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Environmental citizenship based on peasants agroecological practices in Pradera, Valle del Cauca, Colombia*

Ciudadanía ambiental basada en prácticas agroecológicas campesinas en Pradera, Valle del Cauca, Colombia

Cidadania ambiental baseada em práticas agroecológicas camponesas em Pradera, Valle del Cauca, Colômbia

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Abstract
The research's objective was to build a proposal for environmental citizenship based on the agroecological practices developed by the inhabitants of the Peasant Reserve Zone of Pradera, Valle del Cauca, Colombia. Methodologically, the Participatory Action Research approach was used to collect information and firstly a characterization of 15 agroecosystems was made based on the variables: management systems, social, water, soil, and diversity; For each variable, indicators, and sub-indicators of sustainability necessary to interpret them according to agroecological environments were established; in a second moment the components were identified. It was found that the environmental citizenship proposal can be built with 14 sub-indicators: 6 belonging to a social variable (43.55%), 4 sub-indicators of a diversity variable (28.85%), 2 sub-indicators of a soil variable (12.67%), a sub-indicator for the management systems variable (9%), and a sub-indicator for the water variable (5.97%). It is concluded that the social component is of primary importance.

Key words
Agroecology; Rural communities; Diversity; Agroecosystems

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Resumen

El objetivo de la investigación fue construir una propuesta de ciudadanía ambiental a partir de las prácticas agroecológicas desarrolladas por los habitantes de la Zona de Reserva Campesina de Pradera, Valle del Cauca, Colombia. Metodológicamente se utilizó el enfoque de Investigación Acción Participativa para la recolección de información y en un primer momento se realizó una caracterización de 15 agroecosistemas a partir de las variables: sistemas de manejo, social, agua, suelo y diversidad; para cada variable se establecieron los indicadores, y subindicadores de sostenibilidad necesarios para interpretarlos según los entornos agroecológicos; en un segundo momento se identificaron los componentes. Se encontró que la propuesta de ciudadanía ambiental se puede construir con 14 subindicadores: 6 pertenecientes a una variable social (43,55%), 4 subindicadores de una variable de diversidad (28,85%), 2 subindicadores de una variable de suelo (12,67%), un subindicador de la variable de sistemas de manejo (9%) y un subindicador de la variable de agua (5,97%). Se concluye que el componente social tiene una importancia primordial.

Palabras clave

Agroecología; Comunidades rurales; Diversidad; Agroecosistemas

Resumo

O objetivo da pesquisa era construir uma proposta de cidadania ambiental baseada nas práticas agroecológicas desenvolvidas pelos habitantes da Zona de Reserva Camponesa de Pradera, Valle del Cauca, Colômbia. Metodologicamente, foi utilizada a abordagem da Pesquisa de Ação Participativa para coletar informações e, em primeiro lugar, foi feita uma caracterização de 15 agroecossistemas com base nas variáveis: sistemas de manejo, social, água, solo e diversidade; para cada variável, foram estabelecidos indicadores e subindicadores de sustentabilidade necessários para interpretá-los de acordo com os ambientes agroecológicos; em um segundo momento foram identificados os componentes. Constatou-se que a proposta de cidadania ambiental pode ser construída com 14 subindicadores: 6 pertencentes a uma variável social (43,55%), 4 subindicadores de uma variável diversidade (28,85%), 2 subindicadores de uma variável solo (12,67%), um subindicador para a variável sistemas de manejo (9%) e um subindicador para a variável água (5,97%). Concluise que o componente social é de importância primordial.

Palabras chave

Agroecologia; Comunidades rurais; Diversidade; Agroecossistemas

1. Introduction

Environmental citizenship arises as a proposal from the struggles of communities that seek, fundamentally, to stifle the voracious totalizing and hegemonic mercantile relationship that has always constituted a threat to human life and the integral life of nature (Alkaher & Goldman, 2018; Dobson, 2009; Pallett, 2017; UNEP, 2005). It is a feeling, a form of resistance to the market economy (Vallejo Cabrera, Salazar Villarreal, Giraldo, & Nieto Gómez, 2020). For its part, agroecology has been consolidated as an initiative of the communities that appeal to ancestral knowledge to face the offensive to commodify and privatize nature, which the transnational corporate capital calls natural resources or natural capital represented by air, jungles, forests, food, biodiversity, rivers, or soils (Barrera-Bassols, 2018; O. Giraldo, 2018; Gliessman & Rosemeyer, 2010; Machado, 2017; Sevilla, 2018; Sevilla Guzmán, 2017).

In Colombia, organized rural communities that adopt agroecological practices and take care of life and protect it from the market, from the State and from multinationals, are threatened by the food production agri-food system (Giraldo Alzate *et al.*, 2020; González de Molina & Caporal, 2013; Ramírez, Giraldo, & Nieto Gómez, 2019).

Consequently, the concrete proposals for environmental citizenship arising from the communities, although scarce, are particularly important (Cao, 2015; Gudynas, 2009; Humphreys, 2009).

In the municipality of Pradera, department of Valle del Cauca, Colombia, the communities had been organized to take care of, cultivate, protect and defend life from the discourses, practices, and subjects of development that seek the de-peasantization and exploitation of nature, conceiving nature and cultures as resources (Jiménez & Novoa, 2014). One of the strategies for the defense of life is the constitution of a Peasant Reserve Zone –ZRC (in spanish Zona de Reserva Campesina) in which agroecological practices based on peasant ways of life are promoted, that is, on ways of inhabiting the world, which allow to cultivate and affirm life (Barrera-Bassols, 2018; Giraldo Alzate & Rivera Espinosa, 2020; Victoria *et al.*, 2019).

