ECOWEEK 2011

Workshop on
Sustainable Urban Design

Vegetation & asphalt

Supervisors
T.N.Stasinopoulos & I.A.Meir

Figure 1: The 'Glorious' City from high up (left) and at closer distance (above)

The problem

The view of contemporary Athens from above is astonishing: a giant white-gray carpet stretching across the west coast of Attica, with local brown and green patches. That messy rug is home to about 4 million bipedal creatures. That carpet, characterized by the massive dominance of concrete and the persecution of vegetation, has been named 'Cement City'.

If we zoom in a bit, we see that concrete is not limited to buildings but extends also to the open spaces between them: sidewalks, squares, backyards, school yards, are all covered by concrete, with a few holes here and there for the lucky plants that do not live in flowerpots. Moreover, a large percentage of the ground is covered by asphalt for the sake of cars, leading perhaps to a more appropriate name: 'Asphalt-Cement City'.

The extensive coverage of ground with concrete and asphalt reduces the winter mud and summer dust, but it also waterproofs soil. Athens has just 370mm of annual precipitation (coastal Izmir on the same latitude has 650). In spite of the low rainfall, much of the rainwater converts many Athens streets into torrents on its way to the sea through covered streams and inadequate sewers. At the same time the water table drops, and the meagre vegetation becomes thirsty and frail.

Figure 2: Urban stream

Summary

This text is a short description of environmental conditions in Athens, with a brief presentation of a simple scheme that can augment greenery in dense areas of the city.

The workshop will cover urban climate factors (density, geometry, materials, traffic, vegetation), focusing on Urban Heat Island (origins, consequences, mitigation) as it exists in Athens.

Following a review of the role of open spaces (climatic, social, practical), participants will be invited to enhance vegetation and expand social space in Akadimia Platonos, one of the sites suggested by the City of Athens [option 5 here].

And not only that: Asphalt and concrete absorb solar energy into their mass, and send it back to their surroundings as thermal emission, just like underfloor heating systems. Thus the urban heat island develops, where temperature is higher in the dense areas of the city centre than in the periphery. This phenomenon is reinforced by the heat produced by the various kinds of machinery related to city life (cars, air conditioners, boilers, etc. etc.), plus the extra bonus of the air pollution coming from their fumes.

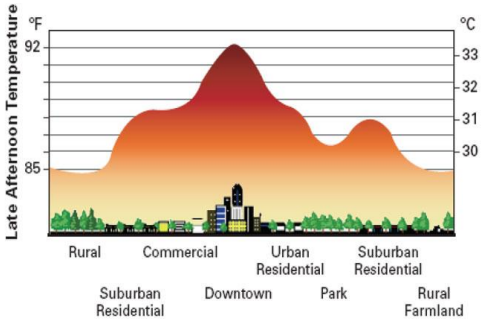

Figure 3: Schematic section of Urban Heat Island

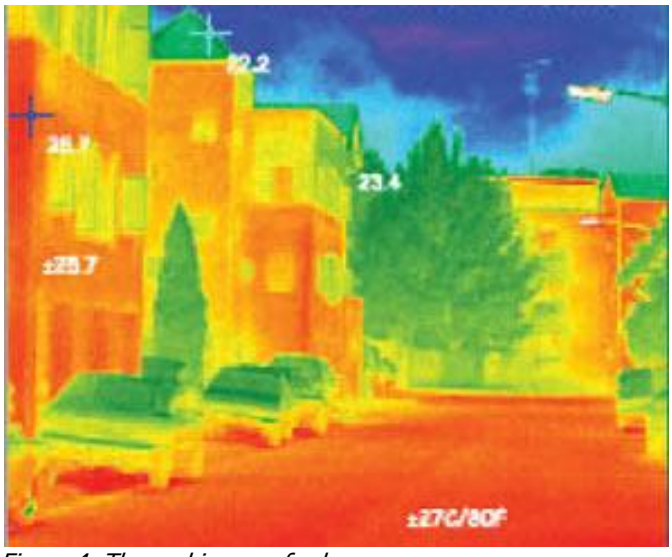

Figure 4: Thermal image of urban space


Figure 5: The effects of smoking?

Perhaps the higher temperature is acceptable in winter, but it is unbearable in summer. Then it is obvious that the city needs *some sort of air conditioning*.

Vegetation is the best way to cool down the urban environment. Trees shade the ground, absorb solar radiation used in photosynthesis, and cool down the air by the evaporation of their perspiration. Moreover, unlike most of the artificial shading devices, they do not act as heat emitters.

