



A methodology for creating typologies of rural territories in Ecuador

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ABSTRACT

This article describes the analysis of geographic information through geostatistical processes in order to systematize a series of steps to create a methodology for identifying the typologies of rural territories, which can then be replicated across Latin America.

Based on the experiences of other countries, such as Argentina and Paraguay, a matrix was created to handle transversal variables and identify rural typologies that are repeated across all Latin American countries.

The final product of the methodology is demonstrated via the Rural Atlas of Ecuador, which is a geographical disclosure document that provides a better understanding of the rural reality in the country and shows where the different types of rural territories exist.

1. Introduction

In recent decades, rural territories in Latin America have experienced profound processes of territorial transformation, as a result of technological changes in production systems, forms of participation in global production chains and the link between the countryside and the city (Tacoli, 2006). Many of these territories have experienced development and production growth (Schejtman, 2003), while others have undergone worsening processes of deterioration and marginalization. All of these transformations have provoked a renewed and deep reflection in the region about which policies would best contribute to the organization and development of rural territories, not only from the point of view of production, but also from a more comprehensive perspective, with a more territorial focus, aimed at enhancing the productive transformation of many of these areas, while also reversing the historically malicious cycles of poverty and rural exodus that many of them have experienced for decades (Sili, 2005; World-Bank, 2008). However, one of the biggest limitations on designing public policies is the lack of up-to-date knowledge on the functioning of rural territories (Sili, Guibert, & Bustos Cara, 2015). This information is lacking not just from the production perspective, but also from the point of view of how these territories are organized because, as mentioned above, changes in production systems and in the relationship between the countryside and the city have reshaped the rural geography of Ecuador.

Based on the above, this work aims to contribute knowledge about the

dynamics of rural territories through the creation of a typology of these territories, taking into account various multidimensional variables that describe and explain the demographic dynamics, the city-country relationship and the employment structure. The goal of this type of typology is to characterize and interpret the functioning of rural territories in this new historical context. It is also an operational tool for planning and designing of territorial development strategies. Each type of territory is clearly defined and corresponds to a type of political strategy and intervention.

2. The typology of rural territories

A typology is a conceptual construction whose main objective is to identify groups or families of objects that have characteristics similar to each other, but very different from other groups (López-Roldán, 1996). A typology is a formal construction that, taking into account the diversity of all possible cases (plants, animals, landscapes, soils, etc.), organizes, systematizes and classifies them according to criteria that may be anticipated or that result from a natural grouping in a way that facilitates their study and understanding (Bayart, 2007).

Thus, a typology is in some ways a research strategy because it reduces the universe of analysis of the phenomena, creating an intermediate level of analysis between the general population and individual cases (types, families or groups), allowing one to more easily propose an operational hypothesis. A posteriori, these types or groups of objects,

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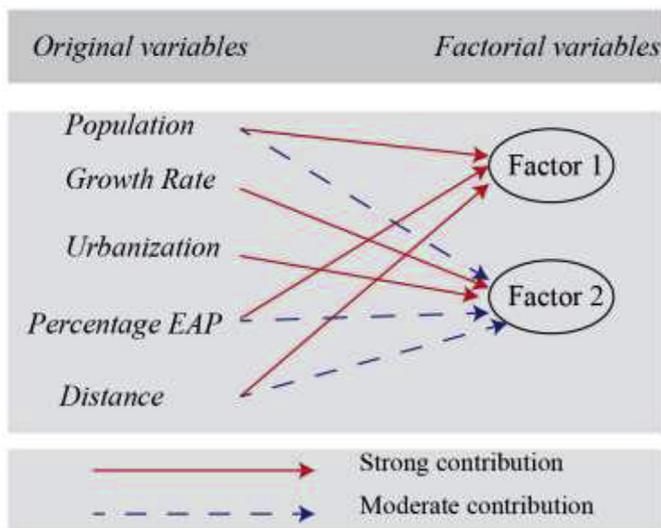


Fig. 1. Results of PCA

facilitate the selection of specific cases that can be studied in detail, thus enriching knowledge, not only of the specific case, but also of the whole type, family or group (Onwuegbuzie, 2007).

There are several ways to build a typology of territories, depending on the variables and criteria selected. Some typologies can be very simple, using for example population density, while other typologies can be more complex and are constructed using a set of variables that present a specific pre-established condition. Ultimately, it is most important to clearly define which objectives are most relevant to the definition of the typology as well as their capacity to validate the hypotheses proposed (Fachelli, López, López Rodán, & Sourrouille, 2012).

The construction of typologies in geography has a long history. The French and German schools of the early twentieth century emphasized the creation of typologies of rural spaces, based on natural criteria and production, with the goal of systematizing organizational models and rural processes. The positivist geography of the mid and late twentieth century also emphasized the construction of typologies of territories, but instead of being based on natural areas, these categorizations were based on administrative political units, with the objective of classifying them according to different criteria. Currently, the strong development of geographic information technologies, based on methodological theoretical advances in geography, especially geographic information systems, has been a key factor in the creation and development of different kinds of typologies created for the purposes of research projects or planning and development (Buzai et al., 2016).

