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Standards of architectural design for the ecological certification of the rural settlements

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Abstract. Before the industrial revolution architecture has been shaped by the natural and cultural inputs. Local constraints become more effective determinants of architecture in the rural contexts because by being disengaged from the webs of transportation and communication, rural settlements have achieved sustainability in difficult conditions. The examples of rural settlement and architecture have provided sustainability through integration with natural inputs within the geographical context because they have reached the goals of ecological design within the local constraints. Although this feature of the rural cultural landscapes has been emphasized frequently, tangible standards could not be developed in order to interpret their ecological design principles from the perspectives of the contemporary building sector and planning. However, the historical experience indicates that the sustenance of ecological performance can be possible as a result of integrated planning at the overall scale of the settlement. Therefore, the existing standards are not qualified for interpreting the rural contexts. This study develops a method for analysing, interpreting and evaluating traditional rural settlements and certifying new implementations in the rural environments in the light of the given literature review, discussion and methodological proposal.

Keywords: ecology; rural settlements; ecological certification

1. Introduction

This study discusses the method for developing specific scientific standards of architectural design for a possible ecological certification of the rural settlements. For achieving this goal, at first the historical background of this issue should be investigated briefly.

Before the industrial revolution architecture has been shaped by local natural and cultural inputs. The rural landscapes, which are the seats of the earliest traces of civilization, encompass characteristic geographical sections which impose such determining factors into architecture. Local constraints become more effective determinants of architecture in the rural contexts because, by being disengaged from the webs of transportation and communication, rural settlements have achieved sustainability in difficult conditions. The examples of rural settlement and architecture,

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which have provided sustainability through integration with natural inputs within the geographical context of the mountain chains are significant because they have reached the goals of ecological design within the local constraints. Although this feature of the rural cultural landscapes have been emphasized frequently, tangible standards could not be developed in order to interpret their ecological design principles from the perspectives of the contemporary building sector and planning. In addition, there is no clear way for transferring these design principles into the future.

In spite of local differences, rural settlements have common architectural features and ecological characteristics. This study opens up potentials for revealing the relations of the rural settlements amongst themselves and with their natural environment, their harmony with the environmental factors at the settlement scale and characteristic material configurations and functional schemes at the scale of the architectural section and detail, namely the architectural patterns.

The objectives and outcomes of this study have important scientific, technological and socio-economic contributions regarding the issues of ecological design, sustainability and energy efficiency, which constitute a global agenda due to the contemporary ecological problems. Universal systems of ecologic design standards such as “Leed, Breeam” and etc. focus on the use of contemporary technological equipment in new urban developments and the performance of singular buildings. However, the historical experience indicates that the sustenance of ecological performance can be possible as a result of integrated planning at the overall scale of the settlement. Therefore, the existing standards are not qualified for interpreting the rural contexts. The proposals of this study have the potential to fill this gap, in this way, the study will have scientific and technological contributions through its fresh theoretical approach enabling the use of ecological design principles in new designs and its potentials for implementation.

2. Research on rural vernacular architecture

A rural architecture and settlement system, where life is very hard due to environmental constraints, has been tested for centuries and its sustainability is approved through long time span. “Environmental coherence” (Kavas 2016) is the outcome of this historical process. The traditional rural settlements are the results of the bygone local economic models and social structures. Therefore, explaining the architectural dimension of environmental coherence is an issue of architectural history. However, in general architectural history has been concerned with monumental rather than vernacular structures (Kavas 2010). Concerning local architecture, monumental examples constituted the focus of attention (Oliver 1969, Rapoport 1969, Al Sayyad 2006). This study also tries to fill this gap by focusing on the architectural value of the historical rural contexts.

For Schittich (2003), the forms of the building types, which have been developed for centuries, are the best representatives of the climatically-sensitive forms. Local architecture is inherently compatible with the user needs, climatic requirements and local economy and it is constructed by the use of local materials. These factors define the local input data. Cal (2012) explains the local input data in two categories: the natural inputs are topography, climate, flora, soil type and water resources, while cultural inputs are environmental images, social structure, family structure, economical resources and technology.

