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## Learning from Tradition: Vernacular Built Heritage of Madeira (Portugal), a Sustainable Proposal

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# Learning from Tradition: Vernacular Built Heritage of Madeira (Portugal), a Sustainable Proposal

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**Abstract.** The archipelago of Madeira (Portugal), of volcanic origin and situated in the intraplate region of the African plate, was formed during the Miocene and seats in a full oceanic domain. Since the settlement of the island (15<sup>th</sup> century), several destructive landslides have happened. In the Island of Madeira, housing is an important expression of the action of man over nature, thus creating a harmonious landscape between the built and its surroundings. In response to the accentuated Topography, terraced platforms appeared to soften this inclination. Vernacular building traditions are repeatedly cited in the academic literature as exemplary models of environmental practice. Therefore, research that addresses the vernacular traditions of the Island of Madeira may emphasize its potential for continuity and viability for maintenance and rehabilitation. Sustainability is indissolubly linked to vernacular architecture and the lessons learned from this architecture of the past can teach us which knowledge to apply in the future. The demand for sustainable buildings with minimal environmental impact is increasing, thus leading the construction industry to adopt new technologies for building design. Achieved for generations, this architecture shows us the art of a population in the construction. The rural housing of Madeira revealed itself as a wise design, where the masters of the craft created a perfect communion between the space, utility, comfort and the volumetric balance, thus creating a new artificial element that connects perfectly with the natural space. Passive strategies have been used around the world for centuries. In the last decades, inhabitants became dependent on mechanical systems with rising economic and environmental impacts. Learning from the past to understand how houses evolved to respond to the surrounding environment is important. The analysis of the local vernacular dwellings will provide insight into well-adapted popular solutions to deal with the local climatic conditions in order to promote responsive passive building technologies and a sustainable proposal is also presented.

## 1. Introduction

Built heritage is an important cultural asset as evidence of any development in the society. It refers to all aspects of the man-made environment such as houses, places of worship, commercial and office buildings, monuments and other places of historical significance. Built heritage helps to define a sense of place and identity for communities [1], [2]. It is not only about monuments of exceptional value, but



it also includes small modest vernacular buildings that represent other equally important historical, social and cultural values [1], [2]. Furthermore, the actual technical requirements are not always compatible with the former building. Regular maintenance of these buildings may include preservation, rehabilitation, restoration, reconstruction, adaptation and interpretation [1], [2].

According to the Charter on the Built Vernacular Heritage “due to the homogenization of culture and of global socio-economic transformation, vernacular structures all around the world are extremely vulnerable, facing serious problems of obsolescence, internal equilibrium, and integration” [3]. Thus, a balance needs to be achieved since the future of built heritage conservation is focused on the sustainable built environment [1], [2]. While heritage conservation is a key player in sustainability planning, interdisciplinary skills are needed to deliver the heritage studies and projects of the new generation architects which combine aspects of cultural heritage with the best preventive conservation, projects, methodologies and practices [1], [2]. The interdisciplinarity and interrelation, which link both research and education [4], are the basis to produce knowledge at Department of Civil Engineering and Architecture of the University of Beira Interior (DECA-UBI) [1]. Among the different research themes, attention is devoted to the built heritage in Portugal, and its connection with the engineering sciences such as thermal comfort, acoustics and daylighting [1], [2], [5], [6], [7], [8], [9], [10].

Passive strategies have been used around the world for centuries. In the last decades, inhabitants became dependent on mechanical systems with rising economic and environmental impacts. It is, therefore, important to learn from the past to understand how houses evolved to respond to the surrounding environment [1], [2], and [11]. The analysis of vernacular dwellings provides insight into well-adapted popular solutions [11], [12], [13] to deal with the local climatic conditions in promoting responsive-passive building technologies [15] which usually are not found in the literature [1], [2] [13]. However, there are significant gaps related to the data and to the understanding of building stocks' composition as most methods to address existing buildings are derived from new construction [1], [2], [15], [16].

Sustainable buildings aim to be adapted to local social, economic, cultural and environmental contexts. They should include all factors that may affect the natural environment or human health, having in mind the consequences for future generations [1], [2], [17]. The demand for sustainable buildings with minimal environmental impacts is increasing, thus leading the construction industry to adopt new technologies for building design [19]. As Kohler and Hassler state [15], overcoming the lack of knowledge about the building stock is vital to inform and validate public policy and professional practice, as well as to act as a driver for change. When compared with industrially produced materials, vernacular materials have a low environmental impact, being an alternative for sustainable construction. Sustainability is indissolubly linked to vernacular architecture and to the lessons this architecture of the past can teach us in the future. Considering that vernacular architecture has some of the most remarkable features of sustainability, this study aims to discuss the vernacular and unique houses, and their materials, found in Madeira [16].

