Landscaping to Improve Building Performance

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Proper landscaping can add considerably to the value of a home. Yet we too often make landscaping decisions without considering their effects on our homes' energy efficiency and living quality. For example, in deciding what kinds of trees to plant in our yards, many people simply think, as did Jimmy Stewart (portraying real estate lender George Bailey) when selecting the most appropriate suitcase for world travel, "I wanna big one!" In other words, in *practice* our landscaping activities tend to focus too narrowly on such considerations as size and visual attractiveness. In *theory*, however, we should treat landscaping as an integral property component, whose major function is to enhance building performance.

When we landscape to improve a home's performance, it is important for us to consider climate (and hence the weather conditions to which the property is subjected), along with the house's directional orientation and its placement on the site. Climatic conditions that a home must endure determine, to a large extent, how the use of trees and other plants can be utilized in improving the quality of the services that the home will provide its owner. Within the United States, we might think of four major climatic regions, based on temperature, humidity, precipitation, sun exposure, and wind patterns. These regions could be classified as cool (Minneapolis), temperate (Champaign), hot-arid (Phoenix), and hot-humid (Charleston, SC).

Trees and Shading

Trees can provide shading when strategically positioned on a site. With appropriate shading, there is a greatly reduced need for fans and air conditioning. Shade trees have been shown to be seven times as effective as interior curtains, shades, or blinds in maintaining cool interior temperatures. To effectively position trees, the landscaper should have an understanding of the sun's movement in the sky, both throughout the day and at different times of the year. (For example, the position of the sun is lower in the winter months than during the summer.)

In the northern hemisphere, eastern, southern, and western exposures all receive direct solar radiation at various times during the day. Eastern exposures receive the morning sunlight, which is of fairly low intensity until perhaps 9:00 AM. (Just ask any central Illinois child with morning swim lessons in a chilly outdoor pool.) In late morning and early afternoon, perhaps from 11:00 AM until 2:00 PM, southern exposures receive the benefit (or detriment) of direct sunlight, when solar intensity is at its maximum. In the late afternoon and evening, western exposures face the sun. Even though the sunlight's intensity is weakening by this latter part of the day, interior space with a westward orientation may be subject to excessive heat toward evening, because the west side of the structure has been warmed by rising air temperatures throughout the day. (Just ask any central Illinois resident with a picture window facing west.) In fact, while the southern side of a house is subject to the most intense sunlight, the overall effect may be less severe there than on the western side.

Many residents have tried to gain protection from sunlight with plantings along their homes' southern sides; the practice was once so common that the name "bride and groom" trees was used to describe a pair of south-side trees. Yet while the idea of two trees has merit, the landscaper must consider how the sun's angles will interact with mature trees' heights. A tree that is too short, or is too distant from the house, can be ineffective for shading when placed on a southern exposure, because the high midday sun causes it to shade its own trunk rather than the adjoining home (or deck, patio, air conditioning compressor, or other important feature to be protected). Roof overhangs can be used with trees for effective shading of southern exposures.

For shading purposes, trees are most effective when used on the east and west sides. Trees on an eastern exposure will help shade a house from the morning sun; it can be especially desirable to protect houses even from early morning rays in hot/arid and hot/humid climates. To achieve full shading of an eastern exposure, the landscaper should utilize two trees: one directly on the home's east side to capture early morning rays, and one on the southeast corner to protect against the stronger late morning sun. Full shading of western exposures is generally desirable regardless of the climate, because of the potential for extreme cumulative heat gain. Again, two trees can be utilized: one positioned at the southwest corner of the house to protect against the late afternoon sun, and another directly on the west side to block the early evening rays.

Of course, a tree's optimal distance from a house will vary with the tree's height and the angle of the sun. In early evening, the sun is hitting the western exposure at a relatively low angle. A tree positioned farther away from the house on the west side will cast long shadows on the house. Generally speaking, the taller the *canopy* (the tree's leafy area), the farther away from the house the tree should be placed to effectively cast shade.[1] While it can be argued that trees should not be planted such that their mature limbs will extend over the roof (because of potential damage), shade on the roof can relieve heat in the attic space.

Landscapers in cool and temperate climates should choose *deciduous* trees for shade. Deciduous trees lose their leaves in autumn, and remain bare until springtime. In the winter months, then, sunlight can enter the windows to warm interior spaces. Of course, a thick trunk or dense branching system will partially block the sun's rays even when the tree is bare. Maple (Norway, red, and sugar) and oak (red and pin) varieties are good choices of deciduous trees for shading. Obviously, selections for colder climates must be able to survive harsh winters. Yet hardy *coniferous* (evergreen) trees, which do not lose their leaves and have pyramidal shapes, are poor shade tree choices.

