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TERRITORIAL AGROECOLOGICAL DYNAMICS: CONSIDERATIONS ABOUT BRAZILIAN SETTLEMENTS

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ABSTRACT
Purpose: In this article we present agroecological experiences in rural settlements in the municipality of Rio Bonito do Iguaçu, Paraná State, Brazil. By analyzing the advances and challenges of these initiatives, we aim to highlight the need for broader, systemic and multiscale actions in favor of building an agro-food system which promotes food and nutritional sovereignty and security of local/regional communities and thereby contributes to the development of territories.

Methodology: This is a case study based on semi-structured qualitative interviews with settled families and representative entities.

Findings: We observed that the practices have contributed to the construction of a socio-environmental consciousness, a more sustainable soil management, the increase of agrobiodiversity, improvement of health and income, as well as greater access to commercialization channels.

Research Limitation: There are challenges and demands regarding training in agroecology, technical assistance, support in organizing farmer groups, financing, construction and consolidation of marketing channels for the income guarantees of families.

Originality: A considerable mobilization of local actors was observed, which impacted the implementation of agroecological initiatives, but a more discrete participation of actors from other scales, which limits the enhancement of experiences as mechanisms of territorial development.

Keywords: agri-food system, agroecology, rural settlements, territorial development, food, nutritional security.

DINÂMICA AGROECOLÓGICA TERRITORIAL: CONSIDERAÇÕES SOBRE ASSENTAMENTOS BRASILEIROS

RESUMO
Objetivo: Neste artigo apresentamos experiências agroecológicas em assentamentos rurais no município de Rio Bonito do Iguaçu, Estado do Paraná, Brasil. Ao analisar os avanços e desafios dessas iniciativas, pretendemos destacar a necessidade de ações mais amplas, sistêmicas e multiescala em favor da construção de um sistema agroalimentar que promova a soberania alimentar e nutricional e a segurança das comunidades locais / regionais e, assim, contribua para a desenvolvimento dos territórios.

Metodologia: Trata-se de um estudo de caso baseado em entrevistas qualitativas semiestruturadas com famílias assentadas e entidades representativas.

Resultados: Observamos que as práticas têm contribuído para a construção de uma consciência socioambiental, um manejo mais sustentável do solo, o aumento da agrobiodiversidade, a melhoria da saúde e da renda, bem como um maior acesso aos canais de comercialização.

Limitação da pesquisa: Existem desafios e demandas quanto à capacitação em agroecologia, assistência técnica, apoio na organização de grupos de agricultores, financiamento, construção e consolidação de canais de comercialização para garantia de renda das famílias.

Originalidade: Observou-se uma considerável mobilização de atores locais, que impactou a implantação de iniciativas agroecológicas, mas uma participação mais discreta de atores de outras escalas, o que limita a valorização de experiências como mecanismos de desenvolvimento territorial.

Palavras-chave: sistema agroalimentar, agroecologia, assentamentos rurais, desenvolvimento territorial, alimentação, segurança nutricional.

1. INTRODUCTION

Agricultural activities have always been a way to ensure the survival of the human species by guaranteeing food supply. Since the Post-World War II period, the capitalist mode of production, through the Green Revolution, has transformed local territorial dynamics and agri-food systems, thus reconfiguring social, economic, cultural and environmental ties. Over the years, production techniques have been modified aiming at increasing production and productivity. After the Green Revolution, subsistence agriculture began to give way to the production of agricultural commodities for export. These markets demanded more and more standardized products and produced in large scale. To meet this demand, farmers used chemical inputs, hybrid seeds, transgenic, and agricultural machinery, which supported the expansion of monocultures, leading to the exclusion of part of the rural population from the countryside as well as affecting food standards.

As for food standards, it should be noted that food has become a commodity, an industrialized product with long durability. A pattern of consumption was created that dominated practically the entire world, making the traditional diets of many populations, considered as a permanent food pattern, to be replaced by the agro-food system characterized by "fast food", combining poor quality and fatty meat with bread without fibers or proteins. According to Triches and Schneider (2015) the late decades of the twentieth century were characterized by the formation of an agri-food system that achieved its internationalization and currently influences the production, distribution and consumption of food, reaching the stage of dictating diets for broad strata of urban population. On the other hand, consumers are becoming increasingly confused and uncertain about their food diets.

This worldwide pattern of consumption represented by "fast food" has caused a very serious nutritional impact, due to excess calories, often combined with nutritional deficiencies (Niven et al., 2019; Finlay, 2020; Patel et al., 2020), besides reducing the food base to basically three species: rice, corn and wheat (Mcneill, 2011).

Processed and ultra-processed foodstuffs are present more and more in the diets of families. According to Belik (2020), over 16 years, while consumption of fresh foods has dropped 7%, ultra-processed foods have risen 46%. The author points out that real food has been exchanged for a commodity that looks like food, but besides not nourishing, it generates social and environmental impacts in its productive chain. The ultra-processed ones have low nutritional quality and excessive amount of sugars and fats, hidden by the advertising of the food industry.

Viecelli (2019) warned that in 2017 there were about 2 billion people in the world who suffered from food shortages, 800 million from hunger and another 2 billion from overweight. Of these, 600 million were suffering from obesity. Thus, it is observed that due to lack of food or excessive calorie intake, hunger (which has never been eradicated) nowadays stands alongside other problems such as overweight, obesity and chronic diseases as diabetes and hypertension. Moreover, the author advises that hunger and obesity are less related to the challenges in food production, but rather to the logic of the agri-food industry and access issues.