Before discussing the rural architectural traditions and their relations with ecological design the history of architectural theory regarding the interpretation of local, traditional and vernacular

architecture should be summarized. The term of "vernacular architecture" were first used by Rudofsky (1964), and in academic terms, by Oliver (1969). In his study titled "Shelter and Society", Oliver (1969) used "traditional" architecture aside "vernacular" architecture, while he explained the history of architectural theory. Guidoni, on the other hand, accentuated the term "indigenous" associated with local architecture (Guidoni 1975). The international symposium titled "Traditional Dwellings and Settlements" in 1988 has been an important medium for the discussion of "traditional" architecture and in this respect, the work of Bourdier and Al Sayyad (1989) has been significant for the introduction of the basic concepts related with this issue (Ozkan 2006).

In his study titled "Environmental Aesthetics of the Rural Architectural Tradition in the Mediterranean Highlander Settlement: Urunlu (Akseki-Ibradi Basin), Kavas unfolds the elements of settlement and architecture which construct environmental coherence (Kavas 2016). Emphasizing that rural settlements are very rarely discussed in the studies of architectural history, Kavas (2016) argues that there is no sound conceptual framework for interpreting the rural settlements in architectural history and he proposes a new method. The methodological proposal of this study for constructing ecological design standards for the rural settlements is built upon the original method put forward by Kavas (2016).

Kavas (2016) analyzes the problems of vernacular architecture studies in Turkey and argues that a new conceptual framework is required for revealing the role of rural architecture in environmental coherence. In general, the studies of vernacular architecture in Turkey are representatives of the typological approach accepted by Kucukerman (1973), Eldem (1984) and Kuban (1995). Asatekin (1994) also emphasizes typology as the dominant approach in the studies of Anatolian vernacular architecture. Asatekin argues that although the traditional vernacular architecture is related with many different disciplines, it is regarded in architecture only as an issue of typology (Asatekin, 1994). Typology disengages the examples of vernacular architecture from their natural and cultural context (settlement pattern, natural environment, cultural needs, etc.) and reduces their image into abstract formal compositions represented by a comparative analysis of plan drawings. The outcomes of this kind of typological studies are generalizations rather than specific local knowledge.

The typological approach is also recognized universally. There are many studies which aim to categorize vernacular architecture from different parts of the world with respect to different properties. Thus, some of these studies try to formulate universal categories. For instance, Vellinga *et al.* (2007) produced an "Atlas of the Vernacular Architecture of the World" by focusing on continental and regional differences with respect to climate, topography, water resources, flora, soil properties, economy, language, religion and culture and classified vernacular buildings in reference to these categories. As a result, according to cultural differences, Vellinga *et al.* (2007) put forward continental and regional categories such as "East and Central Asia, Australia and Oceania, Europe and Eurasia, Mediterranean and Southwestern Asia, Latin America, North America, Semi-tropic Africa". Likewise, in his study titled "Handmade Houses & Other Buildings, The World of Vernacular Architecture", May (2010) introduced examples of vernacular architecture in continental scale. May categorizes local architecture of the world according to construction materials such as wood, stone, earth, ice etc. (May 2010).

In his study titled "Traditional Buildings, A Global Survey of Structural Forms and Cultural Functions," Noble analyzes the traditional structures of the world with reference to terminology, function, form, plan, section, location, organization, material, construction method, climate, finishing materials etc. (Noble 2007). Allen, on the other hand, focused on universally-recognized

features of "rural architecture". Allen analyzes the local types of rural environment such as "farmhouse, cottage, storage and stable" and in the study titled "Rural Architecture," analyzes the issues of material, location, style, structural system and ventilation (Allen 2007).

