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The Environmental Awareness Park "Antonis Tritsis" in Athens: redesigning its role and form

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Abstract

The importance of green spaces and their benefits for large urban centers is well recognized. In the basin of Athens in Greece, a built-up urban environment, the lack of environmental planning has resulted the lack of green spaces, which when present, have been introduced as an element foreign to the whole of the city, without planning or sustainable design. This paper focuses on the Environmental Awareness Park “Antonis Tritsis” in Athens, a large park (1.150 acres) that constitutes an oasis against the degraded local environment. Six artificial lakes comprise the dominant element in the Park’s landscape highlighting the rare in Attica, liquid component of freshwater that attracts different types of birds, while offering one of unique beauty, recreation and walking area within the city walls. The objective of the study is to create redevelopment proposals for this special-purpose Park, targeting both the utilization of the existing structures as well as its redesigning, introducing: a) the use of renewable energy in order to contribute to energy independence and reduce pollutant emissions, b) the operation of systems of biological water cleaning to avoid water wasting and reduce the possibility of groundwater pollution by the urban wastewater, and c) the design, that must be done with bioclimatic criteria, taking into account the solar thermal proceeds of open spaces, the main criterion for the users’ thermal comfort. Besides the Park’s image and uses, the proposed interventions can also improve its vital role in environmental education of the citizens, especially young children, and can be a model for sustainable organization for other urban spaces.

Keywords: urban parks, sustainable green spaces, environmental awareness.

1. INTRODUCTION

Contemporary urban environment constitutes a violent city imposition against the countryside. The city devours the countryside that is the natural scene of the planet, which is shrinking, polluted and conquered by the extensive urban activities [1]. In large urban centers, the quality of life is degraded in direct correlation with the limited areas of open green spaces, the lack of sustainable design and the lack of contact with the natural environment. Green spaces are recognized as a dominant and vital element for the conservation of the natural environment in the cities. Their proper management and sustainability are considered essential for the quality of life in urban centers.

During the industrial revolution, the observed augmented manpower influx to the cities, violently converted them to large urban centers; usually without plan or control on urban development spreading. This practice seems to be revised over the recent decades, since the necessity of green spaces for proper city functioning, and local microclimate improvement, is evident in addition to the residents’ health status improvement and psychological uplift. Based on international experience, the newly introduced interdisciplinary discussion, aims at improving the urban environment.

1.1. Goals of the Study

The objective of this study is to create redevelopment proposals for the Environmental Awareness Park “Antonis Tritsis” in Athens, targeting both the improvement of its educational role, but also its redesigning, in order to be a metropolitan park, introducing a design that must be conducted on the basis of bioclimatic criteria, taking into account the solar thermal profits of open spaces, but also the use of renewable energy in order to contribute to energy independence and reduce pollutant emissions. These interventions can comprise a model for sustainable design of other urban spaces.

2. THE URBAN WEB AND OPEN GREEN SPACES

Approximately 80% of the EU population lives in cities and towns and 20% of those reside in large urban centers with population exceeding 250.000; these figures are constantly increasing.

Public open spaces in cities are areas open to the elements of natural environment, such as sun, wind and water. They allow nature existence and function within urban environment. In that sense, they have regulatory role on microclimate and quality of life in cities [2]. They are also social spaces, extensively contributing to city social life enhancement, as they comprise sites for social activities or rest [3].

Urban green spaces are city sustainability indicators. If cities don't have open green spaces, they cannot function properly, since they cannot provide conditions required for normal inhabitant living; therefore, they are useless and the residents are either trying to escape or are doomed to live a tormented and degraded life [4]. The contribution of green spaces for city residents, was well-recognized by the Rio Earth Summit in 1992.

Their presence gives rise to significant ecological and social benefits, such as: a) improvement of the quality of air; trees produce oxygen and filter gaseous pollutants such as carbon monoxide, sulphur dioxide and nitrogen dioxide, b) their contribution to reduce the temperature, which is important for Mediterranean cities, especially during the summer months, c) absorption of the noise of the city; they are the best natural sound barriers, d) they are the last refuges of biodiversity in urban centers, e) reducing of the risk of flooding by absorbing rainwater, while enriching the aquifer, f) they upgrade the neighbourhoods and the social relations in cities, and g) they are places for concentration for the residents, in emergencies, such as earthquakes and fires. Also, considerable economic benefits arise through the presence of green spaces, in terms of energy savings. Upgrading of open spaces implies upgrading of urban environment, by enhancing the beauty of an area [5].

Unfortunately, the location, organization, interconnection, function and supervision of open spaces, are issues usually managed after city development. The design, in most cases, constitutes a corrective action that can hardly cope with their complex problems [6]. They, thus, usually end up degraded, although open space, especially green space benefits for cities and its inhabitants, are invaluable and complex [7].

3. THE GREEK REALITY

After the war, in Greece, the central government was responsible for the urban planning, instead of the local authorities [8]. In the first decades after the 2nd WW, the primary goal of townsmen was to build every available property. Thus, the open spaces within and around cities, as well as the most fertile agricultural lands or forests were considered as a reserve for future reconstruction [9]. This practice led to lack of green spaces, which coupled with the rise in living standards and the increased urban environmental pollution, contributes to degraded quality of life within cities.

