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SUSTAINABLE RURAL DEVELOPMENT AND INTERDISCIPLINARITY: EXPERIENCES, METHODS, AND LEARNING IN TEACHING, RESEARCH, AND EXTENSION

Desenvolvimento Rural Sustentável e Interdisciplinaridade: Experiências, Métodos e Aprendizagens no Ensino, na Pesquisa e na Extensão

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Abstract: This study analyzes the development of an interdisciplinary perspective applied to Sustainable Rural Development (SRD), integrating theoretical frameworks with teaching, research, and extension experiences within the PPGDRS/UNIOESTE. It is a qualitative, exploratory-descriptive, bibliographic, documentary, and theoretical-reflective study grounded in Content Analysis and the systematization of experiences. The literature review integrates contributions from rural and environmental sociology, interdisciplinarity, dialogue of knowledge, participation, Agroecology, sustainability, and territorial development. As a result, an Interdisciplinary Operational Matrix structured into ten analytical codes is proposed: RUR – Rurality and Territory; SAN – Society–Nature; INT – Interdisciplinarity and Complexity; DIA – Dialogue of Knowledges; PAR – Participation, Democracy and Praxis; AGR – Agroecology, Transition and Resilience; SUS – Sustainability, Food and Well-being; ANA – Analysis, Writing, Systematization and Interpretation; TER – Territorialization and Innovative Extension for SRD; and DEV – Feedback, Learning and Transformation. The matrix integrates theory and experience to guide the interpretation of data and territorial practices. It is concluded that interdisciplinarity in SRD constitutes an academic and territorial praxis that integrates science, diverse forms of knowledge, social actors, participation, and sustainability within a cyclical process of knowledge production, systematization, feedback, and transformation.

Keywords: Interdisciplinarity; Dialogue of Knowledges; Participation; Territorialization.

Resumo: *O estudo analisa a construção de uma perspectiva interdisciplinar aplicada ao Desenvolvimento Rural Sustentável (DRS), articulando referenciais teóricos e experiências de ensino, pesquisa e extensão do PPGDRS/UNIOESTE. Trata-se de pesquisa qualitativa, exploratório-descritiva, bibliográfica, documental e teórico-reflexiva, fundamentada na Análise de Conteúdo e na sistematização de experiências. A revisão integra contribuições da sociologia rural e ambiental, interdisciplinaridade, diálogo de saberes, participação, Agroecologia, sustentabilidade e desenvolvimento territorial. Como resultado, propõe-se uma Matriz Operacional Interdisciplinar estruturada em dez códigos: RUR – Ruralidade e território; SAN – Sociedade–natureza; INT – Interdisciplinaridade e complexidade; DIA – Diálogo de saberes; PAR – Participação, democracia e práxis; AGR – Agroecologia, transição e resiliência; SUS – Sustentabilidade, alimentação e bem-estar; ANA – Análise, escrita, sistematização e interpretação; TER – Territorialização e Extensão Inovadora para o DRS; e DEV – Devolutiva, aprendizagem e transformação. A matriz articula teoria e experiência para orientar a interpretação de dados e práticas territoriais. Conclui-se que a interdisciplinaridade no DRS constitui uma práxis acadêmica e territorial que integra ciência, saberes, atores sociais, participação e sustentabilidade em um processo cíclico de produção, sistematização, devolutiva e transformação do conhecimento.*

Palavras-chave: *Interdisciplinaridade; Diálogo de saberes; Participação; Territorialização.*

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INTRODUCTION

Sustainable Rural Development (SRD) constitutes a field of scientific inquiry and intervention characterized by the complexity and multidimensionality of contemporary transformations. Climate change, social and territorial inequalities, food security, transformations in agri-food systems, and emerging relationships between society and nature challenge interpretations centered exclusively on agricultural production. Understanding rural areas therefore requires the simultaneous consideration of social, economic, environmental, cultural, political, and institutional dimensions.

The understanding of rural areas as social, relational, and territorial spaces is supported by Jollivet (1998), Wanderley (2001), Sachs (2004), and Schneider (2009; 2025). These theoretical perspectives demonstrate that agriculture, labor, ways of life, institutions, public policies, and social reproduction strategies are embedded within broader territorial processes. From this perspective, SRD cannot be reduced to economic growth or productive modernization, as it encompasses social inclusion, sustainability, autonomy, and the capacity to transform territories.

This issue becomes even more complex when the relationships between society and nature are considered. Buttel (1979; 2001) demonstrates that agriculture, technology, institutions, social structures, and environmental transformations are interdependent, while Boff (2012) incorporates the ethical dimension of sustainability. Morin (2005), in turn, provides a foundation for understanding complex phenomena through the relationships, interdependencies, and feedback loops among their components, thereby moving beyond fragmented interpretations of reality.

The multidimensional nature of SRD highlights the limitations of strictly disciplinary approaches and positions interdisciplinarity as both an epistemological and methodological challenge. Philippi Jr. and Silva Neto (2011) emphasize its relevance to new forms of knowledge production, while Raynault and Zanoni (2011) advocate its systematic construction around shared problems. Thus, interdisciplinarity does not simply mean bringing together disciplines or authors, but rather establishing relationships capable of producing integrated interpretations of complex problems.

However, integrating scientific disciplines is insufficient when the problems under investigation are territorially embedded and involve individuals and communities who possess their own knowledge and experiences. Freire (1983; 1987), Santos (2009), Walsh (2009; 2017), and Fals Borda (1987) broaden the construction of knowledge through dialogue, participation, praxis, interculturality, and epistemological plurality. From this perspective, territorial actors are no longer regarded merely as sources of information but instead assume a meaningful role in interpreting and transforming their own realities.

Agroecology constitutes a particularly important expression of this articulation among society, nature, science, knowledge systems, and territory. Altieri (2012), Wezel et al. (2009), and Caporal and Costabeber (2004) connect biodiversity, local knowledge, agroecological transition, autonomy, and resilience. This perspective extends SRD to encompass agri-food systems and brings environmental sustainability into closer connection with food security, social justice, well-being, climate change adaptation, and the strengthening of family farming.

These challenges are also reflected in the teaching, research, and extension

experiences developed within the Graduate Program in Sustainable Rural Development at the State University of Western Paraná (PPGDRS/UNIOESTE). PPGDRS has fourteen years of interdisciplinary experience at the master's level and nine years at the doctoral level and, by 2026, had trained more than 200 master's graduates and more than 100 doctoral graduates (ZONIN; WEIRICH; HANSEL, 2026). Its territorial engagement has fostered interactions with family farming, Agroecology, water management, food security, Indigenous communities, solidarity economy, solid waste management, and public policies, transforming territories simultaneously into spaces for research, learning, dialogue, and knowledge construction (ZONIN et al., 2020; 2023; 2026).

Despite advances in theoretical frameworks addressing interdisciplinarity and SRD, the challenge remains of operationalizing the integration of different theoretical perspectives, dimensions of reality, scientific knowledge, territorial knowledge, and teaching, research, and extension experiences. The central issue is not merely to recognize that SRD is interdisciplinary, but to understand how this interdisciplinarity can be transformed into a theoretical-methodological pathway capable of guiding the analysis, interpretation, systematization, and feedback of knowledge produced within territories.

In light of this gap, the following research question is proposed: How can an interdisciplinary perspective capable of integrating theoretical frameworks, methods, knowledge systems, and territorial experiences in the production of knowledge on Sustainable Rural Development be constructed and operationalized? The underlying assumption is that such integration requires a relational and cyclical process that articulates problematization, interdisciplinarity, dialogue among knowledge systems, participation, analysis, systematization, territorialization, feedback, and transformation.

Within this context, this article aims to analyze and systematize the theoretical-methodological and empirical construction of an interdisciplinary perspective applied to SRD, articulating scientific frameworks with teaching, research, and extension experiences associated with PPGDRS/UNIOESTE. As its main contribution, the study proposes an Interdisciplinary Operational Matrix, structured around the codes RUR, SAN, INT, DIA, PAR, AGR, SUS, ANA, TER, and DEV. The matrix is designed to guide the integrated interpretation of documents, interviews, workshops, observations, case studies, and territorial experiences, while supporting a cyclical model for the interdisciplinary construction of knowledge in SRD.

THEORETICAL FRAMEWORK: FOUNDATIONS FOR AN INTERDISCIPLINARY MATRIX FOR THE ANALYSIS OF SUSTAINABLE RURAL DEVELOPMENT

Sustainable Rural Development (SRD) constitutes a complex field that simultaneously encompasses rurality, territory, society–nature relations, production systems, institutions, participation, knowledge, sustainability, and social transformation. For this reason, its analysis requires theoretical frameworks capable of overcoming both disciplinary fragmentation and approaches that reduce rural areas to agricultural production. The operational matrix adopted in this study organizes this challenge into ten interdependent analytical codes: RUR, SAN, INT, DIA, PAR, AGR, SUS, ANA, TER, and DEV. These codes do not represent isolated compartments, but rather

interconnected dimensions of an interpretive process aimed at linking theory, empirical material, and territorial praxis.

