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Os estudantes da educação básica conhecem a importância dos sistemas de produção agroecológicos para a conservação da biodiversidade?

Does basic education students know the importance of agroecology production systems for the conservation of biodiversity?

¿Los estudiantes de educación básica conocen la importancia de los sistemas de producción agroecológica para la conservación de la biodiversidad?

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Resumo

A percepção dos estudantes da educação básica sobre a importância dos sistemas agrícolas agroecológicos para a saúde humana e ambiental é fundamental para as mudanças de hábitos de consumo, conservação da biodiversidade local e transformação social em longo prazo. Por meio de um questionário, constituído por questões abertas e fechadas, foram analisadas as percepções sobre os sistemas agrícolas agroecológicos e convencionais de produção, de 360 estudantes concluintes da educação básica, residentes em nove Regiões Funcionais de Planejamento do sul do Brasil. Utilizamos categorias de classificação para respostas dentro de

eixos temáticos, expressas em porcentagens e analisadas por meio de testes Qui-quadrado e Kruskal-Wallis. De maneira geral, os estudantes reconhecem os sistemas agroecológicos como mais saudáveis para as suas famílias e para a conservação do solo e da água, principalmente por não utilizar agroquímicos. Entretanto, apresentaram dificuldades em argumentar a sua importância para a conservação da biodiversidade, dos ecossistemas e para a garantia da segurança alimentar das populações. A televisão foi a principal fonte de informação referente a agroecologia, principalmente para os estudantes residentes no meio rural, apontando com isso falhas da educação básica quanto a abordagem do tema nas escolas. Os resultados mostram a necessidade de construir uma complexa rede de conhecimentos e discussões sobre os sistemas agrícolas agroecológicos na educação básica de ensino, que impliquem nas mudanças das percepções dos estudantes, comportamentos e em escolhas sustentáveis.

Palavras-chave: Agroecologia; Educação Ambiental; Conservação; Biodiversidade; Agricultura Sustentável.

Abstract

The perception of a basic education of the importance of agroecological agricultural systems for human and environmental health is fundamental for changes in consumption habits, the conservation of local biodiversity and long-term social transformation. We analyzed, by utilizing a questionnaire consisting of open and closed questions, the perceptions about agroecological and conventional agricultural production systems in 360 final students of basic education residing in nine Functional Planning Regions of southern Brazil. We used classification categories for answers within thematic axes, expressed in percentages and analyzed by means of Chi-square and Kruskal-Wallis tests. In general, students recognize agroecological systems as healthier for their families and for soil and water conservation, largely because they do not use agrochemicals. However, they demonstrated difficulties when arguing their importance for the conservation of biodiversity, ecosystems and for ensuring the food security of populations. Television was the main source of information related to agroecology, mainly for students residing in rural areas, thus pointing out shortcomings in basic education regarding the approach of the theme in schools. Our results show the need to build a complex network of knowledge and discussions on agroecological agricultural systems in basic education, involving changes in student perceptions, behaviors and sustainable choices.

Keywords: Agroecology; Environmental Education; Conservation; Biodiversity; Sustainable Agriculture.

Resumen

La percepción de los estudiantes de educación básica sobre la importancia de los sistemas agrícolas agroecológicos para la salud humana y ambiental es crítica para cambiar los hábitos del consumidor, conservar la biodiversidad local y la transformación social a largo plazo. Analizamos por el medio de un cuestionario con preguntas abiertas y cerradas, las percepciones sobre los sistemas de producción agrícola agroecológica y convencional de 360 estudiantes que completaron la escuela secundaria, que viven en nueve regiones de planificación funcional del sur de Brasil. Utilizamos categorías de clasificación para respuestas dentro de ejes temáticos, expresadas como porcentajes y analizadas mediante las pruebas de Chi-cuadrado y Kruskal-Wallis. En general, los estudiantes reconocen los sistemas agroecológicos como más saludables para sus familias y para la conservación del suelo y el agua, principalmente porque no usan agroquímicos. Sin embargo, presentaron dificultades para argumentar su importancia para la conservación de la biodiversidad, los ecosistemas y para garantizar la seguridad alimentaria de las poblaciones. La televisión fue la principal fuente de información relacionada con la agroecología, principalmente para estudiantes que residen en zonas rurales, señalando deficiencias en la educación primaria en relación con el tema en las escuelas.Nuestros resultados muestran la necesidad de construir una red compleja de conocimiento y discusiones sobre sistemas agrícolas agroecológicos en la educación básica que conducirán a cambios en las percepciones, comportamientos y elecciones sostenibles de los estudiantes.

