making,
458 while 12% of studies did not mention any recommendations. When recommendations were
459 provided, the scale of implementation discussed in the paper was predominately at the
460 local/municipal scale. For their recommendations, several studies discussed the need for
461 validation of data and expansion of frameworks using an iterative process, especially as demand
462 for well-being assessments increases (Hani et al. 2003; Brennan et al. 2020; Poudel et al. 2020).
463 With most studies being cross-sectional, authors also recommended longitudinal studies and
464 long-term monitoring of indicators across multiple scales to better assess farmer well-being
465 (Blackburn et al. 2009; Castonguay et al. 2016).

466
467 Despite most studies having explicit recommendations, very few studies describe how
468 recommendations will be integrated into decision-making (10%) nor have an assessment of the
469 implementation (13%). An exception is provided by Mello et al. (2020) who propose solutions to
470 address issues of water and land access among farmers in Wai‘anae, Hawai‘i, through applying
471 data from research outputs, including maps, to support policy briefs and decision-making.
472 Kauffman et al. (2015) also outline financial support mechanisms that civil society organizations
473 and governmental agencies may target to improve the resilience of organic and non-organic rice
474 farmers in northeast Thailand.

475 476 **6. Discussion: Biocultural approaches to farmer well-being multidimensionality**

477
478 The objective of this paper was to identify the breadth and frequency of farmer well-being
479 domains and the extent to which these domains are derived from values expressed directly by
480 farmers. Among the 92 studies, farmer well-being tended to be defined by generic environmental
481 or economic frameworks. Importantly, we show that the current approach to determining farmer
482 well-being typically relies on pre-established domains rather than those expressed by farmers.
483 While this may lead to the selection of appropriate well-being indicators (Breslow et al. 2018)
484 and the evaluation of well-being indicators at multiple scales (Smith et al. 2018), this current

485 approach may also limit options for farmers to describe what constitutes well-being for them. We
486 found little evidence of the use of farmer expressed values in the sequence of well-being
487 indicator development (Figure 1). Among studies that utilized emergent well-being values from
488 farmer discussions to define domains, these domains differed substantially from those used in
489 studies that relied on predetermined lists. For instance, Bruley et al. (2021) allowed for emergent
490 quality of life dimensions during participant workshops, which the authors describe as different
491 than specific indicators of well-being. In this study, the concept of “rurality”, or the maintenance
492 of traditional agriculture practices and rural life, was proposed by workshop participants as a key
493 dimension during the process of well-being indicator development (Bruley et al. 2021).
494 Arguably, pre-determining domains in well-being indicator development can result in poor
495 implementation of policies derived from well-being assessments as the scope does not capture
496 the multidimensionality that may be exposed when identified by farmers themselves.

497
498 Frequently, more than one domain was measured within the same study. Studies draw heavily on
499 simultaneous indicators of economic and environmental well-being, for instance income, profit,
500 environmental impacts, and/or biodiversity. This is in line with the predominant discourse that
501 connects economics and environment to well-being (Michalos et al.1997; Smith et al. 2014).
502 What is less established is the connections between place, affect, culture and other domains of
503 well-being, including mental and physical health, as well as situated social relationships and
504 practices that can influence the subjective understanding and experience of well-being. We found
505 scarce mention of values related to place, which were often not recorded. The lack of place as a
506 domain in these farmer well-being studies is presumably a result of the scope of research
507 methods in the literature, with most studies not deriving self-expressed, locally informed values
508 from a grounded approach. Yet place-based values are critical to achieve multidimensionality
509 when describing well-being (Cuerrier et al. 2015; McCarter et al. 2018). While quantitative well-
510 being indicators may be common for policy and practical outcomes (Sebastien and Bauler 2013),
511 this is not solely sufficient. The wide range of frameworks (sustainability indicators, sustainable
512 livelihoods approach, life satisfaction domains, achievement of the SDGs, or measuring
513 provisioning, regulating, and cultural ecosystem services) encourages flexibility in methodology
514 but rely on quantitative metrics to achieve comparability. Yet, bioculturally informed well-being

515 indicators have a strong potential to enhance the equity of development strategies and policies
516 (Bunce et al. 2010).