RUR – Rurality and Territory

The RUR – Rurality and Territory category is primarily grounded in the works of Jollivet, Wanderley, Sachs, and Schneider. Jollivet (1998) proposes a rural sociology that is open to broader societal transformations and to dialogue with other scientific fields. Rural areas cannot be understood as autonomous or exclusively agricultural domains, since they encompass labor, economy, social organization, the environment, technology, rural–urban relations, and territory. Rural sociology itself is presented by the author as a field that must engage with different sciences in order to understand the multiple dimensions of rural life, thereby assuming a cross-cutting and interdisciplinary orientation.

This formulation is particularly important for the matrix because it allows territory to be understood as a relational construction. According to Jollivet (1998), agriculture and rural society must be analyzed within broader social processes rather than as isolated realities. This epistemological openness brings Rural Sociology into dialogue with Environmental Sociology, Geography, Economics, Agronomy, and territorial studies.

Wanderley (2010; 2014/2015) further develops this perspective within the Brazilian context by arguing that the rural world remains integrated into society while preserving its historical, social, cultural, and ecological particularities. Rural space is simultaneously a socially constructed physical space and a place of life, identity, and citizenship. Territorial occupation, land tenure and land-use structures, natural resources, landscapes, and rural–urban relations are constituent elements of this rurality.

Sachs (2004) complements this theoretical core by shifting the concept of development toward social inclusion, decent work, and the reduction of inequalities. Rather than equating development solely with economic growth, his approach emphasizes public policies, productive diversification, appropriate technologies, and inclusion.

Schneider (2025) argues that the prospects for Sustainable Rural Development in the post-COP30 context require systemic transformations in agri-food systems, linking efforts to address climate change with the strengthening of family farming, agroecological transition, the development of diversified markets, institutional innovation, and territorially grounded public policies. From this perspective, family farming plays a strategic role not only in food production and income generation, but also in food security, environmental conservation, and the development of more resilient rural systems. Thus, RUR guides the analysis of social and territorial transformations by articulating rurality, labor, inclusion, agrarian structure, identity, and development.

SAN – Society–Nature

The SAN – Society–Nature category brings together the contributions of Buttel,

Boaventura de Sousa Santos, Boff, Singer, Nobre, Morin, and Schneider. Buttel's (1992) contribution is crucial to overcoming the analytical separation between social and environmental processes. In his studies on agrarian structure, rural ecology, and environmental change, the author demonstrates that agriculture, technology, institutions, economic growth, and natural resources constitute interdependent dimensions.

In *Estructura agraria y ecología rural*, Buttel (1979) specifically seeks to integrate agrarian structure, social change, agricultural production, and rural ecology. The text demonstrates that rural sociology cannot disregard resource scarcity, energy use, productive organization, and the environmental implications of agricultural systems. In *Transiciones agroecológicas en el siglo XX*, Buttel (1995) emphasizes that the major agricultural transformations of the twentieth century resulted from simultaneous technological, economic, institutional, and social changes, including mechanization, industrial inputs, and economic concentration.

This perspective is further developed in *Instituições sociais e mudanças ambientais*. According to Buttel (2001), economic, political, family, and other institutions regulate behaviors and social relations and play a decisive role in shaping environmental problems. Therefore, SAN makes it possible to ask not only what environmental impacts exist, but also which economic, institutional, and political structures produce or regulate them.

Santos (2009) broadens this interpretation by questioning the hegemony of a single rationality of knowledge concerning society and nature. The Epistemologies of the South and the ecology of knowledges recognize popular, Indigenous, peasant, and traditional knowledge as part of an epistemological plurality. Their inclusion within SAN is relevant because different societies and cultures construct different ways of relating to territory, natural resources, and life.

Boff (2012) adds an ethical dimension. In his formulation, sustainability involves maintaining the conditions that sustain life, preserving ecosystem balance, meeting the needs of present and future generations, and assuming collective responsibility toward the Earth. Singer (2002), in turn, introduces economic arrangements based on cooperation and self-management. The solidarity economy makes it possible to analyze production systems in which economic organization, democracy, and solidarity are interconnected, rather than focusing exclusively on competitive market relations.

Nobre (2024) draws attention to the climate emergency. The vulnerability of territories results not only from climate events themselves, but also from the interaction between exposure and social, economic, environmental, territorial, and institutional conditions. The SAN code therefore assumes a strong socioecological character: production, institutions, economy, knowledge, climate, and natural resources must be interpreted jointly.

Schneider (2025) emphasizes that family farming plays a strategic role not only in food production and income generation, but also in food security, environmental conservation, and the development of more resilient rural systems. This understanding is supported by Morin's (2005) complex thought, according to which phenomena must be understood through their relationships, interdependencies, and feedback loops, thereby overcoming the fragmentation of knowledge and reductionist separations between society and nature.

INT – Interdisciplinarity and Complexity

The INT – Interdisciplinarity code brings together Morin, Jollivet, Raynault, Zanoni, Philippi Jr., Silva Neto, and Zonin et al. According to Morin (2005), understanding complexity requires recognizing that reality constitutes an organized unity composed of diverse and interrelated elements whose interactions produce properties that cannot be explained in isolation. This approach makes it possible to investigate Sustainable Rural Development as a complex issue in which social and ecological systems mutually influence one another, linking agriculture, territory, climate, biodiversity, economy, culture, public policies, and social actors.

Philippi Jr. and Silva Neto (2011) position interdisciplinarity as a central issue in scientific and technological production and innovation, associating it with the need for new forms of knowledge integration. Raynault (2011) further develops this discussion by arguing that contemporary problems transcend disciplinary boundaries and require a specific epistemological construction.

Interdisciplinarity does not consist of simply bringing specialists together. Raynault and Zanoni (2011, p. 144) refer to this construction as "intellectual reconstruction," involving new research methodologies, the intersection of different perspectives, and the convergence of contributions around a shared question. The authors propose stages that include defining a common object of study, developing a collective research problem, formulating disciplinary contributions, conducting case studies, articulating methodological approaches, and synthesizing results.

Jollivet (1998) reinforces this construction by demonstrating that rural realities themselves require the articulation of different forms of knowledge. Zonin et al. (2023; 2026), in turn, territorialize this conception through the experience of PPGDRS. In this context, interdisciplinarity extends beyond the academic sphere and connects universities, communities, social movements, public organizations, and regional institutions. Thus, INT guides the matrix's central question: Which dimensions need to be integrated so that the problem can be explained without fragmentation?

DIA – Dialogue Among Knowledge Systems

The DIA – Dialogue Among Knowledge Systems category brings together the contributions of Freire, Santos, Walsh, Fals Borda, Caporal, and Costabeber. Freire (1983) provides the communicative foundation by criticizing rural extension based on the unilateral transfer of knowledge. His approach recognizes farmers and other social actors as active participants in the construction of knowledge. In his discussion of agrarian reform, Freire (1983) rejects an exclusively technical approach and emphasizes the need to integrate agronomic, social, cultural, and pedagogical knowledge.

Santos (2009) further develops this issue through the ecology of knowledges. The question is no longer merely how scientific knowledge should be communicated, but also which forms of knowledge are considered legitimate. The ecology of knowledges proposes dialogue between science and popular, peasant, Indigenous, and traditional knowledge, without assuming that they are identical, while rejecting epistemological monoculture.

Walsh (2009; 2017) adds critical interculturality and a decolonial perspective. In

Pedagogías decoloniales, processes of resistance, re-existence, and collective construction are linked to the critique of colonial hierarchies and the recognition of distinct historical and cultural experiences. Intercultural dialogue must acknowledge particularities and prevent diversity from being subordinated once again to universalizing academic categories.

Fals Borda (2009) transforms this epistemological openness into a participatory procedure. In Participatory Action Research (PAR), academic and popular knowledge interact through reflection–action, respectful communication, participation, and the collective production of knowledge. Thus, DIA makes it possible to assess whether territorial knowledge is treated merely as "data" or as an effective component of interpretation.

In Agroecology, knowledge construction requires dialogue between scientific knowledge and the knowledge historically developed by farmers, recognizing experience and local culture as fundamental components of agroecological transition processes (CAPORAL; COSTABEBER, 2004).

PAR – Participation, Democracy, and Praxis

The PAR – Participation and Praxis code brings together Fals Borda, Freire, Bordenave, Dowbor, Caporal and Costabeber, and Zonin et al. According to Fals Borda (1987), the validity of knowledge is linked to praxis, understood as the dialectical unity between theory and practice. Participatory Action Research integrates research and social transformation, recognizing social actors as participants in the construction of knowledge.

Freire (1983) associates participation with dialogue, critical consciousness, and transformation. Bordenave (1983), in turn, broadens the understanding of participation by demonstrating that it responds both to human needs for social interaction and to the capacity to intervene in collective decision-making. In O que é participação, the author distinguishes effective participation from merely instrumental or exclusionary forms, emphasizing that participation involves expression, decision-making, autonomy, and the capacity to influence collective processes.

