

# Agroecology and family farming: A perspective of sustainability in the Brazilian Semiarid region

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Received: 09 Nov 2020; Received in revised form: 06 Dec 2020; Accepted: 08 Dec 2020; Available online: 19 Dec 2020

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**Abstract**—The research focuses on discussing the dynamics between agroecology and family farming in the Brazilian semiarid region. Family plays a significant part in the production of food on the Brazilian territory, contributing to its socioeconomic development, as it generates jobs, contributes to the local economy and diversifies production while contributing to lessen environmental impacts. Therefore, this article aims to analyze the agroecological discourse and practical strategies used in family farming and its role in the socioeconomic development of the Brazilian Semiarid region, by means of a systematic literature review. The works retained center on the following themes: public policies, land management and territoriality, cultivated varieties, and the issues surrounding water usage.

**Keywords**—Family farming. Agroecology. Brazilian Semiarid Region. Sustainability.

## I. INTRODUCTION

The present article aims to address the questions of agroecology and family farming in recent decades as Brazilian agriculture is being modernized through important technological innovation and globalization, resulting in an evolution of economic, environmental, political and social aspects. In view of these changes, we now have large concentrations of land on the part of a few landowners and on the other hand we have a high number of farming families that survive on small rural plots [1].

A survey [2] carried out in more than 5 million rural properties in Brazil, shows that 77% of agricultural establishments in the country were classified as family farming (AF). Family farming has a significant place in the production of Brazilian food, in perennial crops, the segment accounts for 48% of the value of coffee and banana production; in temporary crops, they are responsible for 80% of the production value of cassava, 69% of pineapple and 42% of beans. According to the survey, family farming employed more than 10 million people in September 2017, which represents 67% of the total number of people employed in agriculture [2].

These data show the relevance of family farming to the Brazilian territory, especially the Brazilian semiarid region.

This level of activity, in addition to contributing to the local economy, generates jobs, diversifies production and contributes to actions that help reduce its impact on the environment. In this sense, this article aims to analyze the agroecological discussions and strategies used in family farming and its role in the socioeconomic development of the Brazilian Semiarid region, based on a systematic literature review.

The theme proposed here: agroecology and sustainability, was chosen due to the authors' shared interest. Two guiding questions (QN) were adopted as strategy: which agro-ecological topics are most commonly brought up as socioeconomic development strategies for the Brazilian semi-arid region? Which strategies are being adopted in the semi-arid Brazilian region by family farms for local development in the agroecological sphere?

## II. THEORETICAL FRAMEWORK

### 2.1 AGROECOLOGY

The oldest concept of the word agroecology concerns to the agroecological zones, which is the territorial demarcation where exploitation area of a particular culture is possible given the edaphoclimatic characteristics necessary for its development [3]. For [4] the term

“agroecology” appeared in the 1930s with objective to design the application of the methods of ecology to the study of agricultural crops.

For [5], agroecology seeks to integrate knowledge, in order to establish new strategies for rural development and new designs for more sustainable farming, thus, its elements can be grouped in three dimensions: ecological and agronomic technique; socioeconomic, cultural and socio-political.

Ecological and agronomic technique aspects are where ecology as a science must be taken as a reference as it describes the inner workings of important environmental systems, and in which the parameters of the technology used in agronomy are inserted, this being an aspect that ties the sustainable character and of nature with consistent productivity. Socioeconomic and cultural aspects consider differences among peoples, without discrimination while bringing economic growth to the population involved. Finally, socio-political aspects consider that one must obey a consistent network of justifications and social actions that can help indicate the political path to be followed by political rulers [5].

Thus, when searching among the different definitions for the term “agroecology”, from its origin to the present times, themes arise such as the ecological management of soils, the diversification of agricultural production systems, the rescue and conservation of creole seeds and locally adapted breeds of animals, in dialogue with the resistance struggles of the peasant communities, the production and consumption of food [6].

In this perspective [7], it can be said that agroecology offers essential steps to achieve sustainability and preserving natural resources, as they have a proposal to guarantee food security, family income and market access while maintaining the quality of natural resources. Thus, it provides sustainability through the rebalancing and conservation of biodiversity, water, soil and its nutrients and other living beings, resulting in an increase in the productive capacity of the territory, without degrading the resources that exist there [7].

Thus, agroecology emerges as a possible possibility for family farming, which seeks, above all, conditions for maintaining the activity and the social group through a sustainable development project [5].