However, the construction of typologies aimed at defining types of rural areas has always been a challenge because the criteria that have been utilized historically are primarily characteristics of production systems. In other words, rural typologies have been established based on the dominant kind of production, the type of crops or land use in general (Marie et al., 2015, pp. 1–25), which has contributed to conceptual confusion about the difference between rural space and agricultural space. The purpose of the typology proposed in this work is to define types of rural territories, hence the criteria that form the basis of its creation are multidimensional and linked to the territories' dynamics, such as population, the population growth rate, the level of urbanization of each district, the percentage of the economically active population in the agricultural sector and the district's distance from regionally important cities with more than 15,000 inhabitants. Although all these variables correspond to different territorial elements and represent a broad vision of the rural concept, and therefore can be considered as novel, it is necessary to define what is considered as rural space in the case of Ecuador.

Table 1
Variables used in the methodology.

Variable	Criteria	Description	Information source
Population	Population of the district in 2010	Number of people that live in rural areas of the district. This variable is important because it indicates the level of settlement of the rural area and determines an important set of behaviors and territorial dynamics.	INEC Population CENSUS 2010
Growth Rate	Average annual population growth rate	This variable allows us to observe the changes in the population living in a rural area, as measured through the evolution of the population of the rural area between the last two census years 2001 and 2010, and can show population growth (positive) or loss (negative). This rate is given by the formula: $r = \ln \frac{Nt}{No} \cdot \frac{1}{t} \cdot 100$ where: r = average annual growth rate ln = natural logarithm Nt = population in the year 2010 No = population in the year 2001 t = time in years	INEC 2001, 2010
Urbanization	Level of urbanization of the district	Refers to the level of concentration of the population in the district seat in order to measure the weight of the population that is concentrated versus dispersed within the jurisdictional area of the district.	INEC 2010
Economically active population	Percentage of the economically active population in the agricultural sector	The productive dynamics of a rural area can be clearly seen through its production systems, however, given the difficulty of defining comparable parameters, the percentage of the population that works in activities related to the agricultural sector was used as a statistical criterion. This allows us to observe areas that have a greater dependence on employment in the primary sector or, on the contrary, that have greater dependence on employment in industry or services.	INEC 2010

(continued on next page)

Table 1 (continued)

Variable	Criteria	Description	Information source
Distance	Distance to regionally important cities	Clearly, this is an indicator that allows us to visualize different types of rural territories according to their productive dynamics. Given that the relationship between the countryside and the city has become a key factor for the development or revitalization of rural areas, this classification incorporates distance between these two areas as an indicator. The indicator measures the distance from the center of the district to a city of 15,000 or more inhabitants, which constitutes a center for the provision of goods and services in the region, and therefore is significant for the revitalization of its productive activities.	Vías: IGM-MTOP, 2016 Localidades: IGM, 2016

Table 2
Descriptive statistics. Mean and standard deviation of the variables used.

Variable	Unit	Mean	Standard deviation
Population	Population	5677.41	6203.70
Growth Rate	Percentage variation	0.95	2.57
Urbanization	Percentage	2.51	8.82
Percentage EAP	Percentage	57.05	19.63
Distance	Kilometers	27.37	22.65

Table 3
Initial commonality values.

Variable	Initial	Extraction
Population	1.000	0.514
Growth rate	1.000	0.556
Urbanization	1.000	0.653
Percentage EAP	1.000	0.471
Distance	1.000	0.505

Extraction method: Principal Component Analysis.

Table 4
Variance explained by the components or factors.

Component	Initial auto-values			Sums of the components of the square of the extraction		
	Total	% variance	Cumulative %	Total	% variance	Cumulative %
1	1.620	32.402	32.402	1.620	32.402	32.402
2	1.079	21.572	53.974	1.079	21.572	53.974
3	0.877	17.536	71.510			
4	0.751	15.022	86.531			
5	0.673	13.469	100.000			

Extraction method: Principal Component Analysis.

3. A brief definition of the concept of rural in Ecuador

The idea of rurality as a specific link between humans and the rural environment and as a social and cultural identity has changed notably in recent decades due to technological changes in communications, the massive increase in the mobility of people and goods and the new relationship established between the country and the city.

This phenomenon is clearly visible in Ecuador, where a historical model of rurality in which the rural population's mobility was more restricted to local areas, the country and the city were not highly integrated, and agricultural activities predominated has given way to a more diverse model of rurality, with strong connectivity and proximity between the country and the city, as well as profound increases in diversification and complexity of productive activities and employment (Pascual, 2007).

However, in addition to the changes to the relationship that society has established with the rural world and the concrete forms of organizing this type of space, in Ecuador rural areas are defined as all areas that lie outside of areas where urbanization is either ongoing or has been completed. In other words, there is a clearly spatial and administrative criterion that defines rural areas in Ecuador (Cuesta, Villagómez, & Sili, 2017). We consider that this definition is too limited to be able to interpret Ecuador's new territorial dynamics. Thus, we have reformulated the concept and proposed a more comprehensive and multidimensional definition that attempts to account for the reality of demographics, production and identity, in addition to considering the increasing territorial complexity of the country.

Thus, rurality in Ecuador, for the purposes of this work, may be understood as all those geographical areas where the population is dispersed throughout the countryside and in towns and small cities of up to 15,000 inhabitants, whose productive systems are mostly linked to the exploitation of natural resources, whether primary production (agriculture, livestock, fishing, mining, forestry), transformation activities or services for these primary activities and the use of landscapes and natural conditions (tourism, recreation). In these areas, whether the population is dispersed or more closely grouped, there is a direct and close link between the population and nature as well as links between the populations as a result of the interpersonal relationships sparked by proximity and the shared knowledge established via daily life. Although there is general agreement that the demographic criteria are always arbitrary, the establishment of 15,000 inhabitants as the upper population limit for rural areas, is due to the fact that beyond this number of inhabitants, the social, productive and identity dynamics begin to exhibit other features

Table 5
Matrix of components.