In Colombia, the figure of ZRC has legal recognition in Article 80 of Law 160 of 1994 and is part of the Peace Agreement signed in 2016 by the Colombian government and the guerrilla of the Revolutionary Armed Forces of Colombia -FARC- (in spanish Fuerzas Armadas Revolucionarias de Colombia) (Ángel, Nieto, & Giraldo, 2019). In Pradera, there is the El Porvenir Agricultural Association -Agropor, a political organization, with a collective decision-making level, with political affiliation with Astracava (Asociación de Trabajadores Agrícolas del Valle del Cauca), Fensuagro (Federación Nacional Sindical Unitaria Agropecuaria) and La Vía Campesina, an international movement that coordinates organizations of small and medium producers. The ZRCs in Colombia are a benchmark at the local, departmental, and national level (Falla & Castrillón, 2018; Giraldo-Díaz, Nieto, & Sánchez, 2018; Nieto & Hurtado, 2018; Hoyos, 2019).

Agroecology is materialized in peasant experiences of food production that paint beautiful and exuberant landscapes on the territory as an expression of their culture, their way of producing food, in the cultivation of water, in the care of the soil, in the preservation of the plant diversity, in the maintenance of their management systems. Hence, the defense of peasant life, through agroecology, is conceived as an exercise of environmental citizenship.

This study considers that, in the Pradera ZRC, there is an exercise of environmental citizenship based on agroecological practices for the care, protection, and defense of water, soil, diversity, management systems, and the associated social factor. Facing practices that go against life, peasant communities generate strategies of resistance, action, and praxis in the territories, which are aimed at defending life (Tzul, 2015).

Agroecology is a key element in the construction of food sovereignty that allows popular action and the construction of democratic alternatives to development, with local, national, and international political impact (La Via Campesina, 2015). The adoption of the Sustainable Development Goals -SDG- is the recognition of the current food, climate, poverty, financial, economic, and democratic crisis that affects the rural communities of the country and that justify a change in the current agri-food system, incapable of generate enough food for human beings (La Via Campesina, 2017).

The real solutions to these crises cannot start from the industrial model that generates them. It is necessary to transform and build food systems based on agroecology, which is based on principles such as the manufacture of life in the soil, the mobility of

nutrients, the dynamic management of biodiversity, and the conservation of energy at all its scales (La Via Campesina, 2015). The real solutions to the crisis are found in the peasant communities that defend and take care of life.

In the Pradera ZRC, farmers are in a process of defense, care, and agroecological cultivation of water, soil, diversity, management systems, and peasant culture that are despised and try to be subsumed by the hegemonic model of water purification, which is based on the use of chemicals, especially chlorine and the construction of purification plants in which water is separated from community life (Agroecología, 2015; López, 2005; Salcedo, 2014); by the economistic approaches that conceive the soil as a source of ecosystem services that must be traded in the world market (Institute of Hydrology, Meteorology and Environmental Studies IDEAM & UDCA, 2015); by the bioeconomic market in which diversity is seen as a profitable business (Nieto Gómez & Giraldo Díaz, 2016); and, due to the orange economy that sees nature and local and community knowledge as a source of entrepreneurship for the cultural industry (Mincultura, 2018).

The general objective of the research was: To build a proposal for environmental citizenship based on agroecological practices of the Pradera ZRC, and, as specific objectives, a) to characterize the agroecosystems from the social, water, soil, diversity, and management systems variables, b) to identify the components that integrate the community proposal for environmental citizenship based on agroecological management.

The construction of a proposal for environmental citizenship based on agroecological practices of the Pradera ZRC shows that agroecology is the means that peoples adopt to defend themselves against the aggressions of the dominant agri-food system, thereby affirming their ways of being, their ways of living, their ways of dwelling in the world and inhabiting the earth. This is an important contribution for rural communities and for the agroecological scientific community, contributing to its consolidation as a science and as a tool for the protection, defense, and care of life.

2. Methodology

This research is based on the Participatory Action-Research methodology, which implies being part of a process that generates transformation contexts (Sevilla Guzmán, 2017, p. 15) in which the valuation of popular knowledge and farmer (s) -researcher horizontal interaction for the construction and validation of knowledge prevails (Ramón, 1987; UNAD, 2012).

The present study of the construction of an environmental citizenship proposal based on agroecological practices was carried out in the ZRC of Pradera, Valle del Cauca, Colombia (Figure 1), with farmers unionized in the Asociación Agropecuaria El Porvenir-Agropor, which is part of the Association of Agricultural Workers of Valle del Cauca -ASTRACAVA, which, in turn, is part of the National Federation of Unitary Agricultural Trade Unions (FENSUAGRO-CUT), affiliated with La Via Campesina -LVC, an international movement that coordinates peasant organizations, small and medium producers, rural women, indigenous communities, migrant agricultural workers, youth and landless laborers (La Vía Campesina, 2017).

The Pradera ZRC is characterized by being located in the foothills of the western mountain range (West Andes), with loam/clay soils, with relatively acidic pH, and with