Palabras clave: Agroecología; Educación ambiental; Conservación; Biodiversidad; Agricultura Sostenible.

Introdução

Current agricultural systems have reduced global biodiversity and ecosystem functions Altieri (1999) by using a production system based on monoculture, mechanization and pesticide use. Thus, this modern agricultural model alters the structure and functioning of ecosystems, directly influencing plant productivity, soil fertility, chemical and atmospheric quality, and other environmental conditions that, as a consequence, affect the quality of life of human populations (Perfecto & Vandermeer, 2008/2015; Feiden, 2005; Reganold & Wachter,

2016). In addition, it is among the main causes of the great movement away from the rural exodus and the disconnection of young people with the countryside (Bickel, Strack & Bögeholz, 2014; Feiden, 2005; Altieri, 2004).

Alternatively, agroecological production systems have proved to be an important strategy for the conservation of natural resources and biodiversity (Silva-Andrade et al. 2016). This model aims at managing ecosystems by taking the bases of sustainability as its guiding principles, which consist of ecological, economic and socio-political aspects (Begon, Harper & Townsend, 2007). Their strategies are associated with the conservation of biological communities and genetic diversity by maintaining the landscape, valuing native species and reducing pressures on ecosystems (Altieri,1999; Perfecto & Vandermeer, 2008; Lanka, Khadaroo & Böhm, 2017), alongside the production of quality food at a better price for farmers (Krauss, Gallenberger & Steffan-Dewenter, 2011). It should be noted that in order to meet the growing global demand for food, sustainable agricultural systems with higher productivity and less vulnerability will be needed to improve food security (Perfecto & Vandermeer, 2008; Lanka, Khadaroo & Böhm, 2017).

Agroecology is considered to be a science under construction, which studies agroecosystems in an integrated and interdisciplinary way, encompassing the knowledge of agronomy, ecology, economics, and sociology in the search for an ecologically sustainable agriculture (Feiden, 2005; Altieri, 2012; Capellesso & Cazella, 2013; Caporal & Costabeber, 2004). In the field of education, agroecology has been diffused informal education through basic education, higher education and non-formal education by different institutions (Norder, Lamine, Bellon & Brandenburg, 2016). Despite this, it remains little developed in Brazil, requiring a greater understanding and awareness by society. In Brazilian basic education, initiatives in environmental education focused on agroecology have been developed as transversal content (Norder, Lamine, Bellon & Brandenburg, 2016; Figueiredo, 2012; Parâmetros Curriculares Nacionais [PCNs], 1997), with the objective of overcoming the fragmentation caused by the disciplinarization of knowledge through socially and environmentally responsible practices, both in personal and institutional relations. The aim of the theme is to encourage young people, especially rural and forest populations, to develop activities related to basic education, professional qualifications and the development of citizen participation (Ministério do Desenvolvimento Agrário [MDA], 2013; MDA, 2016) in society.

However, despite the existence of public policies with education initiatives in agroecology (MDA, 2013; MDA, 2016, Decreto n. 7.352, 2010), Brazil has failed to advance

in the definition of a strategy to disseminate knowledge about the subject to society (MDA, 2016). The subject is rarely investigated in the scientific community and few existing studies have identified or characterized the population's perceptions about agroecology (Santos, Santos, Santos, Campos & Freire, 2015; Sá-oliveira, Vasconcelos & Silva 2015; Porter, Runck, Brakke & Wagner, 2015; Azevedo & Pelicioni, 2012). Perception is the result of different experiences, attitudes, values and vision of a person, given by the feeling of belonging and inclusion in the environment in which they are inserted (Tuan, 2012). Perception studies allow us to understand these lived experiences about the environmental dimension, which serve as subsidies for actions in the area of environmental education.

