Journal of Cleaner Production 19 (2011) 609–619

Contents lists available at ScienceDirect

Journal of Cleaner Production

journal homepage: www.elsevier.com/locate/jclepro

Evaluation of ecological design strategies in traditional houses in Diyarbakir, Turkey

M. Baran*, M. Yıldırım, A. Yılmaz

Dicle University, Eng. & Arch. Faculty, Dept. of Arch., 21280 Diyarbakir, Turkey

ARTICLE INFO

Article history:
Received 24 February 2010
Received in revised form
27 October 2010
Accepted 1 November 2010
Available online 11 November 2010

Keywords:
Ecology
Ecological design
Traditional houses (Diyarbakır)
Thermal perception
Renewable energy sources
Hot-dry climate

ABSTRACT

This study focuses on the ecological design between traditional Diyarbakır houses and their physical environment (topography and climate) and structural environment (building form, spatial organization, material, landscape and planting, and technical infrastructure). The basic principle was to identify the criteria that would use natural energy sources and provide the most benefit to the inhabitants. The influence of different seasons on thermal perception was investigated. The average temperature differences between the outdoor and indoor environment of the houses were 7 °C in winter, 6 °C in summer and ±2 °C in spring and autumn. Consequently, this paper discusses ecological design solutions used in traditional houses and their applicability to modern buildings and recognizes that architecture should coexist and maintain harmony with nature.

1. Introduction

From the beginning of time, man has developed many intellectual approaches for organizing the physical environment to meet his needs. He wanted to create livable environments to meet his physical and spiritual needs.

Design that considers the environment is necessary to sustain life. In traditional architecture, the constructers and users share the same culture, and they make designs that are coherent with this culture to create structures that are respectful to people and the environment. The traditional houses in Diyarbakır are among the best examples of ecological architecture that showcase optimum solutions for all stages of building, environmental protection and respect for material by using renewable energy sources. One might imagine the traditional houses of Diyarbakır as a living organism that reduces energy consumption, uses natural resources, and provides comfortable, healthier and sustainable living spaces that are harmonized with the climate. This study focuses on ecological design between the building and both its physical (topography, and climate) and structural environment (building form, spatial organization, material, landscape and planting, and technical infrastructure).

Housing as a new concept within this environment attracts much attention. However, housing was previously considered to have good interactions with the ecosystem. Houses were built around water resources using local materials and energy sources. Even the wastes were evaluated and recycled (Yaren, 1990). Ecology based technologies like energy usage and conservation of natural resources, are closely related to architectural design (Karaman, 1995). These architectural designs are essential for a sustainable life as well as environmental design.

2. Ecological design criteria

Ecological design is sustainable systems, consistent with ecological principles, which integrate human society with its natural environment for the benefit of both. In many ways, the environmental crisis is a design crisis. It is a consequence of how things are made, buildings are constructed, and landscapes are used. We have used design cleverly in the service of narrowly defined human interests but have neglected its relationship with our fellow creatures. Such myopic design cannot fail to degrade the living world, and, by extension, our own health. The great challenge of this new century, then, will be to harmonize human activity with the earth's fragile biosphere. We will all have to create new lives based on ecological design principles (Van Der Ryn and Stuart, 1996).

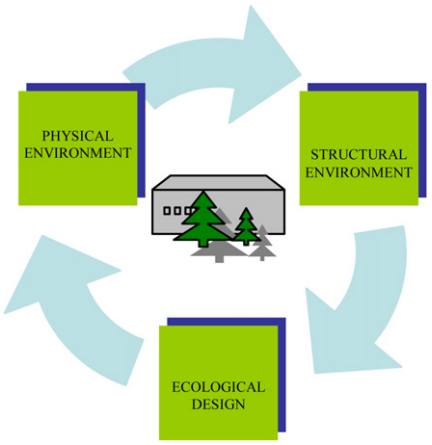
Ecological design criteria are components that have multiple-directions and variability with respect to the current situations.

* Corresponding author. Tel.: +90 412 24 88 403x3575; fax: +90 412 2488405.
E-mail addresses: mbaran@dicle.edu.tr (M. Baran), m.mucahityildirim@gmail.com (M. Yıldırım), ayilmaz@dicle.edu.tr (A. Yılmaz).