On the other hand, some researchers focused on certain locations of the world instead of attempts to develop global atlas of vernacular architecture. Bowyer's book titled "Vernacular Building Conservation" defines the term of "local architecture" and classifies local architecture of England according to design and materials (Bowyer 1980).

This study evaluates the conservation methods in the field of vernacular architecture where material selections are quite significant. Stedman's book titled "Rural Architecture of the American Southwest-Featuring Fences, Barns and Corrals", exemplifies rural architecture of Southwestern America through model drawings and produces a technical guide as a result of the interest in local construction systems during the 1970s (Stedman, 1989). In his book titled "Swiss Dwellings and Landscape / Häuser und Landschaften der Schweiz", Weiss (1959) analyzed the settlements, landscape, dwellings, building units and construction materials in detail.

Studies focusing on certain local traditions were also produced in Turley. Ozcan's study titled "Vernacular Architecture of Teke Peninsula Littoral" analyzes the traditional dwellings of Finike, Kas, Kalkan and Fethiye in Southwest Turkey in terms of their plan organizations, façade designs, construction materials and architectural ornamentations (Ö zcan 1994). Sener's study titled "The Traditional Dwellings in Alanya" produces an inventory of the buildings of the historical town in the South of Turkey according to local inputs (Sener 1984). Likewise, Tuna's book titled "Traditional Architecture in the Coastal Part of the Central Black Sea Region" gives information about the local construction techniques of the Central Black Sea region and analyzes the buildings' foundations, walls, floor and roof systems and other architectural details (Tuna 2008).

The focal points of the typological approach are the compositional and proportional rules and of the plans, singular architectural elements of the buildings and physical explanations regarding construction systems and materials. The rural and vernacular buildings of Turkey are generally analyzed in accordance with the typology of "Turkish House" (Eldem 1984, Kuban 1995). Although these interpretations are correct, they are insufficient for explaining the coherence between the environment and the settlements.

In their study titled "Spatial Hierarchy on Vernacular Houses in Eastern Black Sea Region, Turkey" Saatci and Önder (2015) have undertaken research concerning the spaces which are located in the rural settlements of Eastern Black Sea Region by being inhabited by people of three different cultures such as Laz, Hemsin and Georgian origins. This study argues that users' relationships with their cultural origins have produced both similarities and differences in the spatial configuration of their vernacular houses.

In the limited number of studies concerning rural settlements, the dialogue between environment and architecture is voiced frequently, however this issue has not been discussed referring to a sound theoretical basis. Therefore, there has been limited production of academic knowledge regarding the coherence between traditional settlement and environment. The fundamental reason is the conceptualization of the traditional dwelling as an object isolated from its environment and excessive focus on the organization of interior space and physical explanations. This kind of typological studies produce inventories which reduce the complexity of the issue into oversimplified tables. Due to this reductionist approach, the material properties of local architecture cannot be analyzed in depth and these properties are reduced into variations of materials within a general table of comparisons.

There are also studies which transcend typological limitations and analyze the relation of

architecture with the natural and cultural inputs. These studies provide a conceptual basis for the original method proposed by this paper.

Asatekin (2005) illustrates such a novel approach by enriching the field with interdisciplinary data. Asatekin's study titled "Understanding Traditional Residential Architecture in Anatolia" analyzes the Anatolian traditional dwellings built after the 17th century according to plan type, construction techniques and materials and local character and emphasizes that for a comprehensive understanding of the issue interdisciplinary aspects such as social structure, economical model and neighbor relations, cultural history of the users should be taken into consideration.

In his study introducing the basic concepts of environmental aesthetics, Berleant (1992) explains and exemplifies the important role of architecture during the integration of the rural cultural landscapes and environment. In another study, Berleant (1997) uncovers the theory of environmental aesthetics through several examples of rural settlements and architecture. A significant point of these studies is that many of the examples, which are selected for illustrating the integration between architecture and environment, are representatives of the traditional and rural non-western cultures. Erzen (2006) refers to Berleant's above-mentioned studies and produces the most comprehensive study of environmental aesthetics in Turkey through examples of urban and rural contexts (Erzen 2006).