517
518 An ethnographic biocultural approach addresses this problem by encouraging the identification
519 of farmer-based subjective values as they are expressed in place (Sebastien 2020). Ethnographic
520 methods create space for the emergence of farmer-derived values, such as participant
521 observation, or actively working with farmers, substantially contributing to a holistic and more
522 representative suite of farmer well-being domains and indicators. While many studies use
523 multiple methods, these methods were in fact closely related, such as surveys and formal
524 questionnaires. For instance, Castoldi and Bechini (2010) used surveys and interviews
525 specifically for economic and environmental indicator values for a global sustainability index
526 and Castonguay et al. (2016) expanded further by using questionnaires, surveys, and interviews
527 to assess rice terrace social-ecological system with a focus on local community perceptions.
528 Mixed method approaches that draw on creative and collaborative ethnographic and grounded
529 research techniques could elicit more situational or context-contingent information, for instance,
530 by incorporating narratives and visualization with interviews, or through the use of focus
531 groups.

532
533 A biocultural approach could go a long way to incorporating farmer expression as described in
534 Figure 1, thus increasing accuracy of well-being priorities and enhancing the meaningful use for
535 policy. Elements of place and locality can play a translatable role in connecting more siloed
536 measures of well-being (Caillon et al. 2017). In particular, subjective attachment to place (or its
537 absence) is an important influence on the subjective experience of well-being; capturing place
538 specific notions and experiences of well-being can help to translate and compare results from
539 different locales. Prioritizing farmer expression as a critical first step may also facilitate the
540 implementation of agricultural policy because these are often bound to evaluations and lack
541 consideration of farmer values (Helne and Hirvilammi 2015). This approach incorporates
542 human-nature interactions and relational values that are central to farmers adopting sustainable
543 agricultural systems (Duru et al. 2015; Isaac et al. 2021; Archibald et al. 2022) but is overlooked
544 by top-down or a priori approaches to indicator development.

545

546 The explicit scale at which domains are developed and operate is critical to well-being, as the
547 local is recognized as a definitive scale for evaluating well-being, even as translocal processes
548 and relationships shape everyday lives. A greater focus on the ‘local’ experience to understand
549 well-being will capture the multidimensional qualities of farmers’ lives within which relationship
550 and attachment to place is an important mediating influence (Cuerrier et al. 2015; Sebastien
551 2020). Interestingly though, the scale of data aggregation was often not accounted for in the
552 studies, *e.g.* studies may have combined household data and subnational data to derive a single
553 value for a domain, but adequate consideration of the discrepancy in data resolution across scales
554 was not always evident. Moreover, while many indicators of well-being are identified at the
555 individual or household scale, well-being may be shaped by influences that manifest across
556 multiple scales. For example, in the wine sector, community (*e.g.* vinicultural cooperatives),
557 regional (*e.g.* specific wine appellations), or national (*e.g.* wine sector policies and regulations,
558 including in France under the auspices of the Institut national de l'origine et de la qualité) scale
559 all play a role in influencing farmers' daily lives. It is also true that international processes and
560 institutions can shape well-being, for example the EU common market in wine and its associated
561 policies, but also international norms in wine-making and in the marketing of wine (using
562 appellations or grape varieties as descriptors for instance). These scalar interactions are
563 important as many farmers may see their well-being consequentially and inextricably tied to
564 relations and processes operating at the local scale and beyond. Also, it is important to avoid
565 methodological individualism and to see the well-being of farmers as it is shaped socially and
566 culturally. The importance of the collective has been thoroughly explored (Aumeeruddy-Thomas
567 and Hmimsa 2018; Betley et al. 2022) but is rarely applied in studies that aim to determine
568 farmer well-being, given methodological issues with linking individual to community outcomes.

569
570 Our review highlights the lack of farmer-expressed values when determining the full scope of
571 what constitutes farmer well-being. While there is some emphasis on translocal dimensions in
572 established well-being indicators, subjective farmer expressions of well-being are not common in
573 the literature and are needed in order to better center farmers in the assessment of their own well-
574 being. Others have laid the ground work for linking well-being domains with indicators (Breslow
575 et al. 2016), and centering local, place-based indicators, as determined by farmers, has shown
576 success in accurately developing sustainability indicators (Sebastien 2020). A biocultural

577 approach can help define sustainability indicators while making room for unidentified or
578 overlooked values. More research on integrating farmer-identified and expressed values directly
579 into the assessment of farmer well-being will undoubtedly address this gap. Encouraging
580 multidimensionality in well-being assessments moves beyond generalized packages of indicators
581 and embraces complexity, better reflecting the conjoined, relationally coupled character of the
582 socio-ecological environment of farmers.

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