

URBAN ECOLOGICAL LANDSCAPE PLANNING AND DESIGN FROM GARDEN CITY TOWARD MODERN CITY - A CASE STUDY: TEHRAN CITY IN IRAN

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Abstract- It is widely believed that urban ecological landscape regards the city to be an ecosystem built by human activities and supported by natural and man-made functions and processes over time. In the past, human communities have selected their residing places and designed their cities by paying attention to natural environmental resources. The profound influence of technology and industry has brought lots of changes in population, culture, attitude, and urban ecological landscape. Now, many metropolis of the world have faced rapid population growth and destruction of urban ecological systems. Most of ancient cities in Iran have many historic gardens and villas that organized ecological networks with connections between natural elements and resources inside and outside the cities. Tehran is situated on the northern fringe of the great central plateau and at the foot of the southern slope of the impressive mountain chain of Alborz. New urban development lead to urban ecological landscape destruction with changing land use and has caused major environmental problems. Based on this research and considering the historical formation background of the city of Tehran, it is concluded that in the past the city was formed according to the natural structure, but in recent decades as a result, the comprehensive and detailed plans carried out in Tehran which neglect the environmental structures and landscape ecology and also the valuable historic gardens, we are confronted with the disturbed situation of the city, Environmental pollutions, fragmentation in the landscape ecology, disorder in the city structure and land use, etc. This study reviews the issue that whether we can reach strategies for Ecological Landscape planning and design of the Tehran landscape only with conservation and continuing ecological structures of landscape and their survival in City, taking ecological structures` degradation, historical documents related to landscape of Tehran and its changes during the time into consideration and also according to current research. And there is no other way left for the planning and design of the city's landscape rather than through ecological and historical revision of the city.

Keywords: Urban Ecological Landscape, Human Communities, Iranian Culture, Historic Gardens, Tehran.

I. INTRODUCTION

Urban designers believe that urban landscape comprises the visible features of an area including its physical elements, living elements and human elements such as human activity and the built up environment. In this terminology, urban design brings together the many aspects of creating a success place such as environmental enhancement, social interaction, economic viability, transport movement, landscape and identity.

The city and its problems are the product of considerable diversity of socio-spatial processes, elements, variable problems, and several adaptive forces associated with politics, economics, technology, culture, climate, etc. Also, there are many factors playing a role in each of these processes and forces, which make the modern city more complex and its landscape problems multi-factorial. These factors "operate at all scales in all settlements and throughout the history" and their inter link has greater complex dimensions [8, 9].

In urban planning and design, the rise of the science of complexity has engendered a shift between the old view that sees cities as simple, ordered, structured, expressible by smooth lines and shapes towards a view that cities are complex organisms (as an ecosystems), evolving from the bottom up according to their local rules and conditions, which manifest greater order across many scales and times [16]. Ecologists have two broad approaches toward ecology and urban landscape: Ecology of the city and ecology in the city.

Ecologists have two comprehensive approaches toward ecology and townscape: Ecology of the city and ecology in the city. Ecology in the city focuses on the physical environment, soils, plants and vegetation, and animals and wildlife for understanding urban ecosystems. The ecology of the entire city as a system is represented by research relating species richness to the characteristics of cities [22]. As environmental problems emerged in the cities and their importance in planning and urban landscape designing increased, a new concept "Urban Landscape Ecology" was presented which added a new headline to approaches toward urban landscapes. Urban landscape ecology focuses on structures, functions and transformations of the environment, attempting to find patterns and interrelations between urban ecological

landscape elements, such as patches, corridors and the matrix [3]. If we track the ideological roots of the new landscape ecology in the formation and development of the modern cities, and search for its intellectual foundation in the history of ancient lands and settlements, we are often led to developed historical cities or abandoned ancient settlements, where this new ideology has had historical roots in their formation, growth, or even expansion and development.

Since time immemorial, human communities have selected their residing places and designed their cities by paying attention to natural environmental conditions like climate, landform, landscape and natural resources. When the urban design pattern of human communities has been complied with the regional characteristics, and the formation and development of cities, it has always been accorded with changes of topography, climate, and other natural characteristics. The profound influence of technology and industry has brought lots of changes in population, culture, attitude, urban landscape and urban design. In the recent years, ecologists have typically ignored anthropogenic processes in their study of ecological systems References [22, 23].