The literature review and conceptual interpretation given above illustrates the evolution of the studies towards a more comprehensive and interdisciplinary field encompassing issues of ecological design. This approach is represented by the following studies.

Gurler's study titled "The Solar Factor in the Relation between Building and Climate and Implementation Methods in the Province of Antalya" analyses the effects of the climatic factors on the methods of implementation for new buildings (Gurler 1977). Likewise, in his study titled "Analysis of the Climatic Effects on Domestic Architecture in Antalya", Suer (1986) analyzes the buildings of Antalya in terms of settlement pattern, architectural character and its relation with climate, the climatic effects of new buildings and possible precautions for sustainability (Suer, 1986).

Mirici Cappa's study titled "Ambiente e sistema edilizio negli insediamenti Walser/ Construction System and Its Environment in Walser Settlements" (1997) unfolds the northern Italian settlements of Alagna Valsesia, Macugnaga and Formazza from the perspectives of historical context, regional characteristics, and building scale (Mirici Cappa 1997). Tronconi's study titled "L'Architettura Montana / Mountaineer Architecture" (2008) analyzes the mountaineer settlements of northern Italy in terms of construction technology in architecture, historical and architectural heritage and the relation of these physical configurations with social and environmental values (Tronconi, 2008).

Vissilia (2009) argues that a settlement is a living organism with its material use, construction techniques and climatic circumstances and evaluates Greek vernacular settlements in the article titled "Evaluation of a Sustainable Greek Vernacular Settlement and its Landscape: Architectural Typology and Building Physics". In this study various settlements made up of mud-brick dwellings are analyzed with respect to architectural design, environmental context and climatic solutions for design (Vissilia 2009). In her article entitled "An Ecological Assessment of Vineyard Houses: A Case Study from Bucak," Mutlu Danaci (2014) analyzes the traditional vineyards dwellings located in the town of Bucak in the Turkish province of Burdur in terms of their harmony with the environmental factors and their ecological performance.

Glassie (2000) mentioned vernacular architecture with some examples from different countries in the materials, techniques, forms and history of them, in the book titled "Vernacular

Architecture". Oliver (2006) devoted a chapter to the preservation and continuity of vernacular architecture in his entitled book "Built to Meet Needs: Cultural Issues in Vernacular Architecture". Brunskill (1965) analyzed the British vernacular architecture under the titles of wood buildings, brick buildings, railroad buildings, construction materials, houses, farm buildings, stone buildings, geographic regions, timber and building construction in his article titled "English Vernacular Architecture".

Zhai and Previtali (2010) mentioned technique, energy performance and materials, etc. of vernacular settlements in the world and classified them in the context of some criteria in the article titled "Ancient vernacular architecture: characteristics categorization and energy performance evaluation". Similarly, Singh *et al.* (2009), in the article titled "A bioclimatism and vernacular architecture of north-east India", also emphasized that bioclimatic properties of vernacular architectures, especially in terms of material properties.

As the above-mentioned studies point out, environmental coherence, which enables sustainability, is constructed through rich combinations of multi-scaled spatial patterns, which include but go beyond interior organizations of space and individual dwellings. In addition, rural settlement develops as a comprehensive environmental design rather than construction of individual buildings. The elements of traditional domestic architecture interconnects spaces through relations of neighborhood. These elements relate the dwellings to the topography by means of agricultural production, use of solar energy and other forms of environmental rapports (Kavas 2016).

In his study titled "Vernacular Architecture and Landscape History: The Legacy of the Rebuilding of Rural England and the Making of the English Landscape", Dyer (2006) argues that when the concept of landscape history emerged during the 1950s, the studies of architecture and landscape started to become more unrelated. Dyer demonstrates the advantages of strengthening the link between architecture and landscape and argues that if architecture is analyzed in connection with the landscape, the studies of architectural history and local architecture would be much richer and more successful.

