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Review Article

Evaluating Eco-Cities With A Sustainable Perspective In Human-Nature Interaction

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Abstract

The development of technology and industry, along with the human pressure on ecosystems, is growing and, as a result of rapid population growth, the natural environment is increasingly disappearing and losing renewable power. With the rapid structural developments in urban areas, the green areas are largely left to heavy development in the urban system. Increased use of water in urban areas, despite the reduction of soil to drain rainwater, often leads to an improvement in the composition of the city's waste water infrastructure networks as a result of extensive restructuring. In addition to these issues, air pollution is one of the city's fundamental problems. Multi-storey buildings, which grow exponentially in number every day, are known to prevent air circulation in urban areas and cause air to warm up due to pollution. This leads to global warming, another major environmental concern. To avoid this, the most important thing is to protect green areas in urban areas and to establish alternative applications for green areas. The main research materials are ecological planning, the design of ecological structures, green structures and studies related to the design of sustainable and environmentally friendly structures. This, on the other hand, leads to global warming, which is another major environmental concern. To avoid this, the most important thing to do is to protect green areas in urban areas, along with establishing alternative applications for green areas. The main research materials are ecological planning, the design of ecological structures, green structures and studies related to the design of sustainable and environmentally friendly structures. Within the framework of the study, applications for vegetation of structural surfaces carried out at national and international level and findings such as visual content, projects, etc. have been reviewed. The aim of this approach is to provide a sustainable human settlement where living organisms and natural ecosystems can continue their functions.

Keywords: Eco-city, green cities, sustainability, urban design

Eko Kentleri İnsan Doğa Etkileşimi İçerisinde Sürdürülebilir Bir Bakış Açısıyla Değerlendirmek

Öz

Teknoloji ve endüstrinin gelişmesiyle birlikte, hızlı nüfus artışının bir sonucu olarak ekosistemdeki insan baskısı artmış ve doğal çevreler yok olmaya ve yenilenebilir gücünü kaybetmeye yüz tutmuştur. Kentsel alanlardaki hızlı yapısal değişimler, yeşil alanların azalmasına ve geri planda kalmasına sebep olmuştur. Yoğun yapılaşma sonucu yağmur suyunu drene edecek toprak miktarının azalmasına karşın, kentsel alanda su kullanımının artması, kentin atık su altyapı ağlarının gelişiminde olumlu bir dönüşüm sağlar. Bu sorunlara ek olarak, hava kirliliği kentlerin temel problemleri arasındadır. Sayı olarak her geçen gün artan çok katlı yapılar kentsel alanlarda hava akımını engelleyerek hava kirliliğine bağlı bir ısınmaya nedne olmaktadırlar. Bu da bir başka önemli çevresel sorun olan küresel ısınmaya yol açar. Böyle durumlardan kaçınmak için yapılacak en önemli uygulama, kentsel yeşil alanları korumak ve yeşil alanlara yönelik farklı uygulamaların yapılmasına olanak tanımaktır. Çalışmaya ilişkin temel araştırma materyali; ekolojik planlama, ekolojik yapıların tasarımı, yeşil yapılar ile sürdürülebilir ve çevre dostu yapıların tasarımına ilişkin çalışmalardır. Çalışma kapsamında ulusal ve uluslararası düzeyde yapısal yüzeylerin bitki örtüsü uygulamaları ile görsel içerik, proje vb. bulgular incelenmiştir. Bu yaklaşımın amacı, canlı organizmaların ve doğal ekosistemlerin işlevlerini sürdürebilecekleri sürdürülebilir bir insan yerleşimi sağlamaktır.

Anahtar kelimeler: Eko kent, yeşil kentler, sürdürülebilirlik, kentsel tasarım

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1. Introduction

Eco-city planning is putting the emphasis on the environmental aspects of planning while sustainable planning treats equally the economic, social and environmental aspects. Eco-city planning and management are based on the principle of a cyclical urban metabolism, minimizing the use of land, energy and materials, and impairment of the natural environment, ultimately leading to zero carbon settlements.

