Green areas in open urban spaces

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ABSTRACT

The paper is divided in two parts: the first is about the microclimatic function of the vegetation in built area. Experimental data in different contexts –case studies- are analysed in order to define guide-lines for cooling.

The second presents a data base of the ecological, functional, morphological characteristics of trees and shrubs. This data base contains sixty elements and is a useful tool for designers, when they want to put green elements in an urban context. Plants must be chosen with an understanding of their growth requirements, tolerance or preference of soil, climate, water and so on. This design tool is the result of a research developed by our team and the Department of Vegetal Biology of Turin University.

1. MICROCLIMATIC FUNCTION OF THE VEGETATION IN BUILT AREAS

In the design of urban spaces, the planning of green areas is very important.

In fact their functions related to environmental conditions, landscape, health and psychological condition are essential for human life. Vegetation represents an important aspect of site analysis. It is essential to record existing vegetation, its maturity and health; important factors in determining whether to save particular trees and shrubs. Vegetation may provide protection from adjacent land uses and its conservation may therefore be relevant in maintaining a buffer from noise, pollution or unpleasant views. The design has to control visual relationships, their colour and texture, the play of light and microclimatic effects that include changes of temperature, humidity, wind speed and direction (Peretti, in publication).

Many studies and research projects of universities and research centres have quantified the effects of green areas on the urban microclimate and estimated the differences in temperature between urban sites and parks (in Berlin (Horbert and Kirchgeorg, 1982), Frankfurt (Bernarzky, 1982), Washington, Japan (Kawashima, 1990) (Saito, 1990-91), Spain (Gomez et al., 1998), Saudi Arabia, Arizona, …).

One of the authors Montacchini (2000), in her experimental work has investigated two of the thermal indicators (air temperature and relative humidity) and their daily fluctuations in three different sites in the city of Turin in north Italy.

- Area 1:

Via Servais, a suburban area of NW Turin, near Pellerina Park.

- Area 2:

Piazza Solferino, a high density central urban area.

- Area 3:

The botanical garden of the University of Turin, in Valentino Park, a green area near the River Po.

The difference in temperature between the park and piazza Solferino was around 5°C at night; the difference becoming more evident at higher temperatures and smaller at average temperature.

There is almost no difference between the trends of the temperatures in the Park and in Servais, due to the similar microclimates in these areas (Montacchini, 2001).

The cooling effects of vegetation consist in:

- a decrease in temperature

- a reduction of solar radiation
- an increase of relative humidity
- a slowing and control of wind velocity

The most significant difference that is an advantage, between the cooling effect of vegetation and man-made structures is that the first is a living organism and has the function of cooling the environment by chlorophyll photosynthesis in addition to producing shade, while inanimate structures have only this last effect.

In order to use vegetation for cooling in open spaces the guide lines are:

- site analysis,
  that means: study of soil and existing vegetation characteristics, climatic data (temperature, humidity, wind velocity), urban context,
- analysis of the characteristics of vegetation to transplant,
- choice of specific expected effect: screen to channel breezes, solar protection, proportion of green surfaces, alternance of vegetation with open areas,….
- choice of type of vegetation,
- site design.

2. A DESIGN TOOL

Whether we approach design at the territorial scale or at the building scale, we must understand not only the relationship between vegetation and environment and the specific role played by the vegetation, but also all the characteristics of the individual plants.

Only in this way can we design correctly. The designer can't achieve good results only by relying on the advice of an agronomist; he must have a specific competence in this subject. In line with this concept, at the Polytechnic School of Architecture in Turin we have a degree in Environmental, Gardens and Parks Design, with agronomy and architecture professors in order to give a linked teaching approach already during training.

One of the first results in this research field is a data base developed by our group and the Department of Vegetal Biology of Turin University.

It is a tool for designers, when they have to choose vegetation in different contexts, in order to increase the success rates of the plantings and their functionality, increase the possibility of the natural evolution of the vegetation, maintain biological balances, achieve compatibility with the environment and biodiversity.