In Democracia econômica: alternativas de gestão social, Dowbor (2013) argues that political democracy is insufficient when fundamental economic decisions remain concentrated within large corporate structures; hence the need to democratize economic and decision-making processes. This perspective allows the matrix to incorporate economic democracy, decentralization, social management, participation, local power, and the democratization of economic decision-making.

As described by Zonin and Weirich (2026) and Zonin et al. (2026), Innovative Extension for SRD adds the territorialization of knowledge as a dimension of the matrix. From this perspective, extension, teaching, and research are integrated into interdisciplinary processes in which territories simultaneously constitute spaces for learning, investigation, dialogue, innovation, and transformation. Interaction with farmers, communities, organizations, and institutions makes it possible to confront scientific knowledge with concrete experiences, produce contextualized interpretations, and develop socially grounded alternatives to the challenges of Sustainable Rural Development.

This formulation is central to the article's methodology because it makes it

possible to distinguish situations in which individuals merely provide information from those in which they act as co-producers of knowledge. PAR therefore guides the analysis of the quality of participation, autonomy, and the capacity of territorial actors to intervene in their realities.

AGR – Agroecology, Transition, and Resilience

The AGR – Agroecology, Transition, and Resilience category brings together Altieri, Wezel et al., Caporal and Costabeber, and Nobre. Altieri (2012) provides the agroecological foundation by understanding sustainable agroecosystems through biodiversity, diversification, ecological processes, and local knowledge. In his discussion of peasant family farming, it assumes strategic importance in conserving agrobiodiversity, maintaining food sovereignty and ecological knowledge, and strengthening resilience.

Agroecology thus emerges simultaneously as a science, a productive strategy, and a socioecological foundation for rural sustainability. Within the corpus analyzed in this study, Altieri (2012) serves as a reference for biodiversity-based sustainable agricultural systems, highlighting reasons for considering Peasant Family Farming a global ecological heritage because of its role in conserving biodiversity and cooling the climate.

Caporal and Costabeber (2004) provide the theoretical and strategic foundations for strengthening agroecological rural extension and the agroecological transition process in Brazilian agriculture, while Wezel et al. (2009) emphasize Agroecology as a science, practice, and movement that promotes agroecological transition.

Nobre (2024) warns of the impacts of climate change on food production and the risks associated with tipping points in the climate system, while also emphasizing the need to expand the protection of ecosystems that are essential to climate regulation, particularly the Amazon.

At the launch of the projects of the Extension Program for Territorial Sustainability, organized by ITAIPU Binacional and ITAIPU PARQUETEC in Foz do Iguaçu, Nobre (2024) addressed the climate emergency as one of humanity's major contemporary challenges. Incorporating this issue into the context of university extension highlights the need for territorial, interdisciplinary, and participatory responses capable of connecting science, public policies, universities, and communities in the development of sustainability and socioenvironmental resilience strategies.

Thus, AGR examines diversification, biodiversity, ecological knowledge, food sovereignty, climate change, and adaptive capacity, integrating science, practices, and social and ecological movements aimed at transforming social realities.

SUS – Sustainability, Food, and Well-Being

The SUS – Integral Sustainability code brings together Boff, Altieri, Wezel et al., Caporal and Costabeber, Josué de Castro, D. Mauro Morelli, Schneider, and Dowbor. Boff (2012) provides the ethical and civilizational foundation: sustainability should not be reduced to “green” rhetoric or marginal technological adjustments, as it requires transformations in modes of production, consumption, and relationships with nature. His conception associates sustainability with ecosystem vitality, collective responsibility,

and intergenerational justice.

While Boff (2012) addresses the ethical conditions required for the continuity of life, Altieri (2012) provides the agroecological dimension of sustainability, demonstrating how these conditions can be translated into diversified, biologically complex agroecosystems that are less dependent on external inputs. The articulation between these perspectives supports a conception of sustainability that encompasses ethics, biodiversity, production, society, autonomy, and future generations.

Wezel et al. (2009) emphasize Agroecology as simultaneously a science, practice, and movement, while Caporal and Costabeber (2004) incorporate the multidimensionality of sustainability and dialogue among knowledge systems as foundations for agroecological transition.

Josué de Castro (2002) recognizes that hunger does not result simply from a natural scarcity of food, but from the social, economic, and territorial inequalities that shape access to it. Morelli (2020) adds the ethical perspective of human dignity, the human right to adequate food, and the eradication of hunger. Schneider (2009) connects family farming, agri-food systems, markets, public policies, territory, and resilience, while Dowbor (2013) broadens the analysis to encompass the democratization of the economy, territorial governance, the reduction of inequalities, and the allocation of economic resources toward collective well-being. Integral Sustainability therefore constitutes an interdisciplinary synthesis that connects society and nature, production and food, environment and territory, knowledge and participation, and economy and social justice, with sustainable agri-food systems, resilient territories, and the guarantee of a dignified life as its overarching goals.

ANA – Analysis, Writing, Systematization, and Interpretation

The ANA – Analysis, Writing, Systematization, and Interpretation category brings together Bardin, Jara Holliday, and Marques. Bardin (2016) provides procedures for corpus construction, coding, categorization, inference, and interpretation. Content Analysis makes it possible to construct categories based either on theoretical foundations or on patterns emerging empirically from the material, provided that rigor, relevance, and coherence with the research problem are maintained.

Within an interdisciplinary framework, Bardin's (2016) contribution is particularly relevant because the objective is not merely to identify frequencies, but to relate units of meaning belonging to different dimensions of reality. Thus, a single account may reveal environmental, economic, family, cultural, and institutional components.

Jara Holliday (2012) complements this procedure by understanding the systematization of experiences as a process that goes beyond organizing information. Systematization means critically reconstructing lived processes, interpreting meanings, and generating learning. His approach encompasses epistemological, ethical, political, and pedagogical dimensions and is qualitative, participatory, and hermeneutic in nature.

Marques (2006) adds an often underestimated dimension to interdisciplinary construction: writing as a constitutive component of the research process itself. Writing does not correspond merely to the final stage of communicating results; rather, it contributes to defining the research problem, engaging with other authors and knowledge systems, organizing arguments, and systematizing and validating

knowledge. The movement between writing, reading, and rewriting transforms research into an ongoing process of reconstructing learning. This perspective aligns with the cyclical logic adopted in this study, since systematized results do not mark the end of knowledge production: their communication, discussion, feedback, and reformulation can generate new interpretations and new research problems.

TER – Territorialization and Innovative Extension for SRD

The TER – Territorialization of Sustainable Rural Development (SRD) category is based on the understanding that development does not occur in an abstract or homogeneous manner but materializes within concrete territories shaped by relationships among society, nature, production systems, institutions, social actors, knowledge, and public policies.

From this perspective, Zonin et al. (2020; 2023; 2026) contribute to understanding territory as a privileged space for the interdisciplinary construction of SRD, where research, teaching, and extension can connect universities, family farming, social organizations, traditional communities, public institutions, and other territorial actors. This approach converges with Schneider (2025), for whom the territorial perspective makes it possible to move beyond exclusively sectoral and agricultural interpretations of rural areas by incorporating the social, economic, institutional, and environmental relationships that shape strategies of social reproduction and development. Territory thus becomes simultaneously a unit of analysis and a space for action, allowing local specificities to be interpreted without separating them from regional, national, and global dynamics.

This territorialization acquires a socioenvironmental and participatory dimension when articulated with the contributions of Caporal and Costabeber (2004), particularly through Agroecology and Rural Extension aimed at developing sustainable processes based on the ecological, cultural, and socioeconomic conditions of each territory. Dialogue among knowledge systems, farmer participation, and the recognition of local knowledge make it possible to understand rural development as a process constructed with social actors rather than simply transferred to territories by external agents. This perspective aligns with Morelli's (2020) contribution by placing human dignity, the right to food, and the fight against hunger and inequalities at the center of territorial development. Thus, territorializing SRD means recognizing that food security and food sovereignty, social inclusion, environmental conservation, and access to resources depend on power relations, socioeconomic conditions, and the organizational capacity present within each territorial context.

In dialogue with these perspectives, Dowbor (2013) broadens the territorialization of SRD to encompass economic democracy and local governance, emphasizing the need to bring decisions, resources, and policies closer to the populations and places where problems and opportunities actually emerge. The articulation among Zonin et al., Caporal and Costabeber, Morelli, Schneider, and Dowbor therefore makes it possible to conceptualize TER as an interdisciplinary process of appropriation, construction, and social transformation of territory, connecting actors, networks, knowledge, natural resources, agri-food systems, markets, institutions, and public policies.

From this perspective, territorialization constitutes an operational dimension of

SRD because it translates general principles of sustainability into territorially contextualized practices, strengthening autonomy, social participation, family farming, Agroecology, food security, governance, and socioenvironmental resilience, with territory serving as a space for integrating society and nature, knowledge and action, public policies and social participation.

