Landscaping for Energy Conservation

Quick Facts

- Proper landscaping can modify the climate around your home and reduce both heat gain in summer and heat loss in winter.
- Properly placed plants reduce wind velocity near the home.
- The goal of landscaping for energy conservation is to regulate energy flows from the sun and wind.
- Windbreaks can save up to 25 percent on heating costs.

Faced with rising energy costs, homeowners are looking for ways to conserve energy in the home. Proper landscaping can make a significant difference in the amount of energy required to maintain a comfortable home.

Proper use of trees, shrubs, vines, and man-made structures can modify the climate around your home to reduce heat gains in summer and heat losses in winter. Plants can protect your home from winter winds and shade it from summer sun. Winter heating bills may be reduced as much as 25 percent and summer cooling bills 50 percent or more.

Heat Exchange

Heat exchange in a home occurs through three major processes: air infiltration, heat conduction, and transmission of radiant energy through windows.

Air Infiltration

In winter, heat losses due to air infiltration may represent up to half of the total heat losses on the windiest, coldest days. Properly placed plants can reduce air infiltration by reducing wind velocity near the home.

Conduction

Landscaping can help control the temperature difference between the inner and outer surfaces of walls and ceilings, and thus reduce heat conduction. The outer surface temperature is controlled mainly by outside air temperature, wind velocity, and solar radiation. In summer, trees and shrubs can reduce the amount of solar radiation reaching the outside surfaces of a home, and thus reduce heat conduction into the house. In the winter, solar heating can reduce the rate of heat loss by raising the outside temperature of walls. Blocking cold winter winds also reduces conductive heat loss.

Solar Radiation

The third process for heat exchange in a home is transmission of solar radiation through windows. Large expanses of east or west-facing glass admit undesirable solar radiation in the

summer. Large expanses of south-facing glass can help heat a home in winter. Vegetation around a home can regulate solar radiation during different seasons of the year.

Summer shade is best provided by strategically located plants along the sunny borders of the home. Shade the south-facing roof and wall surfaces that receive the most direct sunlight during midday when the sun is higher in the sky. Also place plants to shade walls that face generally east or west. These walls receive direct sunlight in the morning and afternoon. Vegetation protecting these surfaces intercepts solar energy that would otherwise overheat the home. In addition, the shade maintains an environment several degrees cooler than the temperature in the sunlight.
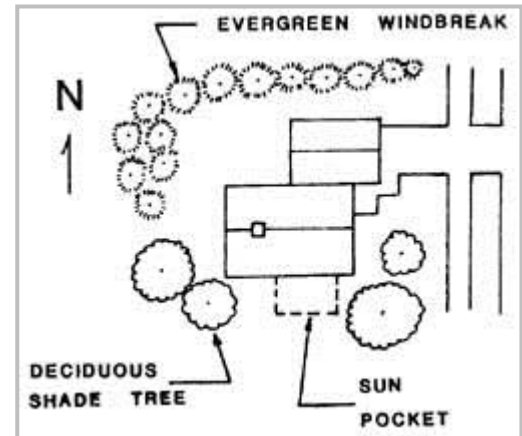

Figure 1 – Suggested locations for windbreak, shade trees, and sun pockets

Providing Shade

The recommended way to provide shade is to plant deciduous trees in an arc encompassing the home on the east, southeast, south, southwest, and west sides (Figure 1). Plant shade trees based on their mature height so they will be properly spaced and provide desired shade. Location also depends on the shape of the tree crown, the position of the sun, the height of the roof or walls, desirable views from windows, aesthetic appeal of the overall landscape, and presence of overhead wires and underground pipes. A small caliper tree will grow faster into a large tree than a larger caliper tree. If the mature height and shape is not planned for in advance, the location of the tree may cause problems in the future.

Summer shade for a south-facing roof generally depends on having overhanging tree crowns. Trees that do not overhang the roof will not cast much shade on it at midday due to the high position of the sun in the sky. Thus, plant shade trees as close to the home as practical. Choose a species that is not susceptible to breakage. Leaves in gutters are an undesirable consequence of large deciduous trees near the home, but most people can cope with this nuisance.

Tree arrangements that provide shade in summer may be detrimental in the winter if they block solar heating. Leafless deciduous trees may reduce the amount of sunlight reaching the home by more than one-third. However, the winter sun is typically less than 45 degrees above the horizon, so shading will be largely from tree trunks. For this reason, plant only those trees needed for summer shade along the southern edge of the home. Prune the lower trunk to allow maximum solar heating of the walls and roof in winter (Figure 2). As few as two or three large deciduous trees with well-developed crowns may suffice.

Growth of a shade tree is a long-term undertaking. To provide shade faster, mix fast-growing trees among slower growing, more desirable trees. As the slower-growing trees mature, remove the fast-growing trees.