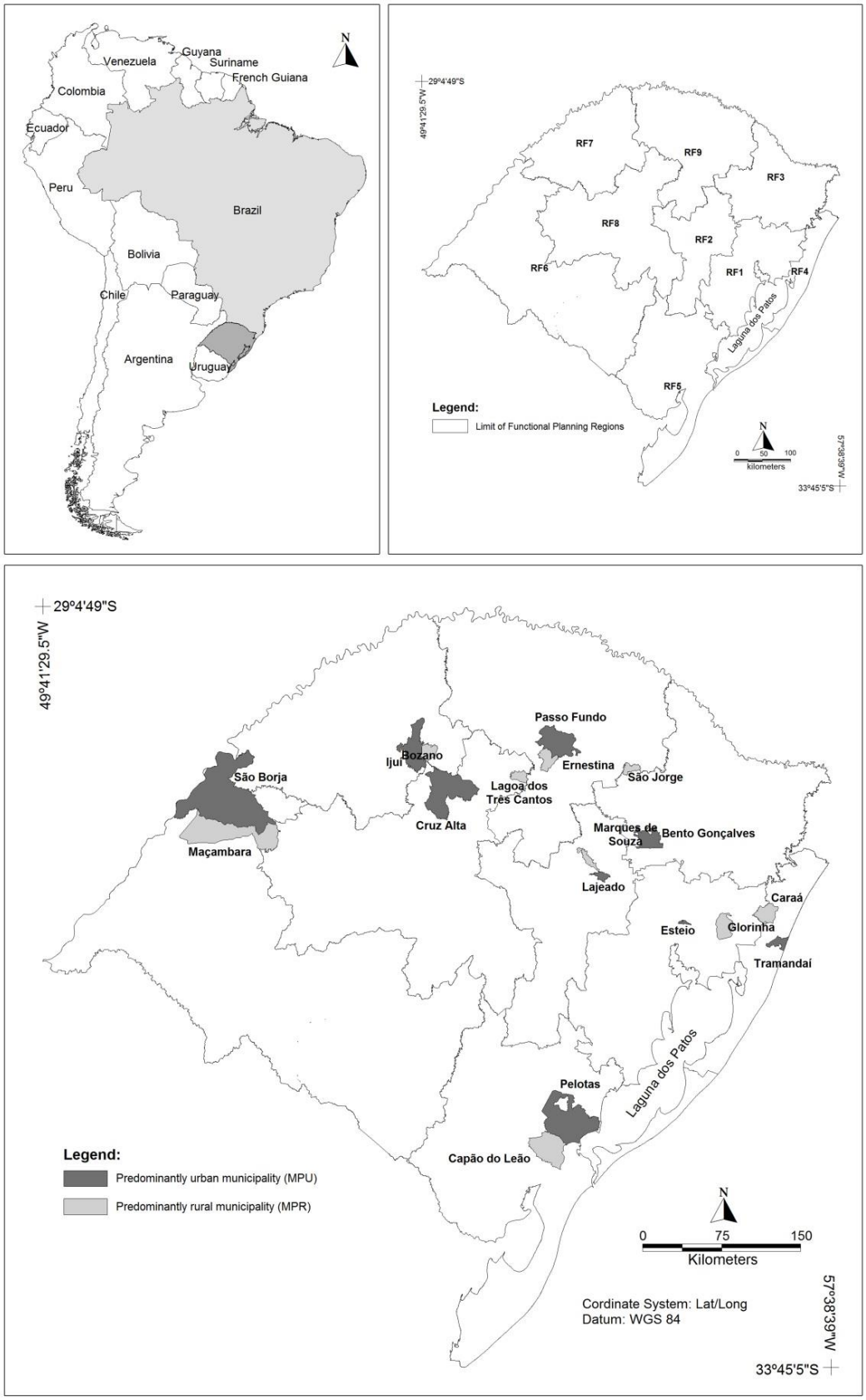
In this sense, to diagnose the reality in which the students of elementary education are inserted is necessary to understand the complexity and subjectivity of the experiences lived in the individual and collective context, and with that, to plan environmental education processes capable of triggering new perceptions and, perhaps, behavioral changes at the local and global levels. Investigating students' perceptions about agroecology is vital for the development of new strategies of action and, in the short term, facilitating the construction of new ways of thinking and acting in relation to the environment and agriculture, contributing to the quality of life of the communities in which these students are inserted. Thus, our objective was to understand the students' perceptions of basic education about agroecological agricultural systems in the State of Rio Grande do Sul. In order to do this, we tried to answer some main questions: i) What is agroecology for students? ii) What sources of information are recognized by the students as determinants in the construction of their knowledge on the subject? iii) Do students associate agroecological systems with socio-environmental sustainability and biodiversity conservation? iv) What socioeconomical-cultural factors interfere with students' perceptions? Based on this information, our study constructed an educated picture of the approach to the theme of agroecology in schools in the State of Rio Grande do Sul and the reflection of the students' perceptions of basic education on sustainable agricultural systems.