This prevailing food pattern is made feasible by the excessive use of agrochemicals which contaminate water, food, animals and the human being, as well as transgenic crops, upon which there are many controversies regarding their impacts. It can be mentioned the undesired biological development of some species, and the subsequent spread of its harmful effects, such as the hypothesis of the propagation of infectious diseases. In addition, the increased use of herbicides and pesticides and the appearance of more resistant pests can be mentioned; as well as the introduction of pathogenic traits in humans, animals or plants, such as allergies and enhanced resistance to antibiotics; genetic contamination, with the crossing of GMOs with natural biodiversity; the decrease in biodiversity and also the loss of genetic variation (Suzuki, 2006; Andrioli and Fuchs, 2009; Altieri, 2012).

Concerning the issue of excluding the rural population from the countryside, here we emphasize the peasants who have been deterritorialized and failed to consolidate their reterritorialization in urban space and thus, together with other social groups, began to seek their reterritorialization in the countryside. This is expressed mainly by the encampments and settlements of the Landless Rural Workers Movement (MST), which is organized in 24 Brazilian states. There are currently 9,340 settlements throughout the country, which occupy an area of approximately 88,314,857 hectares and a total of 1,346,768 settled families. Particularly in the state of Paraná there are 327 settlements, with 33,014 families settled and occupying 429,771.28 hectares (Incra, 2017).

However, it seems a paradox that settled peasants seek for a process of reterritorialization, based on the same technological parameters that expropriated them years before. We refer to the package spread by the Green Revolution, based on monocultures, the use of modern machinery and equipments, as well as the use of inputs external to the property, such as hybrid seeds, transgenics, chemical fertilizers, agrotoxics, among others. This results in a considerable degree of standardization, which neglects both ways of life and local agroecosystems.

Agroecology still represents isolated and punctual initiatives in the settlements of the MST. Although the Movement emerged in the early 1980s, it was only in 1995 that an environmental dimension was included in its discussions and proposals. At the III National Congress held that year, the proposal was that agrarian reform should follow a sustainable development model, promoting the first debates based on agroecological principles. Since then, it has been a way to overcome the challenges within the MST towards a model of sustainable production. By means of meetings with representatives of non-governmental organizations (NGOs), related to the issue of environmental preservation and sustainable development, actions for sustainability were initiated (Costa Neto and Canavesi, 2002).

According to Santos (2015), the MST formally assumed the agro-ecological perspective in 2000, setting in its agendas numerous struggles against the use of agrochemicals and the cultivation of transgenic crops. These struggles became a contraposition to the scientific paradigm disseminated by the large corporations and the way of production implemented by the Green Revolution. From that moment on, the Movement began to encourage the transition from production to healthy food, and to unleash actions aimed at consolidating educational practices in agroecology, on the basis of the political and technical formation of its militants.

De'Carli (2013) noted that the Movement instituted agroecology as a political flag in its discourse to counter the hegemonic agricultural model and as an opportunity to be integrated into global debates on sustainable development. The intrinsic and extrinsic actions to adopt agroecology as a political strategy have materialized in various ways, from direct actions to confront transnational agro-pharmaceutical companies at the Agroecological Journeys, up to local actions such as workshops and training courses regarding agroecology within agrarian reform settlements.

Facing the impacts of the current hegemonic agrifood system on local agroecosystems and human health, as well as the emergence of agroecological experiences in rural settlements, we will attempt to analyze the advances and challenges of these initiatives. The aim of this work is to highlight the necessity of broader, systemic and multiscale actions towards the construction of an agri-food system promoting the sovereignty and food and nutritional security of local/regional communities and thereby contributes to the development of territories.

The paper is organized into five sections, including this introduction. The literature review section addresses the relationships between family and peasant agriculture, food and territorial development in the first part. In the second part, the review section deals with agroecology and its relationship with development processes. The third section presents a brief methodological contextualization. The fourth section discusses the settlements studied and cases of families that produce agroecologically, approaching advances and challenges of the experiences. Finally, there are final considerations and the references.

2. LITERATURE REVIEW

2.1 Family and peasant agriculture, food and territorial development

The agricultural ecological crisis existing in most of the world is an expression of failure in the dominant paradigm of development. Conventional development strategies have revealed to be increasingly limited in their ability to promote equitable and sustainable development. Technological innovations have neither become available to small or poor farmers on favorable conditions, nor adapted to their agroecological and socioeconomic conditions (Altieri, 2009). Food empire empowerment is visualized, which is defined by Ploeg (2008) as a strongly centralized planning mode, composed of large food processing and marketing companies increasingly operating on a global scale.

This planning resulted in a crisis involving several aspects: collapse of banks and the financial sector, climate change and environmental debate, food production crisis and the latent and persistent dispute for land. As consequences, cultural erosion of diverse populations, the reproduction of socio-spatial inequalities, the growing accumulation of capital by transnational corporations and environmental degradation, which has even resulted in a trivialization and vulgarization of the discourse on nature (Facco, 2015), have become increasingly evident.

This situation has significant and negative effects on sovereignty and food and nutritional security. As an example, the hegemonic agri-food model increases simultaneously the problem of hunger and obesity. Data from the United Nations Annual Report on Food and Nutrition Security of 2017 indicated that after almost a decade of decline, the number of people affected by world hunger has increased. In that year, 815 million people were in this situation and 11% of the world population suffered from chronic malnutrition in 2016. On the other hand, there were 641 million obese adults, corresponding to 13% of the total adults on the planet (Fao, 2018). According to the State of Food Security and Nutrition in the World Report 2020 (SOFI), in 2019 almost 690 million people suffered from hunger, which was 10 million more than in 2018. Concerning obesity, the SOFI reports that, at a global level, 5.6% of children under 5 years are overweight. This number reaches 7.5% in Latin America and the Caribbean, which are also the regions with the highest purchase costs for a diet meeting minimum energy needs: US$ 1.06 a day per person, 34% more expensive than the global average (Fao, 2020).