In contemporary Greek reality, cities have been developed apparently detached from the natural environment, with subsequent unsociable and unsustainable urban environment. Hence, urban open spaces are neglected and degraded; city environment reflects compression, deterioration, abandonment, feeble construction and isolated, scarce open public spaces [4].

4. THE IMPORTANCE OF URBAN PARKS & THEIR INTEGRATION IN THE URBAN WEB

As Frederick Law Olmsted said, the more aesthetically pleasant a city is the more people will want to live in it and be happier.

It could be said that the concept of creating an urban park is based on the need of the residents to upgrade their quality of life. Urban open spaces and natural green spaces may exist, but without any meaning for the city, if they are not accessible to everyday uses, and remain isolated, having no environmental impact.

Their connection within a green network could prove a positive measure for urban environment improvement [10]. Their integration into the urban web depends on space organization and on compatibility with certain environmental, social and cultural factors. The main characteristics that ensure their preservation and evolution are their role, position and connections to the city's web and environment. Parks and open green spaces are crucial components of urban regeneration [11]. According to K. Lynch (1960), man perceives the city through the paths of movement.

5. DESCRIPTION OF THE STUDY AREA

The Environmental Awareness Park “Antonis Tritsis” is located within the administrative boundaries of the Municipality of Ilion in Athens (Figure 1). The park is about 10 km far from the sea, at an altitude ranging from 80 to 124 meters and terrain slope of 3% to 25%. The study area is located on the west of the Athens basin and belongs to the drainage basin of the river Kifissos. On the west/north west it is surrounded by the Mount Egaleo and on the north by the Mount Parnitha. Based on the latitude of 38° N, Athens is characterized by hot and dry summers and mild winters.

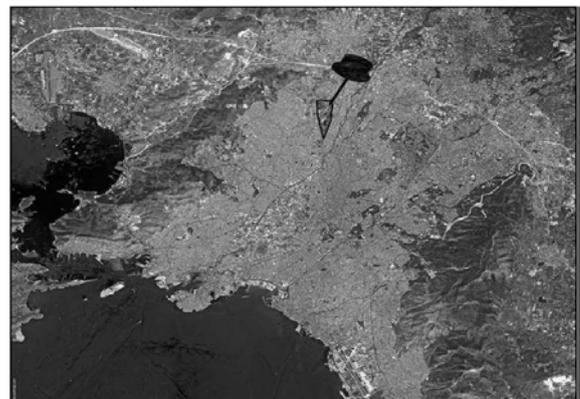


Figure 1: Satellite image of Athens' basin & Park's position in it (source: www.imagekind.com)

The deforestation of Mounts Egaleo and Poikilo, the lack of significant green spaces in the study area, except for the Park, the densely built environment and the increased air pollution, contribute significantly to the encumbered of bioclimatic conditions in the study area. Significant to the burden of bioclimatic conditions is the urban heat island effect that is influenced not only by the terrain characteristics and the presence of buildings, but also by solar radiation, temperature, direction and intensity of the wind and humidity. It is worth mentioning that nearby mountains, despite not being densely vegetated, and the Park presence, do aid in keeping the temperature at normal levels and reducing the incidence of extreme weather conditions, especially during the summer months.

6. THE ENVIRONMENTAL AWARENESS PARK “ANTONIS TRITSIS”

6.1. The history of the Park

In 1838 the British John Wilians and George Miles purchased a land area in Liosia, as it was then called that area, in order to create an innovative farm. They brought gardeners from Malta and with

assistance from local farmers they planted vineyards, fruit gardens and formed ornamental gardens. Unfortunately, their investment plans were fruitless and they wanted to sell their land.

In 1848 Queen Amalia becomes fascinated by the site and urges King Otto to purchase the land in order to create an innovative agricultural center. By the year 1861, a unique estate of 2.500 acres is created, including 2.200 flat acres and 300 hilly. Amalia who was very romantic and she was influenced by the spirit of the Great Idea of that era, called this region Eptalofos (Seven Hills), inspired by the name of Istanbul. Indeed, the area was surrounded by six hills and they added one more, artificially. It was in general a productive farm, with a dense road network. When King Otto was expelled from Greece, the center has begun to desolate and several projects are left unfinished. Then, it passed into the hands of the government and was abandoned for a long time.

In 1987 the Minister of Environment Antonis Tritsis shows genuine interest and decides, for the first time, to draft a study for the “Queen’s Tower Area”. In 1992, the area was conveyed to the Organization of Master Plan and Environmental Protection of Athens and they begun rescue efforts, in order to create a metropolitan park. The main configuration projects encompassed the creation of six artificial lakes, formation of walking networks, enhancement of the green areas, highlighting of the historical royal buildings and development of recreational areas. The work was completed in 1996 and the area was named Environmental Awareness Park “Antonis Tritsis” in honour of the politician who rescued the site from abandonment. The original ambition was to create a model of environmental education, but nowadays the only relevant programs that take place there, are those of the Ornithological Society and the Greek Scouts.

6.2. Presentation of the Park

The Park has a total area of 1.150 ha (Figure 2) (notice that Hyde Park in London has an area of 1.420 ha, while the National Park, in the center of Athens, only 158 ha). It constitutes a supralocal green area and one of the most important green areas with significant flora and fauna, within the built urban environment of western Athens. Inactive buildings are present within the Park.



