

SEVILLA



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SUSTAINABILITY AND CONSERVATIVE REHABILITATION OF EXTREMADURAN PATRIMONIAL RURAL ARCHITECTURE AGAINST CLIMATE CHANGE. VEGAVIANA, CASE STUDY

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Abstract: According to the texts of the own architect of Vegaviana, José Luis Fernández del Amo, the settlement was designed taking into account the place and the climate. However, and despite being a reference of Spanish modern architecture, Vegaviana is only highlighted by its unquestionable aesthetic and plastic qualities. This research creates a parallel and at the same time innovative line of architecture that reviews from the point of view of the criteria of what is currently considered as sustainable architecture the concern for the environment that remained latent in the architects of modernity. The main objectives of this research are to know if there is a bioclimatic behavior in the housing for settlers designed by José Luis Fernández del Amo in Vegaviana, to define sustainable rehabilitation proposals that preserve the sustainable aspects of the dwellings, and to generate a possible model of patrimonial rural architecture against climate change. The research will be based on simulations using advanced computer software for village dwellings, climate monitoring of the environment, preparation of rehabilitation proposals, application of sustainability indicators and indicators of climate change as well as the definition of models of global change. It is expected to verify that the housing for settlers of Vegaviana were designed with strategies of what we know today as bioclimatic architecture. It is expected to conclude that the architect expressed his environmental concerns in the design of housing, emphasizing, therefore, his implication with the environment.

Keywords: Vegaviana; Settlement; Sustainability; Rehabilitation; Climate Change.

1. Precedents

Since the last half century to 2010, the rural area with less than 1.000 population in the region have lost a 60% of population. (Gurría 2014). However, Instituto de Estadística de Extremadura say that more than 50% of Extremadura population live in villages with less than 10.000 habitants – considered rural areas-, being only the 38% of this population living in big city in Extremadura and the reast live in medium-size cities.

In this line, investigations about rural population in Extremadura like the doctoral thesis *Evolución de la población de los municipios de Extremadura: Aplicaciones paramétricas y semiparamétricas* (Sánchez Reyes 2011), Shows possible measures against rural depopulation coming from European and national policies. European Regional Development Fund (ERDF), Rural Employment Plan (PER) - , which are mostly focused on the well-being of the population, and on the need to avoid abandonment and possible disappearance of rural areas. Also a thesis such as *Rehabilitación sostenible de la arquitectura tradicional del Valle del Jerte* (Montalbán Pozas 2015), conveys the importance of the sustainable rehabilitation of traditioinal architecture linked to a regional and European context, within the framework of sustainability and energy efficiency.

Thus, and in a complementary way, whether at national or European level, different analyzes such as the *Plan de Acción de Ahorro y Eficiencia Energética 2011-2020* (Ministerio de Industria, Turismo y Comercio 2011), or the documents within the *European 2020 Strategy* (European Commission 2010), indicate that new actions in the construction sector must incorporate criteria of sustainability and energy efficiency with the new construction and the rehabilitation. This research to control energy consumption provides an important basis for reducing greenhouse gas emissions and achiving with various national and international agreements, such as the *Kyoto Protocol* (United Nations Framework Convention on Climate Change 1997).

Therefore, we understand this project as a clear opportunity to promote a certain positive evolution. In this way, we chose Vegaviana village (Figs 1 and 2), modern Spanish architecture paradigm, to establish it as an example since, despite having been the subject of numerous publications, theses and articles - such as articles the *Revista Nacional de Arquitectura*, or the doctoral thesis *Los pueblos*

de colonización de Fernández del Amo. Arte, arquitectura y urbanismo (Centellas Soler 2010) - all of them focus on their aesthetic virtues, social interaction, landscape protection, etc. However, none makes a profound emphasis on the sustainability of the work, for example through the link with the climate that the architect himself defends when talking about his project. In addition, as it is an architectonic and urbanistic work of indisputable importance, the impact of the research will be predictably greater. We will also study other colonies of the same author to know if there are common points and if in Extremadura the sustainable emphasis is greater.