However, it has become clear that such processes can no longer be ignored, as there are no areas left in this world that are completely untouched by human influence. Urban growth affects ecological habitats when urban areas expand into the surrounding natural areas, diminishing them in size or resulting in habitat fragmentation, as well as generating damaging effects through such sources as pollution and human use [13]. The study of urban systems must be considered integral to the study of landscapes, and urban processes must be studied in order to understand their influences and predict their impact on surrounding ecosystems [10, 16].

Another dimension of contemporary ecological science that bears on the ecological landscaping perspective is the objective of integrating humans and socio-cultural variables into the study of environmental patterns and processes Reference [15], a goal exemplified by the field of urban ecology [20, 21, 22]. Results of urban ecology studies indicate complex and sometimes surprising relationships between socio-cultural and environmental variables within urbanized ecosystems [20]. Now, many metropolis of the world have faced rapid population growth and destruction of natural landscapes inside as well as outside the cities. In most of the developed cities, urban landscapes are destroyed and there is no harmony and coherence between natural structures of urban landscapes and the new built forms. This has made the cities inappropriate places for human settlements. Considering these conditions, urban ecological landscape design can be a better solution for metropolis problems [1].

The focal point in sustainable development of Urban Landscapes is the active structuring of the urban landscape. A major role is played by open spaces or urban open spaces, especially considering that there is increasing mutual inter-penetration of built-up areas and open spaces, creating urban landscapes in which a clear

division between built-up and open space becomes obsolete. For example, household income, advertising, environmental ethics, and aesthetic values, among other factors, have been found to influence urban ecological patterns, especially of plant communities, more than traditional physical-ecological variables because these socio-cultural variables drive human landscaping choices and activities dictate vegetation patterns [7, 11, 14, 24].

Now we realize that what we see today in towns is produced by flows and processes of yesterday. Urban ecological systems can link terrestrial ecological, physical, and socioeconomic components of metropolitan areas in an ecological approach to landscape planning in urban environment [21, 25, 26]. Then, the experiences and theories demonstrate that ecological patches and corridors play a crucial role in the sustainability of urban environments and their transformations directly influence the ecological functions of the city. The underlying premise of urban ecology is that the explicit composition and spatial form of an urban landscape mosaic consisting of interdependent ecosystems affects ecological processes in ways that would be different if the mosaic composition or arrangement were different [6, 12, 27].

II. TEHRAN ECOLOGICAL LANDSCAPE

City of Tehran, the capital of Iran, which has been studied through this research, is currently the largest city in Iran and has experienced a fast growth especially in the past three decades. It has more than 12 million inhabitants and despite all the efforts by the responsible organizations to improve its environmental condition, it is contaminated with various environmental pollutants, and its ecological structure has experienced numerous destructions. The development of parks and public green space has not been able to restore its ecological network which has been fragmented as a result of unplanned and uncontrolled growth (Figure 1).

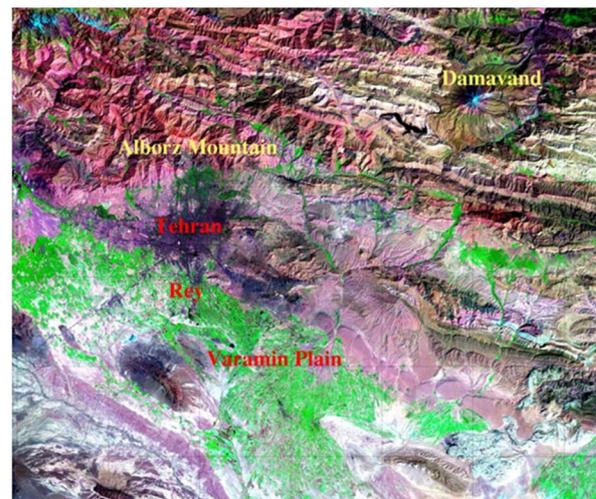


Figure 1. Ecological landscape of Tehran in the south of Alborz Mountain and in the north of ancient Ray

The *Qajar* dynasty, who ruled over Iran until 1925, chose *Tehran* as their capital. After reviewing Old *Tehran* maps in the era of the *Qajar* dynasty, we can identify

numerous gardens within the enclosure, outside it, along river- valleys, and the *Alborz* mountainside. In this era, in parallel with establishment of garden-villas in the mountainside area, intra-town development tends towards development along river-valleys outside the town and mountain wards. In *Tehran*, river-valleys are correlative ecological systems which connect the three general ecosystems of mountain (the *Alborz*), the mountainside (southern mountainsides of the *Alborz*), and the plain (the center of the city at the time of the *Qajar* dynasty) [5].

