PASSIVE DESIGN -THE RATIONAL USE OF LANDSCAPE FOR INCREASING SUSTAINABILITY AND THE QUALITY OF LIFE

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Abstract. As recent history has demonstrated, the future can only be one of efficiency, rationality and sustainability. The later is a very complex concept when it comes to the built environment, but no matter the type of building analysed, without exception, it begins and relies on the relationship with the building site and natural context. Understanding the site is the first step towards designing or substantially renovating a building that will minimise its impact on the environment, minimise the use of resources and be comfortable and healthier to live in. Adressing aspects such as *access to winter sun, summer shading, provision of shelter from strong, cold winds, enhancement of cooling breezes, ensuring privacy, protecting the existing biodiversity* are free of charge, but sometimes can have an invaluable impact on sustainability, energy efficiency and a considerable increase in the quality of life.

Keywords: landscape, site analysys, passive design, shading, cooling,

INTRODUCTION

Passive design is one of the key concepts behind **both** *sustainable architecture* and *landscape architecture*. The purpose of this approach is to integrate, from the design stage, features that ensure the premises for low energy consumption, good context integration and reduced operating costs. This implies a thorough analysis of the climatic, geographical and urban context so that most of the user related needs can be addressed while best adapting a building to the requirements of a particular location. Successfully integrating passive design features implies making good use of them naturally, without competing with the aesthetic and functional requirements considered by users.

Although passive design is a complex topic that involves many building design aspects, the first, and probably one of the most important step in designing a rational and efficient building shall be further analyzed -the impact or benefit of plants, trees and landforms on sun, shade, shelter and a site's intrinsic value.

MATERIAL AND METHOD

Site Analysis implies understanding all the features of a site, using and protecting the best, and minimizing the impact of the worst.

When assessing the existing topography and vegetation of a site, considerations should include: *access to winter sun, the amount of shading required, provision of shelter from strong, cold winds, enhancement of cooling breezes, ensuring privacy, protecting the existing biodiversity.*

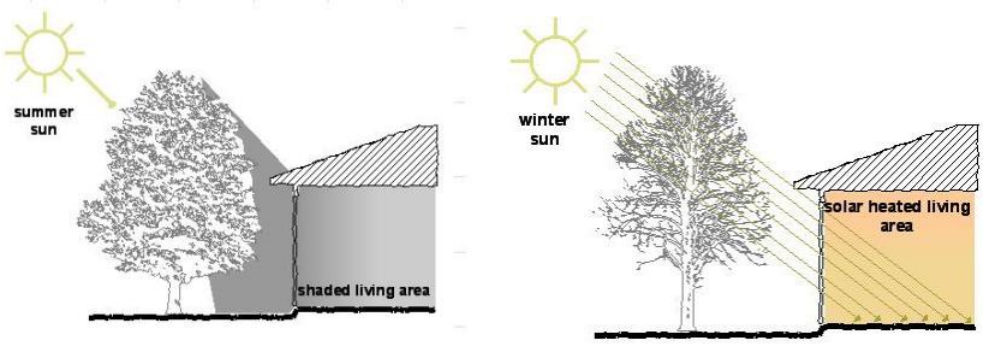
All of the mentioned elements can be addressed with ease in the design stage, but at the same can enhance the sustainability of a building in terms of cost-effectiveness, comfort, attractiveness and durability.

The collaboration between architects and landscape architects is of great importance because plants, trees and landscape features are the ones to provide shade during the summer- *thus reducing energy consumption for air conditioning and providing a "natural"* healthier cooled indoor climate -, wind shelter during winter- *and by doing so a great deal of the building's heating load is reduce-,* help with storm water and erosion control *-the need for more expensive and complicated draining installation is well reduced-*, and finally provide a habitat for native or other wildlife and can make a site more attractive *-an invaluable contribution that can't be quantified nor can it be replaced by any other "artificial" human intervention.*

RESULTS AND DISCUSSION

If properly exploited, plants and trees can have a unique role and can greatly assist the passive design of buildings by both providing shade during the summer (Fig. 1) and allowing solar access –that can enhance passive heating if properly coordinated with good room layout and sensible material selection- during the winter (Fig. 2). No anthropic design feature can achieve this, let alone contribute simultaneously from a visual and an environmental point of view. In order for the shading during the summer and sun access during winter to be done efficiently, trees should be within a distance of between 1,5 – 6m from the building, depending on their height and species.