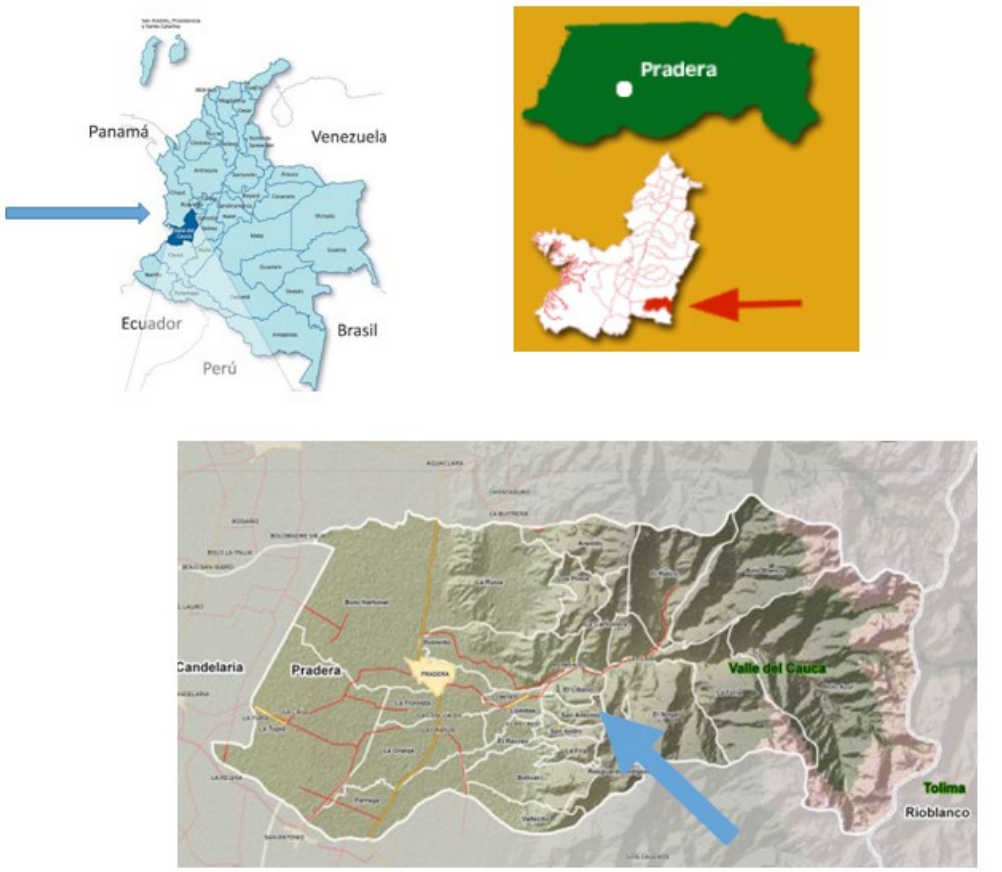

Figure 1. Location of the study area
Source: Oficina de Naciones Unidas para la Coordinación de Asuntos Humantarios (-OCHA, 2013).

multi-diverse cropping systems (Giraldo, Nieto, Sanclemente, & Quiceno, 2018). Agropor farmers market their surplus production mainly in the Pradera marketplace. In the same way, the farmers of the Pradera ZRC carry out various agroecological practices such as the use of compost-type organic fertilizers, they do not use pesticides for crop and animal management, they do not use highly technical irrigation systems and they manage multi-layer systems. In these agroecosystems, care for the soil, water, diversity, management systems, and peasant culture prevail (Giraldo *et al.*, 2018; Vallejo Cabrera, Salazar Villarreal, Giraldo, & Victorino, 2020; Sánchez-Jiménez, Nieto-Gómez, & Giraldo-Díaz, 2018).

The construction of this environmental citizenship proposal was carried out from the characterization of the 15 agroecosystems evaluated, considering the variables: social, water, soil, diversity, and management systems (Table 1). Among the resources used in the development of this research is the characterization of the agroecosystems, which includes the participatory diagnosis with the community, group meetings with Agropor farmers, tours of agroecosystems, and semi-structured surveys for the gathering of information and/or field verification. At all times, respect and appreciation of traditional peasant knowledge prevailed.

Table 1.
Geographical location of the agroecosystems characterized in the Pradera ZRC.

Id	Geographical location	Altitude m.a.s.l.	Area ha	Main crops
1	N3° 23.579' W76° 11.020'	1333	1,92	Ornamental, fruit, citrus, hens
2	N3° 23.569' W76° 11.002'	1480	0,64	Ornamental, banana, fruit, citrus, hens
3	N3° 23.677' W76° 11.113'	1373	1,28	Ornamental, fruit, citrus, hens
4	N3° 23.633' W76° 10.615'	1580	0,96	Oranges, banana, avocado, sugar cane, vegetables and rangpur (Citrus × limonia)
5	N3° 23.595' W76° 10.550'	1584	1,28	Oranges, banana, avocado, sugar cane, vegetables and rangpur (Citrus × limonia)
6	N3° 23.853' W76° 11.003'	1468	0,64	Hens, citurs, banana, coffee
7	N3° 23.867' W76° 11.180'	1481	0,96	Tangerines, banana, Soursop, plantain, stream protection
8	N3° 23.832' W76° 10.981'	1629	0,64	Onion, Erythrina edulis, coffee
9	N3° 23.755' W76° 10.877'	1912	0,96	Onion, Erythrina edulis, coffee
10	N3° 23.825' W76° 10.976'	1883	0,64	Plantain, banana, ornamental
11	N3° 24.080' W76° 11.737'	1489	1,28	Ornamental, banana, plantain, citrus, fruit
12	N3° 23.712' W76° 10.752'	1482	1,92	Cassava, lemon, coffee
13	N3° 23.951' W76° 11.308'	1798	2,56	Onion, Erythrina edulis, coffee
14	N3° 23.967' W76° 11.698'	1600	0,48	Citrus, cacao, coffee
15	N3° 23.952' W76° 11.347'	1420	0,64	Ornamental, banana, lemon

Source: The autors

The 15 agroecosystems were characterized as follows:

- Five variables were defined: social, water, soil, diversity, and management systems.
- Indicators were identified for these five variables that allow them to be categorized.
- Each indicator was discriminated from sub-indicators which were recorded at the field level (Table 2).

For the characterization of the agroecosystems, indicators and sub-indicators were established that allowed evaluating and quantifying the variables, these indicators were adapted from the methodology proposed by Deluchi *et al.* (2015) and the methodology of Bonilla and León (2016); In each of the 15 agroecosystems, a semi-structured interview was applied.

An indicator and the necessary sub-indicators were established for each of the variables to interpret them according to the agroecological environments. In each agroecosystem, a tour was carried out accompanied by the peasant family or at least one of its members. During this tour, semi-structured surveys adapted according to the variable to be evaluated were applied, which allowed the information of the selected variables to be collected.