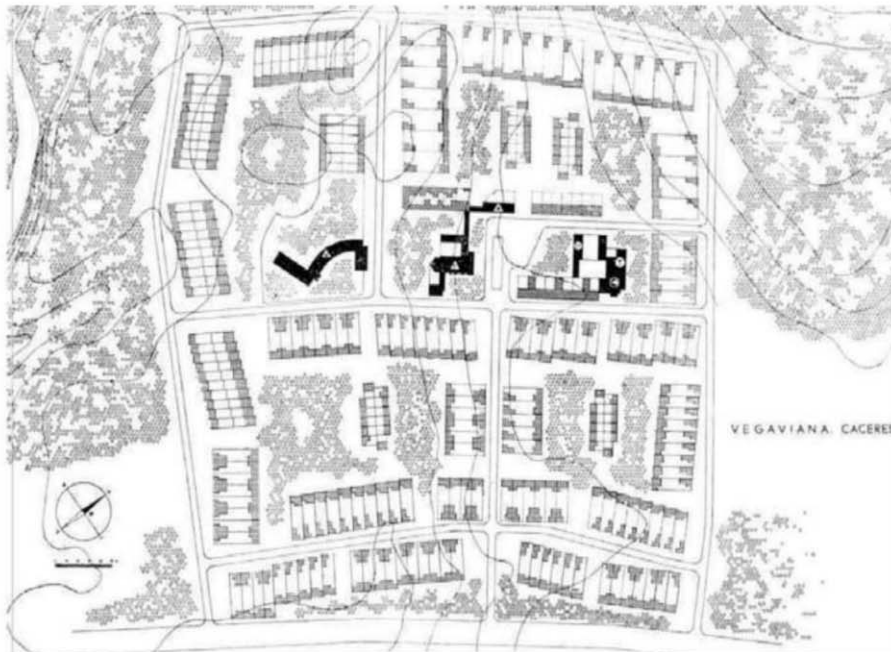


Fig. 1 Planimetry of Vegaviana. Image provided by Rafael Fernández del Amo.



Fig. 2 Aerial view from Vegaviana to 1958 (Servicios Aéreos Norte)

Under this new prism, new researches about modern architecture begins to appear. In this way, doctoral theses in which different analyzes are defended - such as *Arquitectura adaptada al clima en el Movimiento Moderno: Le Corbusier (1930-1960)* (Requena Ruiz 2011) - allow us to discern clearly how within the architecture of Le Corbusier sought an adaptation to the climate; or how a search for methods to discern this inescapable relationship with the environment is initiated - for example in *Desarrollo de Métodos de Simulación Arquitectónica: Aplicación al Análisis Ambiental del Patrimonio*

(Almodóvar Melendo 1999). Also numerous articles published in magazines of impact like *Informes de la construcción: Análisis del confort y el comportamiento higrotérmico de sistemas constructivos tradicionales y actuales en viviendas de Santa Ana- Ciudad Colón (Costa Rica)* (Rodrigo et al., 2012); *Revitalización de antiguos cuarteles a partir de un nuevo espacio climático. Criterios para la reducción de la demanda energética* (Batlle and Pich-Aguilera 2010). Or publications such as *Habitar sostenible. Integración medioambiental en 15 casas de arquitectura popular española* (VVAA 2013).

In order to take a step more, various actions and research on sustainable development, provide the definition of a series of sustainability indicators that allow to evaluate both the efficiency and the performance of interventions for sustainability. Following this line we find studies such as *Sistema Municipal de Indicadores de Sostenibilidad* (Grupo de Trabajo de Indicadores de Sostenibilidad de la Red de Redes de Desarrollo Local Sostenible 2010), or the *Plan Especial de Indicadores de Sostenibilidad Ambiental de la Actividad Urbanística de Sevilla* (Agencia de Ecología Urbana de Barcelona 2007). In our case, these indicators will allow us to estimate the sustainability of the village in four phases: its origin; the current state with the reforms that have been implemented; a possible future scenario in which housing has been rehabilitated in a sustainable way through our proposals; and another possible future scenario in which no sustainability measures are implemented. Using the methodology of the thematic area of Earth Sciences and Global Change, comparing these different scenarios we will be able to define indicators of climate change and global change models, with the advantages that this entails in order to be able to define future sustainable urban or architectural actions, comparing different possibilities and knowing the positive or negative consequences that can be attached to each one. A similar action in the *Klima KONKRET* (Senatsverwaltung für Stadtentwicklung und Umwelt 2016) report is being developed in Berlin, where, through models of the city affected by climate change and the design of climate adaptation interventions, seeks to make it a resilient and more habitable city in the face of the climatic changes expected in the coming decades.

