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Introduction of Agro-Ecological Systems in the Municipality of Exu-Pe

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Abstract *— Agroecology has led us to think a lot far beyond the immediate results of our actions, and it makes us reflect on what they mean about all beings that share the same environment, breathe the same air and share a unique biosphere. Based on agroecological principles, organic farming yields food without toxic waste, guaranteeing a healthy diet in our homes. It is necessary to consider that agroecology is a practice that does not affect the health of the farmers or the ecosystems. This paper presents bibliographic research regarding the questions about agroecology, its characteristics, and the importance of the action of man in work with the practice in question. It aims to achieve a better quality of life in the environment in which we live, as well as healthy nurture, caring for the environment, preserving the ecosystem, making more understandable the importance of agroecology for the quality of life of a society.*
Keywords *— **Agroecology, Life quality, Semiarid zones***

I. INTRODUCTION

The main objective of this work is to verify which agro-ecological practices are carried out in the municipality of Exu-PE, in the region of Chapada do Araripe. The central focus of the analysis will be to verify whether the methods used to present an agroecological production.

The origin of this problem is related to the observations of the methods of agricultural production in the city. Since the main foundation of agroecology is to cultivate agriculture that does not affect the environment, but instead develops mutually, so that one favors the other as opposed to conventional agriculture. In this way, I intend to investigate whether there has been a change in the production methods used in the Lermen family's estate.

With this study, we intend to understand and explain the scenario of agroecological production in the semiarid region, addressing aspects related to the climate of the Chapada (plateau) do Araripe. The study was conducted through bibliographic research and brought a record of agricultural production methods from the beginning to the recent agroecology. The emergence of agroecology took place through the evolution of the thoughts and concerns of the people involved in activities related to the environment, to the soil and the agriculture as a whole (ASSIS, 2006).

In the Brazilian context, the concept of agroecology emerged through the creation of non-governmental organizations in the early 80s years. Nowadays, this concept is present in all regions of the country, especially among small communities, in addition to involving a considerable amount of scientists, academics and scholars from various areas (Santos *et al*., 2014).

Regarding the semiarid region, social representations most often appear associated with a hostile and inadequate landscape for any productive activity. However, when considering this environment in a more attentive way, despite the climatic seasonality existing in the eco-regions, there is a broad biological potentiality of the agroecosystems that are composed in the caatinga biome. In this biome, the main problem is the scarcity of water, and so the crops are so impaired (VIEIRA-FILHO, *et al*., 2016).

In the municipality of Exu, some communities practice agroecology. Among them is Baixio do Meio, Serra do Ingá and Serra da Refrigera with a production, basically of vegetables and fruit trees. However, the community with the highest expressiveness is the Lermen family, in the Serra (mountain) dos Paus Doías. Another aspect that is addressed in the text is the influence of civil society organizations, for the implementation of agroecology in this region.

II. AGROECOLOGY IN BRAZIL

Agroecology can be understood as the ecological

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management of natural resources, through forms of collective social action, participative development from production to the final product, establishing relationships between production and consumption. In this sense, agroecology does not exist alone, since it is integrating science, aggregating knowledge of other sciences, such as ecology, available expertise and traditional knowledge from the experiences of rural farmers (CAPORAL, 2004).

It is important to emphasize that the primary foundation of agroecology is to plant, which does not affecting the environment, developing mutually one favoring the other, unlike conventional agriculture that considers little for the environment (CAPORAL, 2007).

Agroecology emerged in the decade of 1970, to constitute a theoretical basis for different movements of alternative agriculture that were strengthening with the exhaustion of modern agriculture. Although the term has arisen along with the various currents of alternative farming, it cannot be understood as an agricultural method. Agroecology is a science that seeks to understand the functioning of complex agroecosystems, as well as the different interactions found in them, with the main foundation of preserving and expanding the biodiversity of Agricultural systems as support to produce self-regulation and therefore sustainability (ASSIS, 2005).

III. UPRAISING OF AGROECOLOGY IN BRAZIL

Agriculture has always been part of the observations of people seeking improvements in the exercise of the activity. Thus, it causes an actual process of accumulated information making agricultural technologies evolving and diminishing environmental constraints (ASSIS, 2006).

Since the colonial period, problems related to the environment have been observed, more specifically deforestation and soil conservation, caused by the production system in monoculture systems. According Aurelio's dictionary: "*monoculture is the exclusive culture of an agricultural product.*" Although people were aware of the environmental degradation caused by this specific mode of production only in the mid-60 and 70, they decided to seek solutions to these ecological problems (DE DEUS; BAKONYI, 2012). In this context, Assis (2005) elucidates that, from the characterization of these problems, alternative farming movements to the currently predominant production model ceased to elicit in their opponents the relentless discourse that would represent a return to the past.