The housing in Madeira is an important expression of the action of man over nature, thus creating a harmonious landscape between the built and its surroundings. Its buildings are strongly marked by an agricultural economy and are characterized by great regional diversity. The agricultural feature took care of the fertile alluvial land, giving rise to the first settlements. However, with the growth of the population began the conquest of the coast which, in turn, lead to the occupation the dense forest that provided them with good timber for local consumption and for export [16], [19].

## **2. Vernacular Heritage of Madeira**

The archipelago of Madeira (Portugal), of volcanic origin and situated in the intraplate region of the African plate, was formed during the Miocene and seats in full oceanic domain. Since the settlement of

the island (15<sup>th</sup> century), several destructive landslides happened. In the Island of Madeira, housing is an important expression of the action of man over nature, making emerge a harmonious landscape between the built and its surroundings [16], [20].

In response to the accentuated Topography, terraced platforms appeared to soften this inclination. With the land tamed, the next challenge was to control the waters, the first paths between the places of difficult access, which carried the waters of irrigation to various locations, including the north shore and the south shores. Achieved for generations, this architecture shows us the art of a population in the construction, in the creation of treatment technologies and use of materials available on the site and their compatibility with the creation of spaces that result in harmonious environments that have arisen with intention or instinctively. The rural housing revealed itself as a wise design, where the masters of the craft created a perfect communion between the space, utility, comfort and the volumetric balance, thus creating a new artificial element that connects perfectly with the natural space [16].

The family shelter sometimes emerges as a sum of several spaces and activities, resulting in a set of buildings, which although unrelated, form a whole. The house is the centre of the rural activities of each family, structurally adapting itself to the family needs and to their agricultural activities, thus originating other complementary spaces or buildings. Their activities ranged from the cultivation of cereals, sugar, wood, vines, linen, banana trees and embroidery as productive crafts. These were the main activities which contributed economically to the reinvention, invention, and innovation of the currently most representative typologies [16], [19].

The typology of the “Redonda” house was the permanent home of the farmers in the parishes of S. Jorge or Ilha and the “Fio” House, which later evolved into “Meio-Fio”, arose from the need to have a shelter in the parish of Santana which was fast to build and had the minimum comfort (Figure 1) [16].



**Figure 1.** “Fio or Empena” house (A), “Meio-Fio” house (B) and “Redonda” house (C)

The parish of Santana, being flatter, was the place of the crops and the parishes of S. Jorge and Ilha and were the place of residence. As they were distant and so that the population did not need to return every day from work to their residences, the “Fio” House emerged. However, currently, on the Ilha, there are no records of the “Redonda” House. Thus, for the reasons presented, the “Redonda” House has an interesting complexity, and by being lesser known by touristic reasons, this was the type chosen for an academic proposal for seasonal housing [16].

### 3. Studied buildings of Madeira

Vernacular houses of the island of Madeira, Portugal, are located on the north shore. They are owned by individuals and there are three main typologies of this kind of buildings: “Fio or Empena”, “Meio-Fio” and “Redonda” houses (Figure 1). After the recognition of the characteristics of the “Fio or Empena”, “Meio-Fio” and “Redonda” houses, there was, in fact, a larger survey in all the parishes of the city of Santana aiming at registering in which parishes these three typologies could be found and noting its conservation status and identifying if they were still in use [16]. In a previous survey conducted