At the time of the *Qajar* dynasty, in the inferior ecosystem in the plain area, specific morphological characteristics, flat background, consistent irrigation facilities, and farmable lands all have helped pave the ground for the formation of the original nucleus of Ancient *Tehran* (Figure 2).

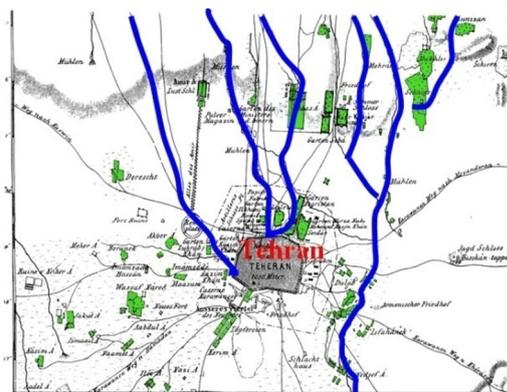


Figure 2. Tehran and river valleys in the Qajar period [5]

The tributaries of *Jajrood* River have dug out small and large valleys in the southern mountainside of the *Alborz*, along which and in the mountainside ecosystem *Tehran* river-valleys (*Dar-abad*, *Jamshidiyeh*, *Darband*, *Darakeh*, *Kan*) have originated. In addition to providing water, the river-valleys also play the role of vestibules to connect the three ecosystems of mountain, mountainside, and plain [5]. At the time of the *Qajar* dynasty in the early 19th century, the original nucleus of *Tehran*, which was located in the plain, was connected to the countryside and mountainside villages through paths. The city and its development were in this area surrounded by the walls.

In the mountainside area, due to a coexistent series of parameters such as water, climate, morphology of the earth, and vegetation, proper conditions have been provided so that villages, farms, and country garden-villas can appear. Furthermore, in this area, owing to green valleys, running waters, cool draught in the summer, and the importance of tourism in the *Qajar* era, constructing garden-villas was as customary among opulent strata of the society and foreign ambassadors to Iran as it was among the rulers. In view of this, in parallel with the increase in constructing garden-villas in the mountainside area, green vestibules have gradually begun to form, which have always played a key role in providing environmental values and services of the city to date. In the early years of the first half the 19th century, this coincides with the *Qajar* ruling over Iran, browsing old Along with the establishment of garden-villas in the

mountainside area, paths which connected this area to the city were developed and at the same time urban areas came into being sparsely along these paths. In this period of time, while gardens inside the city were being converted into public buildings, garden-villas outside the enclosure played a great role as indicators in developing the city mountain ward [14].

Tehran maps, one can detect numerous gardens inside and outside the enclosure, along the river-valleys and in the *Alborz* mountainsides (*Touchal*). During the late *Qajar* era and early years of the *Pahlavi*, anatomical development of *Tehran* was amalgamated with the garden to be so effective in forming urban places that studying *Tehran* in different eras without regard to gardens would be almost impossible. In the era of *Pahlavi I*, i.e. the early 20th century, these green vestibules would orient the axes of future ordering and development of the city. From this era on, urban development mountain wards have increased while disregarding gardens and green vestibules, and at present, with perishing of these valuable natural structures, numerous problems have arisen.

In *Qajar* era, drawing heavily upon the traditional methods of garden constructing brought about outstanding changes in the arrangement of the plants around the whole structure and also in the stance of the structure in proportion to the axis of the garden. However, in *Pahlavi* eras, in addition to these changes, the space of the garden was separated into different parts just to meet the newly arisen needs of the royal family. In *Qajar* and *Pahlavi* eras, all the elements of the garden, in contradiction to one another, would symbolize the garden as a central factor in developing the city toward the mountainside; and water resources in the mountainside, channeling them to irrigate the garden, channeling water along the city axes, providing shade in the streets, creating living and social centers around these axes signify this important point. Also, the garden, playing a physical role, linked the mountainside and the city, and consequently, a visual relationship was established between the city landscape and the garden indeed enriched the Bio-Aesthetic of *Tehran*.

By the way, during the reign of *Pahlavi II* in 1960 year, in line with the development of *Tehran* and population increase, public parks were built after the fashion of Western parks. From these eras on, parks replaced old gardens in *Tehran* and the Iranian garden constructing sank into oblivion. After Islamic revolution, the remnant natural and manmade ecological patches (ancient gardens, modern parks, open spaces, hills, and boundary forests) are under constant pressure of urban development due to scarcity of land in the increasingly heavily built-up metropolitan area in Figure 3 [28]. Some of them most important ecological patches such as large remnant natural patches in the north (ancient gardens, river valleys and etc.), large patches of built urban forests in the east and west and the natural corridors of the seven north-south river valleys and their hydrological flows which have been already fragmented by transportation corridors or disturbed by urban development and other changes in land use in Figures 4 and 5 [3].