Table 2.
Variables, indicators, and sub-indicators defined in the characterization of the agroecosystems of the Pradera ZRC.

id	Variable	Indicator	sub-indicator	Acronym	Unit
1	Water	Water demand	Type of irrigation system used	tsru	Scale*
2			Irrigation frequency	fdr	Scale
3		Potential impact on water quality	Chemical leaching risk	rlxp	Scale
4			Dose, toxicity, frequency of application	dtfap	Scale
5	Soil	Soil physical and chemical properties	pH	pH	0-14
6			Organic matter	MO	%
7			Phosphorus	P	ppm
8			Ca/Mg Ratio	CaMg	less than 1 to more than 5
9			Cation Exchange capacity	CIC	meq/100g
10			Sand	Arena	%
11			Clay	Arcilla	%
12			Silt	Limo	%
13			Texture	Textura	1=F-AR-A 2=F-Ar 3= Ar
14		Soil biological properties	Baclibre	Baclibre	UFC/g s
15			fungus	hongos	UFC/g s
16			Fnasimb	Fnasimb	UFC/g s
17			Micorr	Micorr	UFC/g s
18	Diversity	Diversity of soil mesofauna at the family level	Diversity of soil mesofauna at the family level	Family	Number
19		Number of mesofauna individuals	Number of mesofauna individuals	Individ	Number
20		Number of plant species	Number of plant species	numespec	Number
21		Number of varieties	Number of varieties	numindiv	Number
22		Diversity of cultivated species	Number of cultivated species/ha	nec	Number
23			Crop spatial diversity	dec	Scale
24		Conservation of the diversity of non-cultivated species	Distribution and relation of cultivated and semi-natural areas	dracs	Scale

Continúa en la página siguiente

id	Variable	Indicator	sub-indicator	Acronym	Unit
25	Social	Productive strategies	Marketing channels	cdc	Scale
26			Production marketing	cdp	Scale
27		Financial strategies	Debt level	nde	Scale
28			Access to credits	accacred	Scale
29			extra property income	ingextr	Scale
30		Profitability	Economic benefit	benecon	Scale
31		Satisfaction of basic needs	Access to food	accealim	Scale
32		Health risk	Ways of use and application of pesticides	fduapest	Scale
33		Degree of producer satisfaction	Degree of producer satisfaction	grsatpr	Scale
34		Participation in producer groups	Participation in producer groups	partgru	Scale
35		Access to land	Land ownership	tentierr	Scale
36		Access of the population to varied foods	Varied food offer	ofertalim	Scale
37	**Management system**	Input dependency	Degree of technification of the producer	tecnprod	Scale
38		System control	System control	controlsis	Scale
39		Preservation of soil chemical properties	Fertilization criteria	critferti	Scale
40		Preservation of soil physical properties	Organic matter management	mmo	Scale
41			Tillage practices	pdl	Scale
42		Preservation of soil biological properties	Rotations	rotac	Scale
43			Use of pesticides	udp	Scale

* The sub-indicators that have Scale as a unit were rated from 0 to 4, with 0 being the lowest value and 4 being the ideal value.

Source: The autors

For the characterization of the agroecosystems in the Pradera ZRC, the following information analyzes were made:

- Analysis of variance, in order to find significant statistical differences between the production systems evaluated.
- Analysis of means, in order to compare differences between the production systems evaluated.

- Identification of components that explain the variability through Principal Component Analysis in the SAS program.
- Grouping of production systems, by means of the Cluster Index or Ward's grouping == Groups of highly differentiated agroecosystems based on the variances.
- Definition of variables that explain the agroecological characteristics of the agroecosystems of the ZRC.

Identification of the components that integrate the environmental citizenship proposal.

Considering that each main component is the linear expression of the sub-indicators that compose it, and each sub-indicator has a weight on that component, we proceeded to find the main components. The greater variability and existing relationships between the evaluated sub-indicators are explained, determining the sub-indicators with the greatest weight in each variable.

We proceeded to consider the percentage of contribution of each variable (social, water, soil, diversity, and management systems) and of each sub-indicator to the proposal of environmental citizenship based on agroecological practices of the Pradera ZRC.

3. Results and discussion

43 sub-indicators were evaluated during the study period: January-October 2019 (Table 3) and were included in the analysis to determine the relative importance of each of them through the contribution they make to the total variance and their discrimination capacity of agroecosystems. For the final analysis, 29 sub-indicators were not considered because they did not have the discriminatory capacity and only 14 were considered with contributions to the variance (Table 4 and Figure 2).

Of the 14 sub-indicators included in the final study, those that showed the greatest contribution to the explanation of the total variance of the 15 agroecosystems were: the degree of technification of the producer, with 9%; extra property income, with 8.22% and distribution and relation of cultivated and semi-natural areas, with 7.99%; organic matter, with 6.28%, participation in producer groups, with 6.17% and irrigation frequency with 5.96% (Table 4 and Figure 2).

When adding the values of these sub-indicators for each evaluated variable, it is obtained that these results show greater contributions of the social variable, with 43.55% followed by diversity, with 28.85%, then soil, with 12.67% and management system with 9%. Finally, the water variable contributes 5.97% to the characterization of the evaluated agroecosystems, which coincides with that reported in the literature (Flores & Sarandón, 2015; Leyva & Lores, 2012; Loaiza Cerón, Carvajal Escobar, & Ávila Díaz, 2014; Maza & Sarandón, 2015; Sevilla Guzmán, 2017).

Table 3.
Means, coefficients of variation, and statistical significance for 43 sub-indicators used in the characterization of the agroecosystems of the Pradera ZRC.