Variable	Component	
	1	2
Population	-0.697	0.166
Growth Rate	-0.262	0.698
Urbanization	-0.110	-0.801
Percentage EAP	0.677	-0.111
Distance	0.703	0.106

Table 6
Agglomeration table (Final Stages).

Code (Municipality)	Stratus	Combinaded Conglomerate		Coef.	Diferences		Stage in which the conglomerate appears for the first time		Next Stage
		Conglome. 1	Conglome. 2		1as	2as	Conglome. 1	Conglome. 2	
1	1001	516	976	0			0	0	319
...	497.5		
995	7	2	7	577.2	79.7		993	989	999
996	6	25	687	687.0	109.8	30.10	994	972	1000
997	5	1	38	805.1	118.1	8.30	990	986	1001
998	4	3	217	928.0	122.9	4.80	991	992	999
999	3	2	3	1147.1	219.1	96.20	995	998	1000
1000	2	2	25	1544.2	397.0	177.9	999	996	1001
1001	1	1	2	2002.0	457.8	60.8	997	1000	0

Table 7
Mean of the factors and of the original variables according to the stratification.

Cluster "Ward Method" 5 strata		Population	Growth Rate	Urbanization	Percentage EAP	Distance
		Media	Media	Media	Media	Media
Cluster "Ward Method" 5 strata	1	13.363	2.9	-3.2	35.4	14.3
	2	4.741	1.1	1.5	58.7	22.5
	3	1.755	-0.6	3.6	74.4	40.0
	4	7.190	-1.0	19.8	47.5	22.9
	5	1.498	1.8	-4.0	69.2	82.3
Total		5.677	0.9	2.5	57.1	27.4

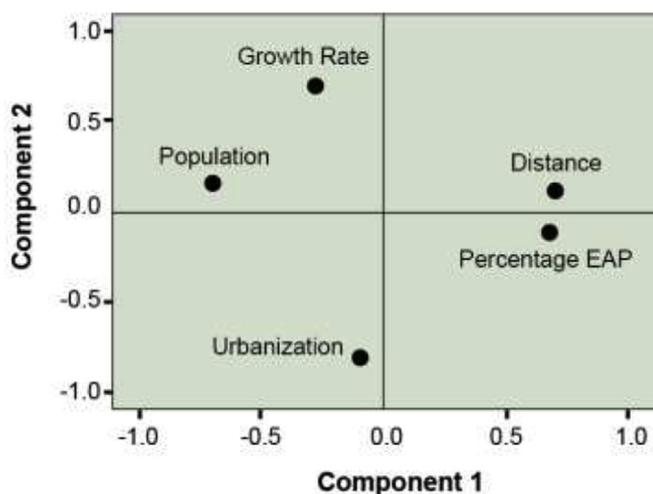


Fig. 2. Components 1 and 2 of the factorial space.

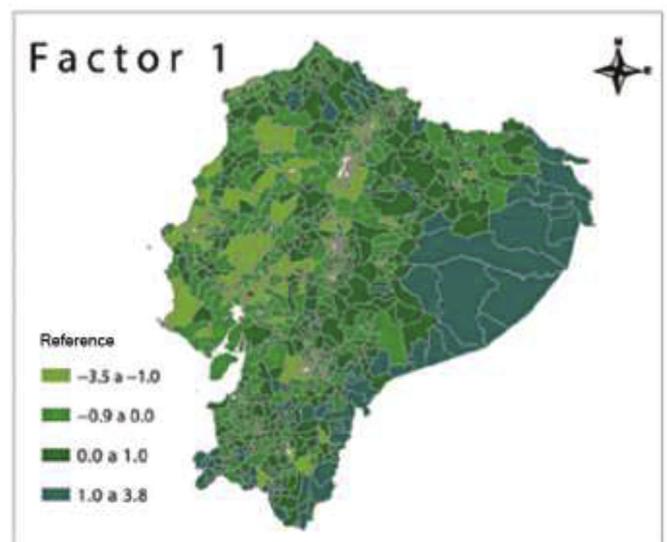


Fig. 3. Factor 1.

more like those of urban centers where productive systems are more linked to services, social distance is greater and self-identification is distinct from rural areas.

Our definition of the rural concept aside, the first methodological problem faced has been to define a spatial unit that allows for statistical analysis, the creation of a typology and comparisons between territories. Although this task is extremely complex due to the diversity of spatial conditions, it has been possible to overcome it given the availability of high-quality cartographic and statistical information in Ecuador, which allows us to observe with detail and clarity consolidated zones (considered urban in Ecuador) and the unpopulated zones (considered rural). Utilizing the available cartography and detailed statistics for each of these areas, we considered all Ecuador's districts as the unit of analysis and then removed the urban areas (threatened zones with more than 15,000 inhabitants).

The remaining areas were considered rural areas and statistical analysis was performed on them. Based on this analysis the construction

of typologies of rural territories was proposed. Specifically, the 1002 districts into which Ecuadorian territory is divided were unit of analysis of statistical data from the most recent census year (2010), after excluding districts located in the Galapagos Islands due to the statistical method and urban areas (consolidated zones of more than 15,000 inhabitants).