Cover walls that face east or west with clumps of vegetation or attached structures to provide shade to those walls. Use deciduous or evergreen shrubs or small trees that grow high enough to shade the wall. You may prefer evergreens on the west side to provide both summer shade and winter wind protection.
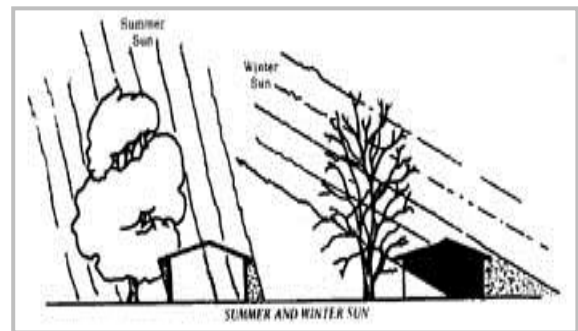

Figure 2 – Effect of deciduous trees in summer and winter

Vines may be grown directly on masonry walls, but on wooden walls grow them on a trellis. Shade east or west walls with a slatted, wooden overhead structure attached to the home. It can be made from 1 inch by 2 inch strips of treated pine, redwood, or cedar spaced 1 inch apart and attached to the frame-work. Training vines to grow over the structure will create an arbor (Figure 3).

Wind Protection

The other important climatic element to control by landscaping is the wind. Research conducted on the Great Plains has shown that up to 25% energy savings for heating is possible from windbreaks. An evergreen, properly placed, can divert cold winds away from the home. Locate the windbreak upwind from the home (Figure 1).
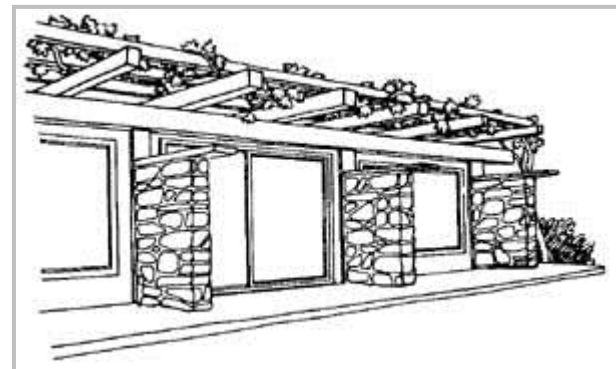

Figure 3 – Use an arbor to reduce solar radiation effects

Distance from the home depends on the tree height. The optimum distance for reducing wind velocity is about 1 to 3 times tree height. However, a windbreak can provide reasonable protection at a distance of 6 times tree height.

Design and composition of the windbreak depend on the space available and the species and size of trees. Where space is limited, a single row of evergreens is adequate. However, up to 5 rows of several evergreen species is more effective. Spacing in 1, 2 and 3 row windbreaks should be 6 feet between trees. Consider the mature shape of the tree when developing a landscape plan for a windbreak. Most windbreaks also can serve other purposes. They provide a visual screen for privacy once they reach 5 to 6 feet high. Well-planned and properly maintained, they are aesthetically pleasing. Choose tree and shrub species that provide protection and food to attract wildlife during the winter.

Evergreens planted close to the home can further reduce effects of wind. If allowed to develop into a thick hedge, spreading evergreens in front of the north and east wall provide additional insulation from the trapped dead airspace they create (Figure 4). If an entry is exposed to wind, an evergreen planting can shelter it.

Planning the Landscape
Sketch your house and site to scale. Identify north, south, east, and west. Mark doors, windows, and other glass areas. Measure the height of the house.
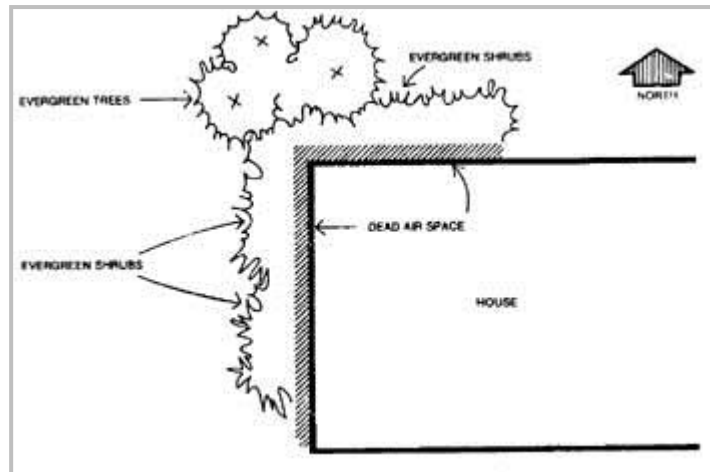

Figure 4 – Foundation plantings to create dead air space

Next, observe how the sun and wind affect the site. Observe the wind during a winter storm. Note the patterns made by drifting snow as an indicator of the direction of the winter winds. Add windbreaks to your plan to block this wind flow. Observe the sun at different seasons. Note how it strikes the house between 9 am and 3 pm in the winter.

Determine how the sun strikes the house during the summer, particularly in the early morning and late afternoon. This lets you plan for appropriate shade. In summer, block the sun as much as possible, except on solar heating devices.

Add shade trees to maximize summer shading and winter solar heating. Choose specific trees based on their mature height. This will determine the proper location for maximum effectiveness. Choose vines and shrubs in a similar fashion. Add man-made structures appropriate for immediate shade and plant protection aiding establishment.

Use fences, windbreak plantings, and shade trees to provide a sun pocket on the south side of your home where outside activities can take place during our sunny, cool, but comfortable winter days (Figure 1). A sun pocket makes an excellent location for a patio or greenhouse.

Source: CSU Ext., L. Walker, S. Newman [1] (3/09)

8793 Kenwood Road Cincinnati, OH 45242 • Store: 513-891-9035 • Landscape: 513-984-8733