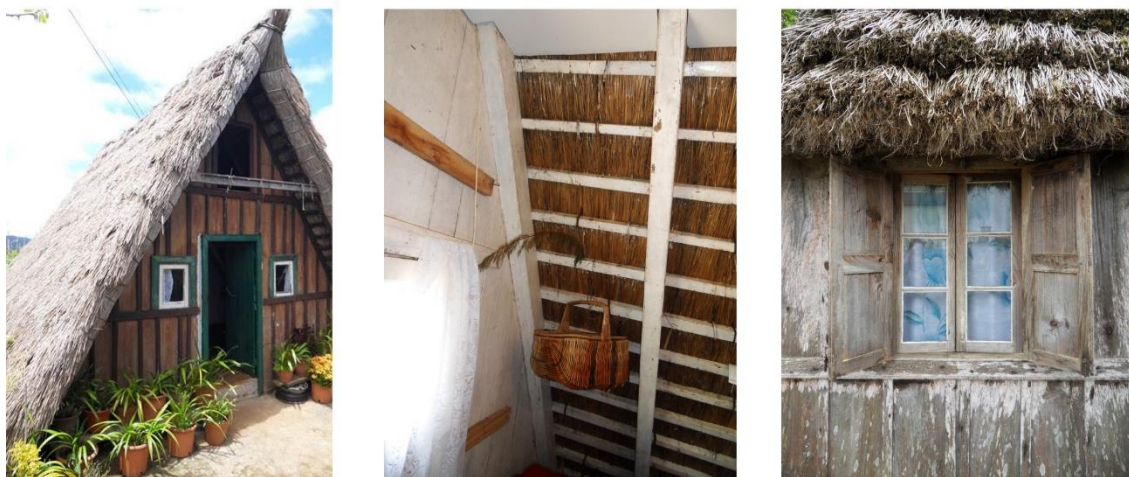
by Martins, Vieira and Carlos [16], [21] were already identified 66 had already been identified as shown in Table 1.

**Table 1.** Typologies of vernacular houses in Madeira.

	Total	Housing	House support	Tourist purpose	Abandoned	New uses
“Fio/Empena”	17	9	2	3	3 <sup>a</sup>	-
“Meio-Fio”	36	18	-	10	7 <sup>b</sup>	1
“Redonda”	13	2	1	-	9 <sup>c</sup>	1

<sup>a</sup> 1 in ruin; <sup>b</sup> 7 in ruin; <sup>c</sup> 5 in ruin

The main characteristics of these houses are the wooden structure and the thatched high-pitched roof (Figure 2). Some of the houses are made of wooden walls and a few of stonework. This vernacular architecture in Madeira stands out for being an unidentifiable type from out of the Portuguese territory. These dwellings, which characterize most of the island of Madeira, were developed according to the habits and customs of the population and were adapted to the site and built with local materials without any influence of foreign styles [16].



**Figure 2.** Wooden structure and thatched high-pitched roof are the main characteristics of these houses

The “Fio” or “Empena” house (Figure 3), a one-floor building, built entirely of wood, with a full frame fitting that joins together perfectly. Supports of its longitudinal beams are directly on the stones of the floor. These constructions are able to be transported to another site changing the first implantation site. This typology is characterized by having the kitchen in a separate area of the house, which is built entirely in wood, with a frame filled with fittings that join and fit perfectly [16].

The “Meio-Fio” house (Figure 4) presents the elevation frame coverage around the perimeter about 90 cm above the soil. This innovation arose in the twentieth century, allowing better use of interior space. These typologies are provided with an attic, in the more evolved cases, whose access is made through an outside steep staircase [16].

The “Redonda” house (Figure 5) presents four facades and a hip roof with rounded corners. The shutters sliding of the windows are found only in this type of construction. In some buildings, there is an attic accessed through a steep staircase. This typology was more concentrated in the parishes of São Jorge and Ilha. In the parish of Ilha, this typology is already non-existent [16].





**Figure 3.** “Fio or Empena” house - Inner and outer view



**Figure 4.** “Meio-Fio” house - Outer view and roof structure



**Figure 5.** “Redonda” house - Outer view and entrance detail

Madeira Island has temperate climates, characterized by mild temperatures all year round. During the survey [16], [21], the inhabitants indicated that this type of houses are warm, with mild temperatures and have the minimum conditions to live comfortably. The exception occurs when there is a strong wind that penetrates through the roof. The cover needs a cyclic maintenance/replacement, every 4 or 5 years, depending on the quality of the stem. This has now become very expensive since the habit of cultivating wheat was lost. This is one of the reasons for abandoning these houses. Guedes et al. [22] state that “In terms of sustainable development, the situation presently found in Portugal offers good opportunities in two critical areas: building refurbishment and the revision of comfort criteria.” The refurbishment should regard, among others, the choice of building materials that has an implication on the local economy.

Through this process, regional development can be promoted if local materials and human resources are chosen [16].

However, some interventions have emerged which changed the identity and typicality of these constructions. The timber in the façades has been replaced by concrete blocks plastered and painted. The aluminium windows are substituting the wood frames. The thatched roof has been replaced with metal sheets. Despite this tendency, some good examples have emerged. A traditional building was restored in San Pedro (Figure 6) and is now a seasonal housing. The original materials were maintained or repaired/replaced [16]. Without losing the identity and cultural tradition, the typical and unique construction of this place can be kept even assigning new uses.