Figure 2: The Park (source: Google earth)

There are six idyllic lakes that overflow each other, in addition to the network of canals (Figure 3), which are surrounded by reeds, agricultural crops, fruit trees, deciduous trees, coniferous and shrubs. These were created in a place where older ponds existed and were soon colonized by aquatic plants and amphibians. Today, the main water supply comes from wells and surface runoff [12]. Due to the diversity in vegetation, many birds are present, many of which are rare in the urban environment.

The existing planting of the Park mainly consists of groves and rows of trees (Figure 4). The dominant species of the trees are Pines, Cypress, Eucalyptus and Olive trees. The planting method helps to define spaces, following axes that define the motion, and thus directing the way to move. They designate the space limits, according to their density, size and permeability. In the Park we can also find extensive sections with perennial tree crops. Olives, vineyards, pistachios, figs still remind the visitor of the Centre for Agriculture and Livestock from the 19th century.

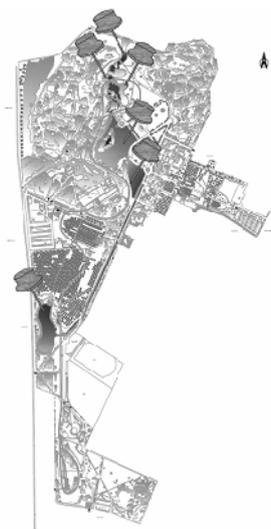


Figure 3: The lakes
(source: Authors)

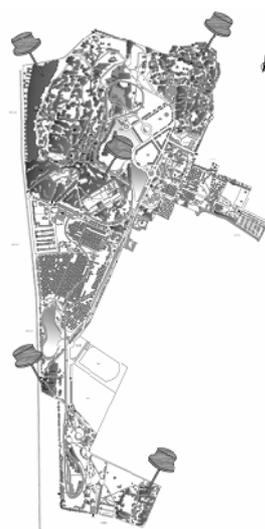


Figure 4: The forest
and the tree crops
(source: Authors)

The Park includes many facilities that are used for various purposes, such as the Municipal Gym and Sports Center, the Guidance & Information Center of the Ornithological Society of Greece, the Reptile Centre, Schools and Student residence, Cafe & Tavern and two chapels. There are also open air theaters, an equestrian center, picnic areas, playgrounds and a thematic sculpture trail, where young foreign artists created sculptures, with trunks of burned trees from Mount Parnitha. Almost all of these facilities and activities Park are located at the center and towards the north of the Park. In addition, there is a rail track running within the Park. These tracks were placed in order to serve the traffic inside the Park, but they have been abandoned and are now useless.

6.3. Evaluation of Uses, Infrastructure, used Materials and Planting of the Park

In order to make redevelopment proposals for the Park, it is necessary to evaluate the existing infrastructure, the present useful sources in the Park, the used materials and its planting.

Table 1: Evaluation of the Uses, the Infrastructure, the used Materials and the Planting of the Park

CATEGORY	POSITIVE	NEGATIVE
USES	The actions of urban agriculture	Absence of an alternative energy park
		Absence of botanical garden
	Exhibitions exposed in selected areas of the Park	Unexploited spaces (at the south)
		Poor trading (insufficient income for the Park)
INFR/RE & NETWORKS	Existence of a water recycling network for the lakes	Untapped installation of the rail track
	Existence of a firefighting network	Inaccessibility from the main entrances
MATERIALS	Gazebos, benches, pergolas made of wood: small environmental consumption, small ecological footprint	Sub function of the Park's drilling and wells
		The joining of pavements are with cement, that does not allow the unobstructed water runoff
	Playground equipment: good reflectivity, water permeability, reduced blur	High reflectivity of asphalt in the parking areas
		Difficulty in moving people with disabilities on the roads with gravel
Positive effect of the greenery in the good bioclimatic function of the existing buildings	Inadequate maintenance of wooden bridges	
PLANTING	Preservation of the old trees from Amalia's estate	Lighting columns: energy consumptive, obsolete, poor maintenance
	Biological control of diseases on fruit trees	
	Creation of natural habitat in the lake areas for bird populations	Extended existence of Pines (Pinus halepensis) in the woods (disease concerns in Attica)
		The ornamental planting is incomplete

6.4. Redevelopment proposals

In a sustainable city, the human intervention on the landscape should encourage the wise and rational management and exploitation of natural resources.

The following proposals don't intend to present some standard solutions for the renovation of the Park and clearly don't aim to cancel any configuration and operation of it. The target is to present some ideas that will provide food for thought about the future of this Park. The basic idea for these proposals, is that the Park, due to its location and size, should not be treated as a large open green space, but as a metropolitan city park with special uses and special purpose; meaning the awareness of the citizens on environmental issues, while providing relaxation. It is important to emphasize that any existing uses or proposed uses should deal with the Park as a continuous unity of space. The strategic plan that has been selected has four key axes: the environmental, the educational, the cultural and athletic approach, and its economic viability coupled with administrative autonomy.

6.5. The environmental approach

By this term we mean that we have to define the guidelines for the improvement of the environment in the Park.

At first we need to define the kind of planting that could improve its look and functionality. The planting in it should be mostly dense, in terms of the woods. It should meet as much as possible the local climatic conditions and contribute to the environmental and aesthetic enhancement of the area. The existing landscape should be preserved and enhanced with new plantings, so that the existing activities can be conducted in an environment with lots of greenery, which lacks in Athens basin. It should be enriched with low greenery by the appropriate formations.