4. A methodology for the classification of rural territories in Ecuador

The methodological strategy proposed in order to identify and model the Ecuador's rural diversity consisted of performing a statistical analysis based on the factorial analysis of relationships and a subsequent automatic classification that would allow for the use of official statistical data that had been systematized and organized. In order to apply the

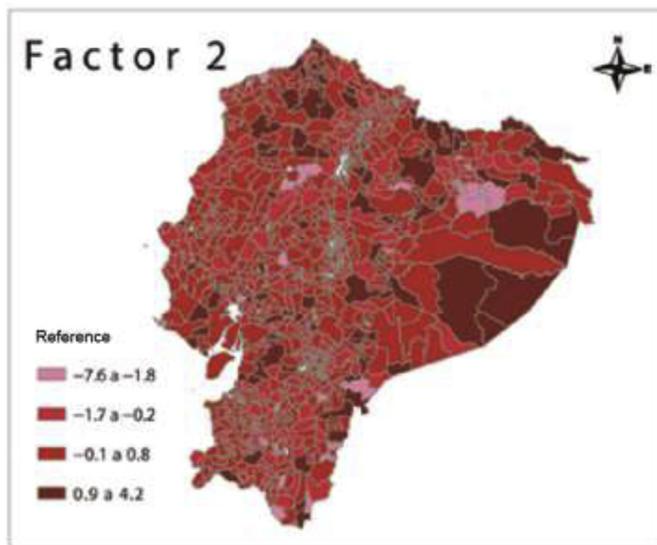


Fig. 4. Factor 2.

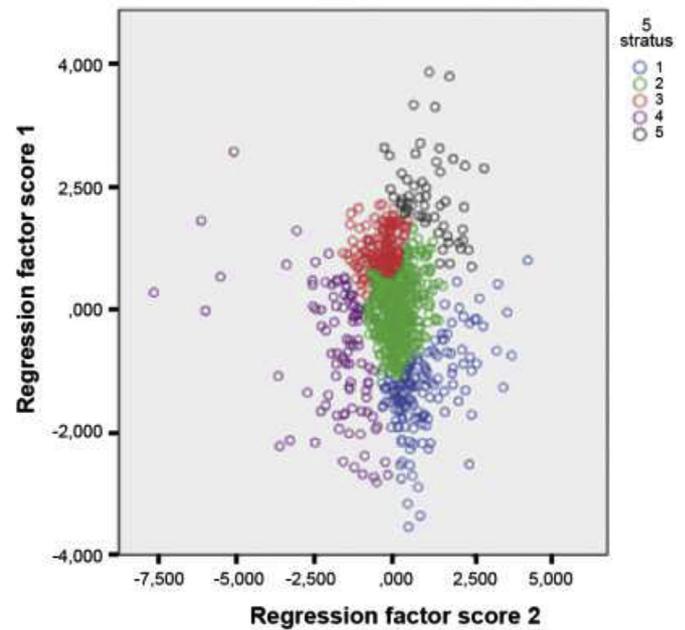


Fig. 6. Rradii classified in five strata in the space of factors 1 and 2.

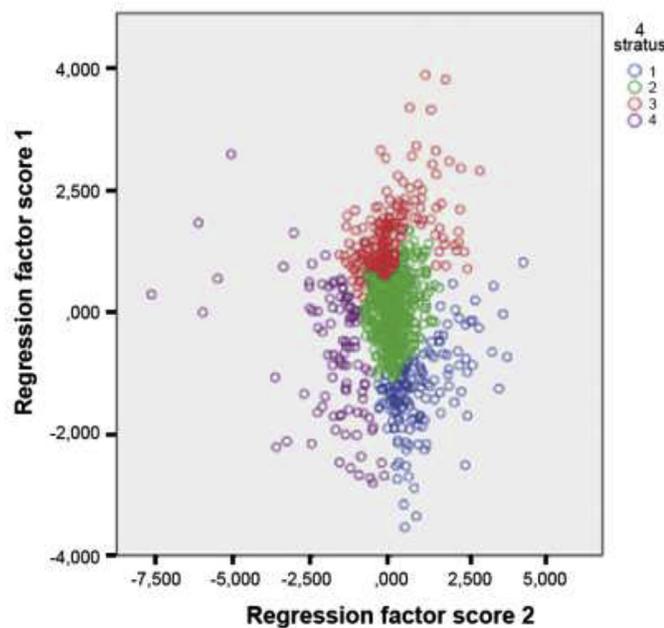


Fig. 5. Rradii classified in four strata in the space of factors 1 and 2.

analytical methodology known as structural and articulated typology (López-Roldán & Fachelli, 2015b) the following steps were carried out:

a) Definition of the unit of analysis

Defining the unit of analysis was the first step. The availability of cartographic information and high-quality statistics allowed us to clearly observe the urban (threatened zones) and rural areas (non-threatened zones) in detail. In order to define rural districts, all districts in Ecuador were considered and then urban areas (threatened zones with more than 15,000 inhabitants) were removed from the analysis. The remaining districts were considered rural areas and statistical analysis and subsequent classification were carried out on these areas. Concretely, the unit of analysis began with the 1002 districts that make up Ecuadorian territory, and then urban areas as well as the six districts corresponding to the Galapagos Islands were excluded (to achieve a more robust analysis).

b) Selection of key variables to describe Ecuadorian rural areas

A set of variables capable of capturing the territorial structure and changes underway in Ecuador’s rural areas was carefully chosen. All these variables were consolidated and systematized in a database using 1002 districts as the unit of analysis. The following key variables were defined:

c) Principal component analysis

After defining and consolidating all the variables, the data was processed in order to divide Ecuadorian territory into a set number of strata that serve to measure the complexity of the rural world. To achieve this, the technique of “Principal Component Analysis” (PCA) was used in the first instance.