Even during those decades, it is possible to identify the initial concerns regarding environmental preservation. From there it has increased the fears of the inclusion of anthropogenic activities with soil, fauna, water resources, flora, and ecosystems, forcing these activities not to cause irreparable losses to the environment and result in safe food for those involved in this process (MONASTÉRIO; MELO; SOARES, 2014).

At this point, it is evident that the emergence of agroecology took place through the evolution of the thoughts and concerns of the people involved in activities related to the environment, the soil and the agriculture as a whole. Thus, it is understood that it was through searches for improvements in production and better quality in the final product for their consumption that people began to practice agricultural activity sustainably (BRASILEIRO, 2009).

Agroecology is, therefore, the result of the evolution of agricultural practices developed through observations and researches of all those involved in agricultural activities in search of more sustainable production. However, it is essential to clarify that some authors do not consider agroecology a science because it gathers the knowledge of common sense that, by definition, is not scientific. Thus, it is possible to understand that the explanations about the concept of agroecology are not yet very well determined since there is disagreement between the opinions of some authors (SANTOS *et al*., 2014).

Feiden (2005) explains that:

(...) agroecology is science under construction, with transdisciplinary characteristics integrating the knowledge of several other sciences and including, traditional culture, but this is validated employing scientific methodologies (even though sometimes it is non-conventional methods).

Agroecology is also considered alternative agriculture because this term is used to define a means of production in which the environment and the soil are not harmed, thus maintaining the health of producers and consumers. At this point, it is indispensable to mention that over the years, different segments emerged for this practice. They are organic farming, biology, natural, biodynamic, and permaculture (FINATTO; SALAMONI, 2008).

• *Organic agriculture*: It is a productive process wrapped with the consistency and sanity of the culture of live food to ensure the health of human beings, for this reason, uses and develops technologies corresponding to the local reality of soil, climate, water, topography, radiations, and biodiversity of each context;

• *Biological agriculture*: It is a mode of cultivation that aims to produce high-quality food and textile fibers while

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promoting sustainable and positive impact techniques in the agricultural ecosystem;

• *Natural agriculture* was developed by MokitiOkada (1882-1955), this method recommends natural cultivation where there is the harmony of the environment, with food, with the health of man, and with spirituality;

• *Biodynamic agriculture*: It is very similar to organic agriculture, treats soil fertility, plant growth and livestock care as ecologically interrelated tasks highlighting the spiritual and mystical perspectives;

• *Permaculture*: A culture that encompasses holistic methods to plan, update, and maintain human scale systems (gardens, villages, villages, and communities) environmentally sustainable, socially fair, and financially viable.

In Brazil, the concept of agroecology emerged through the creation of non-governmental organizations (NGOs), at the beginning of the years 1980. Today, this concept is present in all regions of the country, mainly amongst small communities and settlements, in addition to involving a considerable amount of scientists, academics and scholars from various areas (NODARI; GUERRA, 2015). In regions such as Rio Grande do Sul, Santa Catarina, and São Paulo it has already been implemented agroecological techniques in the crops. From the information provided by the national policy of technical assistance and agricultural extension, an expansion of agroecological activities that occur thanks to the organized extension practices. These activities obtained a considerable increase in Brazilian soil (NOTAROBERTO *et al*., 2017).

In most Brazilian states, there are already programs focused on agroecology, quality of life, and conservation of the environment (AZEVEDO; PELICIONI, 2011).

IV. INTRODUCTION OF AGROECOLOGY IN NORTHEAST SEMI-ARID

The Brazilian semiarid has many chances of becoming a significant producer of organic foods. This region covers an area of 975,000 sq.km, formed by ten federative states. Formerly the semiarid was seen as an unproductive field. However, this time has remained in the past; today, the producers claim that the land is fertile and productive. Thus, non-governmental organizations want to disseminate agroecology to the individual farmer, with greater precision in the communities of family farmers (MAZZOLENI; NOGUEIRA, 2006).

The northeastern region of Brazil, particularly the region corresponding to the semiarid, has been seen over the years as a "problem region", in which the different and recurrent forms of state intervention did not obtain the expected results, in relation to social issues and their resolutions: expressive income inequality, poor living conditions, low levels of employment and income, among others, which mainly affect the rural population.

We observed several experiences in the semiarid, through communities that seek a means of producing healthy foods, through practices with agroecological principles. In this sense, Silveira (2002) argues that:

Overcoming the problems experienced by family farming in regions with water scarcity requires the incorporation of innovations related to agricultural management, which allow achieving a growing balance between the intensification of space use and the regeneration capacity of biophysical conditions that subside the fertility of agroecosystems.