Metodologia

Study area

This study was carried out in the entire state of Rio Grande do Sul (RS) (30.0346 ° S, 51.2177 ° W) in southern Brazil (Fig. 1). It has a total area of 281,730.2 km^2 (Instituto Brasileiro de Geografia e Estatística [IBGE], 2006) and a population of 10,693,929 inhabitants, 85% of whom live in urban areas and 15% in rural areas (IBGE, 2010). Currently, RS is divided into nine Functional Planning Regions (RF) as defined by the RS - SCP Regional Development and Logistics Study (Secretaria de Planejamento e Gestão do Estado do RS [SEPLAG], 2008), based on economic, environmental and social homogeneity criteria. The RS has 1085 secondary schools and 284,890 students enrolled in the year 2017 (Secretaria de Educação. Departamento de Planejamento, 2017).

Figure 1. Location of the state of RS, Brazil. Dark Gray— Essentially urban municipality of RS; Light Gray— Essentially rural municipality of RS. White—Limit of the functional regions of the RS.



Source: Geoprocessing and Environmental Planning Laboratory - URI Erechim (2018)

From an economic point of view, agriculture is one of the most important sectors for the State, with an emphasis on agriculture, representing approximately 10% of the Brazilian GDP (Feix & Leusin, 2015). Family farming is responsible for 30% of production, occupying 86% of the state's agricultural establishments, with 38.9% of agricultural establishments being smaller than 10 hectares and only 2% greater than 500 hectares (Fundação de Economia e Estatística Siegfried Emanuel Heuser [FEE], 2014). It is vital to emphasize that the State is home to 14.60% of certified organic establishments in the country and that there was a 378.54% increase in the number of certified establishments in the State when comparing data from the National Register of Organic Producers with the Agricultural Census of 2006 (IBGE, 2006; Ministério da Agricultura Pecuária e Abastecimento, 2018).

Data collection

Initially, the research project was submitted to the Online Ethics Committee, through the Platform Brazil, and subsequently approved and authorized by the Research Ethics Committee of the Integrated Regional University of Alto Uruguay and the Missions (URI), Campus de Erechim, protocol number 1.862.114/2016. After being approved, by means of a draw, two schools of each RF were selected (Fig.1), one in a predominantly urban municipality (MPU) and one in a predominantly rural municipality (MPR). The municipalities covered in the study were: RF 1- Glorinha e Esteio; RF 2 - Marques de Souza e Lajeado; RF 3 - São Jorge e Bento Gonçalves; RF 4 - Caraá e Tramandaí; RF 5 – Capão do Leão e Pelotas; RF 6: Maçambará e São Borja; RF 7: Bozano e Ijuí; RF 8: Lagoa dos Três Cantos e Cruz Alta; RF 9: Ernestina e Passo Fundo. Thereafter, we made contact with the selected schools and explained the research objectives to the principal of the school. The schools signed an Authorization Term of the Institution to participate in the research. Afterward, the school board presented the research proposal to the first 20 students in the class register of high school graduates and their parents or legal guardians. All parents or legal guardians of students under the age of eighteen signed the Informed Consent Form (ICF) agreeing to data collection and authorizing students to participate in the research. The students signed the Term of Assent, also agreeing to participate. The research was developed in 2017, during which 9 expeditions were carried out for data collection, totaling 4650 kilometers.

For the data collection, the students selected by the school answered a questionnaire consisting of open questions allowing the free use of words and expressions, as well as single choice and closed questions. The questionnaires were structured from four thematic axes

(Table 1) with the intention of obtaining information about their socioeconomic characteristics, students' perceptions regarding conventional and non-conventional production systems and biodiversity conservation. In total, 360 students enrolled in the basic education of 18 public state schools participated in the study, 40 from each functional region.