To validate this methodology, we extrapolate it to another totally opposite zone. In our case, Vegaviana is located in the climatic zone defined by the Código Técnico de la Edificación as C4, with the climatic severity of summer in its most intense degree, which would correspond to extrapolate to a climate of maximum winter climatic severity. Thus we find areas classified as E1, typical of the mountain and Spanish northeastern. The settlement that best meets these conditions is San Jorge, located in Huesca in an area near of the Pirineos and designed by José Borobio for the Instituto Nacional de Colonización, so it will be the village that we will use to extrapolate the methodology and check if is valid applying the possible sustainability indicators.

In an innovative way, to introduce in this context not only computer simulations and indicators of sustainability, but also methodologies and systems of the Earth Sciences area - photogrammetry, modeling and mapping, systematic control of climate analysis, indicators of climate change and models of global change - as a more competent reference against climate change and the efficiency in the use of resources viably applicable to the territory - allows us to reinforce the quality of the research presented as well as its originality, and to obtain information both more reliable and more attractive to the time of its dissemination, following the recommendations of the chapter on Sustainable Rural Development of Program 21 (United Nations 1992), belonging to the Division of Sustainable Development. In fact, it would also be a reference on the extrapolation of the most advanced techniques of the study of climate change to territorial development, urbanism and sustainable architecture.

2. Hypothesis

The starting hypothesis of this research is that in the design of the patrimonial rural architecture, in this particular Vegaviana case, not only aesthetic, plastic or compositional criteria were at stake, but also an important factor that we would now define as sustainability.

Correlatively, if the first hypothesis is fulfilled, the second is framed in that it is possible to establish sustainable rehabilitation criteria for the patrimonial rural architecture with criteria similar to those of its conception, and to generate with it a possible model of rural architecture against climate change.

3. Project goals

3.1. Main goals

The main goals of this research, which encompass and generate all other detailed objectives, are summarized in:

1. To know if there is a bioclimatic behavior in the housing for settlers designed by Rafael Fernández del Amo in Vegaviana.
2. Define sustainable rehabilitation proposals that preserve the sustainable aspects of housing.
3. Generate a possible model of patrimonial rural architecture against climate change through indicators of climate change and global change models applying methodologies and systems specific to the area of Earth Sciences as the best reference applicable in this research against climate change.
4. Generate, through dissemination, a network of sustainable rural municipalities in Extremadura and a community linked and interested in it, as well as enabling the creation of a sustainable rural development platform in Extremadura.

3.2. Detailed Goals

The following detailed goals emerge from the main objectives:

1. Obtain data, through a simulation with an advanced computer program, of the housing for settlers of the town of Vegaviana designed by José Luis Fernández del Amo, to know its bioclimatic behavior. Validate the model with data in situ monitoring some housing that has been kept intact, or different aspects in several houses that can provide data on the sustainability of the initial dwellings.
2. To know if there is an influence of the extreme vernacular architecture of Sierra de Gata, where Vegaviana is located, Las Vegas de Coria, which is beautiful to the southwest with the previous one and is more typical of flat environments similar to where the town is located- , and another area as Campo Arañuelo, which although more distant shares similarities as the flat environment with dehesas of holm oaks and fields.
3. Analyze whether there are common points with settlements of José Luis Fernández del Amo from other regions such as San Isidro de Albaterra (Alicante), Cañada de Agra (Albacete) and Miraelrío (Jaén).
4. Catalog housing, documenting which aspects have been modified over time and the reasons that led to it, and carry out a precise survey of them by photogrammetry.
5. To obtain climatic data and a comparative of the same ones from a systematic control of the climatic parameters.
6. Generate sustainable rehabilitation proposals that preserve the sustainable aspects of housing.
7. To know the process of change and the resilience of housing by applying sustainability indicators to the projected dwellings, their current situation, those resulting from sustainable rehabilitation proposals, and a possible situation in which they are not applied sustainability measures. Define with these data indicators of climate change and global change models. Estimate the impact of these indicators of climate change and global change models on architecture, urban planning and possible development of study areas. Apply the possible sustainability indicators to the colonizing settlement of San Jorge.
8. Check the feasibility as well as the results of extrapolating the most advanced methods and techniques of climate change study in its most competent area of Biodiversity, Earth Sciences and Global Change to sustainable territorial development, urbanism and architecture, through of the extrapolation of the method initiated in the town of Vegaviana to the town of San Jorge.
9. Disseminate the knowledge generated on rural sustainability in Extremadura and the data obtained from this research through a web page along with a blog and social networks, reflecting Vegaviana as an example of rural quality of life being able to extrapolate later to other nuclei rural communities generating a network of sustainable rural municipalities in Extremadura.
10. Promote sustainable rural development and create a sustainable community, which can be reflected in a sustainable rural development platform that produces synergies and proposes solutions to issues related to rural sustainability. In the long term, once the research results have been obtained and the platform linked to sustainable rural development has been created, Extremadura will be able to position itself within the Red de Redes de Desarrollo Local Sostenible del Ministerio de Agricultura y Pesca, Alimentación y Medio Ambiente.