In reference to the study titled "A Pattern Language" (Alexander *et al.* 1977), a "pattern" is the intersection of a context, a problem arising from this context and a spatial solution to this culture-specific and context-specific problem. This abstract definition of a pattern is relevant for all cultures however the form generation of a pattern is culture specific.

In this framework a pattern is associated with a spatial configuration fulfilling defined requirements in the traditional society and this kind of configurations may be analyzed at the scales of region, settlement, dwelling and architectural detail. Patterns are combined in innumerable ways in three dimensions and therefore a culture-specific architectural language is constructed. The important contribution of Alexander's argument is its capacity to derive a conceptual framework for realizing and explaining the continuities between the successive scales within rural settlements. Due to its proposal for introducing objective standards to the performance of architecture, the "patterns" have been influential in architectural education and design process. Architectural history is another field where the concepts of "pattern" and "pattern language" can be implemented. Due to the increasing interest on environmental context in the study of architectural history (Kostof 1985), patterns have important explanatory potentials.

It is necessary to regard architectural patterns as principles of architectural design because during the long course of history the patterns have been successful in terms of sustainability. Regional architecture has been successful by the contributions of design principles and Technologies compatible with the climatic and environmental circumstances. In this way, it will

be possible to adapt passive design principles based on climatic context into contemporary practice of architecture. In addition, the relations between the environment, the building and the climate will be as strong as possible.

This understanding of design can be exemplified by the studies summarized below:

In his proposal for the preservation of natural and cultural heritage titled "New Approaches in the Preservation of Historical Environments, the City of Amasya and the Case Study of Yaliboyu Dwellings", Meshur (1999) argues that local features are becoming more and more important in the framework of globalization and localization. In their study titled "Vernacular Architecture in the Twenty-First Century, Theory, Education and Practice", Asquith and Vellinga (2006) argue that in spite of the rapid technological developments and globalization process in the 21st century, local architecture is still a very important guide for the shaping of research, education and theory. In the context of reuse in local architecture, the study titled "Multiple Criteria Evaluation of Rural Building's Regeneration Alternatives" (Zavadskas and Antucheviciene 2007) develops reuse alternatives for the abandoned rural landscapes of Lithuania.

The rural settlements are shaped according to local materials, local cultural needs, climate and topography and therefore acquire original characteristics of architecture. In his study titled "Eastern Black Sea Region, A Sample of Modular Design in the Vernacular Architecture," Vural (2007) derives contemporary dwelling units based on modular a prefabricate design and tries to set up harmony between these designs and local context by referring to the rural heritage. Likewise, the study titled "Questioning the Prototype Dwellings in the Framework of Cyprus Traditional Architecture," (Günce *et al.* 2008) emphasizes the development of sustainability in rural landscapes and local domestic architecture. In this framework the study argues that local architecture should be analyzed, and new designs proposals based on this analysis should be in harmony with the life style of the local society and the environmental inputs of the local context. Cansu (2008) compares the traditional vineyard dwellings of Ankara in central Anatolia and the contemporary villas in the study titled "The Comparison of Space Configuration in Vineyard Dwellings and Villas of Today" and argues that contemporary design proposals should interpret the traditional patterns as guidelines.

In the book titled "Vernacular Architecture and Regional Design, Cultural Process and Environmental Response", Heath (2009) argues that sustainable design necessitates a comprehensive resolution of reactions towards social, cultural and environmental factors and tries to identify strategies for sustainable design. In this process architectural design concerns not only aesthetic and technic factors but also social and environmental ones.