Table 1. Thematic axes and goals adopted to create the questionnaire in the research of students' perceptions of basic education on conventional and non-conventional systems of production.

AXLES/TOPICS	GOALS
Sociodemographic characterization	To characterize the study participants, according to: Genre Parents level of education Residence
Sources of information on agroecology	Identify as sources of information on agroecology Identify different non-formal and formal spaces in the construction of knowledge about the theme
Definitions and characteristics of agroecology	Identify the concepts of agroecology Conceptualize and characterize traditional and conventional agroecosystems
Socio-environmental benefits	Understand if young people associate agroecology with environmental and biodiversity conservation through their benefits to local ecosystems and biomes as well as to human survival through agrobiodiversity and sustainable agricultural production

Source: Elaborated by the authors (2016).

Data analysis

The data analysis was performed through the quantification process (Sandelowski, 2000), structured across three stages: i) the systematic reading of the material and construction of categories with the intention of grouping the ideas presented by the students to each question; ii) assigning numeric values to the qualitative variables (categories) of each question, in order to allow the reduction of narrative data, creating a single set of quantitative data, so that these could be analyzed statistically; iii) organization of the dataset of each question in Excel 2016. After the organization steps, we calculated the absolute frequency (f_a) of each response (f) (sum of answers for each question) and the relative frequency in percent (f_r). The Chi-square test (X_2) was used to verify whether there was a difference between the students' responses by comparing two variables: municipality (MPU and MPR); genre (male and female) ; residence (urban and rural). To compare the responses of the nine Functional Regions and the parents' educational level, which had more than two variables, the Kruskal-

Wallis test was used. We used the BioEstat 5.0 software para as análises, considering a significance level of $p < 0.05$.

Results and discussion

Of the 360 students participating in the survey, 247 (68.61%) live in urban areas and 113 (31.39%) in rural areas. Of the rural inhabitants, 90 students (80%) are children of family farmers (which have up to 64 hectares of land), 97 students (86%) describe that their families developing the conventional production system and 16 (14%) developing agroecological production system. There was gender equality, with 54.16% female and 45.84% male. To calculate the education of parents or guardians, the highest level of education was considered among them, with 109 (30.28%) not completing elementary school, 30 (8.34%) having completed elementary school, (177) 49.16% completed high school and (44) 12.22% completed higher education.

Sources of information on agroecology

Regarding the sources of information on agroecology, the students answered: (i) television (60%); ii) internet (6.39%); iii) school subjects (4.72%); and iv) other sources that were grouped - conversations with family, friends, technicians of research institutions, participation and visits to fairs, and reading newspapers and magazines, among others (8.33%). There was no significant difference when comparing the answers with the students' place of residence ($\chi 2 = 0.55$; $gl = 3$; $p = 0.90$), nor between the different functional regions ($H = 5.26$; $gl = 8$; (p) Kruskal-Wallis = 0.72).

According to Sá-oliveira, Vasconcelos & Silva (2015), the promotion of agroecology through television facilitates its wide dissemination and reflects the current relevance of the theme and the environmental concern of people. However, McLuhan (1968) for over 50 years cited the media as "event producers," not "conscience makers." From the complexity of informing and critical formation, it permeates school spaces and teachers (Sulaiman, 2011). This idea reinforces the role of the school and the need to promote emancipatory education, capable of teaching students how to critically evaluate the information disseminated by the media.

When comparing the citation numbers between the different sources listed and the RF, the students of RF3 were those who assigned the highest importance to the school (12.50%),

however the statistical results show that there are no significant differences between the functional regions in this question (H = 0.18; gl = 8; (p) Kruskal-Wallis = 1.00).

Students living in rural (92.92%) and urban (44.94%) areas highlighted television as the main source of information on agroecology. According to the responses of the 360 students (32.22% and 43.33%), the subject is rare and never studied in school. It was noted that 42.48% of the students participating in the study that living in rural areas say that the school never taught agroecology. When comparing the variables, it was not possible to affirm differences between the students' perceptions in relation to how often they study the topic of agroecology at school (municipality: $\chi 2 = 3.57$; gl = 3; p = 0.31; genre: $\chi 2 = 4.03$; gl = 3; p = 0.25; residence: $\chi 2 = 1.36$; gl = 3; p = 0.71). Agroecology matter is rarely discussed in the classroom.