As an alternative to this contradictory and catastrophic hegemonic model, Ploeg (2008) indicates the construction and reproduction of short circuits (Renting, Marsden E Banks, 2003) and decentralized ones linking food production and consumption, i. e., agriculture and regional society. From this perspective, therefore, family and peasant agriculture assumes a strategic and protagonist role, primarily to attend human right to food, incorporated in the Declaration of Human Rights in article 25, which recognizes that everyone has the right to an adequate standard of life that ensures, as well as their family, health, well-being and especially food.

The human right to food derives from the concepts of sovereignty and food and nutritional security, a result of a process involving multiple actors of multiple scales. Hence, the 1996 Rome Declaration on World Food Security agreed to understand food security as the state in which people have, at all times, physical and economic access to safe, nutritious and sufficient food to meet their dietary needs and food preferences in order to lead an active and healthy life (Fao, 1996).

Food sovereignty was defined by the World Forum on Food Sovereignty in 2001 as the right of people to define their own sustainable policies and strategies for food production, distribution and consumption. Such policies should guarantee the right to food for the entire population, based on small and medium production, respecting their own cultures and the diversity of their peasant, fishing and indigenous ways of production, commercialization and management of rural areas, in which women play a fundamental role.

The definitions presented implicitly and explicitly state the role of family and peasant agriculture in maintaining a healthy and sustainable diet. Furthermore, official data and scientific studies point to the role of family and peasant agriculture in food production and supply.

According to the United Nations, family farmers are responsible for producing over 80% of all food on the planet. They are essential to ensure everyone has access to food. However, they are also among the most vulnerable groups to poverty and hunger in rural areas. In Brazil, data from the 2017 Agricultural Census show the important participation of family agriculture in food production, accounting for 80% of the amount of cassava production, 48% of coffee and banana production, 42% of beans and 69% of pineapple (IBGE, 2020). Studies carried out by Gazolla (2004), Grisa, Gazolla and Schneider (2010), Schneider, Schubert and Escher (2016) and Maas, Malvestiti and Gontijo (2020) point out that family farmers mainly commercialize products from vegetable gardens, and fruits and products processed by the family agro-industry, often destined for local and regional markets.

Hoffmann (2014) evaluated the importance of family agriculture by comparing the value of its production with the total expenditure on food for Brazilian families. According to the 2008-2009 Family Budget Survey data, the total annual expenditure on food was R$ 292.6 billion in January 2009. The study found that the production of family agriculture corresponded to 21.4% of the total value of family food expenses.

These data demonstrated the importance of family agriculture for sovereignty and food and nutritional security, as it provides the main foodstuffs to be consumed by different publics. According to Pozzebon, Rambo and Gazolla (2018), the differential of family agriculture in relation to agribusiness is that the production of food is mostly intended for both income generation and family self-consumption. Moreover, in the majority of cases, this food production is based on short and decentralized circuits.

In case of colonial, organic or agroecological fairs, for example, prices are more accessible to the consumer, if compared to traditional commercialization channels, thus ensuring a greater income to the producer since they avoid intermediaries. They also contribute to promoting food and nutritional security for both consumers and producers by providing a variety of fresh foods (Cassol and Schneider, 2015) from the local food culture, and products intended for fairs can also be used alternatively for family self-consumption. Schneider, Schubert and Escher (2016) highlighted that in 2016, 77% of food produced worldwide was still consumed in national markets and especially local markets.

Finally, in order to guarantee the human right to food, it is fundamental to reinforce family agriculture, which is responsible for promoting sustainability in food production, with greater incentives to adopt organic and agro-ecological practices. Food production offers benefits related to work opportunities and income generation among family members and the expansion of quality food supply for society, as reported by Antunes, Muterlle and Cunha (2011). Similarly in spanish, Guzmán (2007, p. 191), highlighted that

> *La globalización agroalimentaria amenaza el patrimonio cultural y material agroganadero, rural y alimentario a la vez que contribuye a profundizar la crisis ecológica en la que vivimos. La alteración del equilibrio de los agroecosistemas se entrelaza con los mecanismos de exclusión social que acompañan a la creciente dependencia del mercado. La Agroecología propone un enfoque de análisis alternativo para la comprensión del manejo y diseño de los agroecosistemas, así como propuestas para el desarrollo rural y alimentario basado en la recuperación de los conocimientos y formas de organización sociocultural campesinas.*

Therefore, it is crucial to connect issues concerning sovereignty and food and nutritional security as well as agroecology to the discussions on rural and territorial development. In this sense, Ortega (2010) pointed out that if we take into account that the search for food sovereignty incorporates the perspectives of sustainability and autonomy, the right to food, support for family agriculture, access and control of the population to productive resources, then these should be

elements integrated into the national objectives. A rural development project should be a fundamental instrument for overcoming poverty and food insecurity for large segments of the population. We argue herein that a rural development project should constitute part of a territorial development project.

Hence, we understand territorial development from the perspective of Boisier et. al., (1995), as a comprehensive expression including the development of micro-localities, such as communities, and meso-localities, provinces or regions. It refers to processes involving socio-economic changes, of structural nature, geographically delimited and inserted in a framework configured by economic market systems, broad external openness and decentralization of decision-making systems. It has three main objectives: (a) improvement of the territory, considered not as a container and physical support of natural elements, but rather as a structurally complex, dynamic and articulated physical and social system; (b) development of the society or community inhabiting this territory and (c) improvement of each person who belongs to this community and inhabits this territory.

The development focuses and sustains itself in satisfying fundamental human needs, in generating increasing levels of self-confidence, and in articulating human beings with nature and technology. Development becomes stronger in the interaction between global processes and local behaviors, in the interaction of personnel with social, as well as planning with autonomy and in civil society with the State. This perspective of territorial development brings implicit concepts such as democracy, participation, empowerment, decentralization and education. Consequently, the viability and success of a development program will depend on the degree to which people perceive it as a scenario whereby their collective subjectivity is recognized and reinforced (Boisier, 2001).