## 2.1 FAMILY AGRICULTURE

Family farming is practiced by small rural producers, traditional peoples and communities, settlers by way of land reform, foresters, aquaculturists, extractivists and fishermen. They are responsible for the production of maize, cassava root, dairy cattle, beef cattle, sheep, goats, vegetables, beans, cane, rice, pigs, poultry, coffee, wheat,

castor, fruit and vegetables in Brazilian territory. The management of the property is shared by the family and the agricultural production activity is the main source of income, since the land is their place of work and home [8].

Over the past decade, Brazilian family farming plays a key role in food production for domestic consumption. With the approval of Law 11.326, which provided the legal framework for family farming, the segment managed to guarantee recognition, social and economic importance through the expansion of public policies such as credit (PRONAF); Technical Assistance and Rural Extension (ATER); commercialization, through the Food Acquisition Program (PAA) and the National School Feeding Program (PNAE); agricultural insurance and equality for women [9].

It is worth mentioning that both the Food Acquisition Program (PAA), in 2003, and the reformulation of the National School Feeding Program (PNAE), with Law No. 11,947, of 2009, has helped through their programs to create strategies where food security, nutrition and combating hunger were improved by seeking to establish a connection with production and consumption through the institutional purchase of food from family farming [9].

Family farming is essential for employment and becomes the main ally for the most sustainable practices, as it has the same desires evidenced by a large part of non-rural society. Thus, it is essential that farming families choose a production systems that guarantee economic, social, political and environmental satisfaction in Brazil for the whole family [1].

## III. METHODOLOGY

The present theme, agroecology and sustainability, was addressed due to the mutual interest of the authors, adopting as a methodological strategy a systematic review of the literature. An exploratory quantitative approach was used as it allows for the familiarization of the problem by building hypotheses, limiting the recording of the observed facts without interference [10]. Furthermore, as for the procedures, the research is classified as bibliographic based on materials already elaborated and having its sources as an instrument type [10].

Considering the purpose of this article, to analyze the agroecological discussions and strategies used in family farming for the socioeconomic development of the Brazilian semiarid region. Two QN's were launched which motivated the development of the research. A QN1 - What agroecological discussions are currently brought up as socioeconomic development strategies for the Brazilian semiarid region? QN2 - Based on the agroecological dimensions, what strategies have family farming in the Brazilian semiarid region used for its local development?

Two criteria were used to carry out the work: for conducting the research, the process of conducting independent searches was used, and the second one, the identification of the findings to obtain rigor and reliability in the search [11]. Through the agreement of both researchers in conducting independent searches, the elaboration of a research protocol started, even if they are initially studied in a generic way.

Articles were mainly obtained through use of the portal of journals of the Coordination for the Improvement of Higher Education Personnel (CAPES), using as research descriptors: “agroecology”, “family agriculture” and “semiarid”. Afterwards, the following refinements for research were used: firstly, a search for only articles, secondly, the timeframe cut of the last 5 years and peer-reviewed articles.

The articles obtained in this search, went through other refinement processes, to be included and compose the discussion of this work. Thus, the following were included: articles published in magazines with at least Qualis B2; those whose research region was the Brazilian semiarid region; as to their theme, those could provide results for the Guiding Questions (QN) exposed here and registered in the research protocol. In addition to these selection processes mentioned, articles of methodological strategy for bibliographic review were excluded, thus reaching a plausible number for the systematic study of the theme that included its most important aspects and its updated textualizations.

In addition, the related data were submitted to a preparation process, in order to identify a priori whether the

chosen documents were in accordance with the theme to be reviewed, and then submit it to the analysis of its content. After this stage, the data were submitted to the process of unitarization, through an exploratory reading of all content and adoption of a coding procedure, classification and categorization procedure. Thus, once the data obtained, all systematically aggregated in units, it was possible to carry out the description step, exalting the pertinent characteristics of the content versed in the text, and then, through careful interpretation, to explore the meanings expressed in the literature object of investigation and review.