DEV – Feedback, Learning, and Transformation

The DEV – Feedback, Learning, and Transformation category understands interdisciplinary research not as a process that ends with data collection, analysis, and publication, but as a practice that requires returning knowledge to the individuals, communities, and territories that participated in its construction. In Paulo Freire (1983), this perspective is grounded in the dialogical conception of knowledge, according to which individuals should not be treated as passive objects of research but as participants capable of critically interpreting their reality and acting upon it. The relationship between action and reflection — praxis — gives feedback a meaning that extends beyond the mere presentation of results: it becomes an opportunity for dialogue, problematization, collective learning, and the transformation of reality (FREIRE, 1983; 2013). In this sense, providing feedback means putting the knowledge produced back into circulation among participants, enabling its appropriation, critique, and reinterpretation.

This perspective is closely related to Orlando Fals Borda's (1987) Participatory Action Research, according to which scientific knowledge production committed to social realities must articulate knowledge and action while recognizing the knowledge produced by communities themselves. From this standpoint, feedback is an integral part of the research process, as systematized knowledge is returned to social groups in ways that can strengthen their capacity to interpret, organize, and intervene in the problems they experience (FALS BORDA, 1987). Within the context of Sustainable Rural Development, this conception is consistent with Zonin et al. (2026), who understand research and extension as territorially grounded processes of interaction between universities and society, in which field research, dialogue among knowledge systems, stakeholder participation, and the dissemination of results can generate mutual learning and inform practices, public policies, and development strategies constructed according to the specific characteristics of each territory.

Marques (2006), in turn, contributes to understanding feedback as a moment of knowledge reconstruction and communication, since research and writing do not merely consist of recording previously established results but are integral to the process through which knowledge itself is developed. From this perspective, writing organizes, problematizes, and makes communicable what has been constructed throughout the research process, allowing knowledge to be subjected once again to dialogue and critical examination (MARQUES, 2006).

Drawing on the contributions of Freire, Fals Borda, Zonin et al., and Marques, the DEV code understands feedback as a constitutive dimension of the knowledge production process itself. From this perspective, research findings are returned to the individuals, communities, and territories from which they originated not merely for communication, but also to be shared, discussed, interpreted, and socially validated.

Feedback therefore moves beyond being a procedure carried out at the end of the research process or a mere formal commitment by the researcher and becomes an integral component of the interdisciplinary methodology as a space for dialogue, critical reflection, and collective learning.

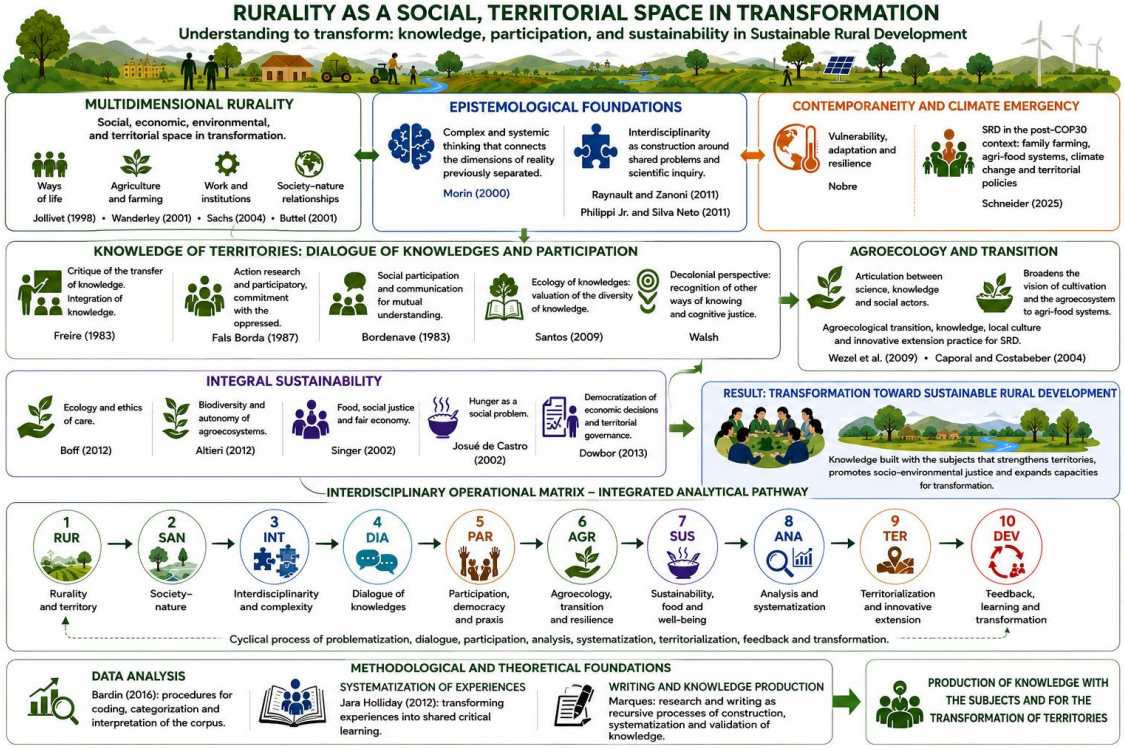
A continuous and participatory process is thus established in which dialogue, research, systematization, and the sharing of results mutually reinforce one another, enabling new interpretations, actions, and transformations within the territory. The knowledge produced is no longer restricted to analysis about social actors but is instead constructed with them, recognizing these actors as active participants in interpreting reality and building possibilities for transformation.

Integrative Synthesis of the Review

T he theoretical review underpinning the operational matrix demonstrates that Sustainable Rural Development (SRD) constitutes a complex and multidimensional issue whose understanding requires moving beyond fragmented disciplinary interpretations, as illustrated in Figure 1.

Innovative Extension for SRD, in turn, articulates these dimensions through the integration of teaching, research, extension, actors, and territories (Zonin et al., 2023; Zonin et al., 2026). Thus, the matrix is not merely a classificatory instrument but rather a theoretical-methodological framework for interpreting empirical data and interdisciplinarily reconstructing the relationships among society, nature, knowledge, food, participation, economy, and territory. In this way, research follows a cyclical process encompassing problematization, dialogue, participation, analysis, systematization, territorialization, feedback, and transformation.

Figure 1. Theoretical-Methodological Synthesis of the Interdisciplinary Operational Matrix for Sustainable Rural Development



Source: Prepared by the author (2026).

METHODOLOGY

The study is characterized as qualitative research of a bibliographic, documentary, and theoretical-reflective nature, with exploratory-descriptive objectives, conducted through a literature review, Content Analysis, and the systematization of experiences. This methodological design derives from the purpose of identifying, organizing, comparing, and interpreting theoretical and methodological contributions related to Sustainable Rural Development (SRD), considering rurality and territory, society–nature relations, interdisciplinarity and complexity, dialogue among knowledge systems, participation and praxis, agroecology, sustainability, analysis and systematization, territorialization, and transformation. The review was not limited to juxtaposing authors from different scientific fields; rather, it sought to establish interfaces and complementarities capable of constituting an interdisciplinary operational matrix, consistent with the understanding that complex problems require the articulation of different dimensions of reality (MORIN, 2005; RAYNAULT; ZANONI, 2011; PHILIPPI JR.; SILVA NETO, 2011).

The bibliographic and documentary corpus was intentionally composed of books, book chapters, scientific articles, theses, academic documents, reports, and publications related to the trajectory of PPGDRS/UNIOESTE, selected according to their conceptual relevance and their capacity to contribute to the interpretation of the research problem. The study drew on theoretical frameworks from rural and environmental sociology, interdisciplinarity, critical epistemologies, participatory methodologies, Agroecology, sustainability, food security, and territorial development. Key authors included Jollivet, Wanderley, Sachs, Buttel, Boaventura de Sousa Santos, Boff, Singer, Nobre, Schneider, Raynault and Zanoni, Philippi Jr. and Silva Neto, Freire, Walsh, Fals Borda, Bordenave, Altieri, Wezel et al., Caporal and Costabeber, Josué de Castro, Mauro Morelli, Dowbor, Bardin, Jara Holliday, Mario Osorio Marques, and Zonin et al. The selection was therefore not intended to constitute an exhaustive systematic or bibliometric review, but rather to form a theoretically oriented corpus appropriate to the interdisciplinary nature of SRD.

The organization and interpretation of this corpus were grounded in Content Analysis, understood as a systematic set of procedures aimed at describing and interpreting communications and generating inferences regarding their meanings (BARDIN, 2016). The analytical process followed the three stages proposed by the author: pre-analysis, involving organization, preliminary reading, and corpus construction; exploration of the material, through the definition of units of meaning, coding, and categorization; and treatment of results, inference, and interpretation, during which the identified content was related, compared with the theoretical frameworks, and interpreted in light of the research problem. The categories were constructed through a combination of theoretical guidance and recurring patterns identified in the material, while maintaining sufficient flexibility to incorporate relationships that emerged during the interpretive process. A total of 40 texts and sources were analyzed, comprising books, book chapters, academic journal articles, and interviews with speakers considered strategically relevant to the topic under investigation (12 books, 8 book chapters, 15 articles, and 5 interviews).