On the other hand, Brandão (2004) states that development policies need to act on the totality of the socio-productive structure, thinking the entire territory as a systemic whole, promoting coordinated actions in that geographic space, attempting to reduce inter-regional disparities, combating the gap between the regions and expanding the self-determination of that community. Therefore, two dimensions of development are relevant, i. e. their multidimensionality and multiscalarity. This means that development should cross several dimensions (productive, social, environmental, technological) and several spatial scales (local, regional, national, global, etc.), in movements seeking for a synergy between top-down and bottom-up dynamics, including horizontal dynamics.

Finally, we understand that promoting territorial development processes which improve the territory, the community, and each person belonging to that community, in multiple dimensions and scales, passes through concerns and actions, although not only, but in an indispensable way, on behalf of agroecology and the sovereignty and food and nutritional security.

2.2 Agroecology and development

As previously mentioned, the agricultural-ecological crisis existing in most of the world results from the failure of the dominant development paradigm (ALTIERI, 2009, 2012). Considering the weaknesses of modern agriculture, alternative agricultural movements emerged in the middle of the 20th century, which began to employ new technological and economic bases, using production systems that rescued the logic of complexity from traditional peasant societies. Alternative agricultures started to emerge in several countries, with different denominations: organic, biological, natural, ecological, biodynamic, permaculture; each one following specific philosophies, principles, technologies, norms and rules, according to the currents to which they were associated (Caporal and Costabeber, 2004).

These movements were of great importance to rescue and understand the complexities of agroecosystems. Despite the fact that these alternative agricultures followed certain principles, technologies, norms, rules, and philosophies, these currents were often unable to provide answers to

the socio-environmental problems exacerbated by the conventional model of rural development prevailing in agriculture, especially after post-war periods (Caporal, 2009).

In this context, according to Caporal (2009), agroecology emerges with the aim of building new knowledge, based on principles to establish a new path for a more sustainable agriculture capable of overcoming the crisis promoted by the production method of modern agriculture, which has caused countless environmental and social impacts. Gliessman (2000) and Altieri (2012) believe that agroecology is a study of economic processes and agroecosystems, on the one hand, and an agent for complex social and ecological changes which need to occur in the future in order to bring agriculture to a truly sustainable basis, on the other.

Agroecology aims to restore resilience and strength to the agroecosystem (Teixeira et al., 2017). Preserving the biodiversity of these agroecosystems is the first principle used to produce self-regulation and sustainability. However, sustainability is impossible without preserving cultural diversity which nurtures local agriculture. The knowledge of local people on the environment, vegetation as well as animals and soils can be learned and used in the development of appropriate agricultural strategies, suited to the needs, preferences and resource base of specific groups of farmers and regional agroecosystems. Agroecology provides the necessary methodological tools for community participation to become the driving force behind development project objectives and activities (Altieri, 2009; 2012).

In this way, agroecology becomes a generator of territorial development processes, whenever it builds collective works in its daily routine and essentially produces and commercializes healthy food adapted to the location, a fact which promotes a process of rooting the peasants in the land, thus guaranteeing a more autonomous and long-lasting reterritorialization. Oliveira, Grisa and Nierdele (2020) reinforce that the goal of agroecology goes far beyond contributing to the so-called more sustainable production, clean development, occupying market niches of green products etc. It is also important to be focused on the search for alternative ways of marketing the products, aiming at better conditions of insertion for family farmers in markets and access to agroecological foods by consumers.

The processes of reterritorialization through agroecology are evidenced by changes in the landscape, the increase in agrobiodiversity, the actions of entities/organizations with families, ensuring collective actions, and through the organicity of families that bring the struggle for agrarian reform beyond the land, but based on the rights to health, education, housing, income and dignity. Thus, agroecology in addition to taking care of the environment, also adopts principles for social change. Therefore, it can be understood as science, movement and practice (Wezel et al., 2009; Van Der Ploeg et al., 2019; Boeraeve, 2020; Dumont et al., 2020). From the 1970s onwards, agroecology continued to be defined as a scientific discipline, but also gradually emerged as a movement and as a set of practices from the 1980s onwards.

The conception of the aforementioned authors is in accordance with the statement made by Altieri (2009; 2012) that new sustainable agroecosystems cannot be implemented without a change in the socioeconomic determinants that regulate what is produced, how it is produced, and for whom it is produced. This shows that agroecology is both a science, a movement, and a set of practices.

In Brazil, since 1970, agroecology has progressed through different social movements. This has not emerged as a recovery of trational agricultural practices, with the objective of assuring food autonomy and sovereignty mainly for peasants, besides being a countermove in criticizing the production method of modern agriculture (Nunes, 2016). The spread of agroecological principles is becoming more and more noticeable, both in society as a whole, by increasing demand for healthier food, with greater awareness of the environment, and within social and intellectual movements, as a way of life, practice, and a science under construction.

In this way, we understand that agroecology has technological and scientific mechanisms as its starting point, while considering social actions and knowledge. Constructing agroecology will only make sense if it starts from what family farmers already possess, that is, agroecological practices as their essence and capacity for social organization, which allows them to reproduce it with relative autonomy from capital, adding new elements through the incorporation of technological and scientific mechanisms. Hence, agroecology can only be practiced by communities, since it is contradictory to construct it in the latifundium, in monopolies. Thus, agroecology will only make sense if there is an interaction between different knowledges:

> Agroecology is a science for the sustainable future. This is due to the fact that, unlike the compartmentalized ways of perceiving and studying reality, or the isolationist modes of conventional sciences, based on the cartesian paradigm, agroecology integrates and articulates knowledge from different sciences, as well as popular knowledge, allowing both the understanding, analysis and criticism of the current model of development and industrial agriculture, as well as the design of new strategies for rural development and sustainable farming styles, from a transdisciplinary and holistic approach (Caporal, 2009, p. 73-74).

