

IDENTIFICATION OF PASSIVE STRATEGIES FOR SUSTAINABLE CONSTRUCTION, ON VERNACULAR ARCHITECTURE OF ECUADOR.

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Abstract

The main goal of the article is to share the preliminary results of the research project “Architecture and Building Ecuador Involved in the work of the Sustainable Construction” in Strategies for Energy efficiency. In this stage it was identified the sustainable criteria of vernacular architecture in Ecuador, from the specific analysis of homes located south of the country, in the provinces of Azuay and Cañar, with temperatures of 6-20° C, which in these latitudes are considered temperate to cold. The research selected houses with traditional construction systems, such as adobe rammed earth, tapial and mixed systems, as these are the ones that represent the traditional architecture of the study area. Subsequently it was performed a critical analysis to identify the passive strategies used to face the environmental conditions, such as: location, sunlight and ventilation, which improve the thermal and light quality inside homes. In conclusion, the article aims put into consideration the advances in the identification of the vernacular architecture characteristic even when performed without specific knowledge of sustainability has been made comfortable thermal and lighting spaces, with passive strategies.

Keywords: Vernacular architecture, sustainable development, comfort

Introduction.

This article analysis vernacular architecture of Azuay and Cañar, regions of the Andean highlands of Ecuador (Figure 1: Map of the study area) in its typological aspects -a territorial scale and scale architecturally,

⁶⁷ Participants in this article are researchers ECOINVOLUCRATE IN 5Rs program of the National Secretary of Higher Education, Science and Technology and Innovation through the Prometheus Project, held at the Faculty of Architecture of the University of Cuenca, Ecuador.

constructive systems –it studied those materials, elements and procedures construction- and passive strategies present.

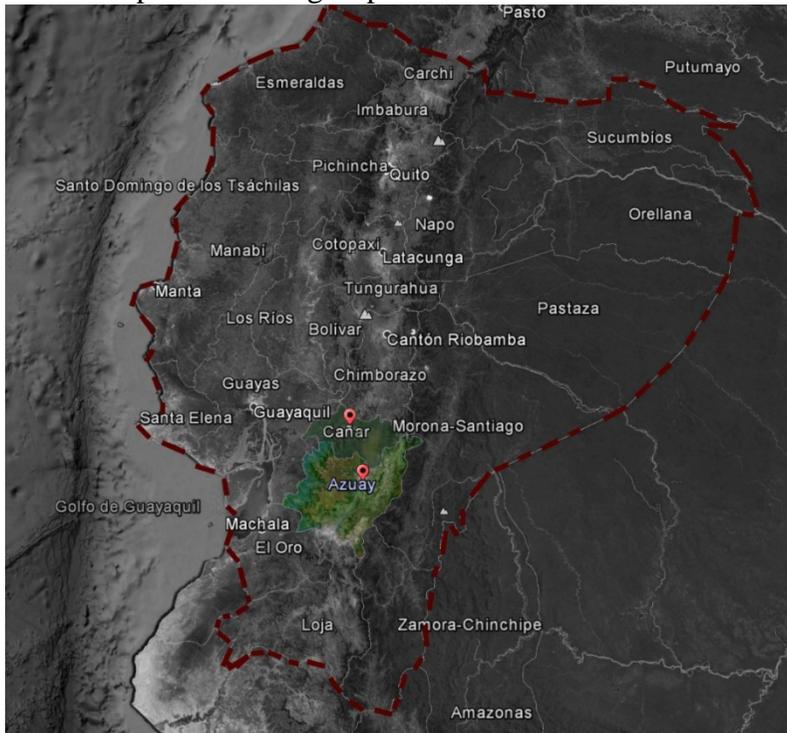


Figure 1: Map of the study area.

The view of the passive strategies is a sustainability perspective in the study of this architecture. It studies methods of analysis and energy recovery systems that have ensured the refurbishment of the interior spaces of vernacular architecture in response to climatic conditions of the territory in which it is located.

That architecture and construction system that the user performs to shape their habitat, not responding to styles, does not represent eras, no need architects / designers / builders, users are those who give them shape, is the vernacular architecture.