The vegetation has the advantage of being a very inexpensive type of air conditioner, both in installation and operation. However, it presents a problem: it requires space.

Solutions

To find free spaces for greenery in densely built areas, there are 4 solutions:

The first is to use *public open spaces* reserved for other uses such as schools and sports facilities. Obviously this solution deprives the community of useful functions; furthermore, such spaces are often small or even nonexistent in many areas in need of green.

The second is the expropriation of *private property*, built or not. This is a costly and time consuming process because it involves high compensation (since it refers to densely populated areas) and legal marathons.

These two solutions add green at *certain locations*, something comforting for their surrounding part of the city but not so for most others. What would be more effective is the *dispersion* of vegetation within the built areas. This is the third solution: green roofs.

Green roofs are much advertised as a panacea for urban microclimate. Are they? Let's skip the technical issues and see only the thermal aspects. In this respect, it is definitely a good solution for a penthouse to have a garden above with plants that reduce solar incidence loads (of course a similar benefit could be obtained by a white reflective roof at a much lower cost). But the thermal benefits to the lower floors are negligible since their facades still remain exposed to the fiery rays –and so is the ground surface. As for the city, it is doubtful whether the cooling effect of perspiration reaches from the roof to the ground 15-20 meters below.

Green streets

Thus we arrive at the fourth option: *green streets*. The idea is simple: streets are converted from 'black' (asphalt) to 'green' with trees instead of cars. So the coolness provided by the vegetation is located at the level of city life, not on the deserted roofs.

In construction terms it is very simple: *the tarmac is stripped-off and trees are planted on the naked soil*. This solution has a significant difference from the normal pedestrian streets: the soil is not covered with the usual cement blocks, etc. that continue to store heat, but it remains exposed, with some narrow corridors for pedestrians and local access to parking using water permeable materials like perforated blocks.

Bare soil absorbs rainwater into the ground rather than forming uncontrolled streams, and promotes wild vegetation like in the countryside. In this way, high and low vegetation grows between buildings at ground level which is the physical space of plants.

The shade of trees protects the soil and nearby walls from overheating, providing a cool microenvironment exactly where people often move. Thus, young and old people have a natural cool space for outdoor activities with a countryside ambience near their homes. The

proximity of natural environment to dense neighbourhoods offers an advantage well-known to the neighbours of Lycabettus or Philopappos hills.

The simple construction of green streets is accompanied by a large financial and legal advantage: the roads are, at present, public and therefore there is no cost for expropriations or demolition.

Of course, in a city where the car is at the forefront, the green streets sound like a utopian solution. But a real example exists in Athens for decades, not far from NTUA campus: it is the so-called 'New Area' on the south side of the Municipality of Papagou.

An applied solution

The New Area of Papagou was designed on a deserted rocky scrubland at the foot of Mount Hymettus in 1960, before it started being built.

The fact that planning preceded the actual buildings is not the only novelty by Greek standards. Even more unusual is the street pattern of alternating stripes of asphalt and soil –i.e., parallel strips and linear parks- thanks to which vegetation penetrates between building blocks.

Asphalt paved streets have fishbone-like extensions on both sides that end in linear groves with dense pine trees, sour orange trees, and lots of wild vegetation on the bare ground. Basically it is a simple Cartesian system with cul-de-sacs and separation of cars from pedestrians.

The effect of that layout is to minimize the distance between buildings and 'countryside' and to create areas reserved for pedestrians without affecting traffic.

A question

The area of Papagos has a medium building density. Can the same layout be applied to other areas of Cement City that are currently suffocating, e.g. Kypseli, Pangrati, or Kalithea?

As degradation of living conditions intensifies in such areas, many residents believe that the lack of vegetation is the most important problem in the neighbourhood, and almost as many resent the parking problem.

As long as the promotion of private cars continues, the second problem will worsen, with no visible solution in sight. But the first can probably find a solution that is simple, cheap, and immediate, along the example of Papagou. Our project is to explore such a scheme.

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Figure 6: The New Area of Papagou


Figure 7: Fishbone streets with linear parks between


Figure 8: Green corridor between the houses

Issues to be addressed

The aim of the workshop is to enhance environmental conditions through vegetation, *considering everyday needs of the local inhabitants*.

Following a site survey, the workshop will deal with:

- Traffic patterns (pedestrians, vehicles, emergency)
- Collective uses
- Vegetation types & layout
- Stormwater
- Materials of surfaces & fixtures
- Outdoor furniture
- Changes over time.

Design proposals should be guided by their sustainability aspects.

The final outcome will be presented as described here.

Part of project area