We understand that dissemination of agroecological practices and way of life demonstrates the ability of peasants to adapt and to act in a proactive way, since according to Schneider and Menezes (2014), family farmers not only react or adapt to external constraints, but are also capable of acting in a proactive way.

However, at this point, as far as agroecology is concerned, there seems to be minimal escalating interaction, since local/regional practices have discreet support from other scales, especially from political actors. In other words, if it is increasingly possible to observe the emergence of local agroecological initiatives in a bottom-up movement, the same movement is not visualized in the top-down direction. Some examples of this are the limited expression of the sustainable Pronaf lines (Agroecology, Eco, Forest) or the National Plan of Agroecology and Organic Production (Planapo). Eduardo (2014; 2016) corroborates our statement by arguing that if on a global scale agroecology seems to be an utopian and poorly designed project, "descending" from scale presents itself as an objective strategy in the construction of territories of life: of production, culture and peasant political organization. At one scale, the subjects are made invisible by the hegemony of agribusiness; at another, the conflict appears as a stress in the territory, in the local territorial systems. There are territories roughly monopolized by capital, where territoriality is largely marked by passivity. There are territories where people become subjects of active territorialities and carry out their life projects with an important degree of relative autonomy.

3. MATERIAL AND METHODS

In the context presented in previous sections, this study aims to analyze the advances and challenges of agroecological initiatives implemented in rural settlements, emphasizing the necessity of broader, systemic and multiscale actions in favor of building an agro-food system which promotes the security and food and nutritional sovereignty of local/regional communities and thereby contributes to territorial development, improving territories, communities and people.

Methodologically, this work resulted from a case study. Semi-structured qualitative interviews were conducted with a sample of 19 families in a universe of 34 involved in the agroecological system who are members of the Ireno Alves Agroecology Cooperative (Coopaia) in the municipality of Rio Bonito do Iguaçu. These 19 families were indicated by Coopaia representatives. The number of interviews was defined based on the degree of saturation of responses found and conducted between 2016 and 2017. Another six interviews were performed with entities/organizations cited by the families, which have representativeness in the settlements studied. In addition to the testimony of the families, we use the photographs as a representation of

the landscape, which depict the resulting territorial transformations, as expressed by the food, environmental, social and cultural diversity of the families. As a technique, it was also performed the participant observation, by which, according to Becker (1994), the researcher collects the data by participating in the group or organization, observing people and their behavior in situations of their daily lives.

4. RESULTS

4.1 Agroecological Experiences in the Ireno Alves dos Santos and Marcos Freire Settlements: Advances and Challenges

By analyzing the effects of the Green Revolution on Agrarian Reform settlements, we can affirm that they are in a continuous process of territorial dispute. First, the struggle for land, and second, the permanence and maintenance of families on the land. Therefore, the agro-ecological experiences in the Ireno Alves dos Santos and Marcos Freire settlements, located in the municipality of Rio Bonito do Iguaçu, in the State of Paraná, reflect this process of dispute.

According to data from the Center for Sustainable Rural Development and Training in Agroecology (Ceagro) and the Ecovida Network there are about 50 families (out of more than 1500 settled families) that are involved with agroecological practices in both settlements, eight of them with certification. Part of these families meets together around the Ireno Alves Agroecological Cooperative (Coopaia). There are also families who are interested in developing agroecological practices, but demand greater support to implement them.

The main commercialization channel of agroecological production consists of institutional markets, through the Food Acquisition Program (PAA) and the National School Feeding Program (PNAE), intermediated by Coopaia. They commercialize vegetables, fruit, bread, sweets, molasses, green corn, pumpkin, beans, cassava, among others. Another channel is the sale on local fairs and directly to consumers, which aggregates around 30% to the products price. Some families produce the agroecological milk, but there are few who sell with agroecological certificate, due to lack of local market. In figure 1, there are some representative landscapes of the researched agroecological properties.

Figure 1: agroecological initiatives in the Ireno Alves do Santos and Marcos Freire settlements.
Source: Fieldwork, 2017.

Table 1: Actors in the agroecological territorial dynamics in the settlements Ireno Alves dos Santos and Marcos Freire. Source: Fieldwork 2017.

Actors	Role of Actors in the Strengthening of Agroecology
Ceagro	Develops activities of education, training, technical assistance, research and technological training with family farmers and settlers of the Agrarian Reform in the central region of Paraná, through the implementation of projects and service provision. Its activities are organized along four strategic and transversal axes: agroecology, cooperation and management, gender, youth.
Crehnor	Strengthens the organization of rural workers, contributing to their sustainable economic development, through the function of rural credit cooperative, which is responsible for providing credit lines and financial products suitable and adapted to foster agroecological production and agroindustrialization. It provides differentiated banking services (interest rates and more accessible payment conditions) and provides a revolving fund for financing agroecological production and agroindustrialization.
Coopaia	Organizational tool for families dedicated to food production based on the agroecological matrix. It is a marketing channel for institutional markets, incentive and support in the production and recovery of criollo seeds, agroindustrialization of fruit and vegetables, production and/or processing and/or marketing of grains, collective purchase and sale of organic inputs.
UFFS – Campus Laranjeiras	Conducts undergraduate and graduate courses focusing on agroecology and sustainable development. It has teaching, research and extension centers, structured in the Technological Vocational Center with focus on Cooperativism, Agroindustrialization and Agroecology.
MST	Representative of the demands of rural workers in the country. It works with training and debates for the awareness of society in various sectors, such as the importance of healthy food, environmental protection, the valorization of peasant culture in a continuous process of struggle.
Núcleo Luta Camponesa - Ecovida Network	Generation and organization of organic participatory certification in the Cantuquiriguaçu territory, by organizing agroecological groups. It works with the organization and initial sensitization in agroecology, organization of fairs, local market. It acts to promote agroindustrialization, commercialization and articulation with Ecovida Network commercialization circuit.