PCA is a statistical technique for information synthesis which seeks to reduce the number of variables. That is, given a numerous set of variables, the objective of this technique is to reduce them to a smaller number while sacrificing the least amount of information possible. The new variables, known as factors or components, resulting from this operation (principal components) are a linear combination of the original variables, and they are also independent of each other (Uriel & Aldás, 2005). Thus, the objective of reducing the original information analyzed is achieved and the principle of scientific parsimony or economy of information is pursued: every model must attempt to be as simple as possible in the interpretation or explanation of the data. The maxim for this type of technique is expressed in the statement “loss of information and gain in significance” (López-Roldán & Fachelli, 2015a, p. 8). This reduction of information is fundamental since it synthesizes or enhances the underlying meaning of the information set. When these techniques are performed, they assume a partial loss of the total variability of the initial information contained in the variables, but they do so as a strategy designed to increase significance, that is, intelligibility, density and explanatory structure.

PCA’s analytical process can be divided into 4 basic steps (López-Roldán & Fachelli, 2015b, pp. 14–15):

a. First, the choice of the original attribute space or set of variables according to an elaborated analytical model is fundamental.

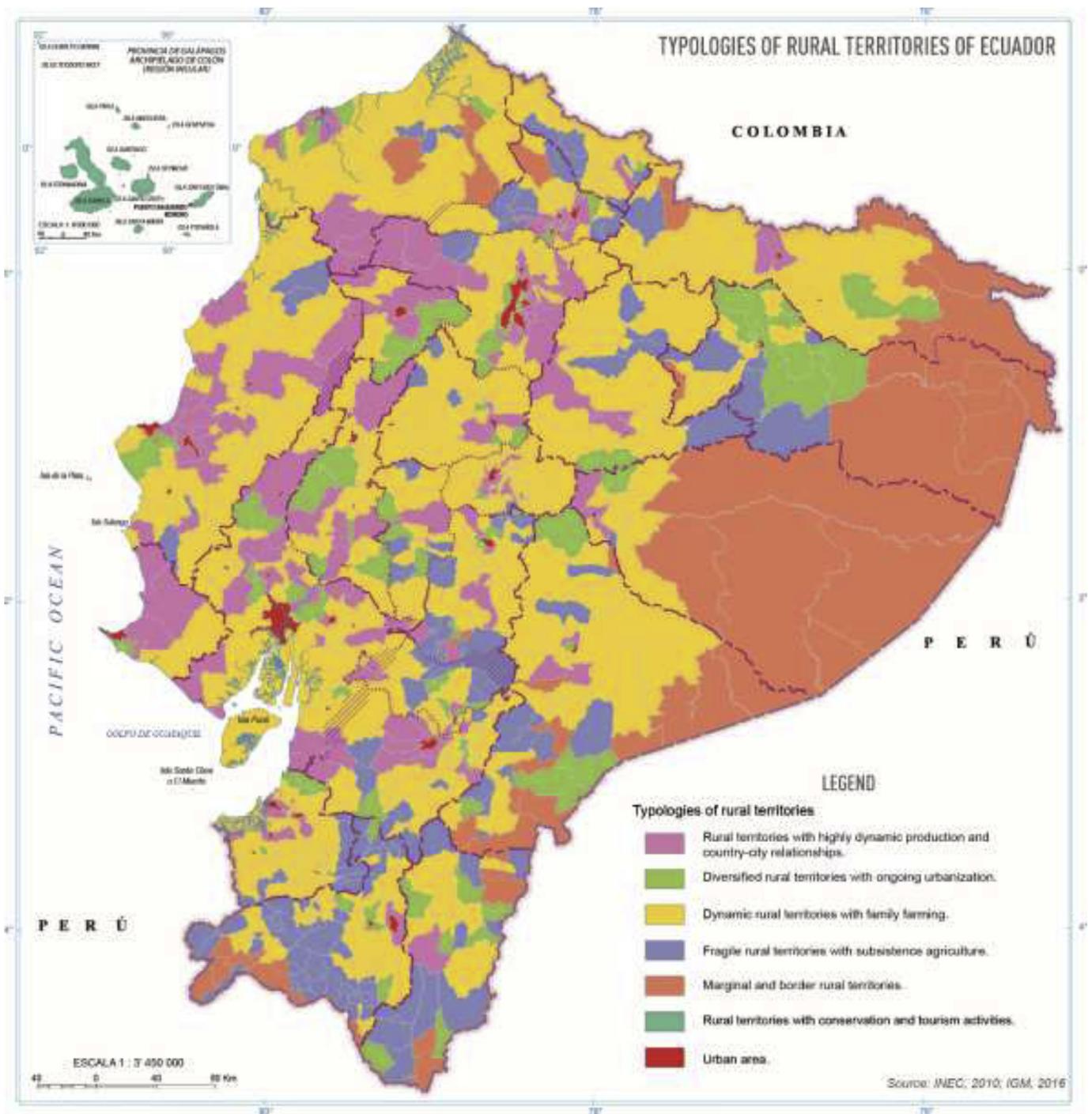


Fig. 7. Typologies of rural territories of Ecuador.