When observing the approaches superficially concerning the agricultural cultivation in the semiarid region of the Northeast, social representations most often appear associated with a hostile and inadequate landscape for any productive activity. However, when considering this environment in a more attentive way, despite the climatic seasonality existing in the eco-regions, there is a broad biological potentiality of agro-ecosystems that are composed in the caatinga biome (VIEIRA-FILHO *et al*., 2016).

Concerning the context of these semiarid regions, it is indispensable to mention that the primary source of water is from rains, these, in turn, are scarce and irregular. This way, Curado, and collaborators report (2014):

In this brief characterization of the semiarid region and adjacencies, it can be affirmed that its primary input is rainwater. These rains are distributed in an irregular uncertain way. However, families depend on regularity in the satisfaction of a series of water demands for human consumption, domestic, for supply to animals and agriculture.

In the semiarid regions with the most significant number of inhabitants, addressing the problems of access to water resources is essential to overcoming obstacles to development. Thus, public policies need to be established to insert appropriate infrastructure to provide adequate water to ensure the animal and human supply, besides assisting in irrigation (SILVA *et al*., 2016).

In this way, public policies work in two ways: building large reservoirs (in this case the dams) with a capacity of billions of cubic meters, which are found in small quantities in some states; and with small reservoirs of capacity of thousands of cubic meters, these being found in the whole region. We can still highlight the cisterns and wells, which also work like other forms of water storage in the rural environment (ASSUNÇÃO;

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LIVINGSTONE, 1993). This number of reservoirs has been growing thanks to the efforts of municipalities and communities in general, but compared to rural needs, this number is still insufficient to meet all local requirements. In this sense, Silva (2007) explains that:

One of the great misconceptions of the actions of "combating drought" by Governments relates to their fragmented and reductionist vision that identifies the lack of water as the main problem to face. Thus, it refers to the need for a new reading that brings the hinterland man closer to nature, with a holistic and ecological approach, perceiving this interrelationship as a fundamental element in the social and cultural processes in the semiarid region.

Still, in this line of Reasoning, Silva (2007) mentions that:

Articulated to the emergence of a new sustainability paradigm, there are changes in the conceptions and perspectives of intervention in the Brazilian Semiarid, as space where it is possible to construct or rescue relations of coexistence based on sustainability quality of life of the country's families and encouraging appropriate economic activities. The protagonist in the affirmation of this new paradigm does not belong to Governments or dominant regional groups. The original formulators of the proposal of coexistence are civil society organizations and some public agencies of research and extension that work in the semiarid. These actors have been putting the challenge of influencing and disputing the processes of formulating public policies in the region.

Besides, this semiarid vegetation requires a brief analysis of the predominant factors of this caatinga landscape. In turn is a biome with high biodiversity, in which it stands out the plant formation xerophytes, with small leaves that decrease the transpiration with moist stems to store water and roots scattered to capture the maximum water in the period of rains (Tróleis, Santos, 2011). In addition to cacti, arboreal, herbaceous and shrubby species stand out, some of which are endemic. With the arrival of the first rains, the Caatinga loses its dry appearance giving way to a green and flowered landscape. This phenomenon serves as an inspiration for the most diverse manifestations of northeastern culture (BRASIL, 2009).

For example, the poet Patativa do Assaré in his work "A Festa da Natureza" cites: "Arriving the time of winter everything is loving and tender, meaning the eternal father his infinite goodness. Our beloved, burninated naked, is soon transformed into the most beautiful garden."

However, the Brazilian semiarid has very complex characteristics, both with human occupation and geophysical aspects, the deceive of its natural resources and even concerning the climate, which is shown with significant differences. In this context, Ab'Sáber (2003) highlights that:

At the beginning of the decade of 1970, the existence of four regional bands within the semiarid: the semiarid bands accentuated or sub-desert (known as "wild hinterland"); the typical semiarid or semiarid bands (the "High Hinterlands"); Moderate semiarid bands (harshly caatingas); and the transitional subareas or subsumed tracks (the harsh lands).

Due to the lack of knowledge of such particularities of this vegetation, agricultural practices lead to degradation causing environmental inequity. In this context, studies conducted by the Ministry of Environment indicate that 68% of the caatinga biome area is anthropic, being 35.3% extremely anthropized (SILVA, 2003). The zoning carried out by the Brazilian Agro-livestock Company (EMBRAPA), of 1993, revealed that the semiarid, about 16 million hectares (16% of the total) with good agricultural potential, 43 million hectares (44%) with limited agricultural potential but likely to be exploited under certain conditions, and about 35 million hectares (36%) with substantial restrictions on agrarian use (VAINER *et al*., 2002).