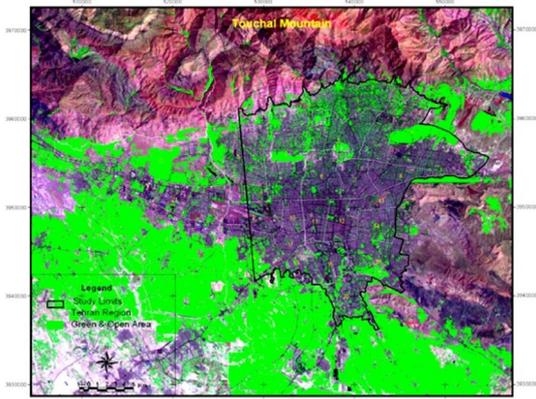


Figure 3. Remnants of green spaces in modern Tehran and sub urban [28]



Figure 4. Destruction of the hills for new development



Figure 5. Destruction of the ancient gardens along river valleys toward

III. CONSERVATION FROM URBAN LANDSCAPE IDENTITY

In according to discussion, Urban Landscape Identity is mainly determined by its natural process, historical and cultural process as well as its social economic activities. Eventually it reflects the structural and morphological characteristics of the city's landscape, and thus it is characteristic of visual scene, habitat and cultural symbols of the city. It is the object to visual aesthetics, the basis of orientation, and the identification of its residents. It is also the carrier of the ecological process and the social economic process telling the historical stories of the city. Therefore, Urban Landscape Identity should be not only visually "beautiful", but also "healthy" and "meaningful".

It follows that the combination of urban landscape identity and the ecological landscape planning and design is an optimal way. Ecological network is the key spatial pattern to keep land and life safe and healthy and to maintain the historical and cultural features. It is the basic security for the city and citizens to obtain durative natural service (ecological service), as well as the rigid frame for urban and land development. Furthermore, the revitalization of urban Brownfield sites and conversion to multi-functional patterns of land-use especially open green spaces and public or private gardens are very important.

For analyzing the historical open spaces structure and ecological urban landscape pattern that can be used in sustainable urban landscape redesign, these kinds of issues can be addressed by studying and identifying the borders of developing cities in several times periods, buffer zones of historic areas, the structural pattern and arrangement of the ancient and new houses, intra and extra city road networks, constructions related to royal areas as well as other parts, open spaces, hills and river valleys, ancient gardens, green roads, parks, etc. and by studying the ways cities have been developed that reveals complete data.

Hence, the concept of New Urban Landscapes planning and Design is proposed to be considered under research on common understanding of current development trends and challenges in the urban regions and landscape ecology. Spatially balanced development perspectives need to be established which can tackle the negative impacts of globalization and achieve a more socially compatible development of new urban landscapes.



Figure 6. Developing city towards west and north from 20 years ago, output of increasing population, now municipality try to interconnect between green patches by green corridors

IV. CONCLUSIONS

Based on this research and considering the historical formation background of the city of Tehran, it is concluded that in the past, the city was formed according to the natural structure features, and the developmental plan and the design of the urban landscape has also been conducted with regard to the ecological structure of the city. In recent decades as a result of population growth and the comprehensive and detailed plans carried out in

Tehran which neglect the environmental structures and landscape ecology and also the valuable historical features of the city such as gardens and green axes, we are confronted with the disturbed situation of the city, Environmental pollutions, fragmentation in the landscape ecology, disorder in the city structure and land use, etc. and there is no other way left for the planning and design of the city's landscape rather than through ecological and historical revision of the city (Figure 6).

Urban landscape planning and design is a multifaceted undertaking that engages the landscape at many scales. It requires an understanding of numerous areas of knowledge and an extensive range of professional skills [18]. The common theme of urban landscape planning and design along with other design is people. In the vast majority of situations, urban landscape design for people of the habitat with specific needs that does not harm the environment, can be accommodated through proper design. For a successful urban landscape design, it is required to make an attempt to suit appropriately the site and context that make urban functions safely, along with urban structure that looks attractive, and fulfills the needs of the people for whom it is designed at the present and future context [19].