- b. Second, the factorial axes or components are extracted by calculating the eigenvalues and the number of factors to be retained in the analysis is decided.
- c. Third, we proceed to the interpretation of the factors or components by calculating the correlation between these and the original variables.
- d. If we conclude that the results are valid, then we can calculate the factorial scores to obtain additional analyses through other procedures.

In the case of Ecuador, we proceeded to the analysis by means of the five key variables from the Ecuadorian rural world chosen previously for

the 1002 selected districts. The structure of the information contained in the data matrix allowed us to reduce the original vector space to one with only two dimensions, axes or factorial variables that represent 54% of the total variance (as previously mentioned the concept of parsimony allows us to simplify of the model by decreasing variables, but to achieve this the partial loss of variance is assumed). (Fig. 1).

Table 2 shows the mean values and the standard deviation of the variables expressed.¹

By calculating the eigenvalues or variance incorporated to each axis we obtain five eigenvectors. Applying generally accepted criteria for

¹ In the proposed model, the index of Kaiser-Meyer-Olkin is 0.609.

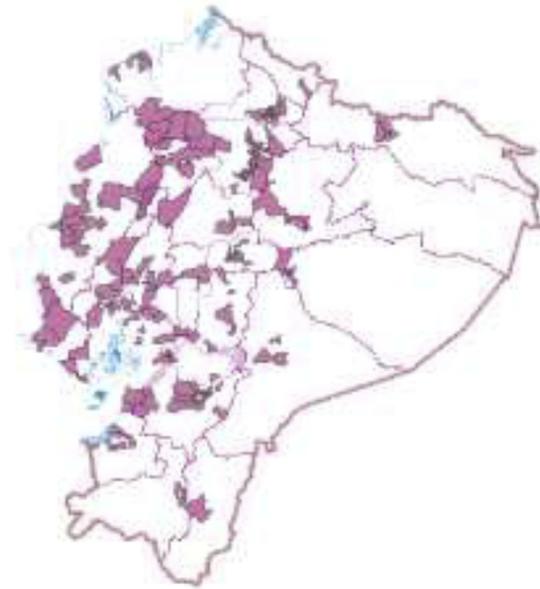


Fig. 8. Rural territories with highly dynamic production and country-city relationships.

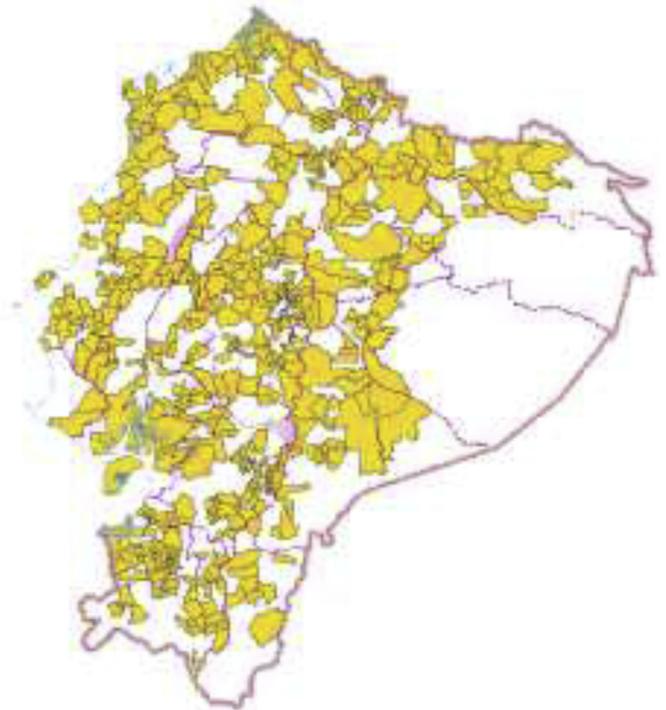


Fig. 10. Dynamic rural territories with family farming.



Fig. 9. Diversified rural territories with ongoing urbanization.

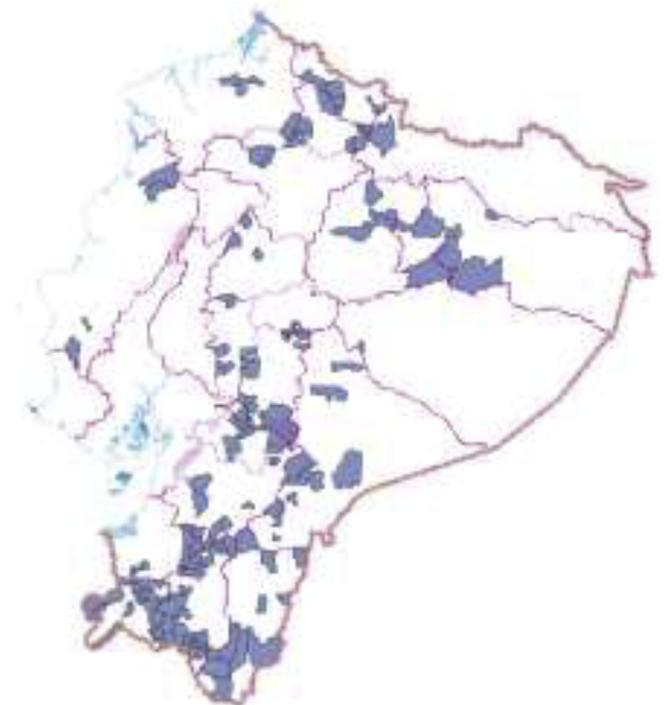


Fig. 11. Fragile rural territories with subsistence agriculture.

eigenvalues that exceed the value 1, the original vector space can be reduced to just two dimensions or factorial variables, which accumulate 54% of the total variance.