id	Variable	Indicator	sub-indicator	Acronym	Unit	Mean	SD	Variance	CV
1	Water	Water demand	Type of irrigation system used	tsru	Scale	0,733	1,033	1,067	140,836
2			Irrigation frequency	fdr	Scale	2,933	1,163	1,352	39,645
3		Potential impact on water quality	Chemical leaching risk	rlxp	Scale	3,800	0,414	0,171	10,896
4			Dose, toxicity, frequency of application	dtfap	Scale	3,733	0,594	0,352	15,900
5	Soil	Soil physical and chemical properties	pH	pH	0-14	5,807	0,526	0,276	9,054
6			Organic matter	MO	%	3,315	0,413	0,170	12,447
7			Phosphorus	P	ppm	18,687	24,607	605,505	131,676
8			Ca/Mg Ratio	CaMg	less than 1 to more than 5	1,634	0,374	0,140	22,892
9			Cation Exchange capacity	CIC	meq/100g	20,904	4,481	20,079	21,436
10			Sand	Arena	%	42,713	7,836	61,410	18,347
11			Clay	Arcilla	%	34,087	7,285	53,067	21,371
12			Silt	Limo	%	23,200	1,474	2,171	6,352
13			Texture	Textura	1=F-AR-A 2=F-Ar 3= Ar	1,867	0,743	0,552	39,816
14		Soil biological properties	Baclibre	Baclibre	UFC/g s	75,200	51,099	2611,076	67,950
15			Fungus	hongos	UFC/g s	0,980	1,199	1,437	122,336
16			Fnasimb	Fnasimb	UFC/g s	0,158	0,252	0,063	159,383
17			Micorr	Micorr	UFC/g s	47,578	8,949	80,087	18,809
18	Diversity	Diversity of soil mesofaunaat the family level	Diversity of soil mesofauna at the family level	Family	Number	66,733	1,831	3,352	2,744
19		Number of mesofauna individuals	Number of mesofauna individuals	Individ	Number	20649,333	1430,258	2045637,810	6,926
20		Number of plant species	Number of plant species	numespec	Number	36,200	26,657	710,600	73,638
21		Number of varieties	Number of varieties	numindiv	Number	46,467	35,918	1290,124	77,299
22		Diversity of cultivated species	Number of cultivated species/ha	nec	Number	3,467	0,640	0,410	18,460
23			Crop spatial diversity	dec	Scale	3,200	0,941	0,886	29,410
24		Conservation of the diversity ofnon-cultivated species	Distribution and relation of cultivated and semi-natural areas	dracs	Scale	3,200	0,941	0,886	29,410

25	Social	Productive trategies	Marketing channels	cdc	Scale	0,933	1,033	1,067	110,657
26			Production marketing	cdp	Scale	2,867	1,506	2,267	52,519
27		Financial strategies	Debt level	nde	Scale	3,933	0,258	0,067	6,564
28			Access to credits	accacred	Scale	3,933	0,258	0,067	6,564
29				ingextr	Scale	2,000	1,414	2,000	70,711
30		Profitability	Economic benefit	benecon	Scale	1,867	0,915	0,838	49,043
31		Satisfaction of basic needs	Access to food	accealim	Scale	2,200	1,082	1,171	49,197
32		Health risk	Ways of use and application of pesticides	fduapest	Scale	3,200	1,146	1,314	35,826
33		Degree of producer satisfaction	Degree of producer satisfaction	grsatpr	Scale	3,467	0,640	0,410	18,460
34		Participation in producer groups	Participation in producer groups	partgru	Scale	2,467	1,187	1,410	48,131
35		Access to land	Land ownership	tentierr	Scale	3,867	0,352	0,124	9,100
36		Access of the population to varied foods	Varied food offer	ofertalim	Scale	2,667	1,345	1,810	50,444
37	Managment system	Input dependency	Degree of technification of the producer	tecnprod	Scale	3,667	0,488	0,238	13,308
38		System control	System control	controlsis	Scale	3,400	1,121	1,257	32,977
39		Preservation of soil chemical properties	Fertilization criteria	critferti	Scale	2,933	1,280	1,638	43,632
40		Preservation of soil physical properties	Organic matter management	mmo	Scale	3,067	1,033	1,067	33,678
41			Tillage practices	pdl	Scale	3,667	0,816	0,667	22,268
42		Preservation of soil biological properties	Rotations	rotac	Scale	3,267	1,033	1,067	31,616
43			Use of pesticides	udp	Scale	3,733	0,458	0,210	12,261

* The variables whose unit is "Scale" were valued from 0 to 4, with 0 being the lowest value and 4 being the ideal value.

Source: The autors

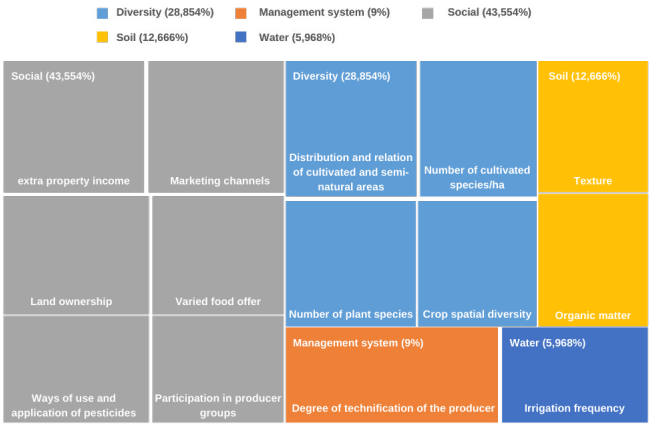

Figure 2. Percentage explained by each variable used in the characterization of the agroecosystems of the Prairie ZRC.
Source: The autors

Table 4.
Proportion of the variance explained by each sub-indicator (communality) used in the characterization of the agroecosystems of the Pradera ZRC.

				Main components						Explained Variance
ID	Variable	Sub-indicator	Acronym	CP1	CP2	CP3	CP4	CP5	CP6	
1	Water	Irrigation frequency	fdr	4,335	1,278	0,181	7,515	0,359	0,984	14,653
2	Soil	Organic matter	MO	0,838	0,823	0,084	5,901	1,865	5,913	15,424
3	Soil	Texture	Textura	3,993	0,001	4,550	1,546	0,617	4,969	15,677
4	Diversity	Number of plant species	numespec	1,829	1,803	4,547	7,330	1,255	0,646	17,410
5	Diversity	Number of cultivated species/ha	nec	0,483	0,604	3,675	10,543	0,058	2,184	17,547
6	Diversity	Crop spatial diversity	dec	0,318	2,427	7,036	4,253	0,609	1,615	16,257
7	Diversity	Distribution and relation of cultivated and semi-natural areas	dracs	1,172	0,111	6,018	4,952	3,348	4,028	19,629
8	Social	Marketing channels	cdc	1,729	1,238	0,287	5,732	9,796	0,686	19,467
9	Social	extra property income	ingextr	0,336	0,257	0,619	0,577	0,176	18,221	20,185
10	Social	Ways of use and application of pesticides	fduapest	0,920	1,134	2,879	6,895	4,232	0,853	16,914
11	Social	Participation in producer groups	partgru	0,372	8,374	0,353	0,289	1,582	4,179	15,149
12	Social	Land ownership	tentierr	0,399	2,673	0,329	3,222	3,929	8,176	18,729
13	Social	Varied food offer	ofertalim	3,467	1,768	3,353	6,863	0,526	0,517	16,495
14	Management system	Degree of technification of the producer	tecnprod	0,535	0,067	0,400	0,057	20,919	0,002	21,980