The water component that is a key component of the Park is a significant factor of elegance that creates wetlands and irrigates the plantations. These formations must be kept and maintained properly so that "life-giving" water continues to contribute to Park's ecosystem.

For Park's environmental upgrading, it is also important to create: a) a park of alternative energy sources, like wind turbines, traditional windmills, solar panels; in that way, energy independence of the Park's facilities can be achieved, using environmentally friendly energy sources, b) towards this direction, the possibility of heating with biomass (from the rich forest biomass) is proposed, together with the use of geothermal energy, where feasible, c) the installation and function of a biological cleaning system for all the Park's sewages, d) the bioclimatic renovation of the existing buildings, to reduce energy consumption, e) the bioclimatic design of all its areas, with materials friendly to the environment (materials with low environmental consumption, small ecological footprint etc), f) the recycling of all materials (plastic, paper, glass, aluminium) and the composting of vegetable waste, g) the organised development of organic farming and the creation of a market for these products, h) the creation of urban agriculture sites, particularly for vulnerable groups.

6.6. The educational approach

The most important aspect of the Park is the education of the citizens on environmental issues. For this purpose, it is suggested: a) to create an Education Center for the Environment, suitable for all educational levels (it is further possible to create a Department of Landscape Architecture), b) to establish the Hellenic Ornithological Society permanently in the Park, so that the public can be informed and educated on issues of relative interest, c) to create a museum of "Queen's Tower", presenting the history of the area and exhibiting alternative technologies for the management of the environment and traditional methods of agro-processing, d) to establish permanent showrooms (outdoor or not) for the organization of exhibitions and conferences on environmental issues.

6.7. The cultural and athletic approach

The Park is a recreation pole for residents and visitors of Athens that could be reinforced, not necessarily only in the direction of increasing the numbers of the visitors, but also in the direction of providing further leisure options. So, we suggest to create: a) small playgrounds and play areas in many parts of the Park and not only in the central area, as today located, b) a thematic – environmental park that can motivate children on activities on environmental issues, c) a tool for the exploitation of the existing railroad tracks, possibly a cyclo-draisine that combines exercise and amusement for children and adults; the cyclo-draisine is a combination of a bicycle running on a railroad track (Figure 5),



Figure 5: Cyclo-draisine
(source: www.wikipedia.com)

d) facilities for rental boats for boating on the lakes. This facility is proposed to be created in the south lake, which is shallow, with small populations of birds and low risk for the ecosystem, e) outdoor dining areas in the south, where there is lack, including organized sites for outdoor events (weddings, christenings, etc), f) athletic facilities, by continuing their abandoned construction, such as open basketball courts, volleyball and tennis, 5x5 football courts, and there could be created cycle paths and skateboard tracks.

6.8. Economic viability and Administrative independence

The issue of the economic viability of the Park is vital. This objective should be achieved without affecting its character, which primarily infers environmental awareness. It could be disastrous, in the name of the economic viability, to create uses incompatible with its environmental identity, targeting the income increase, without taking into account the impact of those uses both for the Park itself and for the wider region. The danger in these situations is the prevalence of individual needs and interests over society and environment.

Therefore, economic income for the Park, which will contribute to its viability, can be derived from rents of catering, cyclo-draisine, boats, the events area, from the operation of the farmer's markets and the operation of the Education Center for the Environment.

Regarding to the management of the Park, the current merger of the former Management Body with the Metropolitan Organization for Restoration and Management for the Protected Areas of Attica, is negatively judged. That is because the creation of a general organization for the management of all the protected areas of the District of Attica, can potentially lead to a confusion of responsibilities. The previous experience indicates that a necessary condition for the viability of the Park is a clear administrative form. The local authorities can and must take the responsibility for the proper operation of the Park, as they are the only ones that have the required knowledge.

7. THE PROPOSED INTERVENTIONS

The renovation of an existing open space or the design of a new one is an opportunity to improve the comfort conditions in outdoor spaces. The possible solutions to the issues concerning these spaces are unlimited, depending on local topography, climate and aesthetics of the proposals. Regardless of the variety of solutions, there are specific issues that the designer must take into account to achieve the recommendation of an attractive and comfortable environment.

The first issue arising during the design process is the profile of the seasonal use of open spaces. Except for the acoustic comfort, which is not affected by the season, the optical and mostly the thermal comfort, require different approaches to achieve the creation of a pleasant environment.

7.1. The plants

Due to the significant contribution of the plants in the Park, we handle it as a special and highly meaningful material. Plants help the creation of the microclimate through the absorption of solar radiation, their low thermal capacity and conductivity, the reduction of air temperature through evaporation and transpiration, reduction of infrared radiation, retention of dust and air pollutants and provided noise protection. They also help to prevent the glare that is directly related to the radiation and the texture of the materials, while they reduce energy needs for summer cooling.