Some authors agree that vernacular architecture is a social and cultural system of human-environment relationship in a way that reflects the ways of living. Hence, some attribute the prominence to materials and environment "homes, attached to the soil, climate and landscape, shaped by these factors, in immediate dependence of the medium, perfectly adapted to it, being true geographical precipitates, resulting a transformation, where the soil provides the raw material and the man transforming activity "(Torres Balbás, 1934). Where the recipient is involved in major or minor scale, materials and construction systems created by man and for man, in short

vernacular architecture is the application of modernist principle "form follows function", where solutions are a rationalist thought out decoration.

Vernacular architecture is the architecture built by the community, responds to social and environmental requirements, using local building materials, achieving optimal results for energy efficiency. In Ecuador, there are countless examples of vernacular architecture that respond to climatic, geographic and cultural diversity that characterizes Ecuador.

Justification

Industrialization starts the depopulation of rural areas, the trades are lost, materials and traditional construction techniques transform disappear, destroying the unique relationship between man and its territory.

Sustainability concept determines the importance of a holistic development without affecting the resources, so that future generations will inherit it. In this framework, researchers seek alternatives to develop sustainable architecture.

Linked to the natural landscape and its resources, vernacular architecture creates a sustainable relationship between the user and the environment, territorial landscapes that cause the vernacular landscape.

In recent years, the initial purpose of architecture has joined the habitability. Since this is a quality characteristic of architectural and critical to the assessment of the architecture space. Vernacular architecture, it is the best example of adaptability to the environment through the creation of an enabling environment for human activities, in any weather conditions.

The concept of sustainable development establishes that it should meet the needs of the present without compromising future generations to meet their own needs. The analysis of examples of vernacular architecture finds the foundation, shape of human adaptation to extreme climates, throughout its habitat, the basis of the architecture and its adaptation to contemporary architecture is applied sustainability.

Vernacular architecture, source of knowledge for sustainability

In the context of sustainable development, vernacular architecture is gaining momentum, considering an example of adaptation to the environment. In environmental terms, vernacular architecture considered an example of sustainability, from its location, orientation and architectural form, allowing lighting, sunlight and ventilation, and with local building materials. Adopt solutions that regulate temperature with passive strategies, with the type and thickness of the walls, decks, etc., with minimal energy expenditure and economic cost for the use of materials that do not require transported and have little or no processing for the construction, so the vernacular is a lesson of good practice.

Characteristics that have allowed vernacular architecture has remained over the years. The importance given to the vernacular architecture is the need to identify and implement in existing buildings passive strategies that characterizes vernacular architecture being that for a sustainable architecture in the region, with vernacular architecture has the answer.

What makes it different from other vernacular architecture is that the solutions are examples of adaptation to the environment. While the environment is crucial in the characteristics of a settlement, Rapoport (1972) mentions that sociocultural factors are those that form of vernacular architecture is determined not only the result of the environmental aspects, rather it is determined by climate and building systems.

Hence, that determine the vernacular building, the environmental aspects, rainfall, temperature, relative humidity and others. However, so are the materials used in construction, with the benefit at the end of its useful life integrated back to nature. Generating over time constructive solutions that have contributed to the care of natural resources and offer a pragmatic and simple solution.

Through centuries of practice in the construction of vernacular architecture, has enhanced its adaptability to the environment using passive systems.

State of art

Vernacular Architecture and Environment Adaptation

The vernacular architecture of Azuay and Cañar, has a characteristic type of the Andean mountain architecture. In this saw geographical, climatic and geomorphological features, coupled with cultural and historical socioeconomic condition the vernacular architecture we been built here given. This relationship affects, at one level, the constructive aspects. In which construction techniques have a strong traditional character, maximizing the potential of the place and with optimum economy of means. In rural areas of the provinces of Azuay and Cañar, the predominant materials are rammed earth, adobe and adobe, adobe and still use that characterizes a greater extent, the architecture of the case studies. However the first buildings were made with stone circular plan, combining the characteristics of the environment and cultural aspects of the user of this architecture has given constructive, formal and functional traditions⁶⁸.

The climate is mountainous, with a pronounced continental character. Winters are cold and long. The temperature ranges between 6° C and 20° C.