Source: The autors

Cluster Analysis (Cluster)

The 43 sub-indicators evaluated were included in the grouping analysis. Quantitative and qualitative descriptors were analyzed; therefore, the distance matrix was constructed with Ward's minimum variance methodology. The grouping analysis formed 4 groups (cluster). Figures 3 and 4 show that there is wide variability between the agroecosystems evaluated.

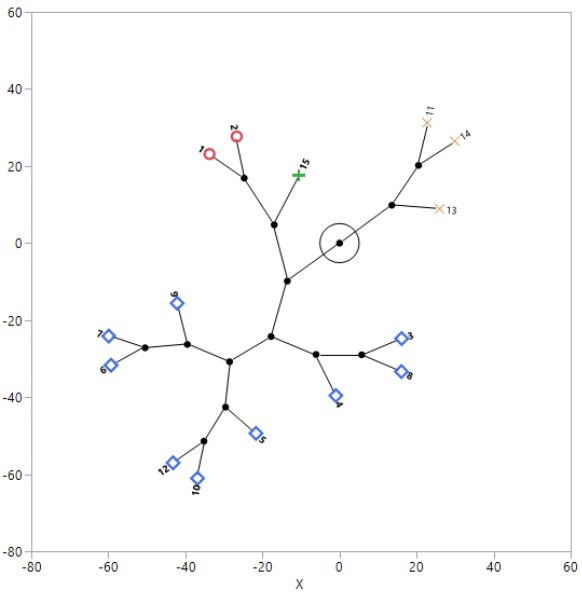

Figure 3. Path diagram based on the correlations of the main components and the values of the sub-indicators evaluated in the characterization.
Source: The autors

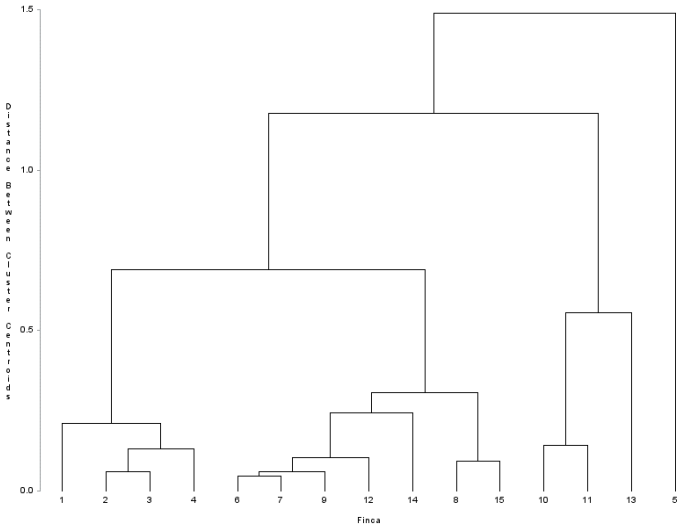

Figure 4. Characterization dendrogram of 15 agroecosystems of the Pradera ZRC
Source: The autors

Four clusters were formed with the 15 agroecosystems evaluated, among which highly significant statistical differences were found (Table 5). Agroecosystems 1, 2, 3, and 4 belong to one group; the 5, to another; agroecosystems 6, 7, 8, 9, 12, and 14 make up another cluster; and agroecosystems 10, 11, and 13 another grouping.

Table 5

Number of clusters formed according to Ward's analysis.

Cluster (Ward)	Agroecosystem
1	1
	2
	3
	4
2	5
3	6
	7
	8
	9
	14
	15
4	10
	11
	13

Source: The autors

The cluster consisting of agroecosystems 1, 2, 3, and 4 has the characteristic of presenting a greater number of plant species and a number of varieties per species, with 128, 103, 106, and 87 respectively (Table 3). This indicates that there is an assessment by farmers of the importance of diversity, which allows its use and conservation. This coincides with the report by Altieri & Nicholls (2019), Reijntjes (2009), and La Vía Campesina (2017), who consider that for poor farmers and/or in marginal areas, and the diversified agroecosystems confer high levels of tolerance to the changing socio-economic and environmental conditions. Leal (2007) reports that diversified agroecosystems have a positive impact on self-consumption and family income since the more technologically advanced families stop eating well to sell their products. In these agroecosystems, families have crops for self-consumption such as cassava, corn, beans, Musaceae, coffee, and sugar cane, among others.

Agroecosystem 5 has low values for the asymbiotic Nitrogen-fixing bacteria sub-indicator (Frene, Gabbarini, & Wall, 2018; Infante, 2015; Sánchez de Prager, Sierra Monroy, Peñaranda Parada, & Peñaranda Parada, 2015; Sánchez, Prager, Naranjo, & Sanclemente, 2012). The cluster consisting of agroecosystems 6, 7, 8, 9, 12, 14, and 15 is explained by the sub-indicators dose, toxicity, and use and frequency of application of pesticides, which show that in these agroecosystems pesticides of biological origin are used in appropriate doses and frequencies. In these agroecosystems, agricultural development projects that ignore traditional agriculture have not managed to change the agroecological practices traditionally adopted by those proposed by the Green Revolution (Infante Lira, 2015; Victoria et al., 2019).