We want to provide a tool to enable the designer to enlarge her/his perspective, to take into consideration a number of factors, to perceive vegetation as a living thing, with its needs but also its potential. The gathering, the analysis and the interpretation of data are carried out by professionals of different specialties, each bringing a specific area of knowledge to the project.

2.1 The Database

For plant species the data are organized into four data cards.

The first, (IDENTIFICATION CARD) (Fig. 1) contains data essential to the identification of the species (family, scientific name, ordinary name, distribution).

The second, (AESTHETIC AND FORMAL CHARACTERISTICS) describes the form (shape, dimensional performances, leafage, bark, flowers and fruits).

The third card, (ECOLOGICAL REQUIREMENTS) details the requirements of the plant indispensable for its growth and maintenance (altitude limits, characteristics of soil and substrate, resistance to pollution, wind, frost, salinity, etc.)

The last card, (FUNCTIONAL CHARACTERISTICS) shows all of the aspects related to the specific function of the plant in relation to the design objectives (maintenance, specific properties, and limiting factors).

Every card displays various entries, with 60 items as a whole.

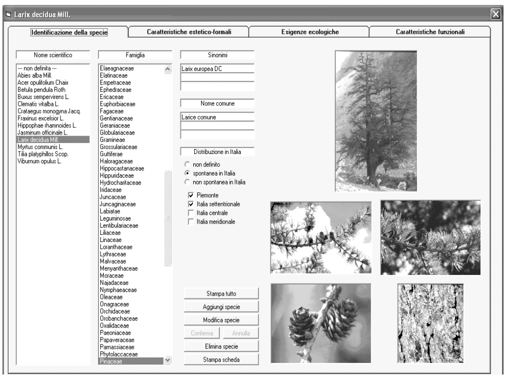

Figure 1: Identification card.

Figure 2: Foliage typology.

Every species has photos related to shape, trunk, leafs, flowers and fruits. The photographs (attached to Card 1: Identification), related to shape, bark, leaves, flowers, and fruits can be an useful instrument also for the correct description of the species in the projects; the picture of the shape together with dimensional data of average height and foliage diameter (available in the Card 2: Aesthetic and formal characteristics), is essential for the geometrical schematisation of the species (the geometrical shape of the foliage is comparable to one or more geometrical pictures and such definition can be important to define, for instance, the shadowing of the vegetation by means of graphical methods, scale model or computer simulation).

The photos related to the bark details, leaves, flowers and fruits can be also useful in realistic representations (rendering).

2.2 The Database use

The user can freely query the database on every aspect of the species, according to the specific designing requirements or the characteristic of the planned site.

There are also guided searches for the choice of the species.

This guided search mode is arranged to help the designer achieve the most suitable species for the success of the design.

We have selected 14 typologies of design action, in which the correct usage of vegetation contributes, in a fundamental way, to the success of the design.

Figure 3: Bark details.

- park/gardens,
- roads/urban paths,
- flower beds,
- parking areas,
- facades,
- roofs,
- arbours,
- phytodepuration,
- restoration of quarries, dumping grounds, rivers, road and railway escarpments,
- sound barrier,
- wind barrier,
- atmospheric barrier.

Within every intervention typology, the features which are indispensable and specific to the species have been selected and then criteria defining particular values have been set within the different cards.

After having selected one particular design typology, the screen lets the user verify which specific values are set for every item: so he can move on with the quest, selecting the species that meet those criteria. In this way the user gets a first species pre-selection inside the general directory. The user must narrow the choice between the resulting species, in relationship with the specific design constraints, specifying, for example, the ecological requirements related to the site or the possible decorative requirements...

2.3 Selection of the species

We have chosen to deal only with the autochthonous species that is with native species present in our regional area. In general terms the designing process should always prefer the autochthonous species of a particular area: when possible, people should use the ones that are native in the neighbourhood of the site where they will be placed.

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