In Brazilian legislation (Lei n. 9394, 1996), rural schools should have curricular contents and methodologies associated with the reality of the field. However, due to the application of the conventional agricultural model, rural schools have had a reduction in the number of students (Vendramini, 2015). Brazilian educational policies are based on the reality of urban schools and rural schools need to adapt to the same model, disregarding their reality and the characteristics present in the place where it is inserted (Zakrzevski, 2007). That is, the school as a space for dialogue and construction of knowledge seems to be moving away from the reality of the field. In particular, the lack of contact of the young with the rural environment is an aggravating factor for sustainability issues, since the educational systems are disconnected from the experiences and daily practices of these places (Bickel, Strack & Bögeholz, 2014; Dillon, Rickinson, Sanders & Teamey, 2005).

For teachers and researchers it is essential to know the perceptions of young people about agriculture and to develop a scientific education that connects young people to life in rural areas. (Bickel, Strack & Bögeholz, 2014; Dillon, Rickinson, Sanders & Teamey, 2005). To transform this reality, teaching systems with transdisciplinary studies, that is, involving several areas of knowledge (Francis et al., 2011), are necessary in order to generate scientific research and innovative management systems, which should be introduced in students' basic education. In addition, EA programs that maintain a link with nature favor changes in the behavior of the students themselves to environmental conservation (Frantz & Mayer, 2014).

The need for basic schools with an agroecological approach is immediate, enabling the maintenance of the traditional knowledge of peasants, which have passed through orality and

experiences in their cultures for centuries, as well as the construction of new knowledge necessary for the transition from conventional agriculture to agroecology (Guterres, 2006). The education of the countryside must be contextualized whilst considering the logic of the subjects inserted in the process, opposing and questioning the modern agricultural models (Melo & Cardoso, 2011).

Definitions and characteristics of agroecology

For total students (64.44%), agroecology is a form of food production without the use of agrochemicals; 4.16%, define it as a science that studies ecological agriculture, that is, the relations between agriculture and ecology; and for just 1.94% it is school discipline. In this question there was a significant difference in relation to the municipalities MPU and MPR ($\chi 2 = 8.25$; gl = 2; p = 0.01). Students from predominantly rural municipalities have not identified agroecology as a scientific discipline (0.00%), but associated science that studies ecology farming (7.22%).

The remaining participants (29.46%) stated that they did not know the definition or would not respond, especially students in RF1 and RF5 (47.5% and 42.5%, respectively). RF1 is the most urbanized region in the state and concentrates the main functions of specialized services and the manufacturing industry, as well as communications infrastructures, universities, research centers, and health services; RF5 has a port structure that serves the entire State and much of the country and is also prominent in rice production and livestock farming (Secretaria de Planejamento, Governança e Gestão [SPGG], 2017). As a result, in none of these regions is family and agroecological agriculture highlighted in the economy, a fact that probably interferes with the students' difficulty in defining agroecology.

There is a difference between agroecological and conventional production systems, according to 72.22% of the students. Functional region 3 (RF3) was the one that showed the greatest difference among the research students, presenting a better understanding of the differences between the two production systems (95%). This result may be related to the large agricultural production in the region developed in the region (SPGG, 2017).

For the students participating in the research, agroecology presents some main characteristics associated with food production: i) free of agrochemicals and agrochemicals, parasites, hormones and veterinary drugs, additives and GMOs (31.39%); ii) is healthier, better quality, and has more color and flavor (29.72%) and; iii) adopts methods that are less

harmful to the environment, seeking to balance the systems (1.94%). It is important to note that 36.95% do not know or did not want to describe the characteristics of agroecological food. In all regions, student responses were similar (H = 4.54; gl = 8; (p) Kruskal-Wallis = 0.99), with no statistically significant p.

There are conceptual misconceptions that confuse agroecology only as a practice that does not use agrochemicals, as alternative agriculture or as an agricultural model generated for the mere solution of the environmental problems caused by modern production systems (Caporal, Paulus & Costabeber, 2009). This reflects the students' difficulty in highlighting the scientific approach of agroecology, with the potential to establish new orientations in the educational field (Caporal & Costabeber, 2004), which means to minimize it when considering it to be only a type of agricultural production practiced in a sustainable way.