Opting for agroecology, as an alternative to the agri-food system based on an intensive production model, allows peasant life in the midst of these adverse conditions (Goulet, Magda, Girard, & Hernández, 2014; Rosset & Altieri, 2018). Agroecosystems 10, 11, and 13 have a limited food supply and a low number of cultivated species, with values of 17, 14 and 13 respectively (Table 6). It is necessary in these agroecosystems to promote diversification, with which a better food supply for families can be achieved. Diversity plays a particularly important role in economic, food, productive, ecosystem and cultural aspects (Leyva & Lores, 2012).

Environmental citizenship proposal based on agroecological practices.

The variable contributes the most to the proposal of environmental citizenship in the Pradera ZRC is the social variable, with 43.55%. Then, the diversity variable is found, with a value of 28.85%, followed by the variables soil, management systems, and water, with values of 12.67%, 9%, and 5.97% respectively (Table 6 and Figure 5). This is especially important because it helps to overcome the difficulties presented when characterizing agroecosystems, such as a) imprecise decision criteria, b) mixed data, c) non-measurable data, d) difficulty in ranking or ordering indicators, and e) difficulty in discriminating between close indicators (Masera, Astier, & Lopez-Ridaura, 2000, p. 68).

Table 6
Percentage explained by each variable and by each sub-indicator in the environmental citizenship proposal of the Pradera ZRC.

Variable	Sub-indicator	The proportion of the variance explained	Percentage explained by each sub-indicator	Percentage explained by each variable
Diversity	Distribution and relation of cultivated and semi-natural areas	19,629	7,99499829	
Diversity	Number of cultivated species/ha	17,547	7,14698838	28,854%
Diversity	Number of plant species	17,41	7,09118754	
Diversity	Crop spatial diversity	16,257	6,62156438	
Management system	Degree of technification of the producer	21,98	8,95257336	8,95%
social	extra property income	20,185	8,22146011	
social	marketing channels	19,467	7,92901481	
social	Land ownership	18,729	7,6284234	
Social	Ways of use and application of pesticides	16,914	6,88916405	43,554%
social	Varied food offer	16,495	6,71850307	
social	Participation in producer groups	15,149	6,17026996	
Soil	Texture	15,677	6,38532723	
Soil	Organic matter	15,424	6,28227896	12,666%
Water	Irrigation frequency	14,653	5,96824647	5,96%
		245,516	100	

Source: The autors

In the environmental citizenship proposal of the Pradera ZRC, the social aspect has a weight of 43.55%, which shows the value of the community and the social fabric, in the

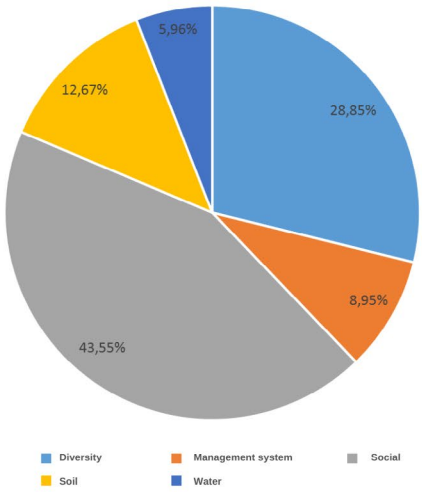

Figure 5. Percentage of contribution of each variable to the construction of an environmental citizenship proposal based on agroecological practices of the Pradera ZRC.
Source: The autors

implementation of social transformation initiatives that promote political scenarios and more just social ones in which agroecology is the response of communities to the processes of de-peasantization promoted by the agricultural model of Western civilization (Victoria et al., 2019). León (2014) highlights the role of culture in the functioning of agroecosystems, highlighting its role in the production of healthy food, the conservation and use of biodiversity, the preservation of moral values, and its fundamental role in environmental education.

Diversity has a weight of 28.85% in the proposal, which coincides not only with the growing global concern about its accelerated loss (Intergovernmental Panel on Climate Change - IPCC, 2019), but its preservation is closely related to the protection of traditional agroecosystems and the social organization of the local population (Altieri & Nicholls, 2019, p. 25).

The soil has a weight of 12.67%, in the construction of the environmental citizenship proposal, and its conservation, protection and defense are essential and definitive for community life, the cycles of water, air, and nutrients, as well as for the conservation of biodiversity and, therefore, for life on the planet (Institute of Hydrology, Meteorology and Environmental Studies IDEAM & UDCA, 2015, pp. 13–14).

The management systems contribute 9% to the environmental citizenship proposal of the Pradera ZRC. Agroecological management systems allow farmers to maintain the health of crops and immunity of the system, the elimination of agrochemicals, the optimization of metabolic function, the balance of regulatory systems, and at the same time, conserve and regenerate the soil, water and diversity (Altieri, 2002; Nicholls, Altieri, & Vázquez, 2015).

The water variable has a weight of 5.97% in the environmental citizenship proposal. The land and water grabbing by the hegemonic agri-food system in Valle del Cauca is documented by Pérez, Peña, & Alvarez (2011), who show the relationship of economic

policies that promote the sugarcane sector and their impact on the use of water, both in its supplying and assimilating function.

The sub-indicators extra property income, marketing channels, land ownership, ways of use and application of pesticides, varied food offer, and participation in producer groups explain the social variable (Table 6). Knowing the extra property income that a farmer or family has allows us to understand if the agroecosystem provides sufficient income to cover the basic needs of the family group. Although the extra property income complements the income of farmers and contributes to the economic stability of families, they also indicate that the work time allocated to caring for the agroecosystem is reduced (Iermanó, Almada, & Sarandón, 2017). For their part, marketing channels are increasingly important for Colombian peasant communities, which was evidenced in the agrarian strike carried out between July and August 2013, where the "National Agrarian Interlocution Table" was formed, which required the State, among its points of claim, to set support prices for peasant production; repeal the regulations on agricultural production, transformation, and commercialization of small and medium farmers; stop imports of food and agricultural products and review, in conjunction with organizations of small and medium producers, free trade agreements (Hidalgo, Houtart, & Lizárraga, 2014, p. 78).