The thematic analysis resulted in the construction of ten analytical codes presented in the operational matrix: RUR – Rurality and Territory; SAN – Society–Nature;

INT – Interdisciplinarity and Complexity; DIA – Dialogue Among Knowledge Systems; PAR – Participation, Democracy, and Praxis; AGR – Agroecology, Transition, and Resilience; SUS – Sustainability, Food, and Well-Being; ANA – Analysis, Writing, Systematization, and Interpretation; TER – Territorialization and Innovative Extension for SRD; and DEV – Feedback, Learning, and Transformation. For each code, a guiding question for interpreting the results and a network of reference authors were established. In this way, categorization transforms the literature review into an operational analytical instrument, making it possible to examine data and experiences through theoretically grounded dimensions rather than using the theoretical frameworks merely as a sequential presentation of concepts.

The construction of the categories did not assume an exclusive correspondence between each author and a single code, since interdisciplinarity itself requires recognition of interfaces, cross-cutting relationships, and the different analytical functions that a single theoretical framework may perform. Thus, Jollivet contributes to RUR by addressing transformations in rurality and also to INT by highlighting the need to open rural sociology to the interfaces between society and nature; Boaventura de Sousa Santos contributes to SAN and, simultaneously, DIA through his emphasis on epistemological plurality and the ecology of knowledges; Freire connects dialogue, participation, and transformation through the relationship between reflection and action; while Caporal and Costabeber intersect DIA, PAR, AGR, SUS, and TER by relating Agroecology, participation, local knowledge, and sustainability. This overlap is methodologically intentional, avoiding the compartmentalization of authors and recognizing that interdisciplinarity is constructed precisely through the relationships among categories and dimensions of the research problem (JOLLIVET, 1998; FREIRE, 1987; SANTOS, 2009; CAPORAL; COSTABEBER, 2004).

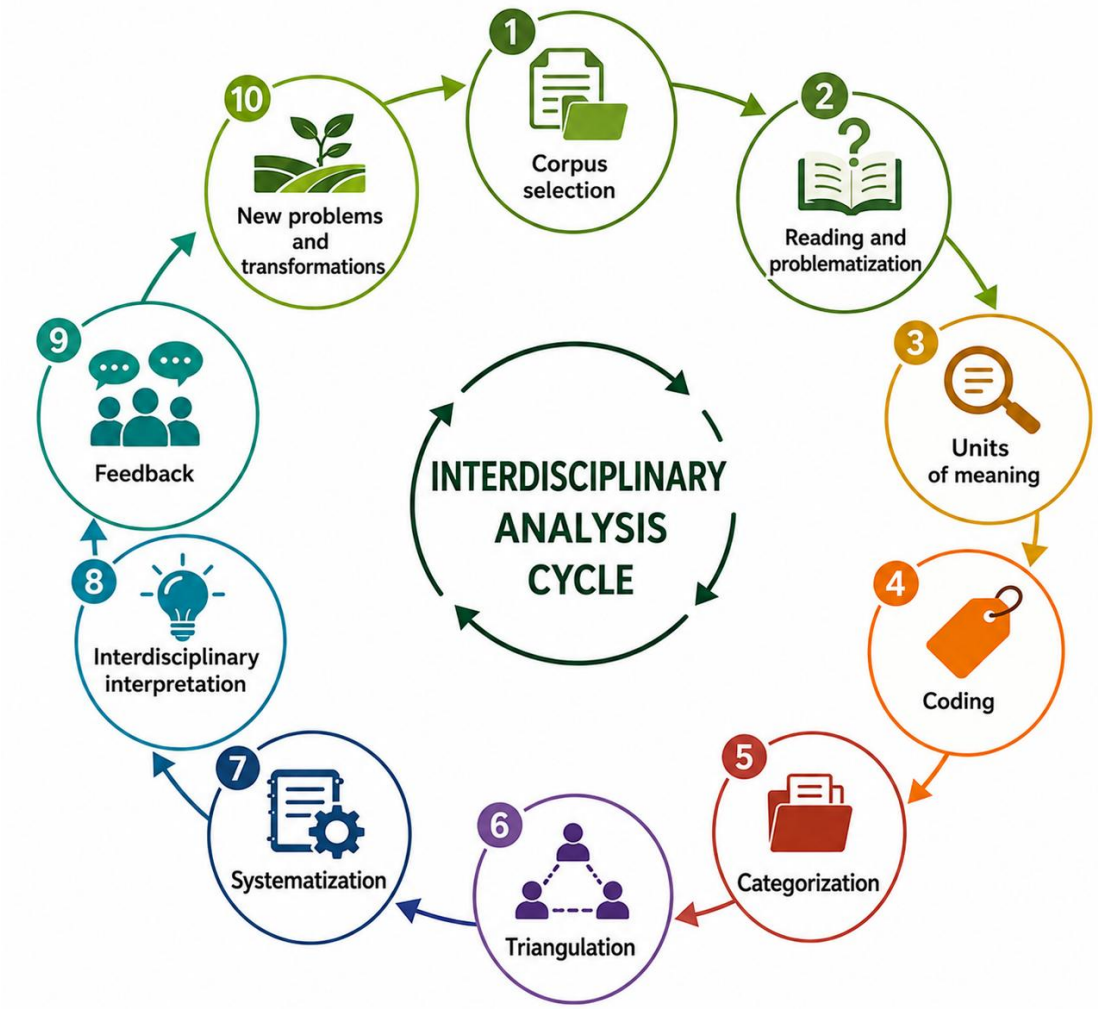
In addition to Content Analysis, the systematization of experiences was adopted as a strategy for reconstructing and critically interpreting academic and territorial practices. For Jara Holliday, systematizing experiences means going beyond their description or chronological organization by seeking to critically understand lived processes, their conditions, relationships, contradictions, and lessons learned, so that experience itself can generate new knowledge (JARA HOLLIDAY, 2012). This perspective is consistent with Mario Osorio Marques, for whom writing is an integral part of the knowledge production process itself, making it possible to organize, reconstruct, and communicate thought (MARQUES, 2006). Accordingly, documents, records, narratives, and experiences were not regarded merely as records of activities but as materials subject to interpretive reconstruction, particularly within the ANA code, which integrates analysis, writing, systematization, and interpretation.

The interdisciplinary construction of the matrix is based on the understanding that interdisciplinarity does not automatically result from the presence of multiple disciplines or from bringing together authors from different fields. Rather, it must be methodically constructed around a common problem. From this perspective, Raynault and Zanoni advocate a process of convergence and intellectual reconstruction capable of articulating different dimensions and disciplinary competencies without eliminating their specificities (RAYNAULT; ZANONI, 2011). This approach converges with the perspective of complexity, according to which knowledge must be capable of establishing relationships among parts, contexts, and wholes (MORIN, 2005). The matrix was therefore structured to enable horizontal movement across the ten codes, avoiding

fragmentation of the research problem and allowing social, environmental, economic, cultural, epistemological, political, and territorial processes to be interpreted jointly.

In a second analytical dimension, the codes were related to teaching, research, and extension experiences, case studies, field activities, and educational processes associated with PPGDRS/UNIOESTE, particularly territorially grounded practices developed within the field of Sustainable Rural Development. Drawing on Freire (1983; 1987) and Fals Borda (2009) makes it possible to understand the field not merely as a site for obtaining information, but as a space for dialogue, participation, problematization, and the shared construction of knowledge. From this perspective, territorial actors are not conceived simply as sources of data, but as subjects who possess knowledge and experiences relevant to interpreting the realities under investigation. The methodological pathway can therefore be summarized through the movements of observing, listening, problematizing, relating, interpreting, and systematizing, thereby connecting theory and reality, scientific and social knowledge, and university and territory.

Figure 2. Methodological Cycle for the Analysis and Interdisciplinary Construction of Knowledge in Sustainable Rural Development (SRD)



Source: Prepared by the author (2026).

The materials were interpreted through theoretical, thematic, and documentary triangulation, comparing units of meaning, analytical codes, theoretical frameworks

from different scientific traditions, and systematized experiences. The objective was not to establish a hierarchy among authors or disciplines, but rather to identify the specific and complementary contribution of each perspective: rural sociology supports the interpretation of ruralities; environmental sociology problematizes society–nature relations; complexity and interdisciplinarity studies guide the integration of different dimensions; Freire, Fals Borda, Walsh, and Boaventura de Sousa Santos contribute to dialogue, participation, and epistemological plurality; Altieri, Wezel et al., and Caporal and Costabeber provide the foundations for Agroecology; Bardin provides procedures for categorization and interpretation; and Jara Holliday and Marques support systematization, learning, and the reconstruction of knowledge. Triangulation therefore constitutes a strategy of interpretive integration rather than a means of merely confirming findings across sources.