The systematization of actions of these actors evidences a complex local territorial dynamics. From these actions, territorialities are being constructed by means of daily actions, recreated based on old elements, knowledge of peasants with the junction of new elements through agroecological techniques. According to Eduardo (2014, 2016) they are processes of activating territorialities that allow individuals to recognize, value and appropriate with greater autonomy the potential resources of the territory for building their territories of life.

The organizations cited are important actors assisting peasants regarding agroecology, i.e., in the reterritorialization of peasants through agroecological practices, whether with scientific, technical or financial knowledge. As Linck (2006) mentioned, territory is a collective heritage mobilized in the production process of society, in this case a society based on agroecological science, movement and practice (Wezel et al, 2009).

Nevertheless, it seems important to highlight the motivations that led families to implement agroecological initiatives in order to analyze the advances and challenges of these initiatives.

Among the 19 families interviewed, 15 of them pointed out that the option for agroecology was to improve family health, mainly due to the problems caused by the application of agrotoxic to crops and the recognition that these cause damage to health. Another aspect frequently mentioned by families was the support of entities/organizations (MST, Ceagro, Núcleo Luta Camponesa of the Ecovida Network, UFFS, Coopaia, Crehnor). It was through training, meetings, and studies that the families came into contact with knowledge about the importance of agroecological practices. Other motivating aspect was the improvement of income, since families perceive a differentiated value in

selling agroecological products, as well as lower production costs and, consequently, larger remainings. Some families consider as the main motivating factor the healthier food, since they know what they are consuming is healthier, which consequently stimulated the decrease of food purchases outside the property. It was also pointed out that agroecological production does not damage the quality of water and soil and allows the preservation of flora and fauna. Figure 2 shows the motivational elements of the conventional transition to agroecological production, as mentioned by the families.

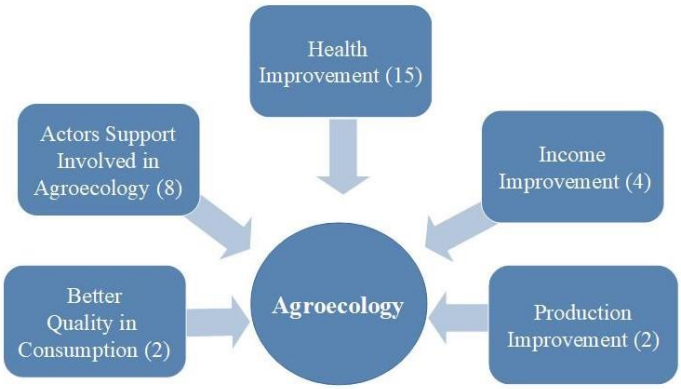

Figure 2: Representation of the motivational elements for agroecological production according to the families involved. Source: Fieldwork, 2017. Own organization.

Following the discussion, we point out the advances achieved and the facilitating actions of the territorial dynamics involving agroecological practices in such settlements. Collective actors (entities; organizations) mentioned advances such as: (1) opening of commercialization channels; (2) production of healthier food at lower production costs; (3) greater autonomy for farmers; (4) organization of agroecological groups; (5) creation of the Núcleo Luta Camponesa; (6) creation of production and commercialization cooperatives; (7) creation of differentiated credit cooperatives; (8) creation of agro-industries; (9) greater environmental awareness of families for preservation and compliance with environmental laws, in addition to (10) greater awareness of consumers, who have been searching for healthier foods and less impacting on the environment.

Among the families interviewed, the increased income was the main advancement for 11 of them, provided by agroecological production. According to the "K" family interview, "in fact, income has increased, practically 100%, the income is from agroecology, from PAA, Pnae". Furthermore, according to the "L" family interview, "the income is left over now, it's not much, but it has left over". The second most cited category as a breakthrough was health: 10 families stated that health improved greatly after they stopped using poisons on crops. The improvement in production was cited by six families and the environment was mentioned as the main advancement by five families, who claimed that there is more diversity in production and more life quality. The quality of consumption was cited by five families, who claim to have more food diversity nowadays, and know the quality of the food they are consuming, being these fresh and without agrochemicals. Leisure was mentioned by four families, who said there is more time left to interact with neighbors and participate in the community. Moreover, two families mentioned the commercialization, which refers to a greater concern and organization in sales and the fact of family satisfaction in providing a better quality of life to those who consume the agroecological products. Figure 3 shows the advances cited by families as a result of agroecology.

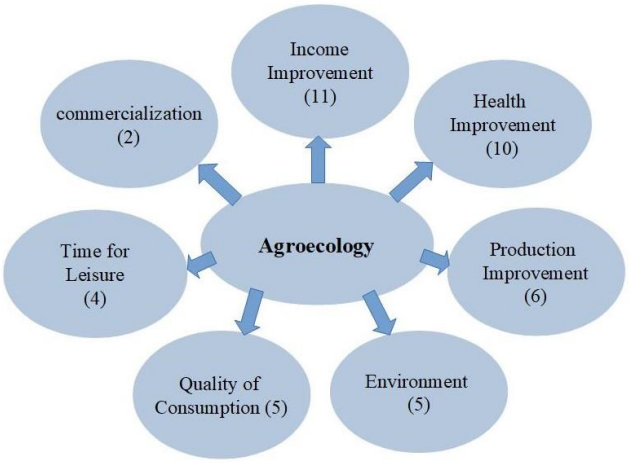

Figure 3: Main advances from agroecological practices according to settled families.
Source: Fieldwork, 2017. Own organization.