These detailed objectives are highly relevant within their scientific and technical context, since they both establish innovative guidelines - such as applying and testing the feasibility of extrapolating methods from other fields to the study of architectural sustainability - as defined by new original lines of research that revalue and redefine other aspects of both the architecture of the Modern Movement and the extremaduran patrimonial rural architecture. In addition, they make it possible to establish new models of reference against climate change, not forgetting that they define an alternative way of

transferring and disseminating results to promote the creation of a community involved with sustainability and the possibility of continuing to face greater challenges in this area.

4. Actual state of the investigation

Since we are looking for an innovative and original point of view about Vegaviana, and to get as close as possible to the village of Vegaviana devised by José Luis Fernández del Amo, we access the original project, analyze it and prepare new study documentation based on this analysis.

The research has gone through an initial phase of approach and basic analysis to the concept of bioclimatic in the houses of Vegaviana, taking as reference the houses type C (Figs.3 and 4) as being the most representative of the village.



Fig. 3 Housing for settlers (type C) in Vegaviana with washerwoman (Kindel)

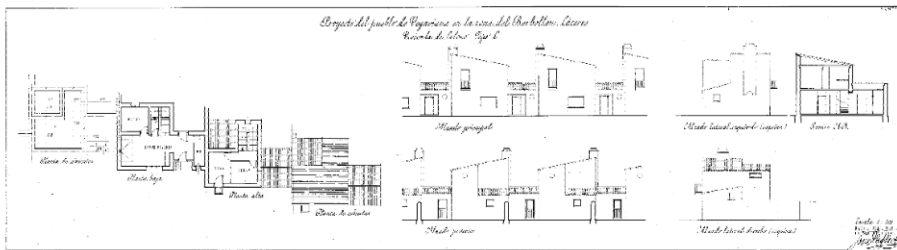


Fig. 4 Plants, elevations and sections of housing for settlers (type C) in Vegaviana. Images provided by Rafael Fernández del Amo.

This initial analysis has been carried out by means of the climatic study of the surroundings of the town with data close to the time of its construction (1954), taken from the *Guía resumida del clima en España* (Agencia Estatal de Meteorología 2012). After obtaining these climatic data, we applied the usual psychrometric diagrams in the study and design of bioclimatic architecture (Olgay 1963) (Givoni 1969), as shown in Figures 5 and 6, and compared the strategies obtained with the design of the type dwellings C according to the architect's own project to know if there is a possible link or relationship between them.

The research is currently under study on the relationship of the influence of vernacular architecture in the village and the possible relationship of the houses of Vegaviana with those of other settlements.