The methodological process is completed through feedback, incorporated into the matrix through the DEV code as a constitutive dimension of knowledge production. Drawing on Freire, the relationship between knowledge and transformation is grounded in praxis, understood as the articulation between reflection and transformative action (FREIRE, 1987). In Fals Borda (1987), this perspective is associated with research committed to participation and transformation; in Jara Holliday (2012), systematization should generate learning capable of informing new practices. Thus, feedback does not represent merely the final presentation of results, but rather the possibility of returning knowledge to the territory, discussing it with the actors involved, generating learning, identifying new questions, and potentially reformulating practices, as shown in Figure 2.

In summary, the method integrates bibliographic and documentary review, Content Analysis, systematization of experiences, triangulation, and interdisciplinary interpretation, with the matrix composed of the ten codes—RUR, SAN, INT, DIA, PAR, AGR, SUS, ANA, TER, and DEV—serving as its integrating framework. The procedure makes it possible to move from theory to the interpretation of experiences and from these experiences back to theoretical reconstruction, while preserving the process-oriented and reflexive nature of scientific knowledge production. The matrix should therefore not be understood as a rigid classificatory structure, but rather as an open and relational theoretical-methodological framework in which each guiding question directs the interpretation of the results and the interfaces among the codes make it possible to reconstruct the complexity of SRD. In this way, the methodology seeks to operationalize a conception of research in which interdisciplinarity, dialogue among knowledge systems, participation, territorialization, systematization, and feedback constitute a unified process of knowledge production, validation, circulation, and transformation.

RESULTS AND DISCUSSION

The results and discussion are presented based on the application of the interdisciplinary operational matrix developed in this study, enabling the empirical data to be interpreted in an integrated and multidimensional manner. The ten analytical categories structure the interpretation of the relationships among rurality, society–nature, interdisciplinarity, dialogue among knowledge systems, participation,

agroecology, sustainability, systematization, territorialization, and transformation. This framework makes it possible to compare empirical evidence with the selected theoretical references, identifying convergences, contradictions, complementarities, and lessons learned.

The present discussion integrates theory, method, and territory as complementary dimensions of the interdisciplinary production of knowledge, as illustrated in Figure 3.

Figure 3. Interdisciplinary Operational Matrix for the Analysis of Data and Territorial Experiences

Analytical code	Guiding question for the results	Main authors
RUR – Rurality and territory	How do social, economic and territorial transformations appear in the data and affect rural ways of life?	Jollivet; Wanderley; Sachs; Schneider
SAN – Society–nature	How are production, environment, institutions, natural resources and climate change related?	Buttel; B. S. Santos; Boff; Singer; Nobre; Morin; Schneider
INT – Interdisciplinarity and complexity	Which dimensions and relationships need to be integrated to understand the complexity of the problem?	Morin; Jollivet; Raynault and Zanoni; Philippi Jr. and Silva Neto; Zonin *et al.*
DIA – Dialogue among knowledge systems	How do scientific, local, peasant, indigenous and popular knowledge systems interact in the construction of knowledge?	Freire; B. S. Santos; Walsh; Fals Borda; Caporal and Costabeber
PAR – Participation, democracy and praxis	How do actors participate in the production of knowledge, in decision-making and in the management of development processes?	Fals Borda; Freire; Bordenave; Caporal and Costabeber; Zonin *et al.*; Dowbor
AGR – Agroecology, transition and resilience	How do biodiversity, diversification, ecological knowledge, agroecological transition, food sovereignty and resilience appear in the data?	Altieri; Nobre; Wezel *et al.*; Caporal and Costabeber
SUS – Sustainability, food and well-being	How do the results articulate environment, society, economy, culture, ethics, food, equity and future generations?	Boff; Altieri; Wezel *et al.*; Caporal and Costabeber; Josué de Castro; Morelli; Schneider; Dowbor
ANA – Analysis, writing, systematization and interpretation	Which patterns, differences, contradictions and relationships emerge from the corpus and how are they transformed into systematized knowledge?	Bardin; Jara Holliday; Mario Osorio Marques
TER – Territorialization and Innovative Extension for SRD	How do knowledge, public policies, extension, actors and institutions articulate in practices of territorial development?	Zonin *et al.*; Caporal and Costabeber; Schneider; Morelli; Dowbor
DEV – Feedback, learning and transformation	How does knowledge return to the territory and generate new learning, actions, innovations, social participation or new research questions?	Freire; Fals Borda; Zonin *et al.*; Mario Osorio Marques

Source: Prepared by the author (2026).

RUR – Rurality and Territory

The RUR – Rurality and Territory code integrates the contributions of Jollivet (1998), Wanderley (2001), Sachs (2004), and Schneider (2025), making it possible to interpret the social, economic, and territorial transformations revealed by the empirical data. Jollivet (1998) contributes to understanding rural areas as spaces of social relations that extend beyond agricultural activity and whose interpretation requires connections with broader societal processes. Wanderley (2001), in turn, adds the historical, social, cultural, and ecological particularities of Brazilian rurality, emphasizing that rural areas remain integrated into society without losing their territorial specificities. This understanding makes it possible to interpret family farming, ways of life, identities, labor relations, and forms of social reproduction as interconnected dimensions of territory. Wanderley's conception of rural areas as simultaneously integrated and distinctive is supported by her formulation of Brazilian rurality.

Sachs (2004) broadens this dimension by relating development to social inclusion, labor, and the reduction of inequalities, making it possible to analyze territorial sustainability beyond economic growth. Schneider (2025), in discussing the

prospects for SRD in the post-COP30 context, updates this debate in light of transformations in agri-food systems, climate change, family farming, and the need for territorially grounded public policies. Thus, RUR makes it possible to examine the permanence of rural populations, succession, productive diversification, new ruralities, inequalities, and transformations in ways of life, understanding territory not merely as physical space but as a historical construction resulting from relationships among actors, institutions, economic activities, and different development projects.

SAN – Society–Nature

The SAN – Society–Nature code brings together Buttel (2001), Santos (2009), Boff (2012), Singer (2002), Nobre (2024), Morin (2000), and Schneider (2025). Buttel (2001) provides a sociological perspective for understanding that agriculture, the environment, technology, institutions, and economic structures are not independent spheres. From this perspective, environmental problems are socially produced and must be interpreted by considering the relationships among forms of production, markets, natural resources, institutions, and processes of social change. Santos (2009) adds a critique of hegemonic rationalities and recognition of the plurality of ways of knowing and relating to nature and territory.

Boff (2012) incorporates the ethical dimension by associating sustainability with care, the preservation of conditions that sustain life, and intergenerational responsibility. Singer (2002) complements this perspective through the solidarity economy, emphasizing cooperation, self-management, and socially oriented economic arrangements. Morin (2000) provides the epistemological foundation for understanding these relationships as components of a complex reality in which ecological, economic, social, cultural, political, and ethical dimensions are interdependent. Nobre (2024) and Schneider (2025) update this code in light of the climate emergency by incorporating vulnerability, adaptation, resilience, and transformations in agri-food systems. Thus, SAN guides the interpretation of connections among production, society, institutions, economy, knowledge, climate, and natural resources, avoiding explanations that reduce environmental problems exclusively to their biophysical dimensions.

INT – Interdisciplinarity and Complexity

The INT – Interdisciplinarity and Complexity code constitutes the epistemological axis of the matrix and integrates Morin (2000), Jollivet (1998), Raynault and Zanoni (2011), Philippi Jr. and Silva Neto (2011), and Zonin et al. (2020). Morin (2000) supports the need to overcome the fragmentation of knowledge and understand the relationships between parts and the whole, providing the matrix with its foundation in complexity. Jollivet (1998) demonstrates, within rural sociology, that the very nature of rural problems requires the intersection of different perspectives. Philippi Jr. and Silva Neto (2011) position interdisciplinarity as a challenge for scientific and technological knowledge production, while Raynault and Zanoni (2011) further develop its operationalization through the shared construction of the research problem.

From this perspective, interdisciplinarity does not correspond to the mere juxtaposition of disciplines or authors. It requires the construction of a common problem, the mobilization of relevant disciplinary knowledge, the establishment of

conceptual and methodological interfaces, and the production of an integrated interpretation. Zonin et al. (2020) add the institutional and territorial dimension of this construction, particularly through the experience of PPGDRS, in which teaching, research, and extension are interdisciplinarily connected to concrete territorial problems. Therefore, INT makes it possible to examine whether empirical data are interpreted in a fragmented manner or whether different dimensions of reality are effectively interconnected to enhance the explanatory capacity of the research.