**Figure 6.** A refurbished traditional “Redonda” house

A building typology “Meio-Fio” was restored and it is now a bar (Figure 7). Another building typology, a “Redonda” house, was restored and adapted to a restaurant (Figure 8). It is referred by the owners of the restaurant “Casa de Palha” that the legalization of its architecture had some problems regarding the right height required by law [16]. However, after several attempts, the construction of this restaurant was accepted as an exception because it is the re-creation of a typical housing and because increasing the height would be a severe transformation [16]. These are good examples of sustainable development.



**Figure 7.** A bar in a refurbished “Meio-Fio” house

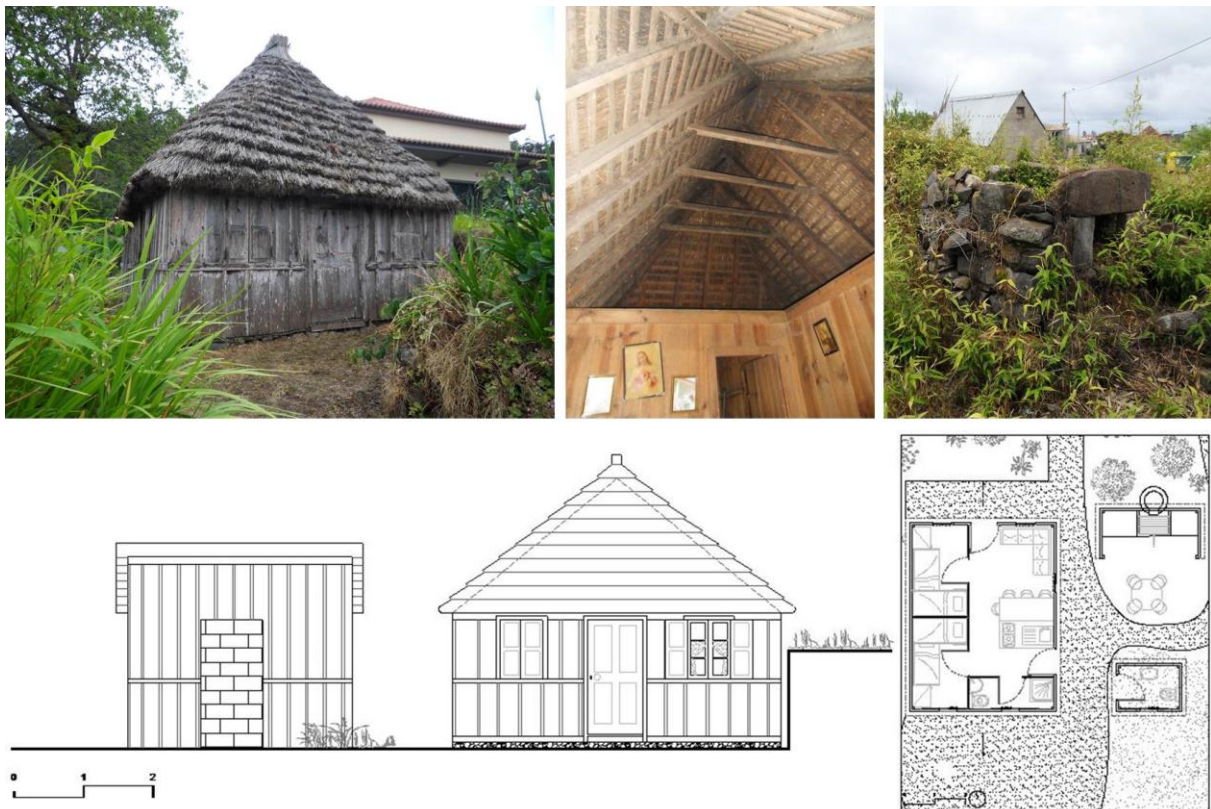




**Figure 8.** Interior view of the restaurant in a refurbished “Redonda” house

#### 4. Two sustainable academic proposals

The refurbishment of “Redonda” and “Fio” houses was very simple. In both houses, a ceiling was placed on the coverage structure to avoid debris falling within it and making the impermeability of the coverage even more effective. In the remaining space, few changes have been made. A kitchen and a bathroom were included. As the houses were in good condition, (requiring only painting and the treatment of some wood structures) regular maintenance of coverage was needed. The central walls were removed to obtain wider spaces and the creation of a distinct area was achieved by using furniture [16].