Before discussing the reasons of bi-directional deterioration within the urban-nature relation, it is deemed more suitable to go around the subject within a general perspective and through cause and effect relation. Economical stratification and development through industrial, commercial and educational opportunities increasing in certain regions, along with the presence of urban spaces with which social and cultural are provided with related service, made these regions rather more inviting for people. In addition to these, the cities, where the technological developments are accepted within a shorter period of time and where reconciliation is more prevalent, have entered into a process of growing, end of which cannot be foreseen due to the swift increasing of population (Çetinkaya 2012). Moreover, the cities are now the main reason of the such environmental problems as pollution, solid waste, noise, high-rates of energy consumption, carbon dioxide emission (Tosun 2017). It is a quite demanding process, which can be defined as transforming urban planning from its current unsustainable forms and trends. Not only need to change the urban form, transportation systems and water, waste and energy technologies, but to represent a sustainability agenda, the value systems and underlying mechanisms of urban governance and planning need to be reformed accordingly (Kenworthy 2006). This problems initiate the emergence of new perspectives in planning, design, finance, urban infrastructure, business and services in cities (Soydan and Benliay 2020). A quasi-utopian approach to the city as a laboratory, as an empty and enclosed container, is primarily related to the emphasis on cities as experimental locations where the new technologies, structures, and environmental-economic reforms are subjected to a testing process. This approach makes the city's physical environment a single site of action, while also conceptualizing the city as a vessel of restricted socio-economic, environmental and technical relationships. (Caprotti 2014). Rather than establishing our life style and built environment all over again for achieving ecologic design and sustainability, we need to shape them by taking as examples the natural eco-systems generated by plant, animal and microorganism communities sustaining their lives naturally. Human beings have to design their life style, business world, economy, physical structures and technologies without tumbling their life sustaining ability in the nature's core in order to survive. Living creatures in the nature survive by evolving as in constant interaction with other life forms (humans and other species). Ecologic sustainability does not mean that nothing in the nature goes through changes and it is not a static circumstance, on the contrary, it is a dynamic process where species evolve together (Göker, Tuna, 2017).

2. The Concept of Eco-City

The concept of ecology was first used by German biologist Ernst Haeckel in 1866. The Haeckel ecology word is derived from the Greek word oikos and logia, which means science or discourse. According to Haeckel, the teachings of ecology or the undisturbed functioning of nature are a science of nature, dealing with the possibility that complex interplay of complex interactions takes place among all the organisms that share the same region of the earth (Cantzen, 1994). The concept of eco-city has emerged as a result of the quest for cities' sustainability and efforts. It is a city design and implementation approach in which people, cities and the environment are treated in interaction and interaction with each other. The word (eco-city) was originally the book of Richard Register's 'Eco city Berkeley: Building Cities for a Healthy Future' published in 1987. Eco city; is a human settlement that provides the residents with a good quality of life while using minimal natural resources. (Rezafar, 2011). The principles that bring the ecological urbanization approach to the forefront are as follows: the cities are a part of the world of nature; the cities are living areas; the cities are ecosystems; the urban ecosystem has a dynamic structure; each city possesses a deep and permanent content; urban design is a tool in the adaptation of people into nature. These basic propositions generate the ecological approach principles in the design of cities. (Tosun 2017). An Ecocity is recognized as a human settlement, which is modelled on the self-sustaining durable structure and operation of natural ecosystems, according to Ecocity Builders and the International Ecocity Framework & Standards (IEFS) (2010). Without consuming more (renewable) energy than it produces, without creating more waste than it can assimilate and without being harmful to itself or surrounding habitats, the eco-city provides its residents with balanced abundance. The ecological effect of its inhabitants reflects planetary supporting lifestyles; its social order reflects universal values of fairness, justice and equal equity. (URL 1, 2020)

Founded in 1992 and gathering many related organizations under a single roof, the International Ecocity Framework and Standards (IEFS)" document, released by "Eco City Builders" scaled the cities from those that are unhealthy to the gaia cities, which claim the world to be a living organism. According to this, the life in the world is named as "gaia", stating that the lands are the bones of gaia; the oceans, seas and rivers are the circulation system; the atmosphere is the respiratory system; and the living creatures are the nervous system, the scaling towards gaia cities are the extremum point targeted to be achieved. Respectively, these scale cities are as follows: unhealthy cities, green cities, ecocities and gaia cities. The cities are classified under these categories pursuant to certain standards and criteria (Işıldar 2012).