To achieve success with this agroecological cultivation, it is necessary to have several cares, the main of which is the zeal with the soil, its recovery, and the maintenance of its natural equilibrium. According to Almeida (1998):

(...) we need to develop and apply creative solutions to minimize the use of industrialized inputs and maximize the use of natural resources, based on the concern with erosion control and the conservation of fertility and biota of the soil/plant system.

The soil is being recognized as a living entity, where the beings present not only depend on physical or chemical conditions, besides interfering with their large scale of practices (ARAÚJO, 2002). The Northeastern family farming is marked by its significant problems, among them the scarcity of rains. Despite these problems, the region is responsible for 55% of the Brazilian family agricultural production. Another issue of great importance in this region is related to the farm production methods and the consequent losses of the soil (CASTRO, 2012), as stated by Sousa (2007):

The lands are getting weaker and weaker because of the off-farm. The deforestation, the "drill," the fires, the planting hill below, the monoculture and the use of poisons, cause erosion, spoil the land and decrease production, year by year, besides contributing to the

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process of desertification of some areas in the region.

Procedures that reduce unexpected losses by water flow in the soil can benefit the penetration of water on the ground. Thus, it can be ensured the supply of water for the cultivation of grains, prevents erosion, and prevents flooding and the obstruction of rivers. At the same time are supplied the groundwater that nourishes the water flows. If during the rainy season, the terrain is not cultivated or graded there may be destruction and damage to the soil as well as the loss of water. Traditional methods of soil preparation, such as sowing in pits, are inefficient to repress the physical deterioration of the terrain (SANTOS; GRIEBELER; OLIVEIRA, 2010).

EMBRAPA researchers evaluated some soil tillage techniques. Among these, the best result obtained was the procedure known as barred grooves. The use of this method provides greater efficiency in the cultivation of grains and the structuring of the terrain (SANTIAGO; ROSSETTO, 2019).

In these agricultural precepts, soil biota is influenced a lot by the activities employed. For example, fertilization, crop rotation, irrigation, and land tillage systems and vegetation protection. However, this same biota manages processes such as mineralization, humidification, decomposition, immobilization and mobilization of micronutrients and macronutrients, aggregation and structuring of soil, nitrogen fixation and regulation of pests (COLOZZI FILHO, *et al*., 2016).

According to Doran and Parkin (1994):
(...) soil quality is the capacity it has to exert its function within an ecosystem, namely: sustaining biological productivity; mitigate the effects of damage on the environment and promote animal and plant health.

In this field of activity, research is evolving and seeking to incorporate sustainability in agricultural production with the help of rural communities. Currently, even more plants that are resistant are developed in Brazilian environments and climates, in this case, the semiarid, in which some plantations may develop with low water consumption; seeds are produced for small cost systems in which fewer chemical fertilizers and pesticides are used for pest control. Included in this with higher productivity, the generated income also grows; these are tactics for conservation and application of our natural and social capital (SAMBUICHI *et al*., 2012). For a better understanding of the terms used according to the Glossary of Culture (2007) "*The natural capital is constituted by the appropriation of natural resources that owns a region, and the share capital represents the degree of trust between the actors of a society, or positive attitudes towards civic behavior that contribute to the general well-being*."

In the hinterland, the agricultural economy is marked by pastoral activities, the creation of livestock and goats and sheep, and other species resistant to drought in the drier areas. This includes cotton and carnauba wax, and the production of maize, beans and manioc in the moistest regions and the sugarcane that is widely cultivated in the swamps of elevation (CARVALHO, 1993).

It is of utmost importance to give special attention to the vegetal extractivist field. Since the semiarid presents a great richness of plants resistant to the dry climate that could be exploited in the economic sphere. As for examples: oil producers (catolé, faveleira, quince and oiticica); waxes (carnaúba); fibers (BROMELIACEAE); latex (pinion, maniçoba); fruit trees (imbuzeiro); medicinal trees (babosa, juazeiro) and general forage (some species of grass) (DUQUE, 2004).

The northeastern hinterlands present a massive amount of plants, but the knowledge about these is quite scarce. In this way, the preservation of the caatinga and the forest management, to keep these species in the environment, so that, subsequently, the population can use these plants, are means that need to be traversed so that it can reestablish this coverage vegetable. In this sense, government actions are essential (SANTOS; CAMERA, 2002).