As previous paradigms of landscape are in crisis, approaches toward urban landscape and its planning and designing have crucial changes. According to previous paradigms, ecologists defined urban landscape as entangled structure of patches, corridors and matrix. However, some insist on this definition currently. Maybe these issues are important in ecological principles but the modern approach of "Integrated Framework Method" explicitly exempts one-way approach toward urban landscape and provides planners and designers with wider concepts in urban landscape. According to Integrated Framework, urban landscape is an interaction among natural environments, physical structure and human beings. Since landscape is defined as interrelation- action among biotic structure, abiotic structure and socio structure, it is necessary to take landscape comprehensively into consideration and its planning and designing interdisciplinary. By reviewing past research articles on urban ecologic landscape in Tehran, as their results are presented following, dominance of one-way approaches toward urban landscape is obvious. If we believe the urban ecological systems can link terrestrial ecological, physical, and socioeconomic components of metropolitan areas in an ecological approach to landscape planning in urban environment [21, 26].

Emphasizing on effects of biologic quality of Tehran city and its connection with landscape structure, Yavari et al. believe that urban environmental quality and the landscape structure of Tehran metropolitan area and utilizing natural river valley corridors for ecological restoration of urban environment in landscape scale and other ecological features were studied to improve the ecological structure and consequently mitigating some of the environmental constraints the city encounters in an increasing rate. On this basis, Aminzadeh et al. have affirmed remnants of natural structures in Tehran City

ecological landscape especially parks, gardens, green corridors and rivers and have stated that research of Yavari et al. resulted:

The main objectives of network ecological design in Tehran must be doing by: 1) To apply landscape ecology approach as could be interpreted in urban ecological planning, 2) To determine the current situation and analyze the natural and built elements of the ecological systems of Tehran which faces numerous environmental problems and pollutions due to its rapid growth, 3) To apply strategies for structural and functional improvement of natural and built urban ecological systems of the case under study, and 4) To propose a model for application of ecology in landscape scale [2]. On the other hand, Aminzadeh et al. suppose protecting the integrity between structural elements, preserving the original pattern of ecological systems, will help to establish and enhance the ecological processes and flows in the urban and suburban environment [2].

With emphasis on the built and natural ecological features of Tehran, they have suggested measures for improving Tehran ecological systems planning and design; namely: Restoring the natural form and structure of the river valleys, Cultivating vegetation and penetration of the natural and built ecological patches and corridors into the urban fabric, Improving rules and regulations against the alterations of ecologically important features for preservation purposes and so on which all show the importance of ecological systems in urban ecologic landscape of Tehran [2]. Such emphasis shows their ecologic approach in urban landscape planning and designing; whilst executing such suggestions in Tehran with complicated landscape and multilayer urban structure seems almost impossible. Besides, when such strategies are offered, it is substantial to determine their scale and how they will tackle intervenes with other characteristics and hindrances in order to implement them and also lead researchers from general ideas to existing facts.

If we handle urban landscape structure only with ecological approaches, we will never succeed in determining realistic strategies. Urban landscape planning and designing never means returning to previous landscape structures. Although identification of ecologic structures of a patch or corridor etc. and their changes in course of time are part of data layers, examining such issues according to modern paradigm denies landscape comprehensiveness in various scales.

In modern approach, interdisciplinary experts of all fields that are related somehow to 3 general landscape structures, i.e. biotic structure, abiotic structure and socio structure attempt to gain an intelligent system by completing other models which is capable of explaining elements of structure, their interactions and their alteration during time. Also, these explanations are assigned to coordinated scales pertinent to landscape and finally integrative and comprehensive strategies are presented for urban ecological landscape planning and designing.

Contemporary structures of the cities illustrate the complicated interactions between human living systems, natural and man-made environments. Due to taking traditional approaches into account in most of the urban development projects, there is no balance between urban networks and natural patterns; hence these networks are gradually coming over ecological networks of the cities. These projects lead to fragmentation and degradation of ecological structure of the urban landscape. Consequently, urban landscape ecology planning and design is the initial step toward achieving urban landscape sustainability. To cover all these issues, vast scope of knowledge and approaches should be taken into consideration. This paper investigates the extent of these studies and through examining the dominant approaches in current paradigm of ecological landscape of the cities and their variations, the necessity of obtaining an integrated, comprehensive and goal-oriented approach has been proved. The study reveals that integrating the model of ecologic and man-made processes through spatial scale i.e. land and temporal scale i.e. dynamism of the landscape will form the fundamentals a new methods in landscape's planning and designing according to new model, that could be more appropriate in comparison to other methods of preparing cities development plans.

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