Plants are important for the solar architecture offering shade in the buildings and their surroundings in a way that their temperature is reduced. They are also capable to reduce the direct solar radiation and reflection in the buildings. Evergreen trees should be used on the north side of the buildings, where they can change the local flow of winds and protect the area from cold winds. The choice of deciduous trees allows us on the one hand to have shade in the summer and on the other hand, to keep winter sun penetration for heating the interior of a building or an area when the foliage falls. Therefore, according to the different daily and seasonal movement of the sun, the optimal placement of deciduous trees with wide foliage is indicated on the south and the west to allow for optimal shade in the summer and optimal insolation in the winter. In the Mediterranean climate and latitudes below 40°, the western orientation is ideal for planting evergreen trees, too.

Hence, the selected trees must have a height of no less than 2.50 meters, so that people walk unhindered under the foliage, maintaining direct visual contact with the surrounding environment. They should also be of different colour, texture and size, in order to avoid monotony.

In conclusion, we should note that vegetation as a surface of grass or as tree foliage, increases reflection of solar radiation, while the asphalt, concrete or other dark surfaces, reduce reflectance and increase absorption.

7.2. Thermal and visual comfort

During the summer period, in order to achieve comfort, it is necessary to control the temperature; the shade is the most decisive factor for this and a significant parameter for the visual comfort. For this reason a variety of types of vegetation can be used, particularly high deciduous trees. These, as mentioned above, should better be placed on the west side of the living room spaces, or the movement shafts, as they have the advantage of cooling the air.

Pergolas can provide shade for several hours during the day and they are useful for shading sitting areas, as is already the case in the Park. But they should be constructed in order to prevent the trapping of warm air beneath the surfaces. In this way, besides protecting against high temperatures, they contribute in the reduction of the glare caused by celestial concave, the facades of the buildings and the ground. Deciduous climbing plants can climb on pergolas, which will contribute both to summer shading and to winter sunlight penetration.

Finally, the surface of the materials is an important factor that affects the thermal and visual environment. Light colours and reflective materials can prevent overheating of surfaces, but can create glare and reflection of heat to the users and the buildings. On the other hand, dark surfaces may overheat when exposed to sunlight. The coating of the surfaces with vegetation not only helps to prevent the reflection, but also contributes on cooling the air through evapotranspiration.

7.3. Using the appropriate materials

The materials in a sustainable design, besides their properties playing a role in the visual and thermal comfort (as mentioned above), should fulfil the following conditions: have a large heat capacity, emit and absorb small amount of thermal radiation, have low reflectivity and the lowest possible amount of embodied energy, have slip resistant and anticorrosive properties, withstand the

local climatic conditions, come from recyclable sources and have minimal toxicity.

According to researches, the materials with better bioclimatic properties, selected for use in the Park, are wood, stones, gravel, soil, Eco-cement (a new product that is going to be produced through the FP7 European project) [13] and obviously plants. In the category of materials we include water, since the contribution of water to the formulation of the microclimate is important; it has low reflectivity in the sense that it absorbs a large part of the solar radiation, incident on the surfaces. It also has about two to three times greater heat capacity than the components of the urban web and it can be a stabilizing element for the temperature in the city.

8. REDESIGNING PARK SECTIONS

For the functional and environmental upgrading of the Park, many proposals regarding areas having designing or functional failures, can be mentioned such as the amelioration of the form and maintenance of the Park's entrances, the improvement of the paving materials so that people with disabilities can circulate unobstructed, the addition of facilities, almost completely absent from the Park, like restrooms for the disabled, etc.

In this section we concentrate in designing and operational interventions in two defective areas. These sites comprise the Parking Areas and the main Pedestrianized Pathway along the canal running through the Park from north to south. The target is not to design these spaces in detail, but to create a model that could be followed so as to improve these spaces.

8.1. The parking areas

Serious problems can be seen at most parking spaces, especially concerning the paving materials (asphalt) and the lack of shading, in the critical summer months (Figure 6). The asphalt, according to the herein, exacerbates the discomfort during the summer, because it works as a heater, raising the temperature of the surrounding buildings therefore is going to be replaced by ecological friendly materials as Eco cement (a special material that is produced by the FP7 European Project) [14] or granite cube stones (of different colour, in order to define the different use).



Figure 6: Existing state (source: Authors)

The key elements of the proposal include: the shading of the cars by using deciduous trees that provide shade in summer and insolation in the winter (such as Persian Silk Tree, Goldenrain tree etc), the creation of flower beds with ornamental planting for the amelioration of the site, and the replacement of asphalt, as mentioned above (Figure 7).