Concerning reforestation, with exotic plants, further studies are needed to ensure more excellent safety when inserting them into the northeastern semiarid region. As an example, it is possible to cite the micro-region of the hinterland of Moxotó (formed by the municipalities of Pernambuco: Arcoverde, Betânia, Custodia, Ibimirim, Inajá, Manari and Sertania), where reforestation activities with eucalyptus are already observed, with results Harmful to the soil (CALDAS *et al*., 2015).

The breeding crop is probably the most important of the options for the caatinga, primarily because it engages a region with a scarcity of protein. Successful actions in the municipality of Taperoá, district of Cariri in the state of Paraiba, have evidenced that the plantation of palm and the haymaking of forage resistant to drought, such as Buffel grass and urocloa, incorporated to the creation of a similarly resistant and double cattle ability (meat and dairy products), have allowed the survival of man in the region. Fish farming is another option that can be accomplished by using the capacity of existing dams (SOUZA *et al*., 2019).

It is also of paramount importance to supply food for animals during periods of drought. Thus, it is an indispensable policy of supply of sugarcane bagasse, from sugar mills located in moist regions of the Northeast, to

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be hydrolyzed and offered to animals (SOUZA *et al*., 2019).

A more refined look is essential concerning the cultivation of grains in the boundaries of the semiarid. Since the climate of the region is severely unstable, making grain production a real "lottery." In this way, the northeastern man is exposed to vexing situations of plowing the soil, planting the seeds and then seeing the production ruin itself with the merciless drought (SARTORI *et al*., 2016).

After evaluating the individualities of the semiarid, it is possible to identify the causes and effects related to traditional agricultural production; thus, it is necessary to analyze the potential changes in this mode of production, so that there is a subsequent modification of the same. Here, it is crucial to cite how the agroecological sustainable output is given, because this way one can redefine the best methods to be used in planting, as well as in the cattle culture, among others (VIEIRA FILHO; SILVEIRA, 2012).

Agroecological practices seek to establish new formats of relationships between society and nature; since this is an environmentally appropriate, socially fair and economically viable practice. According to Santos and his collaborators (2014), this agriculture encompasses several production methods, amongst them:

Intercropping – a technological option for the small rural producer, since the second cultivation becomes a new source of income, strengthening the financial stability of the farmer, and influences to increase the productivity of the crop and decrease the number of pesticides;

Selective weeding – consists of selectively extracting herbs that have been maturing and which have been physiologically rebounded by cultivated plants;

Crop Consortium – Is an agricultural conservation technique that tends to better use in the long term of the soil. It focuses on planting different species close to each other;

Level Curve – it is the name used to indicate an imaginary line that groups two points with the same altitude. Through it is made the topographic maps, because, from the observation, the technician can decode their information through a three-dimensional view of the relief;

Dead coverage – it is one of the most beneficial practices that an owner can use to improve the health of their trees. Dead roofs are materials placed on the surface of the soil to maintain moisture and improve its conditions;

Organic fertilization – fertilizers obtained utilizing vegetable or animal origin, such as manure, flour, bagels, husks and remnants of plants, decomposed, or still in the decomposition stage. These materials are decomposing and can be produced by man through composting;

Green fertilization (or green planting) – it is the name given to the practice of adding leguminous plants on the soil surface to enrich it nutritionally with nitrogen. The increase in the presence of nitrogen in the soil favors the improvement of plant biomass production;

Crop rotation – it consists of alternating, annually, plant species in the same agricultural area. The species chosen must have, at the same time, commercial and soil recovery purposes;

Natural insecticides – natural products derived from plants can be an alternative to pest control;

Reforestation – it is an environmental action that aims to repopulate areas that have had the vegetation removed by the forces of nature (fires, for example) or human activities (burned, wood exploration, expansion of agricultural areas, fires)

Agroecology has been gaining space in all Brazilian socioeconomic aspects, as well as in academic spaces, permeating the political-ideological discussions about sustainable agriculture (NODARI, 2015). As Fávero and Pacheco stress (2013):

Agroecology has been rooted in all Brazilian socioeconomic environments and contexts with a functional diversity of expressions, perceptions, and perspectives; it has increasingly permeated the scientific-academic circuits and, at the same time, is putting firmly into the political-ideological clash as a sustainable option of life in the field. It materializes, therefore, as a movement, carried out by a wide range of social organizations and networks; as a science, which is being constructed from conceptions, principles and methods differentiated from the Cartesian-positivist precepts; and as a practice experienced, experienced, transmitted, innovated and (re)invented by farmers and agriculture in different conditions and realities throughout the Brazilian territory using this denomination or not.

Because of the above, we perceive the evolution of agroecology over the years in Brazil, especially in the semiarid region of the Northeast. Interestingly, agroecology has been expanding in several areas, such as socioeconomic and academic spaces. What is new and particularly relevant to this study are the agroecological techniques used in the territory of Exu-PE, our question is whether these techniques are being worked in appropriate ways, whether there has been changing or just an exchange of methods of production.