⁶⁸ «El estudio del medio natural y del medio humano es fundamental, ya que «la casa popular [...] lleva impresa la marca del medio geográfico y del factor humano: no depende de la herencia o sólo del medio, sino de ambos a la vez» (Torres Balbás, Leopoldo. «La vivienda popular en España», p. 148).

Rainfall is irregular, occurring mostly in the months of the year. The altitude 3160m to 2566m; latitude: 2° 53' 12" South; longitude 79° 09' West. Prevailing winds are running SW to NE.

The investigation aim

The research aims to review the vernacular architecture of the Andean highlands of Ecuador, from the perspective of the inherent passive strategies to traditional construction, thus defined these objectives:

- Understand and analyze the physical environment that has developed vernacular architecture Andean Sierra of Ecuador based on literature references and fieldwork.
- Analyze the construction systems and characterize them in terms of building materials, architectural elements and construction techniques.
- Understand the mechanisms of energy use of the vernacular architecture of the study area, by analyzing their typological and constructive aspects.

Methodology

The research method combines the work of the field office. Cabinet papers comprise the documentation prior research, involving the collection and literature review and study of traditional building techniques, as well as documentation and analysis of the study area both geographically and natural as historical and socioeconomic status⁶⁹.

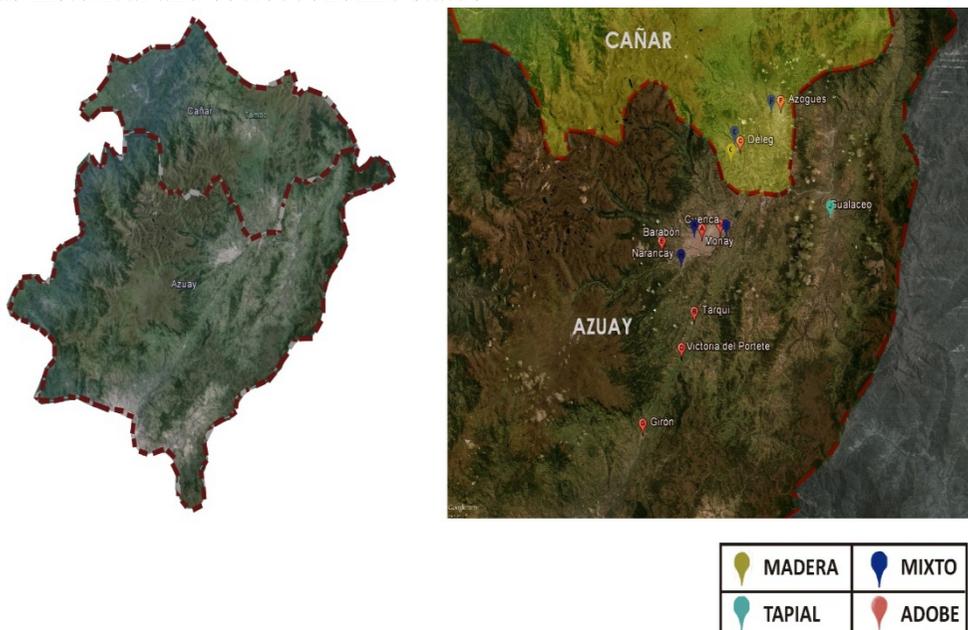


Figure 2: Location of the case studies.

⁶⁹ The investigation began in 2014, when the research project PROMETHEUS-DIUC of ECOINVOLUCRATE IN 5Rs program starts.

For the identification of case studies in class Construction 6 8th cycle race of architecture and urbanism in the period March to September 2014, the classes of "Vernacular Construction" defined parameters vernacular architecture with reference students performed the data collection. Taking aim to gather information, to value the architectural features, local construction systems, while reflecting on the pathologies presented. Adobe, rammed earth, tapial, wood and mixed: of which references typologies and building systems were taken: these academic papers case studies (Figure 2. Location of the case studies) were chosen.

Selection parameters

With reference fieldwork and documentation collection, plans and surveys, analysis and graphical interpretation of the constructive systems, supported by graphs and documentaries interpretations performed.

The climatic zones in which the case studies are located and how each building system responds in relation to thermal, lighting and ventilation behavior observed.

Finally, I defined the typological operation and construction systems analysis to understand the use and employment of passive strategies as a means of energy use in elements of vernacular architecture performed.