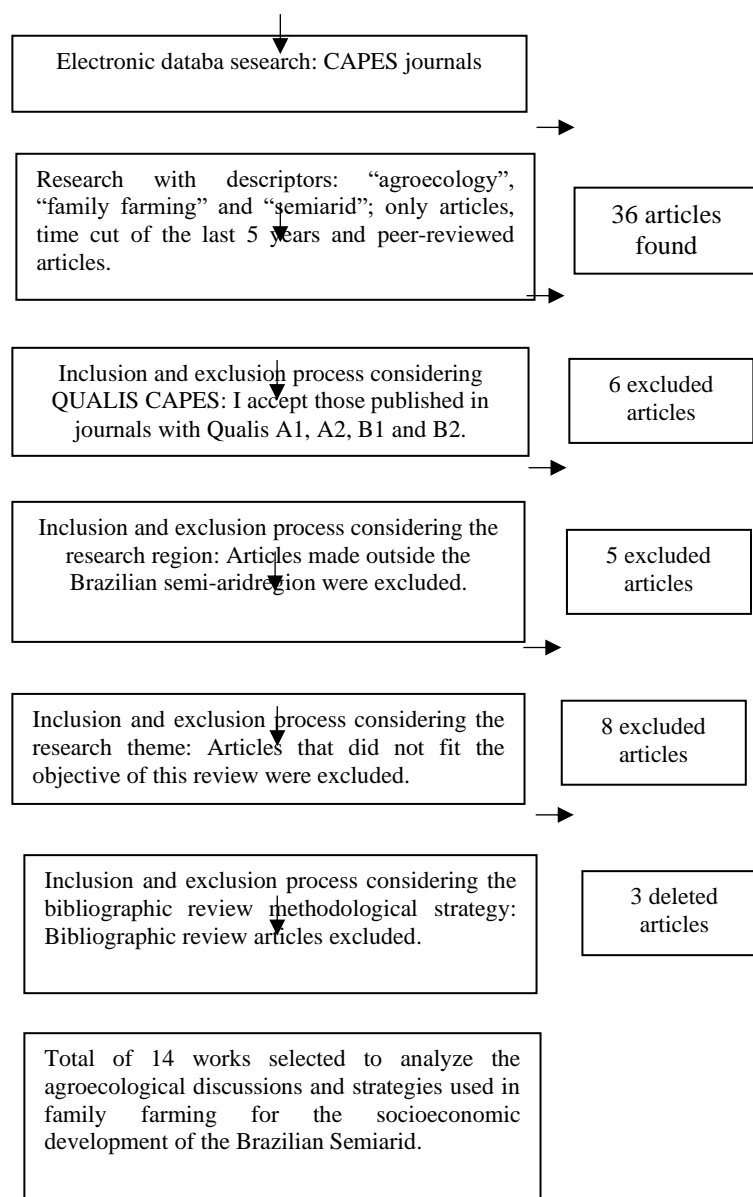
Through this research it was found that there were no articles that worked on this topic, within a systematic review, much less in the cited region, it shows how important and relevance this work is.

#### IV. RESULTS AND DISCUSSIONS

Table 1 presents a research flowchart, with its refinement processes. At the end, 14 articles were selected to compose the discussion of this bibliographic review, as shown below.

For a better understanding and analysis of the 14 selected articles, an organization was carried out according to the central theme of its contents, as shown in Table 2. In short, the analyzed articles focused their research on public policies; land use and territorial reality; cultivation and planting of varieties in family farming; water issue and water use.

Table 1. Flowchart Flowchart of research, refinement process and internal criteria



Source: prepared by the authors (2020)

Table 2: Organization and classification of articles according to their central themes

Nº	Title of Article	Authors	Year of publication	Qualis	Thematic
1	The Transformation of "Agroecological Ideas" into Public Policy Instruments: dynamics of contestation and institutionalization of new ideas in policies for family farming.	Schmitt.	2016	B1	Public policies
2	Public policies for Rural Development in Brazil: the dilemma between productive inclusion and social assistance.	Cazella et al.	2016	B1	Public policies
3	Diagnosis of land use and conservation in an agrarian reform region in the semiarid region.	Carvalho et al.	2017	B2	Land management /Territoriality

4	Soil management and conservation practices: Perception of farmers in the semi-arid region of Pernambuco.	Lima et al.	2016	B2	Land management /Territoriality
5	Chemical attributes of traditional agriculture and Caatinga managed at different depths in an Inceptisol.	Neto et al.	2017	B1	Land management /Territoriality
6	The semi-arid, A relationship of society and nature in a dynamic of social organization of space.	Teixeira.	2015	A2	Land management /Territoriality
7	Territorial reality of family units in the Brazilian semiarid.	Vidal et al.	2016	A1	Land management /Territoriality
8	Agronomic evaluation of cowpea varieties under rainfed cultivation in the municipality of Coremas-PB.	Santos et al.	2015	B2	Cultivated varieties
9	Evaluation of creole varieties of corn for organic production in the semi-arid potiguar region	Araújo Junior et al.	2015	B2	Cultivated varieties
10	Production of chili pepper under organic fertilization and irrigation with treated wastewater.	Silva et al.	2019	B1	Cultivated varieties
11	Production tanks for improving the quality of life in the semiarid region of the state of Pernambuco.	Ferreira et al.	2015	B2	Water issue / Water use
12	Efficient use of rainwater stored in a cistern for vegetable production in the semiarid region.	Ferreira et al.	2016	B2	Water issue / Water use
13	Food and nutritional security of semi-arid farm families benefiting from rainwater collection equipment in Brazil.	Fagundes et al.	2020	A1	Water issue / Water use
14	Measuring the invisible: analysis of the Sustainable Development Goals in populations exposed to drought.	Sena et al.	2015	B1	Water issue / Water use