The facilitating elements, which have contributed to the progress, are shown in figure 4, and have been classified into five categories, sorted by the number of times cited. These include: access to public policies (especially those implemented or improved during the Lula and Dilma governments - PAA and PNAE, National Policy of Agroecology and Organic Production - Planapo, Technical Assistance for Rural Extension -ATER) and the National Supply Company - Conab. It was also mentioned the organization of actors involved in agroecological production (creation and strengthening of agroecological groups, creation of the Peasant Struggle Nucleus, constitution of production and marketing cooperatives, differentiated credit cooperatives, agroindustries), access to marketing channels (PAA, PNAE, fairs, Ecovida Network circuit, direct sale to the consumer), improvement in production (autonomy of farmers and organic inputs), and training/capacitation via courses in agroecology (Ceagro, UFFS, MST).

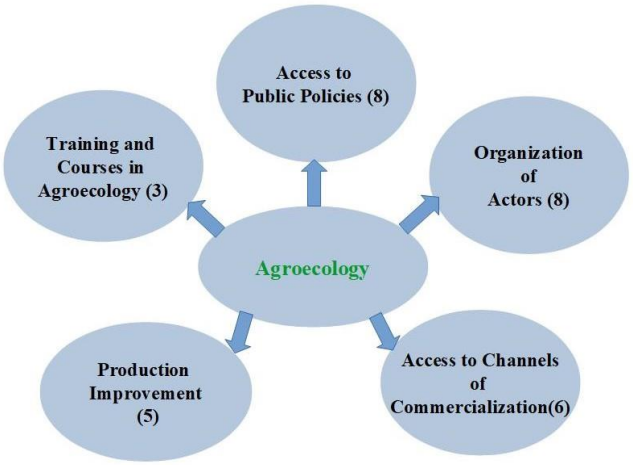

Figure 4: Representation of facilitating elements of agroecology territorialization, cited by interviewees.
Source: Fieldwork, 2017. Own organization.

The elements cited by collective actors that represent restrictive aspects of agroecology are systematized as follows. Without considering repeated terms, 20 limiting elements of agroecological territoriality were cited. These were grouped into six categories, as shown in Figure 5.

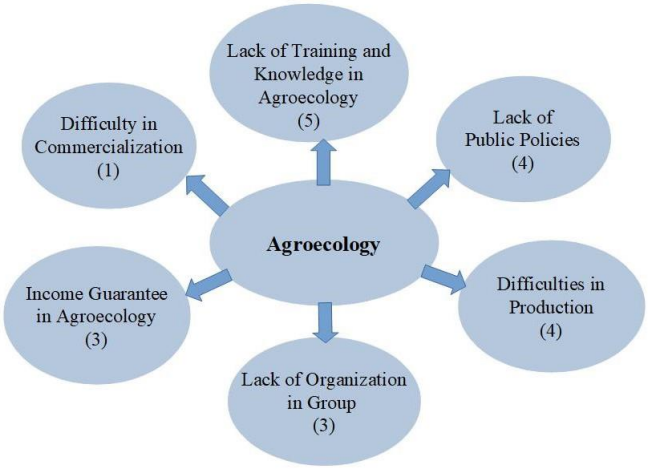

Figure 5: Representation of the main limiting factors of agroecology territorialization according to collective actors
Source: Fieldwork, 2017. Own organization.

Interestingly, among the limiting elements cited, the most frequently mentioned by collective actors was the lack of training and knowledge in agroecology. This demonstrates that agroecology could progress further if there were greater awareness and support from entities, organizations, that would guarantee training, courses, capacity building, and technical assistance, especially in the areas of cooperation, management, and agroecological production, involving diverse topics. Demands for training were mentioned ranging from production techniques, rational voisin grazing, agroforestry systems, cultivars consortiums, disease and pest control, as well as principles of cooperation and management, so that families could improve agroecological production and marketing techniques. The lack of public policies for incentives and support for commercialization channels with differentiated prices for purchasing inputs and sales of production, in addition to resources for investments, as a way to ensure quality and increase production, were also elements cited as limiting experiences in agroecology.

Subsequently, we tried to understand the main difficulties of the settled families regarding agroecological practices, which resemble the views of entities and organizations, highlighting technical difficulties related to production. In total, 42 limiting elements of agroecology were cited. These were systematized into categories, as illustrated in figure 6. The order of priorities of the categories changes, which for the settled families refers firstly to difficulties in production and secondly to difficulties in marketing.

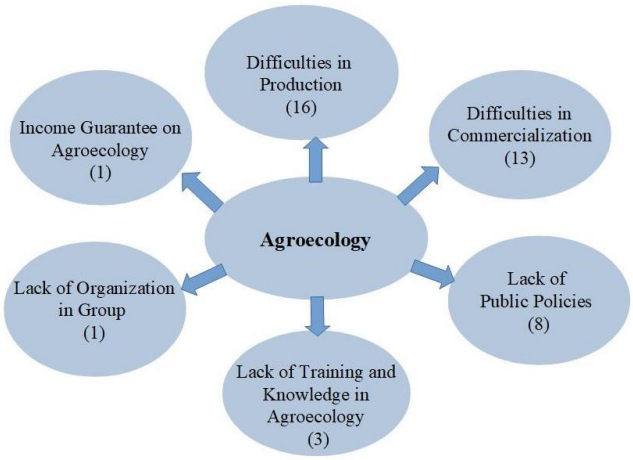

Figure 6: Representation of the main limiting factors of agroecology according to the settled families.
Source: Fieldwork, 2017. Own organization.