Another sub-indicator that plays an important role in the social variable is land ownership. In Colombia, this is historically a high point and has to do with the development of the political, social, and armed conflict. The agrarian issue has not been resolved in the country and rural communities continue to demand from the State to stop favoring the dispossession of land to indigenous, Afro-Colombian, and peasant communities (Ángel et al., 2019). The National Agrarian Interlocution Table, in 2013, demanded that the Colombian State stop the policy of foreignization of land; recognition of peasant, Afro-descendant, and indigenous territoriality; and the immediate constitution of the Peasant Reserve Zones (Rural, 2013).

The sub-indicator ways of pesticide use and application, belonging to the social variable, reveals the political nature of agroecology. The use and application of pesticides is strongly related to the prevailing agrarian and agri-food system, while peasant agriculture is based on ancestral technologies and practices.

The offer of varied foods is a sub-indicator of the social variable that is also particularly important in the processes of building environmental citizenship. The agri-food system tends to homogenize diets throughout the world. Agroecological food production, carried out by rural communities, is in line with the processes of vindication of local knowledge, food sovereignty, and the promotion of diets based on local plant genetic resources (La Vía Campesina, 2017).

The sub-indicator participation in producer groups is closely related to the community processes of vindication, struggle, and construction of alternatives to the world agri-food regime. The participation of farmers in the processes of vindication and promotion of agroecology is especially important in the consolidation of forces and sum of wills for the transformation of social reality (Sánchez, 2018; UNAD, 2012).

The diversity variable contributes 28.85% to the proposal for the construction of environmental citizenship of the Pradera ZRC. Diversity is fundamental for the maintenance

of life; it represents essential intangible benefits for human beings, such as cognitive and spiritual enrichment, a sense of belonging, and aesthetic and recreational values. Its monetary valuation overlooks these intangible benefits that shape societies, cultures and the quality of life, and the intrinsic value of biodiversity. The land area is finite, and its sustainability is fundamental for human well-being (Intergovernmental Panel on Climate Change - IPCC, 2019).

The diversity indices, both plant and soil mesofauna, allow a better understanding of the soil connections and the importance for agroecology of the design of agroecosystems that allow farmers to dispense with external inputs and technologies developed by the Green Revolution, by promoting synergies and interactions that generate soil fertility and crop health.

The social relations, practices, and collective knowledge of the peasant community of Pradera are the support for the conservation of plant diversity and have to do with their strategies to confront the agri-food system, which are based on the expansion of self-management and community self-organization. It is through a slow but strong organizational, community process that the farmers of the Pradera ZRC have managed to maintain plant diversity and defend themselves against state policies and the guidelines of multilateral organizations that seek to homogenize the territories through the promotion of a food production model based on the technological penetration of the Green Revolution. The existing relationship between community social practices and the conservation of plant diversity are authentic supports for the collective contribution of the communities to the implementation of the Colombian Peace Agreement signed in 2016 (Ángel *et al.*, 2019).

The soil variable, with the sub-indicators texture and organic matter, presents a contribution to the environmental citizenship proposal of 12.66%. Soil is one of the most important concerns that humanity currently has (Institute of Hydrology, Meteorology and Environmental Studies IDEAM & UDCA, 2015; Food and Agriculture Organization of the United Nations FAO, 2015). Soil is essential for food production and food sovereignty; it is the largest filter and source of water storage; contains large amounts of carbon; regulates the emission of carbon dioxide and other greenhouse gases; and hosts organisms of great importance in the functioning of terrestrial ecosystems (Cortes, 2018).

The management systems variable contributes 9% to the environmental citizenship proposal in the Pradera ZRC. The sub-indicator that defines this variable is the degree of technification of the producer, which reveals the hegemonic nature of the agri-food system, based on the idea of progress and development. Deruralization in Colombia, but also in Latin America and the world, has occurred thanks to the promotion of private property, modernization, and access to global markets (Sourisseau, 2016).

The variable water contributes 5.96% to the environmental citizenship proposal. Community life sustains the diversity of the territory and the defense, care, and protection of water. It is an experience that contains a high ethnopolitical value (Maldonado, 2013) that is threatened by the penetration of urban life in the countryside (Sánchez, Valencia, & Montes, 2012). In the ZRC, social life is shaped from another place, different from the one that is enabled by capital and its state political form of regulating life (Tzul, 2015).

5. Conclusions

The characterization of agroecosystems is a methodological tool that allows decisions to be made in the short, medium, and long term in the construction and consolidation of an environmental citizenship proposal based on agroecological practices.

In the Pradera ZRC, 14 sub-indicators were identified that contribute to the discrimination of the social, water, soil, diversity, and management systems variables, namely, Degree of technification of the producer, Extra property income, Distribution and relation of cultivated areas and semi-natural, Marketing channels, Land ownership, Number of cultivated species/ha, Number of plant species, Ways of use and application of pesticides, Varied food offer, Crop spatial diversity, Texture, Organic matter, Participation in groups of producers and Irrigation frequency.

In the construction of an environmental citizenship proposal in the Pradera ZRC, the social variable contributes 43.55%, the diversity variable 28.85%, the soil variable 12.67%, the management systems variable 9%, and the water variable 5.96%. It is corroborated that the social component plays a preponderant role in the construction of environmental citizenship.

The greater the integration and participation of the social components, water, soil, diversity, and management systems, there is a greater opportunity to achieve the protection, care, and defense of peasant culture through an exercise of environmental citizenship.

The construction of an environmental citizenship proposal based on agroecological practices of the ZRC in Pradera supports the processes of improvement of the living conditions of rural inhabitants and contributes to the quantitative and qualitative advance of agroecology through the accompaniment of social movements.

The qualitative and quantitative expansion of agroecology requires governance, financing, technical, and political frameworks that support peasant systems. This is not achieved spontaneously, showing the benefits of agroecological agroecosystems, but by strengthening the social movement.

Conflict of interest

The authors declare that they have no conflicts of interest.

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