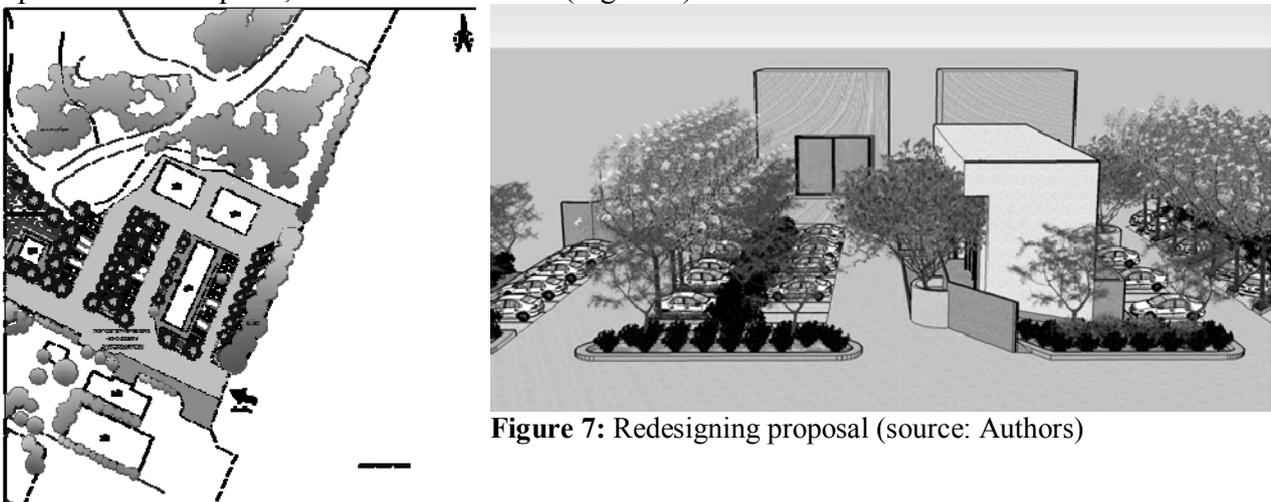


Figure 7: Redesigning proposal (source: Authors)

The proposed interventions improve the solar architecture, as demonstrated in the shadow simulation drawings, based on the current and proposed situation (Figures 8 & 9).

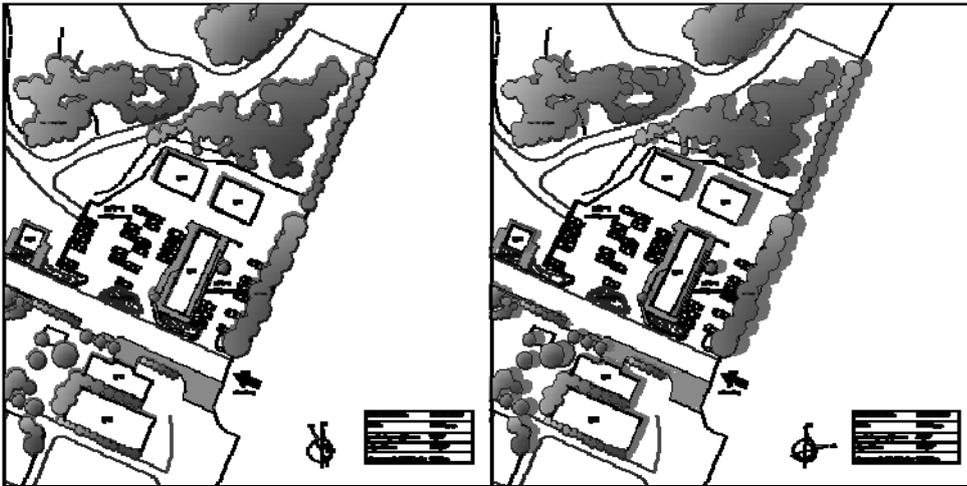


Figure 8: Simulation of shadows of the existing configuration on June, 21 (15.00 p.m.)

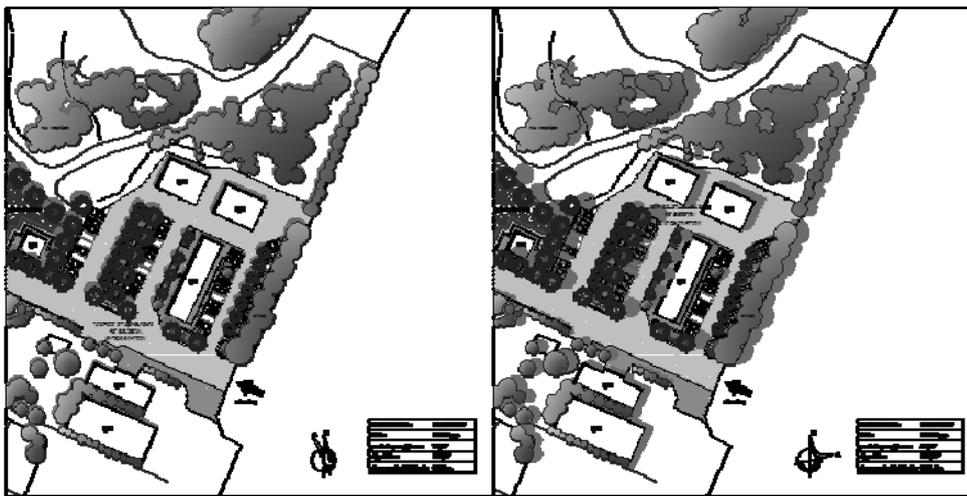


Figure 9: Simulation of shadows of the proposed configuration on June, 21 (15.00 p.m.)

8.2. The main pedestrianized pathway along the canal

The most significant issue occurring in this site is the complete lack of shadow, so that the pathway is completely hostile, especially during the summer. Another major problem is the absence of sitting areas along this pathway, forcing the walkers to cross a pedestrian zone of approximately 350meters length, without even one bench (Figure 10). The basic purpose of this walkway appears to be exclusively the connection of the south to the northern area of the Park!

Figure 10: The pathway along the canal
(source: Authors)



The switching of the type and arrangement of paving materials is considered also defective, in the sense that it makes it difficult to “understand” the route, while in the sections alternating paving panels with gravel, it hampers the movement for the disabled.