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V. AGROECOLOGY IN THE MUNICIPALITY OF EXU-PE

The Araripe region, in which the municipality of Exu is located, concentrates 40% of the world gypsum reserves and is therefore characterized by the exploration of the mineral in the so-called gypsum-polo. The mineral reserves are one of the significant differentials of the region, is estimated at 1.2 billion tons. Gypsum extraction represents 95% of the national gypsum production, which enabled the formation of an industrial park in the region, generating about 12,000 direct and 60,000 indirect jobs (IBGE, 2010).

Besides the extraction of gypsum, which is the main activity, there is the subsistence culture in the upland areas; the large livestock and the diversified agriculture in the Chapada (plateau) do Araripe (SILVA *et al*., 2006).

Exu is part of the Araripe development region, located in the hinterlands of the state of Pernambuco mesoregion. It represents 18.8% of the state territory with 18,576.9 sq.km and covers the municipalities of Araripina, Bodocó, Cedro, Granito, Ipubi, Moreilândia, Ouricuri, Parnamirim, Salgueiro, Santa Cruz, Santa Filomena, Serrita, Trindade and Verdejante. The municipality of Exu is mainly inserted in the Geoenvironmental unit of the Maciços and Serra Baixas, with altitudes between 300 and 800 meters. To the north, a portion is embedded in the Geoenvironmental group of the high plateaus (IBGE, 2010).

Exu is a municipality in the state of Pernambuco, in the Brazilian outback. Administratively, the city is composed of the headquarters district and the villages of Tabocas, Timorante, Viração, and Zé Gomes. Located on the BR-122, the height of the Serra do Araripe is the last city in the border between the states of Pernambuco and Ceará. With its 109 years, it has been growing gradually. The region where the municipality is located was initially inhabited by the Ançus Indians, from the Cariris' trunk. The area was occupied by cattle farms in the early 18th Century, with Leonel de Alencar Rego and subsequently his son, Joaquim Pereira de Alencar. After the occupation, Jesuit missions lived in the region, where they built the chapel of Bom Jesus dos Aflitos (IBGE, 2010).

The municipality was installed on June 7, 1885, gaining autonomy on July 9, 1893, due to Law # 52, of August 3, 1892. The first mayor was Manoel da Silva Parente. The municipality was suppressed in 1895 and restored 1907, with the designation of Novo Exu. By state Decree-Law # 235, of December 9, 1938, the city of Novo Exu became the denominate Exu (IBGE, 2010).

The city is located in the polygon of drought; its relief presents flat and rugged terrains influenced by the Chapada (plateau) do Araripe, with highlands, flat and descending the mountains, are low lands, fertile land, and several springs at the foot of the hill. The vegetation is predominantly of deciduous forest and hypoxerophyll caatinga. The municipality also has the plant of the savanna at the foot of the plateau, with species such as aroeira, braúna, sabiá, plum, pequi, sucupira, angico, white and red amburana, cedar, angico, eucalyptus, and the barriguda, almost extinct (SILVA *et al*., 2006).

Yres explains (2014):

Among the vegetation types in the semiarid region is the Cerrado, whose flora represents the continuity of the flora present in Central Brazil. The Cerrado has two distinct seasons: dry winter and rainy summer. With tropical savannah soil, nutrient deficient and rich in iron and aluminum, it houses dry-looking plants, between sparse shrubs and grasses, and Cerradão, a denser type of vegetation, of forest formation, formed by low and twisted trees highlighted in the middle of the greens covering the top of the plateaus.

The main animal species of the region are the preá, tatupeba, opossum, sagui, vulture, owl, hawk, fox, as well as a large variety of birds and reptiles. The municipality of Exu is located in the watershed of the Brígida River. Its main tributaries are the streams of Brígida, Carnaúba or Carrancudo, Queimada Grande, Tabuleiro, Cantarino, do Ouro, California, Maniçoba, Zé Gomes, Estrada, Paus Grandes, Tabocas, Mocambo, São Joaquim, and Tigre, all of which are intermittent. It also has the lagoons of Caraíba, de Dentro, Cascavel, Caracol, Grande, and Marrecas (SILVA *et al*., 2006).

The city of Exu has the predominant economic activity of agriculture. Cattle and swineherds are in more significant numbers. The main cultivated agricultural products are beans, tobacco, corn, cassava, coffee, and castor bean. The agrarian practice in Exu gives itself, in its vast majority, in a traditional way; from soil preparation to harvesting. The soil is prepared by burning after the first rains expect the process for planting the seeds. In this period, farmers expect the rainy season to thrive for the plantation to be harvested; the harvest is done manually.