DIA – Dialogue Among Knowledge Systems

The DIA – Dialogue Among Knowledge Systems code integrates Freire (1983), Santos (2009), Walsh (2009), Fals Borda (1987), and Caporal and Costabeber (2004). Freire (1983) provides the dialogical foundation by criticizing extension understood as the unilateral transfer of knowledge and proposing instead a communicative and problem-posing relationship among subjects. Santos (2009), through the ecology of knowledges, broadens this principle by recognizing epistemological diversity and questioning the monoculture of scientific knowledge. Walsh (2009) incorporates critical interculturality and a decolonial perspective, making it possible to problematize historical power relations that establish hierarchies among forms of knowledge, cultures, and social actors.

Fals Borda (1987) brings dialogue into the research process by integrating theory, action, and participation through Participatory Action Research, recognizing social actors as participants in knowledge production. Caporal and Costabeber (2004), in turn, territorialize this debate within Agroecology and Rural Extension by proposing a shift away from conventional models of technology transfer toward participatory and contextualized processes of knowledge construction. Their work explicitly connects Agroecology, Rural Extension, SRD, and food security. Thus, DIA makes it possible to assess whether scientific, local, peasant, Indigenous, and popular knowledge systems merely coexist or whether they effectively interact, confront different interpretations, and contribute to the construction of research findings.

PAR – Participation, Democracy, and Praxis

The PAR – Participation, Democracy, and Praxis code brings together Fals Borda (1987), Freire (1983), Bordenave (1983), Caporal and Costabeber (2004), Zonin et al. (2026), and Dowbor (2013). Fals Borda (1987) grounds praxis in the articulation among knowledge, participation, and transformative action; Freire (1983) attributes a dialogical, educational, and emancipatory character to participation; and Bordenave (1983) makes it possible to distinguish effective participation from merely formal involvement. From this perspective, participation means moving beyond the role of informant toward increasing levels of expression, decision-making, shared responsibility, and intervention in processes that affect social realities.

Caporal and Costabeber (2004) connect this participation to agroecological transition processes and the construction of a new model of Rural Extension. Dowbor (2013) adds the dimension of economic democracy and social management, making it possible to question not only who participates in research, but also who has the effective capacity to influence economic and territorial decisions. Zonin et al. (2026),

within the framework of Innovative Extension, integrate participation, citizenship, autonomy, participatory methodologies, institutional networks, and social transformation; the model itself identifies institutional, educational, political, and innovative dimensions. Thus, PAR makes it possible to assess the extent to which territorial actors participate in knowledge production, decision-making, and the governance of SRD processes.

AGR – Agroecology, Transition, and Resilience

The AGR – Agroecology, Transition, and Resilience code integrates Altieri (2012), Wezel et al. (2009), Caporal and Costabeber (2004), and Nobre (2024). Altieri (2012) provides the ecological foundation by emphasizing biodiversity, diversification, local knowledge, autonomy, and agroecosystem resilience. Wezel et al. (2009) conceptually broaden this approach by demonstrating that agroecology has historically developed as a science, a movement, and a practice, progressively incorporating environmental, social, economic, ethical, and developmental dimensions. The scale of agroecology has also expanded from the crop level to the farm, agroecosystem, and food system.

Caporal and Costabeber (2004) connect agroecology, Rural Extension, and SRD, understanding agroecological transition as a process that goes beyond the mere substitution of techniques or inputs. The very structure of their work links agroecological transition, a new model of Rural Extension, sustainable development, and food security. Nobre (2024) complements this dimension by incorporating the climate perspective, making it possible to understand the diversification and sustainability of production systems in terms of adaptation and resilience. AGR therefore makes it possible to identify biodiversity, ecological knowledge, food sovereignty, diversification, autonomy, adaptive capacity, and transition processes toward more sustainable agri-food systems within the data.

SUS – Sustainability, Food, and Well-Being

The SUS – Sustainability, Food, and Well-Being code brings together Boff (2012), Altieri (2012), Wezel et al. (2009), Caporal and Costabeber (2004), Castro (2002), Morelli (2020), Schneider (2025), and Dowbor (2013). This broader approach is relevant because it prevents sustainability from being reduced to environmental conservation. Boff (2012) establishes its ethical and intergenerational foundation; Altieri (2012) contributes the ecological sustainability of agricultural systems; Wezel et al. (2009) integrate science, practices, movements, and food systems; and Caporal and Costabeber (2004) connect sustainability, agroecology, extension, and food security. The latter authors' work includes food security and sustainable agriculture among the components of the agroecological perspective.

Castro (2002) adds a crucial social dimension by making it possible to interpret hunger in connection with social, economic, and territorial structures, while Morelli (2020) connects food, rights, and public policies, particularly through the right to food and school feeding. Dowbor (2013) adds economic democracy, participation, and social management, while Schneider (2025) updates the debate by incorporating sustainability and agri-food systems into post-COP30 perspectives on SRD. In this way, SUS makes it possible to analyze whether the results integrate environment,

production, economy, culture, ethics, food, equity, participation, and future generations, understanding well-being and food security as constitutive rather than ancillary components of Sustainable Rural Development.

ANA – Analysis, Writing, Systematization, and Interpretation

The ANA code integrates Bardin (2016), CIDAC and Holliday (2007), Jara Holliday (2012), and Marques (2006). Bardin (2016) provides the systematic procedures of Content Analysis, making it possible to organize the corpus, construct codes and categories, draw inferences, and produce theoretically grounded interpretations. Jara Holliday (2012) adds the systematization of experiences, enabling the critical reconstruction of lived processes and their transformation into communicable learning. From this perspective, systematization is not limited to classifying information but seeks to critically interpret practices and experiences.

Marques (2006) makes a particularly relevant contribution by understanding writing as constitutive of the research process itself. Writing, reading, and rewriting participate in constructing the research problem, engaging with theoretical frameworks, developing arguments, and validating knowledge. Thus, Bardin (2016), Jara Holliday (2012), and Marques (2006) make it possible to understand ANA as the transition from empirical materials to interpretation and from interpretation to systematized knowledge: the corpus is categorized, experience is critically reconstructed, and writing transforms these relationships into scientific argumentation.

TER – Territorialization and Innovative Extension for SRD

The TER – Territorialization and Innovative Extension for SRD code integrates Zonin et al. (2020, 2023, 2026), Caporal and Costabeber (2004), Morelli (2020), Schneider (2025), and Dowbor (2013). Caporal and Costabeber (2004) provide the link among agroecology, participation, and Rural Extension; Schneider (2025) incorporates transformations in rural development and agri-food systems in the post-COP30 context; Morelli (2020) highlights the capacity of food policies to connect rights, institutions, and territory; and Dowbor (2013) adds social management and the democratization of economic decision-making.

Zonin et al. (2020, 2023) connect interdisciplinarity, sustainability, and territorial agency with the institutional experience of PPGDRS, while Zonin et al. (2026) advance the concept of Innovative Extension as a process that integrates university and society, teaching, research, extension, participatory methodologies, local knowledge, and territorially contextualized solutions. The institutional, educational, political, and innovative dimensions identified in this model connect networks, autonomy, inclusion, agroecological transition, markets, school feeding, associations, and cooperatives. TER therefore represents the stage at which scientific frameworks, territorial knowledge, public policies, and institutional capacities are translated into concrete SRD practices.

DEV – Feedback, Learning, and Transformation

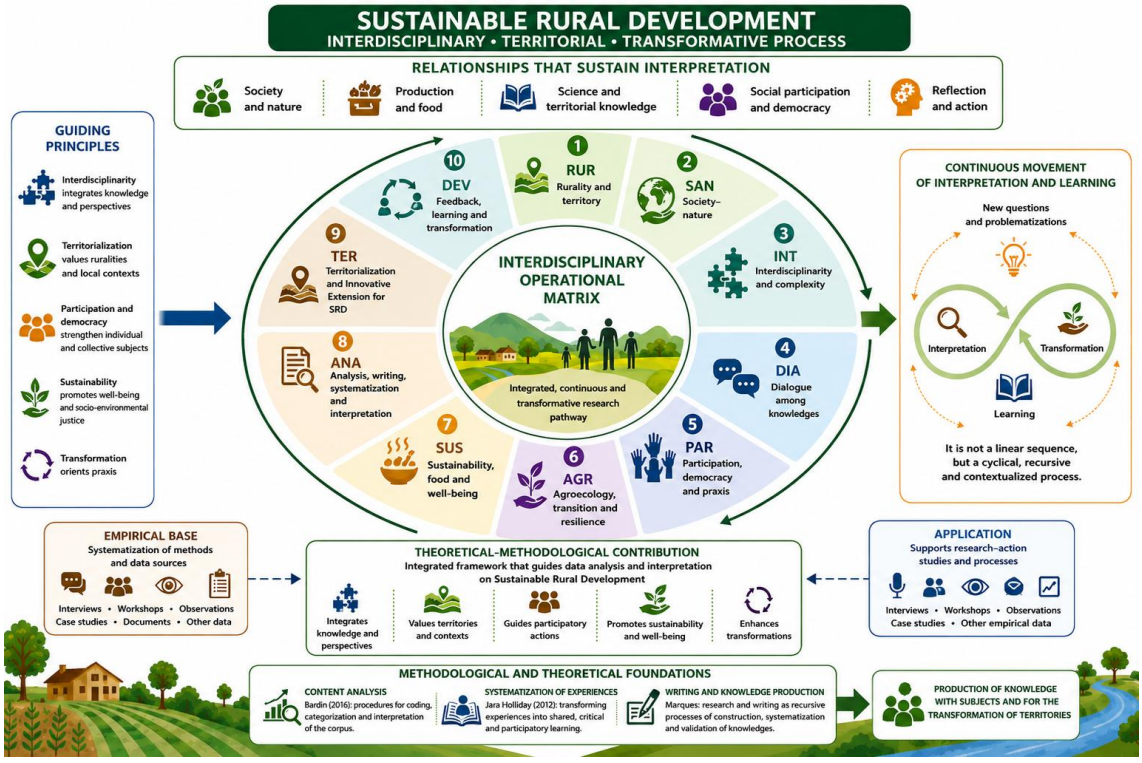
The DEV – Feedback, Learning, and Transformation code brings together Freire (1983), Fals Borda (1987), Zonin et al. (2026), and Marques (2006). Freire (1983) provides