In light of the above observations, the redesigning proposal is based on three guidelines: the improvement of the solar architecture by adding rows of deciduous trees (e.g. Plane trees that can be harmonically combined with the element of water), the improvement of the aesthetics of the area by adding flower beds with ornamental planting, and the improvement of the established uses, by adding sitting areas and benches under the trees, and by creating a cycle route with specific marking at the eastern boundary of the walkway; this will start from the main entrance on the north-east and

end to the south entrance of the Park (Figure 11).

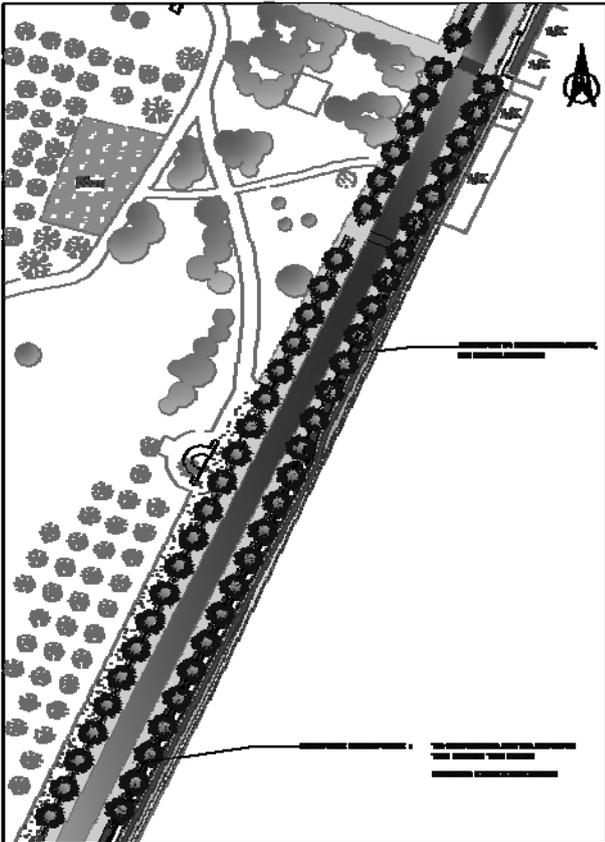
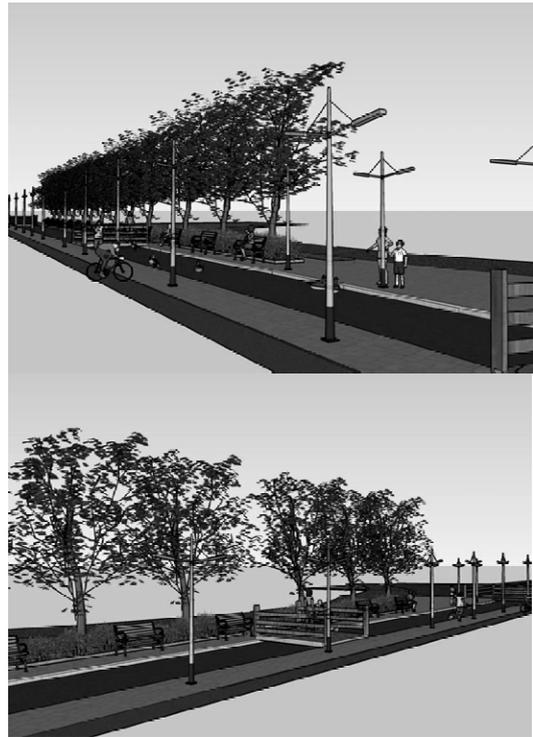


Figure 11: Redesigning proposal (source: Authors)



The proposed interventions improve the solar architecture, as shown in the shadow simulation drawings, based on the current and proposed situation (Figures 12 & 13).

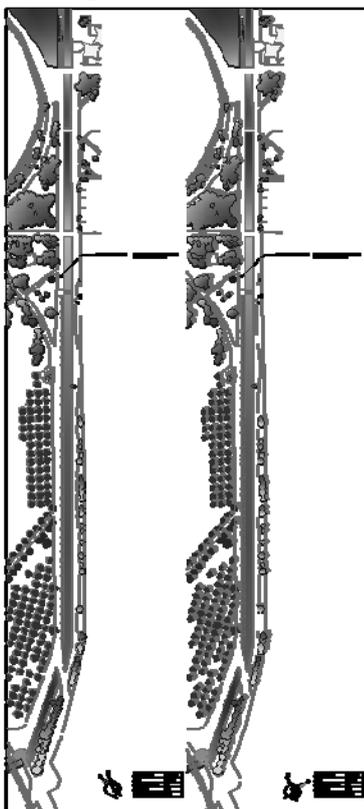


Figure 12: Simulation of shadows of the existing configuration on June, 21 (15.00 p.m.)

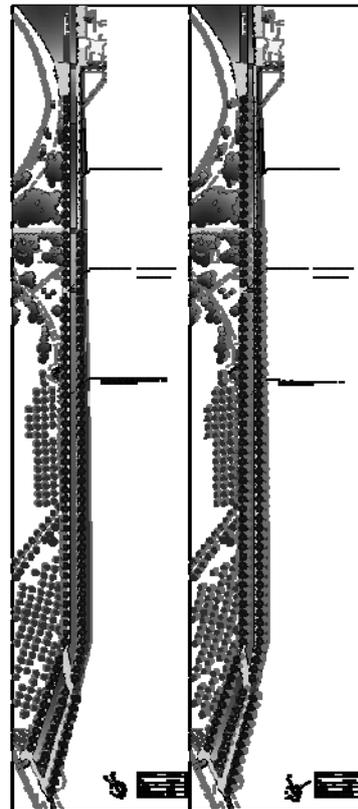


Figure 13: Simulation of shadows of the proposed configuration on June, 21 (15.00 p.m.)