In a study of 464 undergraduate students enrolled in the Environmental Education (EA) and Sustainable Development Education (ESD) courses at the University of Bayreuth, Germany, the family was identified as the main source of knowledge, followed by one's school (Maurer & Bogner, 2019). Schooling, especially maternal education, was associated with environmental knowledge and student behavior in favor of environmental issues (Maurer & Bogner, 2019). Thus, we emphasize the importance of schooling and the transmission of knowledge across generations to the construction of a conscious society in relation to agroecological systems.

Socio-environmental benefits

For 262 of students (72.77%) agroecological systems generate benefits to the environment, with RF3 (82.5%) being the highest, having environmental agroecological benefits. They justify agroecological systems generating benefits mainly because they: i) do not generate pollution by the use of agrochemicals (50%); ii) do not generate pressure on natural ecosystems (5.27%); and iii) practice polyculture, thus contributing to the conservation of genetic diversity and species (3.89%). When questioned about the importance of agroecology for the conservation of biodiversity, 55.56% of the students declared that they had no opinion on the subject and 42.5% affirm that agroecology is important for the conservation of biodiversity. Only 23.33% knew how to justify the contributions, highlighting: i) not polluting, conserving forest ecosystems and making sustainable use of natural resources (8.06%); ii) valorization and use of Creole seeds, contributing to the

conservation of agrobiodiversity (6.11%); iii) developing conservation management practices, especially of soil, maintaining its biodiversity (5.55%); and iv) reducing species' extinction risk due to hybridization or competition by organisms (3.61%).

Natural ecosystems have been increasingly impacted by the modern lifestyle of society, based on consumption and social habits that require greater natural resources (Vargas, Fontoura & Wizniewsky, 2013). Biodiversity conservation is fundamental to the environmental balance and maintenance of so-called ecosystem services, characterized by the supply of goods and services generated by natural components that contribute to human sustainability. Diversity (Primack & Rodrigues, 2001) provides resources and resource alternatives to people, possessing value, be it at the individual, species, community or ecosystem level. According to a survey carried out in the United Kingdom from 1970 to 2012, to assess the impacts of human actions on four hundred species of different taxonomic groups, it has been shown that biodiversity loss is associated with intensive agriculture, mainly because of the way the habitat was managed into increasing arable land, and worsening climate change (Burns et al., 2016).

For just 31.39% of the students, biodiversity conservation is of great relevance for food production. These ideas suggest disturbing realities as students do not associate sustainable farming systems with biodiversity preservation, and it is difficult to associate the importance of maintaining diversity with food production.

In agroecological systems, biodiversity is considered the basis of its functioning, given its economic and environmental importance (Hainzelin, 2015). It consists of a broad set of organisms that contribute to various ecosystem functions in the environment, such as the regulation of energy flow, nutrient cycling, soil erosion reduction and ecosystem services for humans (Altieri, 1999). In order to withdraw natural resources, it is necessary to think ethically and sustainably, valuing different species considering three factors: i) the value of the products to be exploited; ii) their indirect value, in which the resource generates profit without having to be removed; and iii) their ethical value (Begon, Harper & Townsend, 2007).

Comparative studies in the USA have illustrated that educators, using ecological theories, can change students' conceptions of food systems, making it possible to transform their attitudes and even the future of society (Francis et al., 2011). For this, they affirm that learning about agroecology is based on the exchange of knowledge and the production of new technologies that guarantee productivity and food safety (Francis et al., 2011).

The increase of agricultural areas has occurred in an alarming way, disrespecting the requirements established by law, causing the reduction of native forest in all Brazilian biomes (Ferreira et al., 2012) and in a fragmented manner, generating the so-called "mosaics" (Gliessman, 2009). These fragments are usually isolated, which may be determinants of population decline and extinction, especially those that are endemic (Primack & Rodrigues, 2001). Fragmentation also leads to the reduction of alpha and gamma diversity; there is a proliferation of generalist species, resistant to edge effects, altering the biological interactions and key ecological processes for the maintenance of these habitats (Tabarelli, Lopes & Peres, 2008).