Fig. 1 Fig. 2



The effects of placing vegetation adjacent to buildings in relationship with the summer sun (Fig. 1) and winter sun (Fig. 2)

Other very important roles of vegetation come into play when assessing the relationship between the building and the winds, both during summer and winter. Thus, trees should have the important function of funneling breezes where cooling is required during the summer.This can be achieved by creating a "green corridor" that directs prevailing summer winds inside the building, where it can pleasantly cool indoor spaces in a passive way providing that sufficient design features have been introduced in order to help in this matter (Fig. 3).

During winter (and colder month), vegetation should have the purpose of providing shelter from intrusive winds. This is important because as with the human body, heat transfer –and thus the perception of "cold" is greatly accelerated when the speed of adjacent traveling air is higher. Both deflecting and damming the wind are viable solutions and can be achieved by placing trees in either a convex or concave shape relative to that of the building (Fig. 3). The difference is that one makes winds go around the building and

the other solution just slows it down, reducing its speed and pressure. The benefits are considerable, and can provide great amounts of shelter to buildings while at the same time proving the habitat for wildlife.

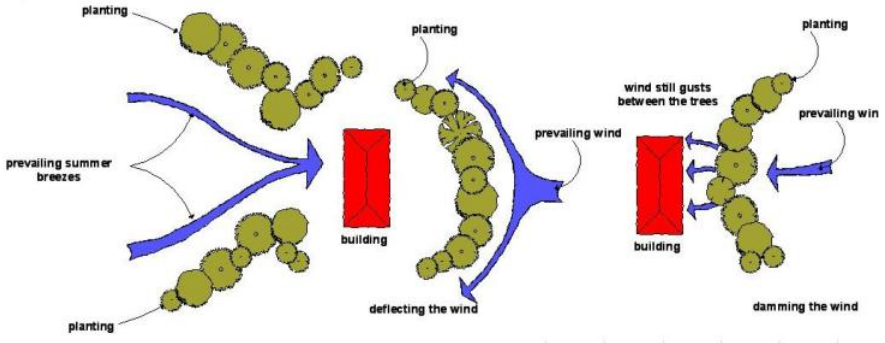


Fig. 3 Using vegetation to naturally cool buildings during summer as well as sheltering it from prevailing winter winds

Finally, building location in relationship with a site's topography should be taken into consideration. Good location is a matter of balancing all aspects of a site, prioritizing requirements and considering how both site and building will impact on each other.
For maximum solar gain, a building should in general be located near the site's northern boundary. In most cases, this is likely to reduce the risk of shading from neighboring properties, and also provide sunny outdoor space. However, the best location for solar access will vary from site to site depending on site shape, orientation and topography; and shading from trees and neighboring buildings (or future buildings). It is often not possible to obtain the ideal building orientation on a site (particularly in urban areas) and compromise will be necessary – for example, where the view is to the north, the site has a north-facing slope, there is a source of noise on the south side, or the view and sun face into strong prevailing winds. In such cases some compromises must be made, but it is still very important to try and implement some of the passive design features described.

CONCLUSIONS

In the wide context of sustainability, where all elements have their part in creating a more efficient future, the relationship with the natural context and the building site is the first, and in the light of its impact on all other aspects of the design process, a very important one. The collaboration between architects and landscape architects is essential to the good outcome of sustainable projects because it creates a strong link between buildings and their particular environment. Plants, trees and topography can be used as passive design tools, and if exploited properly, can provide cooling and shading during the summer, heating and sheltering during winter, beautiful views and a natural habitat for wildlife during both. All these elements, in turn, can enhance the sustainability, energy efficiency and passive design features of the built environment, resulting in cost savings and a considerable increase in the quality of life.

REFERENCES

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