Source: prepared by the authors (2020)

#### 4.1PUBLIC POLICY

From the 14 articles selected to compose this research, 2 of them dealt with issues related to public policies. Returning to the definition of [5], agroecology integrates different knowledge, and among its dimensions are sociopolitics. However, it was observed from the reading of the articles that, the discussion about the implementation and application of public policies aimed at strengthening family agriculture, extended to all of Brazil, there was no specific direction for the Brazilian semiarid.

Article number 1 brings a reflection made by [6] about the recent dynamics of institutionalization of agroecological ideas in public policy instruments, considering their relationship with the policies for strengthening family farming. Coming to the conclusion, that the process of affirming “agroecological ideas” in public arenas in Brazil was slow and marked by advances and setbacks and did not

come to constitute itself as a force-idea capable of decisively influencing the Program National Strengthening of Family Agriculture (PRONAF).

Some of the public policies for rural development in Brazil are addressed in article number 2 of [12], where an analysis of policies of a productive and assistance nature is carried out, such as: agrarian reform actions, the National Program for Strengthening Family Agriculture (PRONAF), the Food Acquisition Program (PAA), the National School Feeding Program (PNAE), the rural social security system and the income transfer from the Bolsa Família Program (PBF), used as a research base by the agricultural census of 2006 which, although old, was the most recent database on the Brazilian agrarian structure, taking as reference the number of beneficiaries.

In general terms, the results obtained by [12] demonstrate that, despite the advances achieved in the last

25 years in the design of specific public policies for Brazilian family farming, three aspects stand out in this process: the separation of policies of a productive nature and of character assistance, the difficulties of expanding the public contemplated by policies aimed at promoting agricultural production and the lack of socio-environmental counterparts for those who benefit from public subsidies.

#### **4.2 EARTH MANAGEMENT AND TERRITORIALITY**

Leaving the scope of public policies and entering the context of land management and territoriality, from the 14 selected articles, 5 of them deal with this broad theme, which according to [6], nowadays, among the themes that arise when discussing agroecology, is the ecological management of soils. The authors focus attention on the territorial reality of family units in the Brazilian semiarid region and, from a plant production perspective, the issue of sustainable soil management.

Thus, [13] used family units in Ceará as the object of study, to visualize this territorial issue and, they observed that, as the members of a rural family manage to increase their income, their territory is strengthened and their sustainability increased, because the extra income is invested in infrastructure and in the improvement of available areas and production, even those that have no relevant influence on total production.

In the family units analyzed, according to the aforementioned authors, the work perceived as a factor of production is present, being the main responsible for the economic dynamics of small rural production, with aspects related to land, which in most sometimes limits greater production. It was also observed that in these family units, family work is predominant and wage earners appear only as an assistant in periods of greatest need for labor. Vegetable production is the main source of income for these farming families who concentrate their activities on the cultivation of corn and beans, and on the specific management of small ruminants.

In this perspective of plant production, researchers tried to highlight the practices of management and use of land by family farmers. Bearing in mind that in the Brazilian semiarid region, an aggravation in soil degradation with the lack of rain in the region is perceived, related to its intrinsic characteristics, associated with the farmers' lack of knowledge of the problem, in the desire to get the most out of their crops, land due to economic and social limitations. Representing a challenge for the implementation of sustainable practices for the use and management of soil and water [14].

In view of this, a diagnosis of soil management and conservation practices, carried out by farmers in a

settlement located in the Semi-arid region of Ceará, revealed that, even in the case of family farming, there are still inadequate conventional practices that degrade the soil, leaving unproductive land, such as the process of planting and sowing crops in the settlement a little more than half of the families prefer to follow the direction of the slope of the land to line up the plantations, this long-term practice can contribute to the erosion process of the soil generating environmental damage [15].

