

The Visual Fragility of the Scenery And Agricultural Production Logistics in the Territorial Planning of San Luis De Riobamba - Ecuador

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Abstract: Scenery considered as space in which nature coexist itself as well as human intervention on both individual and collective perception of that space, constitutes one of the tools to be incorporated into local territorial zoning plans, depending upon visual fragility of landscape unit analyzed, activities can be established according to each of the zones that make up the territory. This research assess visual fragility scenery at rural parish of Riobamba city, province of Chimborazo. Landscape unit observed of 2,392 hectares out of a total of 2,927 hectares, which includes greenhouses also. A field data collection was carried out, in which landscape unit was delimited through geographical position data gathering using geographic information systems GIS tools and finally applying a model for assessment of landscape visual fragility including features such as: vegetation and land use, slope, orientation, accessibility, size, form, compactness and relative height of the observed landscape. Greenhouses for agricultural production are incidental elements of extrinsic fragility of landscape but it is not a determining one since this depends on interaction of several elements. The present study includes zoning of landscape units of entire territory at San Luis Parish with the purpose of helping parochial territorial ordering plan focused on determining potential land uses.

1. Introduction

Scenery is defined as "the area in which natural features coexist as well as those influenced by man and that gives rise to a visual and mental perception both individual and collective of the whole of that space (Soria and Quiroga 2006), without any doubt it constitutes a fundamental criterion tool for territorial planning that should be incorporated into territorial planning decision making.

Territorial planning is considered as a process of territorial organization on both economic and social scopes which allows that a greater number of endogenous components merged in a consensual manner and makes compatible the so-called environmental values of the territory, social aspirations and growing productivity levels of economic activities (Montes Lira 2001). Territory planning is being used in Ecuador and several countries of the world to determine a geographical

unit of study, thus a country, region, province, city or parish according to political division; in this case established by the National Secretary of Planning and Development SENPLADES for Ecuador.

San Luis parish, from Riobamba county, at province of Chimborazo is located at west of Riobamba with altitudinal range that goes from 2584 to 2839 meters above sea level (msnm), with temperate sub-Andean climate, temperature ranging between 10 to 14 Celsius degrees C°, a population of 120.002 by year 2010 according to last census of the National Institute of Statistics and Census INEC 42 % of its population is dedicated to agricultural and livestock activities, which compromises 82% of geographical space in such activities (Luis 2015).

From the revision made to the plan of development and territorial ordering of the San Luis Parish, it can be seen the inexistence of an assessment of the landscape aspect as a tool for territorial planning, so that through this research it is expected to have relevant information that allows influence on the territorial ordering of the parish.

Considering that three quarters of its territory are destined for agricultural and livestock use besides having a marked local tendency with respect to agriculture in greenhouses, it is established to carry out research focused on the analysis of visual fragility of the landscape, which can be defined as "the susceptibility of a landscape to change when a use is developed on it; is the expression of the degree of deterioration that the landscape would experience before the incidence of certain actions" (Cifuentes 1979).

2. Area of Study

The geographic area under study is located at San Luis parish from Riobamba, Province of Chimborazo, with a territorial extension of 2,927 hectares, north of border with Riobamba city, south with Punin parish of Chambo county; west with parishes Yarouquies and Cacha Parishes. Its geographic location with latitude: 1° 45' 19''S y longitude: 78° 38' 39''O, altitudinal range of 2,584 to 2,839 msnm.