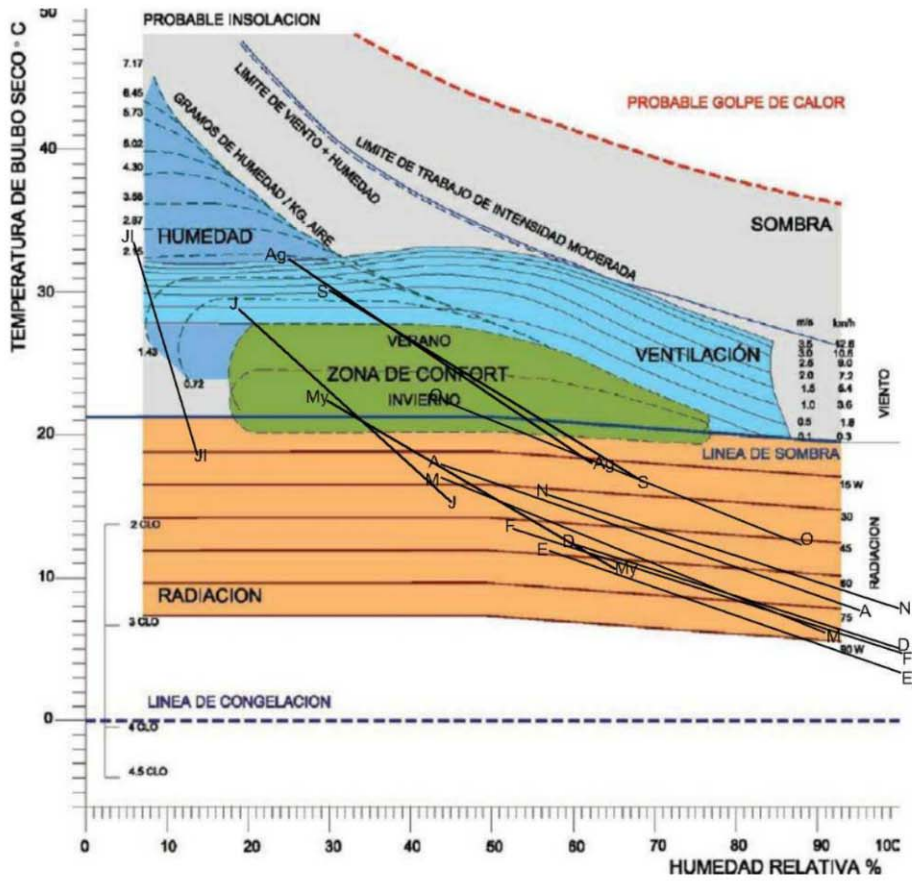


Fig. 5 Climogram of Olgay with information about Cáceres climate (Bote Alonso 2017)

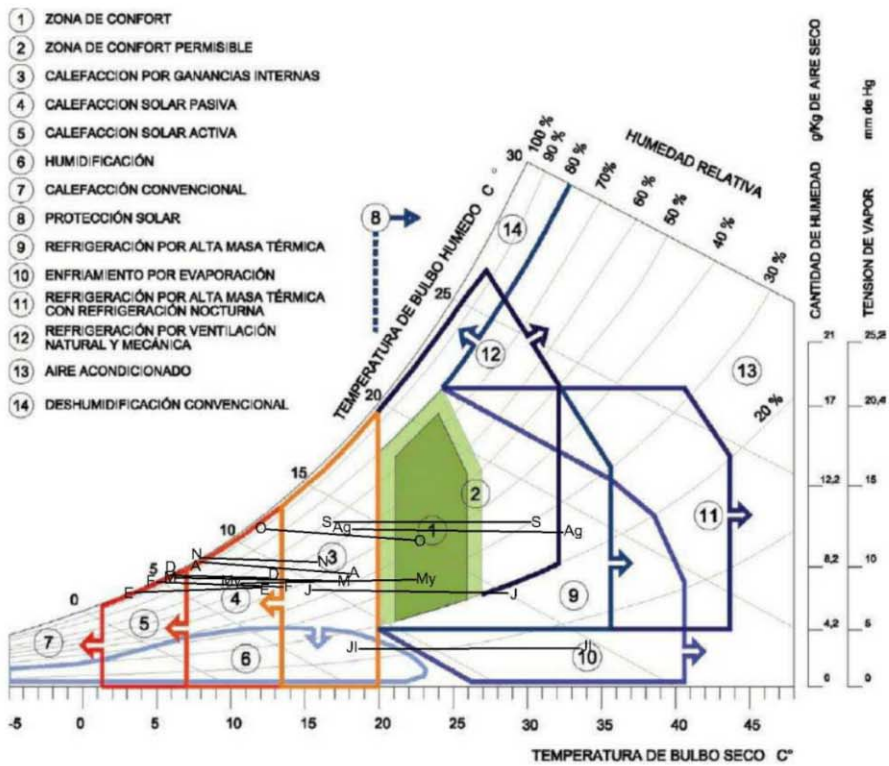


Fig. 6 Climogram of Givoni with information about Cáceres climate (Bote Alonso 2017)

5. Results

The results we currently have are only those obtained with the initial analysis. These results provided us with the bioclimatic strategies inherent to the climate of the environment in which Vegaviana is located, and the bioclimatic strategies associated to the study dwellings as represented by figures 7 and 8, as well as the evidence of the possible reflection of these strategies in the original design of the type C housing of Vegaviana made by José Luis Fernández del Amo.