In his study titled "The Preservation of Local Architecture and Rural Settlement Patterns: The Case Study of Balikli District in Artvin Savsat," Aydemir (2010) identifies the natural and cultural characteristics of the case study, analyzes local culture, defines the local features of architecture, analyzes the changes in the settlement pattern and develops way to cope with the preservation process. In his study titled "Methodological Bases for Documenting and Reusing Vernacular Farm Architecture", Fuentes (2010) searches for a method of reuse in the abandoned agricultural buildings of Spain, develops inventories for understanding typologies and construction techniques and prepares a guide for the reuse process. For instance, it was proposed that the local agricultural buildings which were unused for decades due to the economic developments in the European agricultural sector, could be converted into wine cellars. In the study titled "New Uses for Old Traditional Farm Buildings: The Case of the Underground Wine Cellars in Spain," the traditional buildings in Spain were analyzed in terms of architecture and landscape features and they were classified according to their potentials for reuse (Fuentes *et al.* 2010).

In the study titled "Remodeling of the Vernacular in Bukchon Hanoks", Yun (2012) analyzes the Korean local dwellings called "hanoks" and interprets local vernacular architecture in a flexible way and tries to produce richness during the architectural design process. Meanwhile, in their study titled "Variations in Vernacular Architecture Depending on Climatic Properties: a Case Study from Vineyards of Anatolia", Mutlu Danaci and Bakir (2013) aim to derive design principles through the analysis of Anatolian vineyard dwellings in Kayseri, Bucak and Elmali.

In their study titled "Analysis of Kayaköy Within the Scope of the Sustainability of the Vernacular Architecture" Kisa Ovali and Delibas (2016) depart from the inspiring qualities of local architecture for the future design strategies and interpret Kayaköy, a Western Anatolian settlement, as a qualified local settlement exhibiting the traditional knowledge of ecological building transformable into inputs for contemporary sustainable architecture. The resolution of the data obtained through analysis of this settlement is interpreted within the principal and strategic framework of the "VerSus (Vernacular Heritage Sustainable Architecture)" project supervised by four different countries and supported by the European Union Cultural Program. The study presents findings of the field work and tries to resolve the local building codes which are underlined by environmental, socio-cultural and socio-economic dimensions.

In their study titled "Effects of Vernacular Architecture Structure on Urban Sustainability Case Study: Qeshm Island, Iran" Pazhouhanfar and Mazraeh (2017), aim to understand the vernacular architecture of the Qeshm Island as a sustainable pattern, they discuss the issue in terms of three aspects, namely, urban fabric, one-based architecture, and architectural details. In this study, the traditional built environment and the settlement pattern is analyzed through 42 existing buildings of approximately 70 years of age. The authors conclude that in settlement scale, factors such as the structural system, the frame of the neighborhood spaces, and in detail scale, factors such as thickness of the walls, and the openings contribute effectively into sustainability. In general, studies showed vernacular architecture of the island has developed an orientation between the climate of the region and a good understanding of the construction.

In their study titled "Climate Responsive Building Design Strategies of Vernacular Architecture in Nepal" Bodach, Lang and Hamhaber (2016) review examples of vernacular architecture and its constitutive building elements in Nepal and analyze in a qualitative manner which bioclimatic design strategies were applied.

In the study titled "Investigating climate responsive solutions in vernacular architecture of Bushehr city" Motealleh *et al.* (2016) investigate climatic solutions and their advantages in order to reach sustainability in contemporary architecture. For this end, qualitative methodology based on a descriptive–interpretative approach is applied in this research for analyzing appropriate climatic solutions in vernacular architecture of Bushehr.

3. Discussion and methodological proposal

The scholarly work summarized above illustrate that many studies have been undertaken in different parts of the world regarding the harmony between local architecture and environment. However, how to interpret the architectural heritage and its patterns for ecological design of the future buildings remains as a problem to be solved. The following studies have identified this problem together with its causes.