In the municipality, there are already some communities that practice agroecology. Among them are the Baixio do Meio, the Serra do Ingá and Serra da Refrigera with a production, mainly of fruit and vegetable trees; the most prominent community is ruled by the Lermen family, in the Serra dos Paus Doías site.

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VI. INFLUENCE OF CIVIL SOCIETY ORGANIZATIONS IN THE IMPLEMENTATION OF AGROECOLOGICAL SYSTEMS IN EXU-PE

The NGO Caatinga (Center for Advisory and Support to Workers and Alternate Non-Governmental Organizations) has been working for more than 25 years with agricultural families in rural communities in the territory of Sertão do Araripe, in the State of Pernambuco.

Indirectly, its performance extends to the entire semiarid through its participation in the Network of Technical Assistance and Rural Extension of the Northeast (Ater-NE network), the Articulation of the Brazilian Semiarid (ASA) and the National Articulation of Agroecology (ANA).

About the NGO, Carvalho argues that:

Since its inception, the entity has maintained its firm purpose to support the construction of knowledge, technologies, and practices of agroecological basis together with agricultural families and their organizations, as a way to strengthen the capacity of rural populations for dignified and sustainable coexistence with semiaridity. (2007)

In 2006, the CAATINGA acquired the position of national Focal Point of Civil Society of the United Nations Convention on Combating Desertification (UNCCD), a political representation attributed and backed by ASA.

Several families and rural communities have changed their lives through the most harmonious relationships with nature. His experiences prove that environmental degradation is not an irreversible result of family farming in the semiarid. Accordingly, Carvalho (2007) states that: People do not degrade because they want to. On the contrary: many public policies and market agents continue to be encouraged to adopt degrading practices that put them in a situation of a significant vulnerability in the context of drought risk. Besides, most families have not yet had the opportunity to develop innovative initiatives based on the principle of coexistence with the semiarid in their properties.

The experiments developed in the Araripe region indicate that there is a broad "sensitivity and receptivity" to the new management approaches based on the principles of agroecology. However, many limitations hinder the generalization of these techniques. The local novelty is a necessary condition for these techniques to progress and adapt to the particularities of each family and community. It requires "mobilization and social organization" to create adequate spaces for the cultivation and socialization of agroecological knowledge. This mobilization is essential to influence public managers and public policy formulators. Thus, it is indispensable that the struggle for the stabilization of sustainable development is constant, building knowledge in a dialogical way and committed to a "fair society, economically viable, environmentally balanced and fraternal" (TEIXEIRA PIRES, 2017).

By extending the positive influences of the experiments that already exist in coexistence with the semiarid, it can be ensured that the environmentally sustainable and socially inclusive development is probably in the region. However, Carvalho (2007) clarifies that:

(...) it is necessary to involve more people, organizations, and networks of civil society to maintain and broaden the dynamics of the construction of agroecological knowledge, mobilizing and gathering forces to achieve the stable and concrete changes in the policies of State and finally in the rural development model in the region.

The caatinga has offered its support in this procedure, acting as an organization encouraging the building of new knowledge alongside communities, agricultural families, networks and articulations, as well as encouraging the spaces for the elaboration of public policies with the help of social organizations and movements (SANTOS; SILVA, 2015; SANTOS; SILVA, 2016; SOARES et al, 2018;.

The Center for Enabling and Supporting the Small Farmer of Araripe (CHAPADA in Portuguese), was created in April 1994, by a group of farmers/the family and technicians of the municipality of Araripina, Sertão de Pernambuco.

The work of CHAPADA is developed in ten municipalities of the Araripe region in the state of Pernambuco, in addition to six towns in the area of the middle São Francisco in the state. The actions of the entity are geared towards farmers and family farms organized in associations, cooperatives, unions, and forums. This work is supported by the Association of the One Million Cisterns Program (AP1MC); Ministry of Agrarian Development (MDA); Secretariat of Family Agriculture (SAF); Secretariat for Territorial Development (SDT); Project Dom Helder Câmara (PDHC); International Service/European Union; Secretariat of Agriculture and Agrarian Reform (SARA) and Pro Rural.

The activities developed to allow the recovery of soils and native vegetation, as well as enable the implantation of agroecological systems, and the development of the production chains of manioc-cultivation, horticulture, beekeeping, and caprino-ovino-

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culture. From this, the institution implements actions to create a good water infrastructure in rural communities, especially concerning access to water for human consumption, domestic, water supply for animals and other productive purposes.