Still on soil management and conservation practices, [14] carried out a diagnosis in the municipality of Pesqueira Pernambuco, making it noticeable, on the part of researchers, that the vast majority of farmers are unaware of the concepts of soil management and conservation, despite, they carry out sustainable management practices, revealing the need to support these farmers, due to the importance of this theme.

#### **4.3 CULTIVATED VARIETIES**

Another issue that drew the attention of the researchers who authored the articles selected for this research was the varieties planted by family farmers in order to draw attention to the use of traditional seeds, which are the creole varieties, due to their genetic, environmental, social and economic, totaling 3 articles related to this theme.

Taking into account that the populations of Creole varieties are important because they are a source of genetic variability and the use of these varieties also presents several advantages related to the sustainability of production, such as resistance to diseases, pests and climatic imbalances, and may have the seeds stored for the crops, subsequent harvests, reducing the cost of production [16].

In this follow-up, [16] carried out a study with the creole varieties obtained in rural communities in the state of Rio Grande do Norte and evaluated characteristics related to the growth and production of corn grains in an organic production system, comparing the results in relation to cultivar hybrid, the results showed that Creole varieties presented results similar to the values observed in the hybrid culture for the characteristics of growth and grain production. This type of research rescues local varieties of corn and provides farmers with more accessible options for genetic material for cultivation.

Along with this type of work carried out by Araújo [16], an evaluation was made of the productivity of certain varieties grown by small producers, in view of the problem of the low yield of some crops, justified by the use of low technology and varieties not adapted to production conditions.

This is the case of research by [17], who evaluated the productivity of cowpea varieties (*Vigna unguiculata* L.



Walp.) Under rainfed cultivation in the municipality of Coremas-PB. Tests were carried out with four varieties of evergreen cowpea (*BRS Marataoã*), purple (*Phaseolus vulgaris*), cow's rib (*Vigna unguiculata*) and garanção, where the cow rib variety showed the highest yield. This type of research contributes to the development of family farming, as it guides farmers in relation to the best varieties for cultivation, taking into account local conditions.

#### 4.4 WATER ISSUE/WATER USE

So far, some causes influencing the production of family farming have been discussed, such as public policies, land use and management and cultivated varieties. Now the discussion will be focused on the use of water, considering that the semiarid requires particular attention, given the irregularity of rainfall that occurs in the region, 4 out of 14 articles were found discussing about this same theme.

Discussions in this regard are focused on the use of the sidewalk cistern of the Uma Terra e Duas Águas Program - P1 + 2, a project for Living with the Semiarid Region, which ensures access to land and water for the rural population, both for family consumption and animals, as well as for food production, teaching them to take care of the land in a sustainable way.

Considering that the cistern ensures an improvement in the diet of rural families, as it allows the insertion of fruits and vegetables in the diet, [18] carried out a survey of the current situation regarding the use of production cisterns and their real contributions in improving the quality of life of rural families in the São Francisco Valley micro-region, in the State of Pernambuco.

They noted that the implementation of P1 + 2 cisterns is an important tool for improving families' diet, however, there is a need for better technical monitoring as to the rational and efficient use of water in the cistern. For presenting this result, [19] built flower beds for vegetable production, in order to define the best water/production ratio, reaching a condition of application of a blade of 4 mm dia-1 sufficient to provide daily consumption of 33,71 grams of vegetables in a family's diet. As observed in the other articles, this research benefits the rural producer of family farming, giving support in controlling the use of water in their agricultural production.

#### V. CONCLUSION

This bibliographic review, which deals with the dynamics of agroecology and family farming in the Brazilian semiarid region, will serve as a basis for other researchers who wish to explore this theme, to reflect on the progress and direction of the published works. As, for example, the reflection in relation to the publication dates,

which reveals that most of the articles were published in 2015 and 2016, signaling the need for more current studies.

In addition, going back to the guiding questions that drove the realization of this work, it was noticed that the discussions raised in relation to agroecology and family farming, are driving the socioeconomic development of the Brazilian semiarid. Since, in each theme that was highlighted, there is a possibility of further development.

Whether in the scope of public policies, with the purpose of diagnosing, or how these policies connect with producers and how they are developed, we can visualize possibilities for improvement. Furthermore, in the study of soil management, we can highlight unsustainable management practices, so that, through diagnosis, outlining a plan for changing practices becomes achievable. Also, within the scope of agroecological practices, in which the study of the production conditions of seeds of Creole varieties or other cultivars, it will support the producer for a more sustainable production, including in the management of water during production.

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