Results

For the analysis the information was structured into three types of records for each case in which the data of building systems, location, type of building, number of floors, number of inhabitants, area, foundation, structure, roof, walls, pathologies, waste treatment, environment, heating, air conditioning, among others.

The first is a table with the basic data structured from the analysis of the construction system of each case study, besides identifying the strategy that the construction system used to deal with environmental conditions pathologies present, served to the domain of case studies (Figure 3).

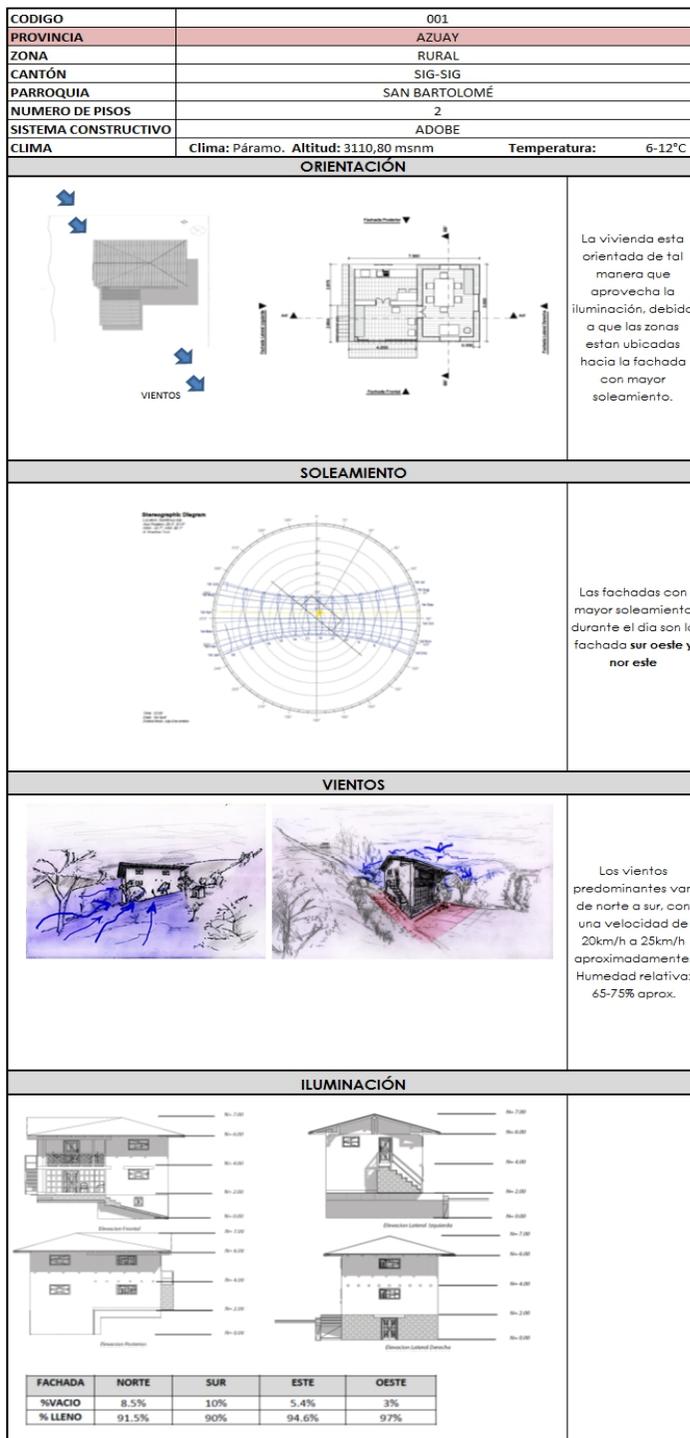


Figure 4. Analysis of the case studies.

Finally, a record in which passive strategies used for each case analyzed, considering the climate in which they are located, was organized (Figure 5).

Piso Clima Páramo (Adobe)



La cimentación se construye con base en vigas corridas en roca y material de relleno conformando un entramado de vigas bajo los muros principales de la edificación. Los Sobrecimientos se construyen con ladrillo cocido sentado con cal y canto o barro con fragmentos de roca equivalentes a los de la cimentación.