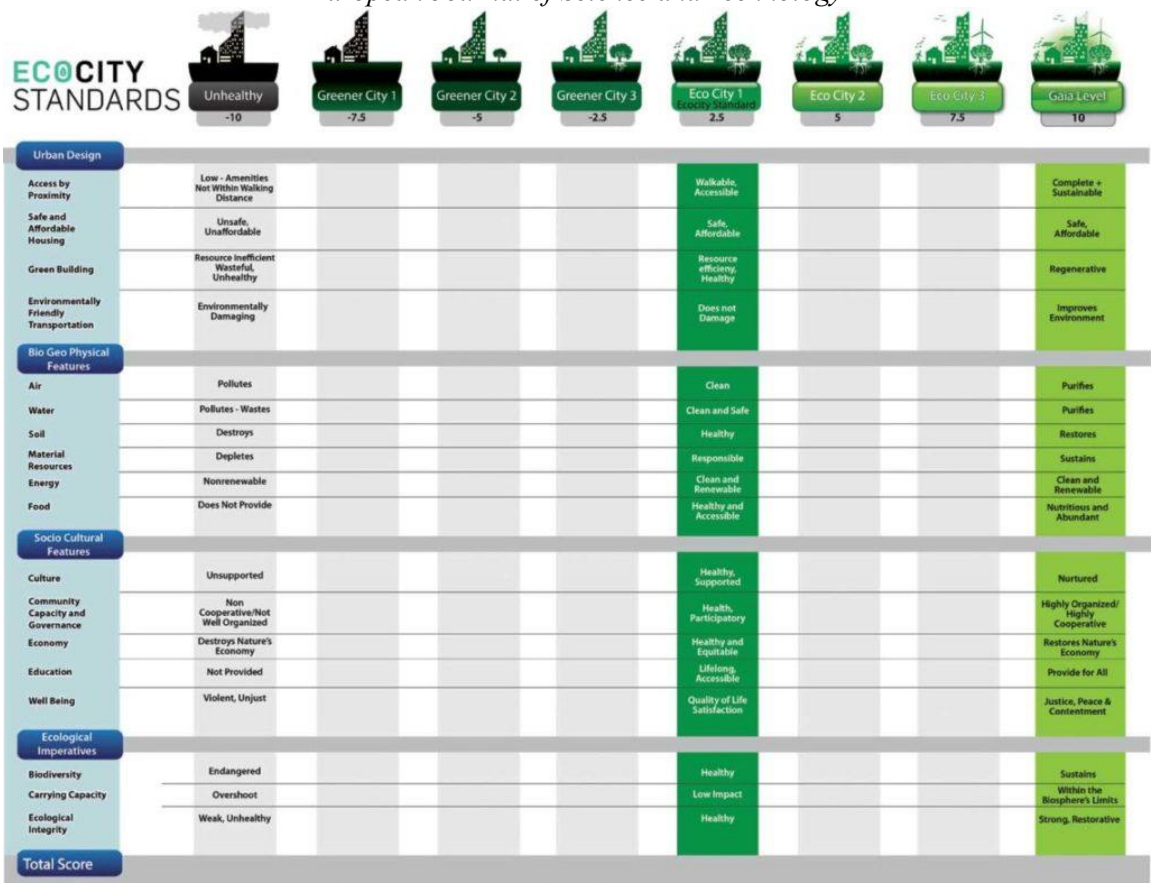

Figure 1. Levels and standards for Cities (URL-1)

Within the scope of the eco-city project supported by the European Union Framework funds, criteria for eco-cities and indicators to measure these criteria have been developed. A total of 20 basic criteria and 34 indicators were determined (Baalawi, 2016).

Table 1. Basic Creteria of Eco-Cities (Baalawi, 2016)

	CRITERIA	INDICATORS
SCOPE	Location	• Urban infrastructure (current potential and accessibility to basic needs). • The affordability of the demand for land (the amount of idle area, green space and urban area in the area to be planned).
URBAN TEXTURE	Building Density	• Area density
	Multiple Use	• The ratio of residential to non-residential area in the total area. • Access to basic amenities: School, playground, grocery store, butcher, etc., leisure areas.
	Public Spaces	• Its size and quality
	Landscape area (accessibility and surface quality)	• Accessibility to green areas (number of people living near green areas). • Ecological quality of outdoor areas (trees, water environments, lawn areas, etc.).
TRANSPORTATION	Transport infrastructure	• Reducing private vehicle traffic. • Length of highways / working population. • Bicycle paths / working population.
	Close to public transport	• Access to public transportation within a 300-meter radius or being within 150 meters of stops.