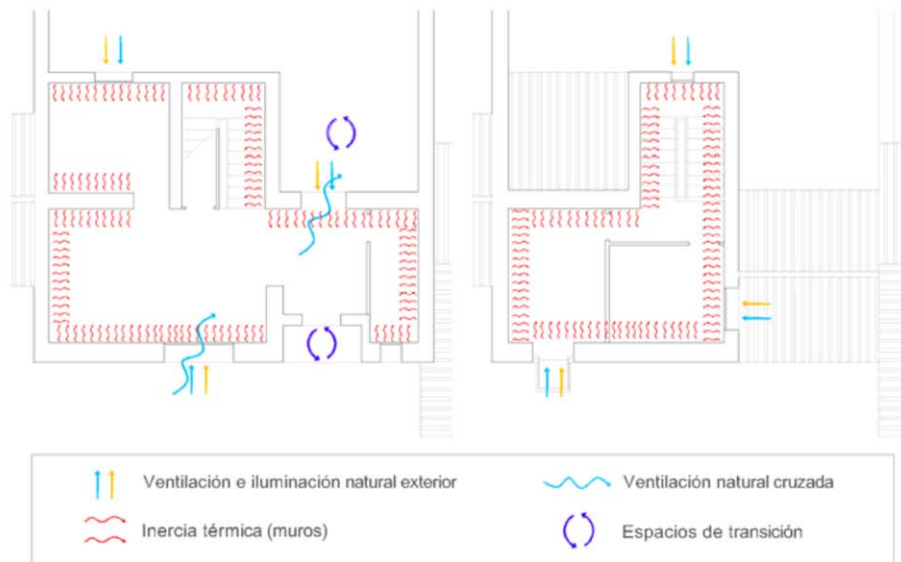


Fig. 7 Diagram of the possible bioclimatic strategies on the floor; left ground floor, right top floor (Bote Alonso 2017)

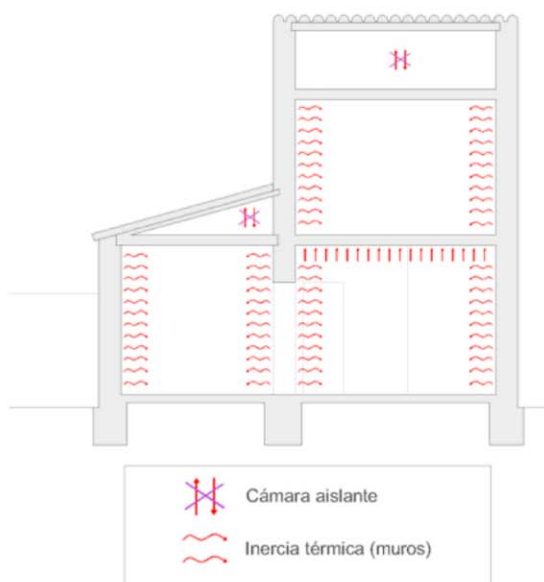


Fig. 8 Diagram of the possible bioclimatic strategies in cross-section (Bote Alonso 2017)

6. Conclusions

Analyzing a work of the 50s of great influence as Vegaviana, from the point of view of the current bioclimatic architecture, allows us to know new aspects of it that enrich our point of view on the patrimonial rural architecture of Extremadura, while revalorizing the play. However, prior to this dialogue between the two issues so far apart in time, it is necessary to establish a common relationship, such as concern for place and climate, which already in the twentieth century begins to manifest itself in the architects.

The data that we have so far speak of the possibility that the architect really had a concern or an interest for the environment in his designs of houses of Vegaviana, although until the end of the investigation we will not be able to corroborate it in a firm way. Based on this, the most suitable characteristics for the models of sustainable rehabilitation of the patrimonial rural architecture in Extremadura will be defined, thus fomenting the sustainable rural development of the region.

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