Below are the tables extracted from the principal component analysis that allows us to make decisions and interpret the corresponding results. Specifically, we are focused on the table of commonality statistics (Table 3) and the table of eigenvalues that tells us the proportion of variance explained (Table 4).

All the variables contribute to the model, with urbanization being the most important and the percentage of the EAP the variable that contributes the least. The rest of the variables make a contribution around

0.5.

As for the matrix of components, the main characteristics of the analysis are observed from the relationship between the initial variables and the axes or components obtained (Table 5). This information, which is represented in Fig. 2 Components 1 and 2 of the factorial space, allows us to interpret the results obtained (Table 6).

In the proposed model, the Kaiser-Meyer-Olkin index has a value of 0.609. However, relative to the few variables used, two main factors are

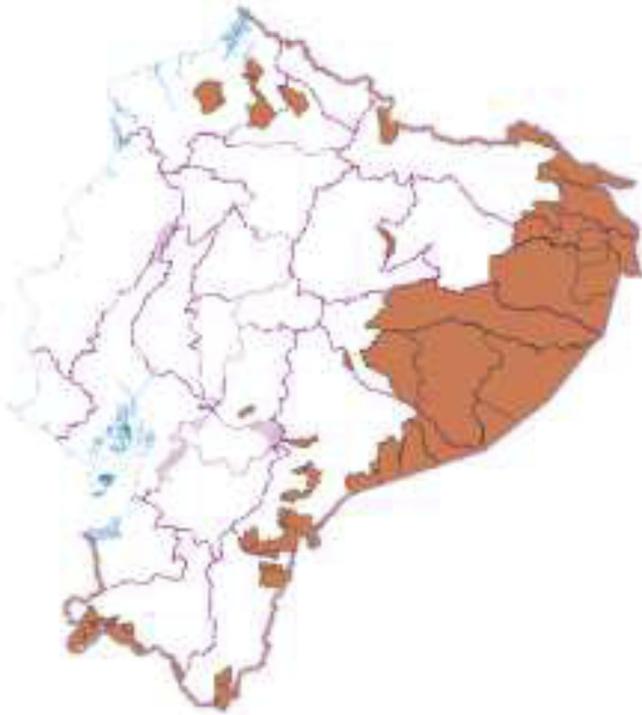


Fig. 12. Marginal and border rural territories.



Fig. 13. Rural territories with conservation and tourism activities.

obtained that synthetically describe the structure of Ecuador's rural territory:

Factor 1: Principal factor which accounts for 32% of the explained variance and describes the rural structure in terms of population and activity. Along this dimension, districts with high levels of population are at the opposite end of the spectrum from the districts that are most distant from the urban centers, which exhibit a population that is mostly employed in the primary sector (Fig. 3).

Factor 2: A second, independent factor explains an additional 21% of the variance. It describes the degree to which districts exhibit high rates of population growth, as opposed to those with a lower degree of urbanization (Fig. 4).

Based on the PCA, the aforementioned districts were grouped using the "Classification Analysis" technique. The objective is to classify the districts in strata that contain sections grouped as homogeneously as possible, while ensuring that the greatest heterogeneity among that strata.

The classification procedure used is the "Ward Method", which consists of a progressive process of aggregating units or groups so that in each stage those units that are more homogeneous or similar are grouped together by following a criterion of minimal variance or internal inertia (López-Roldán & Fachelli, 2015a). Using this method, it is possible to divide the districts into the appropriate number of groups, by evaluating the coefficients of the agglomeration table, which for this case have been defined in five strata. In addition, Fig. 5 and Fig. 6 shows the radii classified in either four or five layers in the area of the factors obtained.

Each of the sectioned strata presents a different characteristic. In the following table one can find the description of the content that characterizes each of the strata by looking at the means (averages) of each of these original variables.

5. Analysis of the types of territories identified

Once the different strata or types of territories were identified, we performed a detailed descriptive analysis of each one. This process allowed us to identify patterns of behavior, characterize them, and propose a name that would highlight the most significant elements. The following types of territories were identified:

1. Rural territories with highly dynamic production and country-city relationships
2. Diversified rural territories with ongoing urbanization
3. Dynamic rural territories with family farming
4. Fragile rural territories with subsistence agriculture
5. Marginal and border rural territories
6. Rural territories with conservation and tourism activities

Once each group of territories was identified and defined, each was analyzed and a general characterization was performed. A posteriori, three territories (districts) were chosen from each category in order to carry out a more specific and detailed analysis of the characteristics and dynamics of each of these territories. This analysis was carried out through research and interviews with key individuals from each of these territories. In addition, the behavior of the productive systems and the local and regional dynamics were observed.