In his graduate thesis titled "A Comparative Study about the Effects of Local Data on Vernacular Architecture in the Context of Sustainability: Akseki-Ibradi and Piemonte-Val

D'Ossola Examples", Cal (2012) departs from the recognition that the natural and cultural inputs affect architecture and settlement patterns and analyzes pattern languages constructing the sustainability of local vernacular architecture. In order to understand the sustainable pattern languages of traditional architecture, two mountaineer regions around the Mediterranean Basin are selected as case studies. The Akseki-Ibradi Basin in Southwestern Turkey and Piemonte-Val D'Ossola in northern Italy involve characteristic mountaineer settlements. In this study the case studies are analyzed in terms of green building evaluation and certification systems. As a result, it is argued that there is no relevant evaluation system for traditional settlements and need for the development of new certification systems are pointed out.

Cal (2012) emphasizes that the effective use of local resources is a requisite for sustainability which means "being able to continue". Just like in other fields, in architecture sustainability can be ensured by analyzing the local inputs and interpreting them for the development of a new architectural product. The best examples of this ideal process may be observed in the traditional settlements because the traditional settlements, especially the mountaineer settlements, exhibit the adaptation of architecture to the very difficult environmental conditions and scarcity of natural resources. On the contrary, the "modern" settlements, in which we live today, do not feel the need to be adapted into environmental factors and provide environmental comfort only through unsustainable technological devices.

In the article titled "Overview of rural building energy efficiency in China," He (2004) mentions the rapid increase of energy consumption due to the economic and social changes in China and identifies changes in the energy consumptions of the rural settlements and energy efficiency of construction materials. He (2004) argues that due to climate, life standards and economic level, the standards and policies implemented in the urban areas cannot be realized in the rural contexts and states that it is necessary to develop characteristic standards of design and materials by informing the farmers and local inhabitants. However, this study does not propose any further solutions to the stated problems.

In their article titled "Is your building, which is designed according to "Ecological Architecture", really ecological?" Mutlu Danaci and Kavas (2016) questions if the contemporary implementations labelled as "ecological" are really ecological in their essence. Today architecture aims to design more comfortable spaces and tries to reach this goal through "ecological design". In every historical period technology has been a part of architecture. However, it is wrong to assume that ecological building is a smart and green building solely furnished by technological devices. The fundamentals of the architectural design process demonstrate that there are timeless ecological principles independent from technological advances (Alexander 1979). For instance, maximum use of solar energy in certain spaces is a very important criteria which should be preserved from the very beginning of the architectural design process. Therefore "ecological design" is based on a deep consciousness which should be active from the very beginning of design. Ecological character cannot be added to a building which was not designed with this consciousness. Ecological character cannot be reduced to technological devices installed to buildings later than their conception and construction.

This discussion shows that a new method should be proposed for designing sustainable buildings in the characteristic context of the rural landscapes (Fig. 1). The systems of ecological certification should be derived by a comprehensive analysis of the rural context rather than imposing urban certification systems which are incompatible with rural environments. The appropriate method for developing a rural certification system for ecological design is to refer back to the concept of "pattern" and "pattern language" because these concepts are capable to

Fig. 1 An example from rural settlement (Golova/Antalya/Turkey) (Mutlu Danaci 2012)

identify timeless spatial principles and solid configurations which enable ecological buildings. Therefore, certification system of rural settlements should regard the settlements as compositions of patterns in many scales. After such a systematic fragmentation of the rural settlements into patterns, the ecological dimensions of each spatial configuration can be revealed, and these patterns can be interpreted as guidelines for ecological architecture. Therefore, certification systems can be developed by checklists of patterns in every scale. In this way, the rural settlements can be evaluated according to their ecological performance in every scale and this checklist may be used as a guide for new designs (Fig. 1).

4. Conclusions

It is a great necessity to develop ecological consciousness in order to solve environmental problems in architectural design. Today the design and construction processes of buildings are questioned in terms of their ecological dimensions. In general, it is accepted that the analysis of traditional buildings and settlements teaches us ecological principles which can be adapted to contemporary requirements and technologies. In spite of this assumption how to reach this goal is not defined properly. In this framework this study tries to contribute to the development of a sound method for analysing, interpreting and evaluating traditional rural settlements and certifying new implementations in the rural environments.