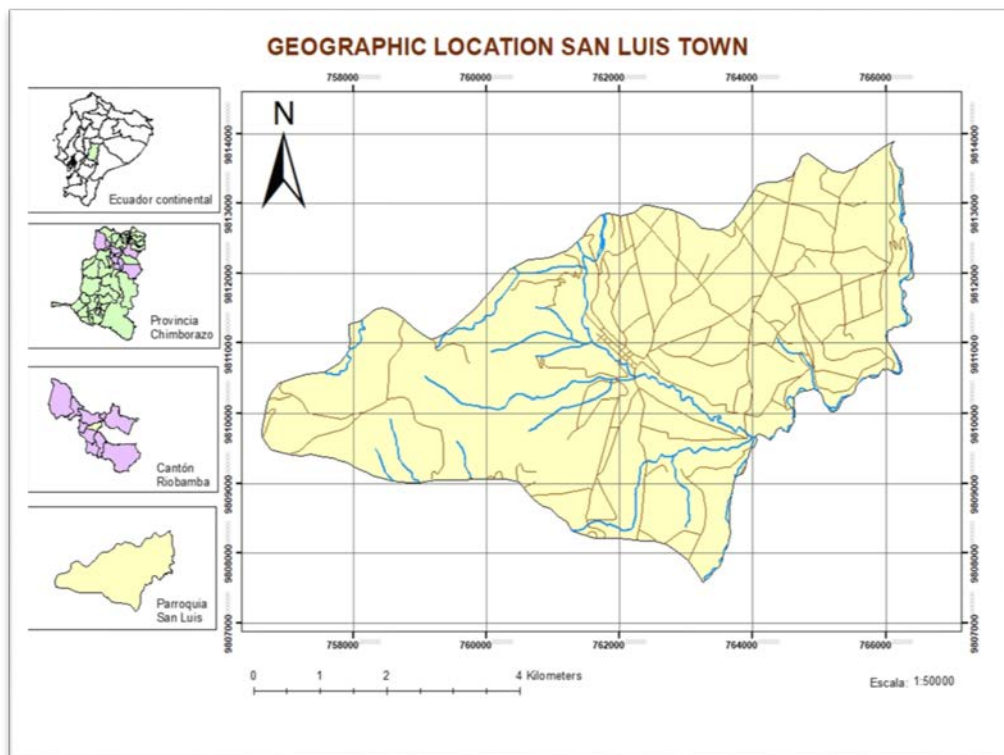


Figure 1. Geographic location of observed area

Intrinsic visual fragility is formed by those variables of visual absorption, such as vegetation height, slope or surface orientation which mostly affect observer's visual angle. Extrinsic visual fragility refers to susceptibility of a territory to be observed (Serrano Giné 2015).

3. Methodology

1) Field recognition. Social, environmental and economic characteristics of the parish were identified, geological characteristics such as inclination and geographical position utilizing Clinometer Suunto® Tandem/360 and GPS Garmin Inreach SE®+.

2) Landscape visual fragility analysis. for this analysis geographic information systems were used with ArcGis 10.3.1 Esri® software, with the purpose of analyzing existing cartographic information of parish, such as, land uses, hydrology, vegetation and life zones which were compiled from Instituto Geográfico Militar y del Ministerio del Ambiente del Ecuador's website on a 1:50000 scale.

3) Evaluation of scenery visual fragility was carried out through (Solari and Cazorla 2009) model described (Table 1) for which 3 groups should be considered as advised.

Table 1 Scenery visual fragility model

Slope	Topographic index	FRAGILITY POINT	SCENERY VISUAL FRAGILITY
Orientation			
	Vegetation soil		
Size		SORROUNDING FRAGILITY	
Shape			
Compactly			
Relative height			
		ACCESIBILITY	

✓ Point visual fragility

Soil and Vegetable cover. Vegetation fragility is defined as the inverse capacity to hide an activity that takes place in a territory. For this reason, plant formations of a greater height, greater complexity of strata and greater degree of coverage are considered to be less fragile.

Based on these criteria a reclassification of different types of vegetation and land uses have been carried out in three types, from less to more fragile. Urban centers are excluded into this classification.

Table 2. Valuation of vegetation

Minor Fragility	Low	Tree formation high and dense	Value 1
	Medium	Tree formation scattered and low	Value 3
Major Fragility	high	Fields and crops	Value 5

- Slope. It is considered that the greater the slope the more fragile, because there is a greater exposure of shares.

Table 3. Slope Valuation

Minor Fragility	Low	Slope < 1 %	Value 1
Major Fragility	High	Slope > 1 %	Value 5

- Orientation. Sunny slopes are more fragile because of sun exposure than shady ones

Table 4. Orientation valuation

Minor Fragility	Low	Shaded	Value 1
Major Fragility	High	Sunny	Value 5

✓ Visual fragility of environment point

It is comprised of visualization factors derived from environment configuration of each point. Here enter parameters of visual basin both in magnitude and shape and complexity.

Size of visual basin. It is considered that greater the extension of visual basin, greater the fragility since any activity to be carried out in an extensive unit can be observed from a greater number of points. Here two classes were established

Table 5. Visual basin valuation

Minor fragility	Low	Size less than 100 hectares	Value 1
Major Fragility	High	Size more than 100 hectares	Value 5

Compactness of basin. It refers to morphological complexity of basin and it has been considered that the greater the compactness the greater the fragility, since visual basins with less morphological complexity have greater difficulty to visually conceal an activity. Two kinds of compactness were differentiated.

Table 6. Compactness of basin valuation

Minor fragility	Low	Many holes	Value 1
Major Fragility	High	Fewer holes	Value 3

Form of basin. It will be considered of greater fragility those which take a direction on views (ellipse shape) and of less fragility if the shape is rounded. In the urban case, squares are less fragile than linear parks and boulevards.

Table 7. Shape of basin valuation

Minor fragility	Low	Round visual basin	Value 1
Major Fragility	High	Elliptical visual basin	Value 5

Relative height of point with respect to its visual basin. Two classes were established according to altimetric location of point in relation to its visual basin.

Table 8. Height valuation with respect to visual basin

Minor fragility	Low	Points with basin of same level	Value 1
Major Fragility	High	Points unlevelled with basin	Value 3

✓ Accessibility

Greater the accessibility, greater the fragility. Three classes of fragility were determined according to accesses.