8.3. The chosen vegetation

The most important consideration for the selection of the plants is the proportional use of evergreen and deciduous species, in order to provide the necessary understanding of seasons changing. So:

- On the pathways, we propose the use of deciduous trees such as the Mulberry trees (*Morus alba*, *Morus plataniifolia*), Plane trees (*Platanus* sp.), Pissard plum (*Prunus cerasifera* Pissardii), Catalpa trees (*Catalpa bignonioides*) and Jacaranda trees (*Jacaranda mimosifolia*). Most of these species already exist in the Park.
- In the northern and western side, where the dominant winds blow, the existing forest area is enriched with evergreen species in order to avoid the monotony of the existing Aleppo pine. These species are the Carob tree (*Ceratonia siliqua*), Peruvian Pepper (*Schinus molle*) or Holm Oak (*Quercus ilex*).
- In the existing beds that retain no vegetation, but also in the new ones, we propose compositions of endemic shrub, acclimatized in the Attic landscape and having small irrigation requirements, such as the Bay Laurel (*Laurus nobilis*), Oleander (*Nerium oleander*), Rosemary (*Rosmarinus officinalis*), Laurustinus viburnum (*Viburnum tinus*) etc.
- We suggest the targeted placement of lawn in the central areas of the Park, near the main square, both for operational purposes (avoiding dust from the existing soil, play soccer, etc.) and for aesthetics purposes. It is necessary to choose xeric varieties that allow for minimum consumption of water for irrigation.

8.4. The selected materials

The proposed materials are:

- Concerning the pedestrian areas, it is recommended to use granite cube stones, which is a porous material and the joints could be filled with sand. The basic selection factor for these materials is their water permeability. The coating materials should not “entrap” the underlying ground, because in this case there would be floods and the aquifer would not be enriched; moreover, its exclusive use in these central areas would indicate the main streams within the Park. At the main parking area is going to be used the Eco-cement (environmental friendly material), in order to mitigate the threats mentioned above (greenhouse gas emissions and waste management). This material, that is a new product produced through a European Project (FP7), will allow recovering valuable resources from industry, capturing carbon dioxide and transforming both products into ecological cement that can be use in construction or novel environmental applications. The main objective of Eco-cement is to develop novel bio-mimetic technology for enzyme-based microbial carbonate precipitation through the revalorization of industrial waste as raw materials, in order to produce eco-efficient environmental cement. The Bio-mimetic Technology will convert industrial waste, mainly cement waste and others by-products, into high strength, ecological cement using microbial carbonate precipitation via urea hydrolysis. The idea is based on the nature’s way of creating natural formations through bacterial contribution to carbonate precipitation: extensive sedimentary rock masses as limestone or marble and calcareous sandstone in marine, freshwater and terrestrial environments. Natural carbonation occurs by the reaction between atmospheric CO₂ and alkaline materials, which is called “weathering”. The difference of Eco-cement respect to nature principles is that the microbial carbonate precipitation reaction takes a relatively short period of time instead of millions of years. [13] The auxiliary paths, finally, could be paved with gravel, which is a material with small environmental consumption and allows for wetting of the underlying ground.
- The wooden pergolas on the sitting areas could be made of impregnated timber (low environmental consumption) and with a canopy from trellis where plants could climb. The benches and tables in the picnic area could also be of impregnated timber, like the present ones.
- At the playground the existing installations may be used. The safety floor could consist of recycled rubber. This kind of floor is porous, allowing for fast and complete drainage, in

order to avoid problems created by stagnant waters; it also allows for easy cleaning and maintenance. It is very effective in avoiding falls and risk of slipping. Moreover, its properties of thermal insulation help to control the temperature.

- At the pathways along the Park we recommend the placement of lighting posts, small and big ones, because the Park is poorly illuminated. These posts should have solar panels, in order to use a renewable energy source.

9. CONCLUSIONS

This study deals with the redesigning of the role and the form of the Environmental Awareness Park “Antonis Tritsis” in Athens and examines the importance of open green spaces, in particular urban parks, and their contribution to the amelioration of the quality of life for residents of large urban centers, targeting a sustainable environment. Environmental planning plays a major role in this context, since it can contribute to the improvement of urban environment.

By examining the case study we have been led to the following conclusions: a) the Park does not, as it should, constitute a model on energy independence, b) the Park does not comply with environmental education of the public (except by scarce fragmented actions), and c) the Park meets its role as an urban green space; yet with underdeveloped infrastructure and poor landscape formations, since the landscape is mainly woodland.

The suggested interventions in the Park can improve both its image and its vital role in the environmental education of citizens, especially young children, and present a model for the sustainable management for other urban areas.

Only in that way, may the people live in harmony with their fellow citizens within their city and still be able to coexist with billions of others on the planet, in an environment not consumed by the previous generations [1].

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