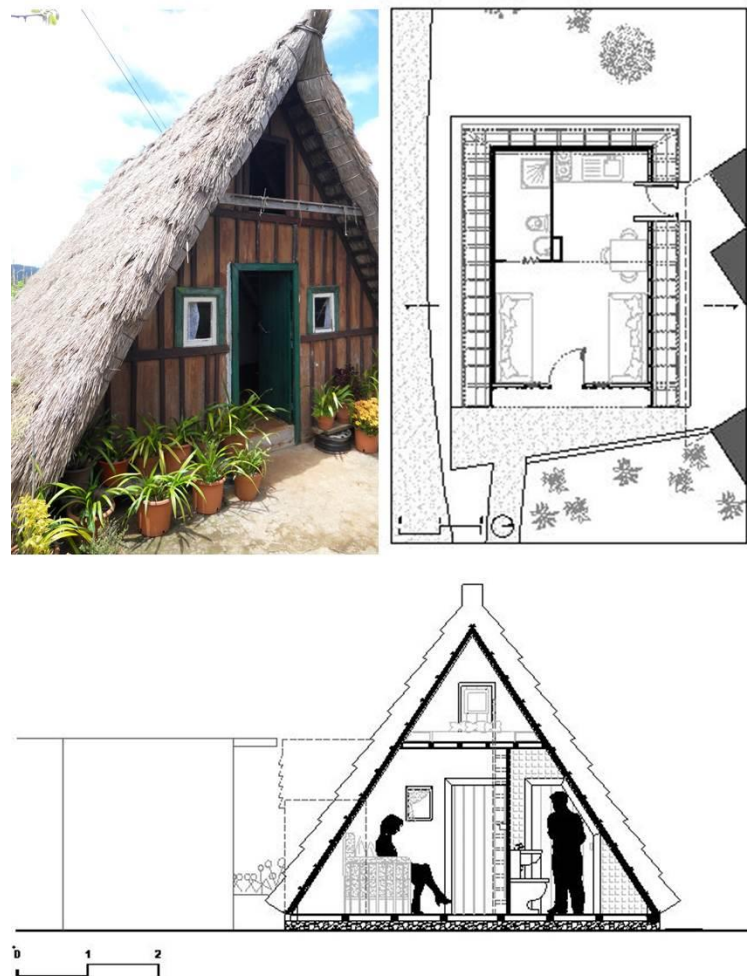


**Figure 9.** Academic proposal – “Redonda” House, Santana, Madeira

In the “Redonda” House, the ruins of secondary spaces around it were removed, as this presents a greater area of land surrounding a smaller outside bathroom and a barbecue space, leveraging the existing oven base [16]. This way, it becomes more perceptible as would be the routine of the population in these homes. A door window was open in the kitchen space (Figure 9).



In the “Fio” House, the entrance space was kept as a living room and it was also used as a bedroom. The central wall of the kitchen was removed and a window-door was used because the windows were non-existent. The attic has been adapted into a space of relaxation or as a second bedroom with access by fixed stairs inside. At the side, the thatched roofs above the door were reconstituted. As this housing does not present such availability of surrounding terrain, as the previous example, external independent housing spaces were not created (Figure 10) [16].



**Figure 10.** Academic proposal – “Fio” House, Ribeira Funda, Madeira

## 5. Conclusions

This paper aimed at presenting an overview of a vernacular architecture in Madeira built with sustainable materials. Crucial to this process is the exchange of information hoping to be a contribution of knowledge and awareness to further studies regarding this kind of buildings towards a sustainable refurbishment. This kind of vernacular architecture seems to have been the simplest form of addressing human needs in Madeira. The structures can accommodate more than a few people and can be altered to fit an extra floor at the attic level.

The aim of this academic project is to avoid the excessive sealing of the terrain and use the traditional high interior wooden floor. In wetlands, a waterproof floor should be used and should never be placed on the ground but on a raised platform.

A long-term approach to this kind of building stocks would acknowledge the different needs of the refurbishment and maintenance processes over the life of the buildings. The historical issue is of great importance to societal identity and should be conserved and improved at its own rhythm.

On this basis, several scenarios could be formulated by considering technological and economical choices. The dominant long-term objective would be the value of the conservation of the vernacular building stock. To preserve this heritage building in a sustainable way further studies are important to follow.

The recommendations for the future are: a) monitoring the energy efficiency for selected original buildings and rehabilitated ones; b) economic sustainability on maintenance and refurbishment costs; c) a post-occupancy survey to check if the satisfaction of the inhabitants is achieved; d) publicly visible information signs of cooperation with social-scientific analysis to deliver new knowledge.

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