Los muros pueden tener distintos aparejos pero el mortero de pega debe tener y contener una dosificación de áridos y paja similar sino la misma de los ladrillos de adobe. De ser necesario se realiza un recubrimiento para las paredes normalmente de cal, talpuja y agua.

SISTEMA CONSTRUCTIVO ORGÁNICO: ADOBE. Accessed November 11, 2014. https://www.zoade.net/7556741/SISTEMA_CONSTRUCTIVO_ORGÁNICO_ORGÁNICO_ADOBE



Piso clima Adobe (Adobe)

ESTRATEGIA

- Las ventanas y puertas de madera preservan el calor y permiten que al interior del edificio se conserve el calor necesario para el clima de páramo.
- La paja en la mezcla de los muros evita las fisuras y hace una masa mas compacta.



VENTAJAS

- Disponibilidad en grandes volúmenes de tierra para adobe en la mayores regiones
- Normal mente tiene bajo costo o ningún costo
- Sencilla trabajabilidad, no requiere de equipo especial
- Resistente al fuego Comportamiento favorable en términos climáticos en la mayoría de regionales debido a su alta capacidad térmica, mantiene el confort dentro del ambiente.
- Bajos insumos de energía en procedimiento y manejo, no crea demanda para leña y no causa contaminación.
- No hay desperdicios ya que se puede reutilizar y reciclar la tierra usada de adobe

VIENTOS



SOLEAMIENTO

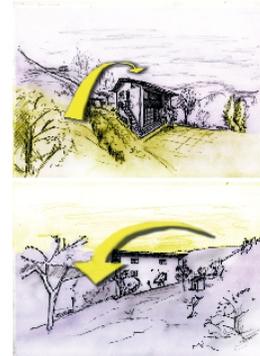


DIAGRAMA DE ESTRATEGIAS CLIMÁTICAS

Figure 5. Passive Strategies vernacular architecture of the Andean highlands of Ecuador.

The theoretical basis to be had in the program ECOINVOLUCRATE IN 5Rs through the research project "Architecture and construction in Ecuador involved was used for the determination of sustainability criteria in the vernacular architecture through case studies, in the work of sustainable construction".

The vernacular architecture of the Andean highlands of Ecuador

Due to geographical, climatic and cultural diversity of around 283,561 square kilometers that make up the Ecuadorian mainland, with a variety of vernacular architectural expressions.

Currently in Ecuador, there are still examples of vernacular architecture mainly in rural areas, in places geographically isolated territories belonging to the peoples. In the examples studied the architecture of Azuay and Cañar, present the architecture of the mountains, Andean. However, other cases are not included in this study and are equally significant.

The vernacular architecture of the Andean highlands of Ecuador answered settlements that have features in common: a series of cultural and environmental values and the close relationship and respect for the area in which they seated. On the other hand, the abandonment of settlements by emigration, has caused a fragmentation of the social structure and the consequent gradual loss of ancestral knowledge construction with a strong respect for the environment.

The study of these cases, in turn, aims to raise the architect in training and practice, the importance of a design process that responds adequately to the demands of the environment. Aims to bring the knowledge of the application and use of passive strategies for low energy architecture, looking for that from the reinterpretation of the elements of the local vernacular architecture, the Andean Sierra, proposals for sustainable contemporary architecture is achieved.

Conclusion

Vernacular architecture has managed to adapt to the environment in which the user is located, all with minimal or no energy consumption required for welfare.

Fill the gap of lack of knowledge of the value they have passive strategies Ecuadorian vernacular architecture is not easy, however, jogging knowledge from training, is a strategy for future sustainable architecture.

Similarly required educate both the authorities and local communities, about the close relationship between vernacular architecture and sustainable development. Enhancing the vernacular architecture is not only concerned with the immediate environment, but with the response of this architecture the environment and how affects the livelihoods of

communities living. Vernacular architecture has a mass of knowledge, especially in isolated contexts of Ecuador, with high rates of poverty, where settlements represent a real lesson of sustainable habitat, compared to current architectural solutions. The ECOINVOLUCRATE IN 5Rs, and this article as an integral part of the research project, a program intended to contribute to the formation of such awareness through education and awareness on environmental improvement of Ecuador.

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