	Noise	• The amount of noise exposed during the day and night. • The number of people exposed to noise that exceeds limits.
	Parking areas	• Comparison of transportation with private cars and public transportation.
ENERGY FLOW	Energy requirement	• Maximum energy requirement for heating, cooling and other purposes.
	Energy efficiency	• The amount of solar energy used. • Thermal insulation.
	Greenhouse gas emissions	• Share of renewable energy sources. • Contribution to global warming (CO2eq / non-renewable energy • production / MWh).
MATERIAL CYCLE	Construction materials	• Minimum use of materials, use of renewable, recyclable and local materials.
	Soil movement	
	Water Management	• Measures to minimize water use.
SOCIO-ECONOMIC INDICATORS	Social infrastructure	• Social infrastructure index-social diversity and integration.
	Economic infrastructure	• Economic infrastructure index.
	Labor issues	• Job and unemployment rates.
	Affordability	• Benefit cost analysis.
PROCESSES	Holistic Planning	• Multidisciplinary planning team. • Analysis of different scenarios.
	Public participation	• Indices that measure public participation in processes and the quality of participation.

3. Discussion

People adapts to the world he lives in two ways, biological and cultural. Biological adaptation occurs with changes caused by environmental conditions; cultural harmony takes place outside the body / body in contrast to biological harmony, and strengthens human inadequate biocompatibility in the face of changing environmental conditions. Mankind realizes this by its ability to learn, store, accumulate and interpret. Nature is humanized through culture, rules are set; so that nature is classified and transformed. This harmonization process, which has been made to the natural environment of man, has brought its relations with nature to a different position than other living things. Other creatures depend on natural laws against nature; but people are able to put some limits on natural laws and make changes. These limits and changes are diversifying and developing with differentiation by scientific and technological activities. It is natural that every living creature, like human has to propose measures to protect itself (Aydın, 2013).

The production-consumption pattern, organization and functioning of industrial society are the main sources of urban and environmental problems. The activities between production and consumption processes make the relationship between ecology and economy multi-faceted. In the process from production to consumption, the first energy input does not correspond to the last energy output, so the conversion of wastes or a lower utilization increases the imbalances within the ecological cycle. At this stage, it has emerged that the viable healthy cities of the future can be realized by the eco-city planning model, which is designed with environmental consciousness, economy, ecology, energy and technology integrity and balanced. Ecological urban thought has a special precaution in today's environmentally oriented new ecological approaches. These approaches emphasize the importance of environmental awareness and argue that economic stability must be balanced with nature. This process, rather than branding the space, is a quality that socializes and historicises nature. Therefore, the legal and managerial structure of environmental problems should be dealt with in a historical approach, and the human-environmental unity and economy-ecology balance should be devised by being associated with cultural values. (Meydan Yıldız, 2016).

3.1. Environmental Problems in the Cities Depended on the Destruction of Ecological Cycles in the World

3.1.1 Air pollution

Air is part of a system that interacts with each other. All living things have a role in the formation of the atmosphere. Any change in the atmosphere affects the whole life. Two main reasons for air pollution are industrialization and urbanization. Urbanization is a phenomenon that brings together and increases population density. Air pollution caused by urbanization is also due to population density as well as the settlement of the city in a manner unsuitable for topographical and meteorological conditions. Transportation vehicles such as private cars, taxis and buses which are used in urban transportation lead to air pollution with exhaust gases. Air pollution causes problems in this context as it has effects on human health, nature, climates, animal and plant communities and on the way. It also leads to global problems such as greenhouse effect and slimming of the ozone layer. All major cities in the world are heavily influenced by air pollution. In Western Europe, air pollution is the most important environmental problem. Previously only acid rain in some parts of Europe and North America and the cross-border transport of air pollution have been increasingly observed in Asia-Pacific and Latin America (Meydan Yıldız, 2016).

3.1.2 Water pollution

Water pollution is an important environmental problem, especially for cities. Water pollution, in general, is a phenomenon that emerges as the result of human intervention in the hydrological cycle, which is called natural circulation of water in the earth's surface. The deterioration of the natural water is the basis for its impairment in other words that leads to pollution. In the contamination of water resources, industrial wastes, inadequate sewerage system, leaking out of municipal landfill by accumulation under the ground, and all kinds of urban pollution carried by the sellers and all kinds of agricultural materials carried by the sellers constitute the main sources. The settlements, together with agricultural and industrial activities, are the main causes of water pollution.

Domestic wastes cause chemical, physiological and biological pollution in the water they mix. If hospital wastes, which are considered as hazardous wastes, are mixed with domestic wastes without being subjected to a separate treatment, urban wastes also become toxic and radioactive wastes.