It is in the perspective of guaranteeing food security and the generation of work and income for agricultural families, which gives access to markets for commercialization of agroecological products *in natura* as well as processed ones. The CHAPADA promotes educational actions that strengthen the organizations represented by farmers/family members, intending to facilitate access to public resources, and in defense of social rights, contributing to the realization of citizenship.

The institution discusses and considers in all its projects, gender relations from the perspective of differences and inequalities existing between men and women. The idea is to build an alternative path to promote equal opportunities. Currently, in all its activities, the CHAPADA has privileged and stimulated the presence of young people.

The mission of the institution as mentioned earlier is to strengthen the socioeconomic, political and cultural development of family farming, through the recovery and preservation of the environment, through agroecology and the realization of citizenship in the semiarid. The objectives of the NGO are:

Provide professional training, advice, and technical assistance to farmers/family members, enabling food security, generation of employment and income with environmental and social sustainability of the estates.

Offer professional training, advice and technical assistance to the processing units of agricultural products, seeking the quality of processed products;

Offer professional and business training to farmers/family members, stimulating the associative organization ensuring access to markets. In particular, concerning the organization of agroecological fairs and access to government marketing programs;

Develop actions to create a water infrastructure in rural properties and communities;

Develop measures that facilitate the access of farmers to public policies for the development of family farming and the improvement of quality of life in rural communities;

Promote educational activities that strengthen associative political articulation, in a way that assures the conquest of social rights and citizenship;

Develop actions that contribute to gender equality and the promotion of youth rights.

The NGO participates in the following institutional spaces: articulation in the Brazilian semiarid (ASA Brazil); Sustainable Development Council of Pernambuco (CDSPE); Araripina Rural Development Council (CDRA); State Environmental Council (CONSEMA); Municipal Council for Social Action of Araripina; Municipal Council for Rural Development of Araripina (CMDR); Municipal Council for Sustainable Development of Ipubi (CONDESI); Araripina Municipal Environmental Council (CONDEMA); Municipal Council for Food Security and Sustainable Nutrition of Araripina (COMSEA); Forum of the Goat and Sheep Breeding in the Araripe region; Manioc-Culture Forum of the area of Araripe in the state of Pernambuco (FOMAPE); Araripe Women's Forum; Territorial Forum of Araripe (FOTEAR); Pact of beekeeping of the Sertão do Araripe (Forum Pasa).

The CHAPADA is affiliated with the Brazilian Association of Non-Governmental Organizations (Abong). The NGO directs its action, from four strategic axes that enable the fulfillment of its mission. They are:

Agroecology and coexistence with semiarid – guiding activities aimed at the implementation and development of agroforestry systems, organic horticulture, honey production, goat and sheep breeding, poultry farming, fish farming, enlargement and adequate management of hydric infrastructure of rural properties and communities;

Entrepreneurship in family farming and access to markets – agriculturists and family farmers qualified in property planning, cost calculations and sales price, and rural entrepreneurship. Technical monitoring in the implementation and development of agroecological municipal fairs, local fairs of goats and sheep and sales to commercial establishments;

Youth Protagonism – stimulating actions that contribute to the professional qualification and insertion of young people in agroecological farming activities, as a fundamental strategy for the generation of income and fixation of young people in rural areas. Youth Protagonism is stimulated from community activities and local development;

Communication and institutional strengthening – expansion of social visibility through institutional actions, in the perspective of strengthening and disseminating the results achieved with the agricultural families and their organizations involved in the work of Entity.

The CHAPADA strengthens the socioeconomic, political and cultural development of family farming, through agroecology and the realization of citizenship in the Brazilian semiarid. The city of Exu is part of the organization's territory and has significant results in the

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field of sustainable family farming and coexistence with the semiarid.

VII. CONCLUSION

The primary purpose of this work was to describe the agroecology, its methods and utilization, verifying the implantation of the same in the municipality of Exu-PE, more precisely in the Chapada (plateau) do Araripe in the Serra (Mountain) dos Paus Doías. Agroecology is providing scientific and methodological bases for the production of various types of sustainable agriculture, having as one of its main objectives the need for food production in larger quantities and high quality biologically for the whole of society.

From the study, we also understand that agroecology brings with it its characteristics enabling a more precise understanding regarding the life of the family producer who inhabits the municipality of Exu-PE. The results of this work help to conceive the importance of agroecology, highlighting its fundamental social role of the inequality of the countryside and cities, this sector must be regarded as a strong element of wealth generation for the economy, not only for the agricultural sector or even for a specific region, but also for the whole country. Thus, we believe that agroecology fulfills a significant social, cultural, and economic role, also guaranteeing food safety for consumers of food produced under this method.

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