the foundation for feedback as dialogue and renewed problematization of reality, avoiding its reduction to the unilateral communication of research findings. Fals Borda (1987) reinforces its participatory and transformative dimension by integrating theory, action, and participation and by assigning research a commitment to the subjects involved. Marques (2006), in turn, makes it possible to understand that systematization and writing do not bring research to an end: reading, writing, communicating, and rewriting constitute processes through which knowledge is continuously reconstructed.

Zonin et al. (2026) territorialize this conception by understanding extension as an interaction among universities, society, and territorial actors, so that systematized knowledge can return to concrete experiences, foster learning, and contribute to new processes of innovation and transformation. The educational dimension of Innovative Extension emphasizes the shared construction of knowledge, autonomy, citizenship, inclusion, participatory methodologies, and the recognition of local knowledge. DEV therefore completes the cyclical and recursive nature of the matrix: research begins with a territorial problem, produces knowledge through interactions among disciplines, subjects, and knowledge systems, analyzes and systematizes the experience, and returns to the territory, where the findings can be discussed, reinterpreted, and transformed into new learning, actions, and research questions.

Integrative Synthesis of the Discussion

Figure 4. Interdisciplinary Operational Matrix for Research in Sustainable Rural Development



Source: Prepared by the author (2026).

The integrated analysis of the ten codes demonstrates that the matrix should not be used as a sequence of independent compartments. Rather, its components establish recursive relationships. RUR situates the research problem within its social and territorial context; SAN highlights society–nature relations; INT reconstructs complexity

through the integration of different perspectives; DIA incorporates epistemological plurality; PAR positions actors as participants in decision-making and knowledge production; AGR connects production systems, agroecology, and resilience; SUS integrates sustainability, food, justice, and well-being; ANA transforms the corpus and experiences into systematized knowledge; TER territorializes this knowledge through public policies, institutions, and Innovative Extension; and DEV promotes feedback, learning, and transformation, as illustrated in Figure 4.

CONCLUSION

This study made it possible to understand Sustainable Rural Development (SRD) as an essentially multidimensional, territorial, and interdisciplinary issue whose interpretation requires moving beyond fragmented approaches to rural realities. The articulation among Rural and Environmental Sociology, interdisciplinarity, agroecology, sustainability, dialogical education, critical epistemologies, and participatory methodologies demonstrated that transformations in rural territories result from inseparable relationships among society, nature, production, institutions, public policies, culture, knowledge, and social actors. From this perspective, interdisciplinarity is not limited to the presence of different disciplines or theoretical frameworks within the same investigation; rather, it constitutes an epistemological and methodological process involving the shared construction of the research problem, the integration of analytical dimensions, and the development of syntheses capable of broadening the understanding of the phenomena under study.

The literature review and Content Analysis made it possible to systematize these contributions into an Interdisciplinary Operational Matrix structured around ten analytical codes: RUR – Rurality and Territory; SAN – Society–Nature; INT – Interdisciplinarity and Complexity; DIA – Dialogue Among Knowledge Systems; PAR – Participation, Democracy, and Praxis; AGR – Agroecology, Transition, and Resilience; SUS – Sustainability, Food, and Well-Being; ANA – Analysis, Writing, Systematization, and Interpretation; TER – Territorialization and Innovative Extension for SRD; and DEV – Feedback, Learning, and Transformation. Rather than constituting independent categories, these codes represent interrelated dimensions that bring theory closer to empirical reality. The matrix therefore constitutes a methodological contribution of this study, as it provides an instrument that can guide the analysis of interviews, documents, observations, workshops, case studies, and other research and extension experiences related to SRD.

The analysis also demonstrated the complementarity among different theoretical traditions. Jollivet, Wanderley, and Sachs contribute to the interpretation of rurality, territory, and development; Buttel, Boaventura de Sousa Santos, Boff, Singer, and Nobre broaden the understanding of society–nature relations; Jollivet, Raynault, Zanoni, Philippi Jr., Silva Neto, and Zonin et al. provide the foundations for the interdisciplinary construction of the research problem; Freire, Santos, Walsh, and Fals Borda support dialogue between scientific and territorial knowledge; Freire and Bordenave place participation and praxis at the center of the analysis; Altieri and Nobre connect agroecology, biodiversity, and resilience; Boff and Altieri provide the foundations for an integral conception of sustainability; and Bardin and Jara Holliday offer methodological

pathways for transforming empirical materials and experiences into interpretation, systematization, and critical learning. This convergence demonstrates that SRD requires not only scientific interdisciplinarity but also epistemological plurality, intercultural dialogue, and the territorial co-production of knowledge.

The trajectory analyzed within PPGDRS/UNIOESTE demonstrates, in turn, that interdisciplinarity can take concrete form when incorporated into education, research, and extension processes. Experiences developed through courses, territorial immersion activities, case studies, fieldwork, extension projects, and scientific events have contributed to bringing together students, researchers, family farmers, communities, social organizations, institutions, and public officials. Within this process, territory assumes a dual role: it constitutes an object of investigation while simultaneously serving as a pedagogical, epistemological, and social space for knowledge production. This experience reinforces the importance of integrating teaching, research, and extension in interdisciplinary education committed to addressing concrete societal issues and the challenges faced by rural territories.

As a theoretical-methodological synthesis, the study supports the Cyclical Model for the Interdisciplinary Construction of Knowledge in SRD, in which the complexity of reality leads to the construction of an interdisciplinary research problem; this, in turn, guides territorial engagement and immersion; the territory enables dialogue among knowledge systems and participation; interaction generates empirical materials and experiences; their interpretation requires interdisciplinary integration; analysis and systematization transform experiences into knowledge; and feedback and extension return this knowledge to society, potentially generating learning, transformations, and new research questions. It is therefore a cyclical, reflexive, and recursive movement rather than a linear methodological sequence.

It should be acknowledged that the proposed matrix results from a qualitative and purposive literature review and the systematization of experiences and is not intended to exhaust the diversity of theories and methodologies applicable to SRD or to establish a universal model. Its primary purpose is to provide an open interpretive framework that can be adapted and refined across different territorial contexts. Future studies may apply the ten codes to broader sets of interviews, workshops, case studies, and territorial experiences, comparing their explanatory capacity across different social groups and territories, while also incorporating new theoretical frameworks and categories emerging from the empirical material itself.

It can therefore be concluded that the central contribution of this study lies in transforming interdisciplinarity from an abstract principle into a praxis of knowledge production. For SRD, this means articulating disciplines without eliminating their specificities, integrating social and ecological dimensions, recognizing different knowledge systems, expanding the participation of territorial actors, and ensuring that scientific findings can return to territories through extension, systematization, and social feedback. From this perspective, teaching, research, and extension cease to constitute separate stages and instead become part of a continuous process of observing, listening, problematizing, dialoguing, participating, analyzing, systematizing, territorializing, and transforming, thereby strengthening an interdisciplinary science that is socially committed to sustainability, diversity, resilience, and the collective construction of alternatives for rural territories.

DECLARATION OF THE USE OF ARTIFICIAL INTELLIGENCE

The author declares having used the generative artificial intelligence tool ChatGPT, developed by OpenAI, as an auxiliary resource during the preparation of the manuscript. The tool was employed in the creation of Figures 1, 2, 3, and 4, as well as to assist in structuring and organizing the text, standardizing bibliographic references, and performing linguistic review—including corrections regarding spelling, grammar, and textual clarity. The use of artificial intelligence served exclusively as a supporting tool; the author retains full responsibility for the review, validation, and approval of the scientific content presented in the manuscript.

NOTE

This manuscript is integrated into and guides the activities established in the Teaching Plan for the course Interdisciplinary and Participatory Methods, offered to regularly enrolled doctoral students in the Graduate Program in Sustainable Rural Development (PPGDRS) at the State University of Western Paraná (Unioeste).

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