Table 9. Accessibility valuation

Minor fragility	Low	Without access	Value 1
	Medium	Off roads or secondary roads	Value 3
Major Fragility	High	Urban area or routes	Value 5

For interpretation of results obtained through assessment model of visual fragility on landscape, an evaluation scale is made and is shown in table 10

Table 10. Interpretation of results

Interpretation of results		
Very low fragility	1	
Low fragility	2	
Regular fragility	3	
High fragility	4	
Very high fragility	5	

4. Results and Discussion

Through cartography available at Military Geographical Institute regarding San Luis parish on existing land uses, an extension of 2,341 hectares can be determined that are destined for agriculture and livestock; however, in the present study, the analysis is made of only 239 hectares because greenhouses for agricultural production were established in the area; which is valued according to scenery visual fragility model. Obtained results are as follow:

Table 11 Results of scenery visual fragility valuation

Variable	Valuation	weighing		Result
Slope	1	3	4	4
Orientation	5			
Vegetation	5	5		
Size	5	12	3	
Shape	1			
Compactness	3			
Relative high	3			
Accessibility	5	5	5	

From application of assessment model for visual fragility of landscape a value = 4 was obtained, which is interpreted as a high fragility, a value that can be attributed to the different human activities developed in the study area, such as intensive agriculture. Availability of road access, creation of greenhouses, electrical wiring and irrigation channels; activities that, since they are not specific to the ecosystem, have a direct influence on their fragility.

As the visual fragility of the landscape is composed of two evaluation elements corresponding to intrinsic visual fragility and extrinsic visual fragility, the establishment of greenhouses influences directly in the extrinsic visual fragility, since by the establishment of this type of infrastructure the territory loses its capacity to be observed as a scenic landscape unit. Creation of greenhouses for agricultural production is one of the variables that influence assessment of visual fragility of landscape, which cannot be attributed absolute responsibility for its impact on them since this fragility depends on other factors such as vegetation and land use, slope, orientation, accessibility, size, shape, compactness and relative height of landscape unit.

A landscape unit is created corresponding to territory in which greenhouses are established for agricultural production and covers an area of 239 hectares, this unit has been determined qualitatively and quantitatively, considering their different levels of homogeneity in territory (Chávez and Puebla 2013), conditions of land use, slope, hydrography and state road network.

The study is based on an agricultural area, and considering visual fragility of existing landscape in the area, it is appropriate to consider the objectives of the territorial planning for this landscape unit, since it is very difficult due to its established characteristics in the area. It can be established activities related to the use of scenic landscape quality.

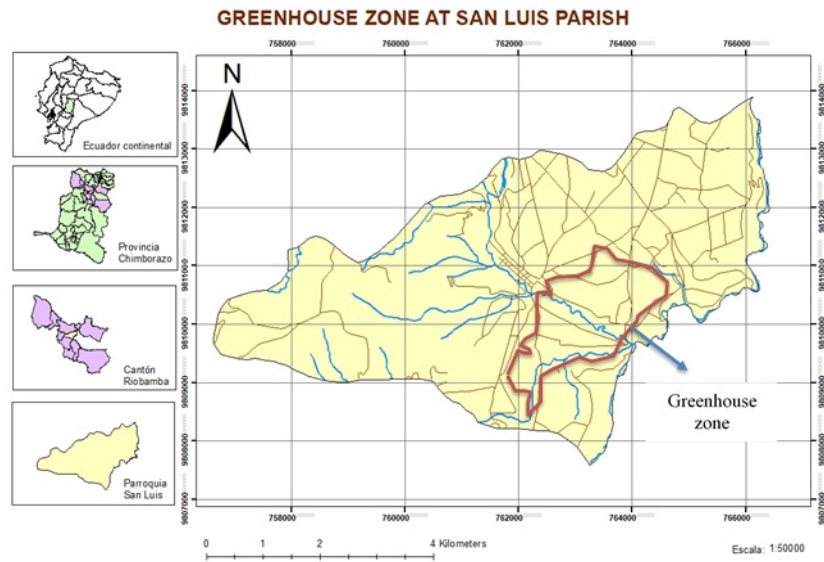


Figure 2. Scenery unit



Figure 3. Scenery unit (greenhouse zone at San Luis parish)

5. Conclusions

Once visual fragility landscape valuation has been determined that has a high degree of fragility which landscape unit from greenhouse area at San Luis parish was analyzed, it can be established that greenhouse plantations are a incident factor only in extrinsic visual fragility due to dimensions that have this type of infrastructure. The landscape unit in question loses the ability to be appreciated as a scenic landscape; however, it cannot be attributed to a determining factor for affectation of visual fragility of landscape, because this fragility is determined by a set of elements according to the valuation model used.

Valuation of landscape can be considered as one of the tools to be used for territorial planning

since through them land uses can be established for each unit of landscape and with this potentiate activities in areas of ecological interest and landscape sustainable quality, as in the case of this study which a high degree of landscape visual fragility was established and could not be used for activities of natural scenic interest. However, San Luis Parish has ecologically sensitive areas such as the paramo ecosystem, the same as more than being a unit of water recharge can be assessed its quality and landscape fragility that entails to make efforts for its protection and conservation.

Creation of landscape units for assessment of visual fragility of a given area of study allows a better approach of study of the area since by integrating classification approaches of topological, typological type, it is possible to delimit, classify and map units relatively homogenous, with which the criteria established in the model of assessment of the visual fragility of the landscape can be integrated more precisely and thus obtaining a result that fits the reality of the study area.

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