3.1.3 Soil pollution

In the most general sense soil contamination is the change and deterioration that occurs in the physical, chemical, biological and geophysical structures due to various external conditions of the soil in the living natural balance. One of the characteristics of urbanization is that it affects the land, especially land, for a variety of reasons. People living in cities have changed the nature and distribution of soil in a variety of ways. Urbanization is a concept that has direct and indirect continuous interaction with the soil. Soil is influenced in this way by urbanization, pollution is born from the same source. Indeed today, the pollution of the land is caused largely by chemical substances used to protect the durable waste of the house, the farm and the industrial, cultivated and planted areas, and the poisonous gases in the air combined with the rain gasses and mixing with the soil. If our big cities are thought to have expanded on fertile agricultural land, it is a fact that the contribution of the national gorilla is reduced through agricultural products of the earth. On the other hand, the contamination of the soil condensation and other pollutions that reach up to deep soil layers. The most striking example of this is the pollution of groundwater around large settlement areas. The main causes of this pollution are sewage, solid wastes and poisonous gases that pollute the air.

3.1.4 Noise pollution

Noise is an important type of environmental pollution which negatively affects the hearing health and perception of humans, disrupts physiological and psychological balances, reduces work performance, and changes the quality of the environment by eliminating the pleasure and calmness of the environment. Major sources of urban noise include airports, industrial activities, construction works and traffic. There is a noise pollution in Turkey, especially in large cities, in industrial areas, in the regions where construction is carried out at a high speed, and in the residents of the towns, which causes adverse effects from hearing loss to mental disorders. Most of the cities are devoid of green belt that can hold up to a noisy scale.

3.1.5 Solid waste and garbage problem

Domestic and industrial solid wastes are a source of many problems. Solid wastes have as much content as waste from houses, wastes from commercial activities, and mining materials. Solid wastes have become an important problem especially in big cities in recent years. One aspect of solid waste that is relevant to local managers is the difficulty of collecting, transporting and destroying hazardous and toxic wastes. Irregular urbanization makes garbage vehicles enter the spontaneously created streets and avenues making the collection of waste very difficult and expensive. Often, local managers lack the means to be sent to every corner of the ever-growing city and give priority to the more visible face of the city. As a result, there are various problems in terms of both human health and natural resources. Apparently, the garbage problem is more than a problem to be solved without the garbage-producing people becoming conscious of this issue and organized to some extent. Reducing the amount of waste, the efficient processing of the recovery processes, is only possible with the conscious participation of the local people, so the incentive measures and other methods have to be put into practice (Rezafar, 2011).

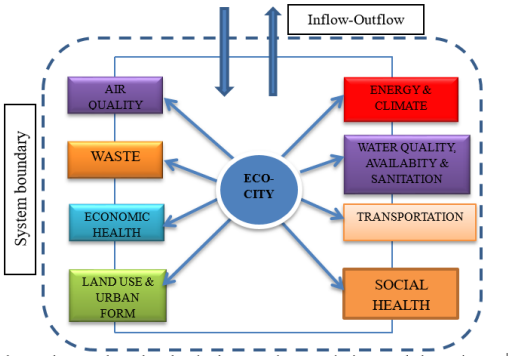

Figure 2. Eco-City Indicator System Model shows a system diagram of the Eco-City indicators within a semi-porous boundary that allow flow of material to and from the eco-city system. This depicts consequential inabilities of such systems to be self-sustaining (Amahpah et al. 2016)

4. Eco City Samples in The World

4.1. Tianjin Eco-city – Singapore

The Sino-Singapore Tianjin Eco-city is the second flagship Government-to-Government project between Singapore and China after the China-Singapore Suzhou Industrial Park (figure 1). The project was mooted by then-Singapore Senior Minister Goh Chok Tong and then-Chinese Premier Wen Jiabao in April 2007, against the backdrop of rapid urbanisation and increasing global attention on the importance of sustainable development. On 18 November 2007, Singapore Prime Minister Lee Hsien Loong and then-Chinese Premier Wen Jiabao signed a Framework Agreement for Singapore and China to jointly develop the Sino-Singapore Tianjin Eco-city (URL-2).

Figure 3. The Sino-Singapore Tianjin Eco-city (URL-3)

4.2. Dongtan Eco-City – China

It is an ecological settlement consisting of a combination of three towns to bring the Dongtan center, which is located on the Chonming Island, at the mouth of the Yangtze River (Fig. 2). The design of the city is based on the Manhattan Village or town plan. The first phase of the project (100 hectares) planned to be cultivated in 2010 at the World Expo in Shanghai is planned to accommodate a population of 5,000 people. In the later stages of Ecocity, it is planned to have a settlement of 500,000 people in 2050 (650 hectares) and 80,000 people in 2050 (3.000 hectares) in line with the development of the project (URL-4).