6. Results: the types of rural territories in Ecuador

Thus, based on the statistical work carried out, the five major types of rural territories were identified. In addition, a sixth type of rural territory was designated, but it was not analyzed statistically because of its strong differences with the rest of the territories found in continental Ecuador; the sixth type corresponds to the particular case of the Galapagos Islands. As such, the typology of rural territories in Ecuador consists of six types of territories which are distributed across Ecuadorian territory according to the spatial patterns shown in Fig. 7.(Table 7, Figs. 8–13)

- a) Rural territories with highly dynamic production and country-city relationships

The presence of agricultural activities linked mainly to the international market and the close relationship with the city are the key factors that configure the functioning of this type of rural territory. These territories are generally densely populated with high population growth, especially in outlying areas; that is to say, although the population in general grows, it does not tend to be concentrated only in the main population centers, but also in outlying areas. This phenomenon is possibly the result of conurbation because territories of this type are very

close to cities with more than 15,000 inhabitants. From the productive point of view, these areas exhibit a low proportion of the economically active population in the agricultural sector. Instead, business and/or family-based systems of production predominate. These may be highly technical, depending on the type of activity and the characteristics of the natural environment. In environmental terms, the natural environment has been highly altered in these areas, as a result of intensive use and continuous exploitation of the land for agricultural development.

b) Diversified rural territories with ongoing urbanization

The process of economic and labor diversification and the increasing concentration of the population in the most important localities are the key factors that define this type of rural territory. In terms of population, these territories have high populations, although the growth rate is low or zero in rural areas, while most people are concentrated in the most important urban centers, which are moderate distances from one another. The productive systems are diversifying, with moderate amounts of people working in the agricultural sector compared to other territories. Family farming dominates the primary sector, but there are hotspots with agribusiness. The rest of the economically active population works in various activities that are novel in rural areas such as oil, mining and tourism. This situation contributes to a dynamic country-city relationship that facilitates the arrival of additional activities.

c) Dynamic rural territories with family farming.

The strong presence of family farming, diversification of production and demographic dynamism characterize this type of territory. These territories exhibit significant population numbers in both urban and rural areas. In terms of production, these territories are characterized by the strong presence of family farming undergoing a trend toward specialization. Nonetheless, significant levels of agribusiness linked to the export market are also present, particularly tied to specific areas and products. In short, family farming remains strong in these territories, and it is supported by a greater connection to the cities that provide goods and services for the rural areas. From an environmental perspective, this category is made up of highly disturbed areas as a result of human activities as well as areas that are nearly unchanged due to their natural conditions (topography and vegetation), constituting a true mosaic of landscapes.

d) Fragile rural territories with subsistence agriculture

These rural areas are marked by decreases in their already low populations and the predominance of subsistence agriculture. The population has been slowly declining and those inhabitants that remain are concentrated in the most central localities where services are better. In terms of production, most of the population works in agriculture, mostly subsistence or for the local market. The distance to the nearest cities limits opportunities to sell products, as well as the provision of education and health services. From an environmental perspective, the continual utilization of land for agricultural production has affected environmental conditions.

e) Marginal and border rural territories

These rural areas are characterized by low population density, predominance of indigenous peoples, the great distances to urban centers and particular types of ecosystems. These territories are far from cities, severely limiting the provision of goods and services. In terms of production, much of the population works in subsistence agriculture. From an environmental perspective, these rural areas are largely untouched.

f) Rural territories with conservation and tourism activities

These territories are marked by unique natural resources and the development of ecotourism. The Galapagos Islands constitute a unique and preserved environment where population growth and productive activities are limited by conservation and sustainability policies. However, existing agricultural activities are limited to producing goods and services for domestic consumption.

7. Conclusion

This methodological proposal seeks to contribute to the design of spatial analysis tools that aid in defining and constructing territorial categories that have similar characteristics of territorial organization and share certain spatial, social and productive criteria. The identification of the typologies of rural territories in Ecuador enables the construction of a model for territorial analysis, by characterizing spaces according to thematic variables that contribute significantly to the identification of rural areas with similar characteristics, thereby facilitating decisions regarding future development plans.

Performing these kinds of studies in territorial management greatly improves decision-making, especially in terms of equitable resource allocation because stratified information is available related to the most appropriate implementation of development policies in rural areas for common problems shared by similar types of territories. Bearing in mind that because the construction of a typology is the result of an exercise of empirical analysis, great care must be taken to ensure the quality of the data, which is the backbone of the entire process since the final result is closely linked to the processed data. The reliability of the data directly influences the construction of typologies.

Ecuador is a country with many geographical, social and economic disparities. Thus, having a tool that allows for the creation of typologies, especially in this case as applied to rural areas where asymmetries are even greater, can help to focus state intervention and optimize the allocation of economic resources. In the same way, areas of intervention can be prioritized and thus improve the linkages of territorial management among the various levels of government from the central government down to the local level.

CRedit authorship contribution statement

Rosa Cuesta Molestina: Conceptualization, Validation, Investigation, Data curation, Writing - original draft, Project administration, Funding acquisition. **Martha Villagómez Orozco:** Conceptualization, Validation, Investigation, Resources, Data curation, Writing - original draft. **Marcelo Sili:** Conceptualization, Methodology, Writing - review & editing, Visualization, Supervision. **Andrés Meiller:** Software, Formal analysis.

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