Trees and Wind Protection

Trees can also be used to protect against, or to enhance, wind and air circulation. In cool and temperate climates, where snow and winter winds can be fierce, a dense

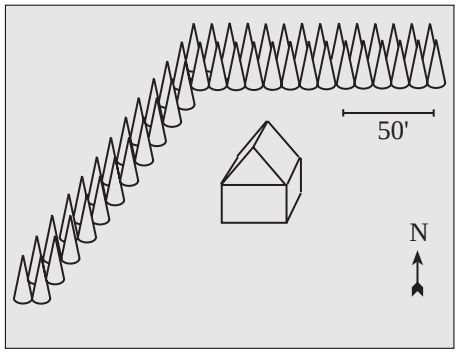
planting of trees along a north wall will reduce heat loss by blocking the impact of the wind against the home's northern exposure. In fact, planting several small evergreen trees next to a north wall not only provides wind protection, but also affords some insulation by creating an air space between those trees and the wall.

Such a row (or several rows) of trees planted closely together upwind from a building is called a *windbreak.* A windbreak does not prevent wind from hitting the protected structure; rather, it reduces the speed at which the wind hits (and may be useful in controlling snow drifts). Ideally, a windbreak should be positioned at a right angle to the wind. In Illinois, winter winds come from the north and west, so the best windbreak location is outward from a home's northwest corner.

Figure 1 depicts a typical windbreak. As a general rule, the ends of a windbreak should extend 50 feet beyond the edge of the area to be protected. In planning a windbreak, it is wise to avoid trees that are susceptible to breakage from ice, snow, and wind. While non-deciduous varieties (which do not lose their leaves in the winter) are ineffective shade trees, they are the *best* trees for windbreaks. But evergreens with foliage that does not extend to the ground, such as pine, should be avoided. Hemlock, fir, and spruce are good windbreak choices.

In regions with hot/arid or hot/humid climates, trees can be used in facilitating ample circulation around interior spaces. In achieving this end, it is desirable to place trees far enough from a house that summer breezes can circulate. Air circulation is particularly important in hot, humid regions, where landscapers should avoid dense tree plantings (which can impede free air movement) close to houses.

Figure 1



Trees can also be placed strategically to channel summer breezes into windows, thereby effectively pre-cooling outdoor air before it enters interior spaces.

Finally, there are some important issues that the landscaper should address after initially deciding which type of tree seems most appropriate to the task at hand. First is to determine whether roots could potentially cause damage to underground water supply lines, drains, or sewers; correcting problems after the fact can be quite costly. The least problematic in this regard are trees with deep descending root systems. It is also crucial, before planting, to make sure that the height and canopy spread of the mature tree(s) will not interfere with power and telephone lines. Under typical easement provisions, utility companies have great freedom to cut tree limbs whose growth interferes with line maintenance; their pruning actions can sometimes be brutal.

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Vines

Vines are another type of vegetation that can be used to enhance building performance. Deciduous vines, such as Boston ivy, Virginia creeper, or wisteria, can be placed on south and west walls to protect against sun exposure during the summer months by absorbing solar rays. In the winter months, they lose their leaves and allow the sun to warm the wall surfaces. The use of evergreen vines, like English ivy, should be avoided on southern and western exposures, as they do not lose their leaves and thus prevent the winter sunlight from penetrating. However, these vines are appropriate on *northern* exposures for thermal protection.

The major problem with vines that grow directly on walls is that they can cause structural damage. This danger is present with older masonry buildings and those with wood siding, on which vines can grow in between wood framing and cause rot. A trellis attached to a wall will keep vines away from the wall surface, and allow air to circulate between the vines and the building. Vines can also be used for shading above patios and decks, where trees might not be high enough to provide the desired protection.

Ground Cover

Ground cover and low-lying shrubbery can be used for protection against the sun and wind. They can provide ground-level shading for buildings; for example, in cool and temperate climates, hedges can be used along western exposures to absorb any late afternoon rays that pass beneath trees' canopies. In hot/arid and hot/humid climates, hedges and other ground vegetation reduce the thermal impact on buildings by absorbing large amounts of water. When this water is released into the atmosphere, the surrounding air temperature drops. Thus, various types of grass and other forms of ground cover are significantly cooler than concrete, asphalt, and other paving materials. Moreover, the taller the ground cover, the greater is this cooling effect.

Ground cover also provides effective control for soil erosion, particularly on slopes and banks. Good choices for erosion-controlling ground cover include junipers, dwarf willows, lilies of the valley, day lilies, and perennial grasses.

Conclusion

This brief examination of landscaping as a tool to improve building performance ignores its ability to reduce pollution, abate noises, and enhance homes aesthetically. The focus here is to get property owners thinking of ways to landscape toward improving the efficiency, and hence the utility, of their living spaces. ■

1. "Landscaping for Energy Conservation," Vol. 5, No. 3 of the University of Illinois Building Research Council's *Council Notes*, provides more detail on positioning trees for shading, as well as other landscaping tips.