In the light of the literature review, discussion and methodological proposal summarized by this study, it is understood that reducing ecological architecture into technological devices and fixtures is a misconception of the essence of ecology and that the rural settlements cannot be analysed,

evaluated and certified through the same concepts and methods used in the urban contexts. The traditional rural environments possess characteristic spatial concepts and environmental relations. Their harmony and ecological performance are based upon timeless patterns and pattern languages which are underlying elements of harmony between building and environment. Therefore, the rural settlements and buildings should be analysed, built and rebuilt by fragmentation into multi-scaled patterns. The buildings and settlements of the rural landscape should be seen as rich and varied compositions of patterns existing in many scales. This ensures the formal richness of the rural architecture, which acquires form according to the specific topography, climate and other environmental inputs by following the common patterns.

Therefore, deriving guidebooks of fixed building types to be built in certain rural landscapes is an erroneous conception, or even misconception of traditional rural settlements. Typology assumes fixed building forms which are to be constructed regardless of immediate environmental inputs. However, the original rural buildings do not follow such fixed types. It can be observed that although they follow same underlying principles of space, every single building of the traditional settlements is different from each other. This reality is also in tune with the nature of architectural design. It is the task of the architect to find characteristic solutions to different problems and in every case the formal compositions should be different. This is completely in tune with the logic of patterns and pattern languages as identified by Alexander (1977).

This abstract definition of *pattern* is generic while the form acquisition of *patterns* is culture-specific (Alexander 1979). Any act of construction "brings a handful of patterns into existence", then these multi-scaled *patterns* are three dimensionally combined in infinite variety and form a specific *pattern language* just like the language of a particular people (Alexander 1977). For instance, the traditional dwellings in a rural settlement are connected to each other in terms of social relationships. In addition, these dwellings are integrated to the topography due to climatic and agricultural factors. All these connections and integrations are shaped according to an architectural *language* with definite rules. This set of rules, which regulates the derivation of patterns and the forms of composition between the patterns, may be conceived as the factors of an ecological certification method. The concepts of Alexander can explicate the multi-scaled manifestation of an ecological certification method which is able to test the performance of architectural implementation in multiple scales. Therefore, in order to legitimize the ecological performance of a settlement in rural context, the patterns, which systematize the integration between environment and architecture, should be revealed. Al least three scale levels should be proposed for such an analysis. These should correspond, respectively, to the scales of architectural detail, architectural section and settlement. The vertical relations between these scale levels exhibit the integrity of ecological performance, which manifests itself through a scale sequence ranging from settlement pattern to architectural detail.

The rural settlements can be traced by the use of exemplification method and this assessment may yield the traditional spatial patterns of coherence between architecture and environment. The climatic comfort level of these spatial configurations can be measured by using contemporary technology. These outcomes may become the chapters of the proposed certification standards which unfold the ecological performance of the traditional built environment. This method will make it possible to conceive, measure and plan the built environment as a living organism of architectural patterns, which has the flexibility for adaptation into the nature in any situation and will prevent the straightforward production of fixed types associated with the local context.

To conclude, rural-ecological certification systems should consider the settlements as composition of multi-scaled patterns and should divide the settlement into fragments while

analysing the ecological performance of every scale. The outcomes of this study have potentials for scientific, technological and socio-economic contributions regarding the issues of ecological design, sustainability and energy efficiency.

In addition, the proposed certification system is able to constitute the guidelines for new developments in the rural cultural landscapes such as villages and plateaus whose ecological integrities are threatened due to current population decrease or increase. In the framework of socio-economic contributions, the further outcomes of this study may contribute to the preservation of ecological balance and cultural heritage and the development of consciousness regarding these issues. Moreover, as regards implementations, official institutions may use the design criteria of the proposed certification system.

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