Based on the motivating and facilitating elements, the advances and challenges pointed out by the families and collective actors interviewed, we can verify that the agroecological initiatives developed within the settlements are capable of promoting the sovereignty and food and nutritional security of the families that carry out this production, as well as those who access these foods, either through direct purchase or via institutional markets. This is achieved through the production and consumption of varied, fresh and non-agrotoxic foods. Reports related to health improvements and more time for leisure are important elements in this respect, which implies territorial repercussions both on the community and on each person who composes it. There are also territorial repercussions on the territory, since there have been reports of increased biodoversity of local agroecosystems, improvements in water and soil quality.

It should be noted that, despite the advances that must be recognized, there are still significant challenges to be overcome. Initially, it is worth pointing out that the initiatives analyzed are representative of rural settlements of the MST. A priori, this can be understood as the most useful space for the dissemination of agroecology, throughout the counter-hegemonic trajectory of the movement. However, what is perceived are occasional initiatives, and agroecology is not being taken as a massive option among the settled families. This reality sheds light on several issues and can be analyzed from the limitations indicated by the interviewees.

The first concerns the multiscalarity of development. In the case of agroecology, there is a much greater mobilization of local actors around agroecology than in other scales. National policies, with an agroecological bias, are still scarce and difficult to access. They are specific actions, in a sectorial rather than territorial perspective, as an appendix of broader policies. A more active action of the State in this sense is fundamental. It is also considered that the MST, as a movement on a national scale, with repercussions on a supra-national scale, should assume a greater role in these scales. Since the implementation and consolidation of agroecology is essential for those accessing the land, but the issue of producing healthier food at affordable prices and maintaining environmental diversity is a matter for the entire population.

The question of the multidimensionality of development, which is not disconnected from the previous one, shows that there are necessary advances in each dimension and in an integrated way. The advances and the challenges referred to the same element on several occasions. For example, if on the one hand public policies were elements that facilitated the implementation of initiatives, on the other, there was a demand for more policies, either for the consolidation of initiatives already implemented or for the dissemination of agroecological practices. From complementary policies and actions that foster not only production, but also commercialization. Likewise, there have been advances in training and capacity-building for agroecology, but families still encounter significant problems with technical assistance and rural extension, and the lack of technologies adapted to the realities of families.

Considering the current political-economic crisis, the scarcity of resources and policies, it can be inferred that it is increasingly up to local communities and their multiple actors, through the power of organization, mobilization and empowerment, to initiate bottom-up movements, but promoting scalar mosaics of interaction in favor of their development projects. We hereby argue that such projects, based on agroecological references, whether as a technique, movement or science, have the potential to generate quality of life for a wide range of the population by contributing to sovereignty and food and nutritional security.

5. CONCLUSION

In this paper we seek to analyze the trajectory of agroecological experiences implemented in rural settlements in the municipality of Rio Bonito do Iguaçu, southwest of the State of Paraná, including Ireno Alves dos Santos and Marcos Freire. We believe that agroecology, considered a

science, movement and practice, in addition to allowing greater autonomy of peasants in relation to resources outside the property, has the potential to contribute to a healthier diet for the general population and the maintenance of agroecosystem biodiversity, thus promoting sovereignty and food and nutritional security, in accordance with the hegemonic agrifood model, based on agrifood empires. Thus, its territorial repercussions easily go beyond the limits of rural properties.

Locally, as results, we can point out that the agroecological practices developed by the peasants have contributed to the construction of a socio-environmental awareness, a more sustainable management of natural resources, an increase in agrobiodiversity, greater food diversity, contributing to the improvement of health and family income. This results in the improvement of the quality of life of peasants and consumers of their products.

In turn, there are still many challenges to be overcome, so that agroecology becomes a widespread practice, whether in the settlements or in rural areas as a whole. The challenges pointed out by the interviewees range from production, through organization and management, to marketing. There are demands for training in agroecology, technical assistance, help in organizing farmer groups, financing, construction and consolidation of marketing channels that ensure income for families. It should be noted that there have been advances in all these areas, which, however, still do not seem sufficient to consolidate agroecology as a mechanism for territorial development.

As there was a greater density of local actors and actions in relation to other scales, it became evident the need for broader, systemic and multiscale actions in favor of the construction of an agri-food system that promotes the security and food and nutritional sovereignty of local/regional communities and thereby also contributes to territorial development.

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DECLARATION OF CONTRIBUTIONS TO THE ARTICLE - CRediT

ROLE	LCarvalho	ARambo	JStofell
Conceptualization – Ideas; formulation or evolution of overarching research goals and aims.	x	x	x
Data curation – Management activities to annotate (produce metadata), scrub data and maintain research data (including software code, where it is necessary for interpreting the data itself) for initial use and later re-use.	x		
Formal analysis – Application of statistical, mathematical, computational, or other formal techniques to analyze or synthesize study data.	x	x	x
Funding acquisition - Acquisition of the financial support for the project leading to this publication.			
Investigation – Conducting a research and investigation process, specifically performing the experiments, or data/evidence collection.	x		
Methodology – Development or design of methodology; creation of models.	x	x	x
Project administration – Management and coordination responsibility for the research activity planning and execution.		x	x
Resources – Provision of study materials, reagents, materials, patients, laboratory samples, animals, instrumentation, computing resources, or other analysis tools.	x		
Software – Programming, software development; designing computer programs; implementation of the computer code and supporting algorithms; testing of existing code components.			
Supervision – Oversight and leadership responsibility for the research activity planning and execution, including mentorship external to the core team.			
Validation – Verification, whether as a part of the activity or separate, of the overall replication/reproducibility of results/experiments and other research outputs.	x	x	x
Visualization – Preparation, creation and/or presentation of the published work, specifically visualization/data presentation.		x	x
Writing – original draft – Preparation, creation and/or presentation of the published work, specifically writing the initial draft (including substantive translation).	x		
Writing – review & editing – Preparation, creation and/or presentation of the published work by those from the original research group, specifically critical review, commentary or revision – including pre- or post-publication stages.		x	x