0959-6526/$ – see front matter © 2010 Elsevier Ltd. All rights reserved.
doi:10.1016/j.jclepro.2010.11.001

Table 1
Ecological design principles.

Ecological design principles	
Physical environment	Topograhy Climate
Structural environment	Building form Spatial organization Landscape and planting Building envelope (material) Technical infrastructure



Eventhough there is no definite model for the design criteria to use to understand ecological architecture; most researchers emphasize the need to determine some criteria (Krusche et al., 1982; Lyle, 1985). The determined design can be classified as physical environment components and structural environment criteria and are given in Table 1.

2.1. Physical environment criteria

A building's integration with environment primarily involves the consideration of some features like topography and climate (thermal condition suitability and natural conditions). Rational use of these environmental systems which minimizes negative effects on ecosystem, leads to the physical environmental components of ecological architecture (Crowther, 1992). At all of the scales, buildings and urban spaces have an impact on the environment and the external environment has an influence on buildings (Schiller et al., 2007). Thermal impacts and variables affect human comfort and will influence energy demand. The changes in air movement, solar radiation and humidity determine the thermal comfort of the users. With the concern about greenhouse gases and global warming there is a pressure to use of non-renewable energy and the impact of fossil fuels. The destruction of the patrimony of indigenously designed urban places is accelerating. Instead, unique built environments are removed from their context and replaced by global forms and designs. The increasing concern on cities and urbanization in the developing world is about green and brown issues, such as pollution, urban waste and energy consumption (Lim, 2007).

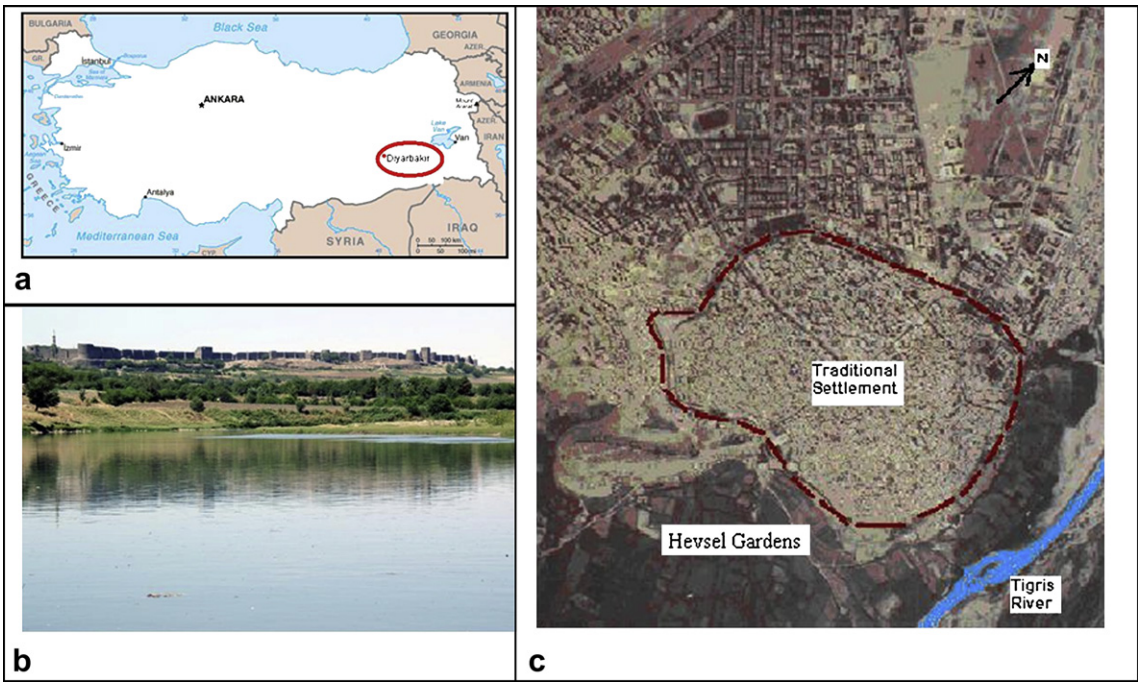


Fig. 1. Location of Diyarbakır and general views of the City Wall (Suriçi).