Students believe that agroecological systems contribute to water conservation (76.11%). The main justifications indicate the non-pollution of surface waters with agrochemicals and fertilizers and groundwater (36.11% and 5.83%, respectively); makes rational use of water: do not waste and reuse; and it conserves the ciliary forest, avoiding the silting of the water bodies (8.06 and 1.67%). There is no difference students perceptions between regions ($H = 0.18$; $gl = 8$; (p) Kruskal-Wallis = 1.00). Additionally, a survey conducted (Carneiro et al., 2017) in the 1990s in the Mata region of Minas Gerais (Brazil) recorded the actions that initiated the agroecological transition, and noted that the drainage of floodplains for agricultural use impacted no hydrological volume of micro catchments; moreover, the use of agrochemicals contributed to contamination of water and soil. Changes to more sustainable agricultural systems increased soil cover and provided better drainage and water absorption, which resulted in an increase in groundwater level and allowed the opening of artesian wells with drinking water. For Carneiro et al., 2017, agroecological systems contribute to the maintenance of physical, chemical and biological soil resources and to the conservation of water resources.

The effectiveness of agroecological systems in soil conservation is also considered by students (83.89%), and due to: i) reductions in the use of agrochemicals (45.56%); ii) increased soil nutrient cycling and fertility (11.39%); and iii) maintenance of soil diversity, and increased nutrient cycling and fertility (3.89%). This perception is similar if compared with all variables (municipality : $\chi2 = 1.51$; $gl = 2$; $p = 0.46$; genre: $\chi2 = 3.89$; $gl = 2$; $p = 0.14$; residence: $\chi2 = 2.75$; $gl = 2$; $p = 0.25$; RFs: $H = 0.65$; $gl = 8$; (p) Kruskal-Wallis = 0.99; and the parents' educational: $H = 0.43$; $gl = 3$; (p) Kruskal-Wallis = 0.93).

Soils are considered to be one of the largest biodiversity reservoirs in the world because they have thousands of animals and microorganisms, and these organisms contribute

to diverse ecosystem services, such as infiltration and storage of water in the soil (Empresa Brasileira de Pesquisa Agropecuária, [EMBRAPA], 2015). Currently, 33% of the world's soil area is degraded and several threats make it difficult to manage, such as soil erosion, loss of organic matter and biodiversity, pollution, flooding and waterproofing of soil (Food and Agriculture Organization [FAO], 2018).

Conclusions

Our study has provided a realistic scenario of the teaching of agroecology in the State of Rio Grande do Sul, showing that agroecology is recognized by most of the students of basic education only as a form of food production without the use of agrochemicals. Still, they affirm that agroecology generates benefits to environmental and human health, but does not associate agroecology with food safety, nutrition or biodiversity conservation issues. Students also find it difficult to associate biodiversity conservation with food production, which means that improving agricultural productivity and using cleaner technologies reduces the vulnerability of species and natural ecosystems. However, they consider these systems of production to be fundamental in the conservation of water and soil, as they do not contaminate these resources with pesticides. Our results show that there is a large gap in the teaching of this crosscutting theme in schools, especially with regard to links about agroecology and its role in human health, natural ecosystems and increasing agricultural production.

Thus, it is necessary to develop educational practices and activities that take an interdisciplinary viewpoint of the importance of the sociocultural, political, economic and ecological aspects those agroecological systems can provide to the population. Certainly, students capable of recognizing sustainable farming systems have a greater capacity to understand and value natural resources, biodiversity, and ecosystem services, subsequently ensuring quality food choices, human and social well-being.

The RS in have an economy based on agriculture, it is a state with great potential for the transition of sustainable agricultural systems. Our study shows that there is no affinity of the students, from the nine regions of the State, in relation to agroecology, since they present difficulties in justifying their answers. Our results portray a worrying reality of the basic education of the RS, which implies that greater investments and works in the area of environmental education (EE) needed, with a focus on agroecology. Therefore, it is

recommended to implement projects in the area of EE, associated with public policies for students of basic education, especially those residing in rural areas. From integrative educational projects in schools, it is possible to strengthen human ethical conduct by stimulating the construction of values and knowledge associated with agroecology.

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