The project will set up a city that improves the biodiversity of Chongming Island and provides buildings, infrastructure and transportation requirements from renewable sources. 90 percent of all Dongtan's wastes will be collected, recycled and reused. Thus, over time the city is aimed to be a zero-waste city. In the design of the city, a social structure which does not try to look like a city of China but tries to make Chinese social life sustainable in modern life is also observed. The Dongtan Sustainability Institute will be established in Tongji University, and the relationship between the environment and economic performance experienced in this city will be examined (URL-4).

Figure 4. Dongtan Eco-City (URL-4)

4.3. Masdar Eco-City - Abu Dhabi

Established in 2006, the city provides energy savings in the sense of the area it occupies. Apart from this, building shell systems support a sustainable approach to the minimum use of active energy systems used in buildings. In addition to photovoltaic electricity generators, sunlight collectors used to obtain hot water from solar energy and condensed solar and geothermal heat support ventilation in the city by providing cooling absorbents with single and double acting collectors. In addition, the system that separates and classifies waste is systematized in every unit, and wet areas are used in landscape and solid areas are recycled in many areas. Apart from this, the vehicles are electric and it is expected that they will be commissioned in transportation when the public transportation network is completed in the near future (URL-5).

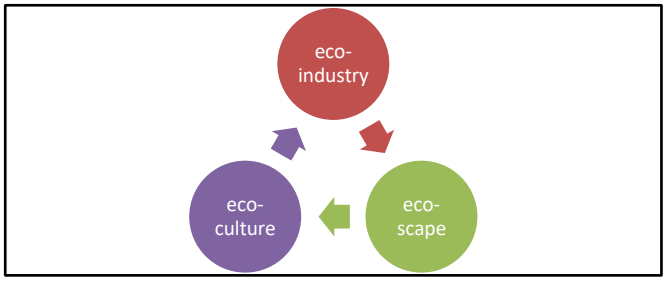

Figure 5. Three Goals of Eco-Cities Development

Figure 6. Masdar Eco-City - Abu Dhabi, (URL-6)

5. Conclusion

Cities are the regions most affected by environmental degradation and irritation due to crowded crowds and intense human activities. Green areas that strengthen people, nature and environment in the cities are the areas most affected by rapid urbanization and industrialization activities especially in developing countries such as Turkey. Green areas with ecological functions, protection of ecological balance and formation of healthy cities, recreational, visual and aesthetic functions; stressing the importance of economic functions and green spaces in urban planning through the use of urban landscapes and the possibility of allowing citizen to be renewed by getting rid of the stress and tiredness in daily life. Landscape architecture is the art of green and green science, which protects ecological, cultural and natural landscape values, natural destruction (habitat destruction) and environmental degradation. For this reason, open green spaces should be planned in cooperation with landscape architects and other professional

groups. Otherwise, it is impossible to make sustainable plans for the right, usable, future oriented, ecologically sustainable.

In order to create a successful eco-city, first correct and appropriate criteria should be determined. It is also necessary to identify and implement appropriate assessment methods. In order to create different methods, attention should be paid to border differences, advantages and disadvantages. As a result, examples of successful eco-cities can be created, which include livable, sustainable, social and economic development, while at the same time solving different environmental, economic and social problems of cities.

As a result, it should be that the requirements that are important in shaping and planning the cities are not the quantitative dimension but that they are met without destroying the resource base and environmental values. For this reason, it should be taken into consideration that the cities are primarily ecosystems where socio - economic activities are carried out. With this really moving, ecological principles should be foregrounded in urban designs.

Ecologic and environmentally sensible structuring/architecture suggest being more careful and wise about disappearing living environments. In this context, there must be structuring (Erdoğan, Aliasghari, 2013);

- Minimizing the structure mass and including open and green places,
- Integrated with the environment, topography, land morphology and vegetation,
- Using recycled construction materials and benefiting from local material means,
- Not consisting of many artificial components and where many biologic and ecologic services are provided naturally,
- Involving a conscious structuring culture,
- Recommending organic and hygienic solution ways,
- Using energy resources including water, air, wind and the Sun effectively and accurately,
- In harmony with the nature and in human scale,
- Where open, semi-open, closed place passages are provided most appropriately,
- Where social relationships are important,

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