



# Conserving Energy with Landscaping

*Alex X. Niemiera, Associate Professor and Extension Specialist, Department of Horticulture, Virginia Tech*  
*Reviewed by David Close, Consumer Horticulture and Master Gardener Specialist, Horticulture, Virginia Tech*

Well-placed plantings can significantly alter the microclimate around a home, resulting in a more comfortable environment and significant savings in heating and cooling costs over time.

## Windbreaks for Winter Savings

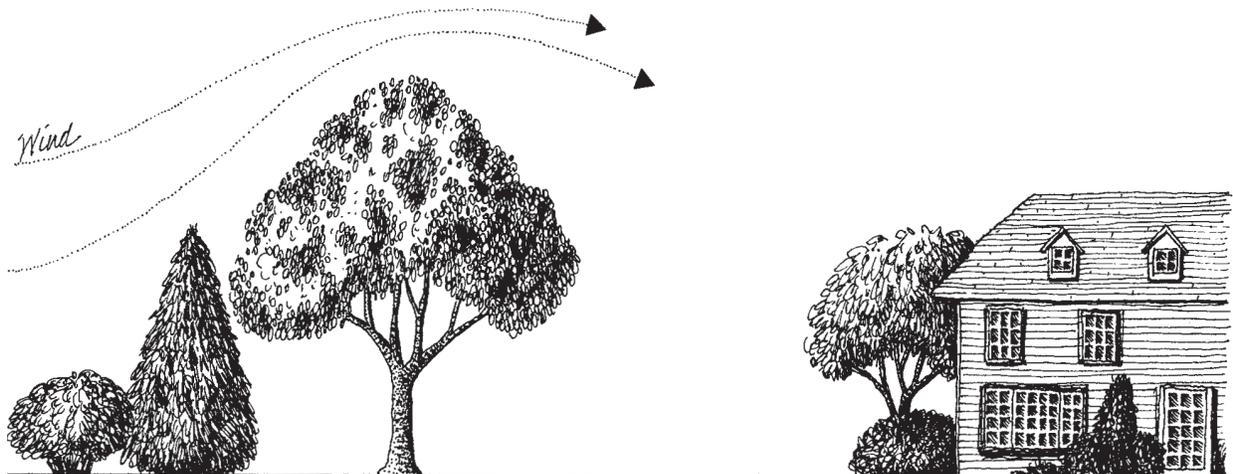
Winter winds increase the rate of air exchange between the interior and exterior of a house, lowering the house's interior temperature and thereby increasing the heating demand. In a windy site, a windbreak planting (also called a shelterbelt) can account for up to a 50-percent wind reduction and up to a 25-percent reduction in heating fuel consumption. A windbreak is a single or multiple rows of trees or shrubs in a linear configuration.

The goal of a windbreak is to reduce wind speed. Living windbreaks will reduce wind speeds for a distance 30 times the height of the windbreak. However, the maximum zone of wind reductions occurs at 5 to 7 times the height of the windbreak. For example, if the mature height of a windbreak planting is 30 feet, then the zone

of maximum wind reduction occurs 150 to 210 feet downwind of the windbreak. A wind barrier that permits 50 to 60 percent wind penetration (as in the case of evergreen trees) is more effective than a solid barrier (such as a fence) because it provides a larger area of protection on the leeward side. Evergreen trees (conifers or broadleaf evergreens) are very effective in reducing wind speed.

Shrubs next to a house can also reduce wind speed. Dense evergreen shrubs planted about 5 feet from a house will create an area of dead-air space. This dead-air space decreases heat loss from the house walls.

**Location.** For maximum effectiveness, windbreaks should be oriented perpendicular to the direction of prevailing winter winds. In Virginia this is usually the northwest side of the area to be protected. The windbreak should be longer than the area to be protected. Wherever space permits, an extension on the east side will help, too. Generally, savings from windbreaks increase as the protected perimeter of a house increases; however, even a few well-placed trees make a difference.



**Suitable Species.** Choose a relatively fast-growing, dense conifer or broadleaf evergreen species with stiff branches that will mature at a height about 1.5 times the height of the house. The species should retain branches low to the ground at maturity.

Most pines lose their lower branches with age, thus, they will serve as an effective windbreak for about 20 years. For a long-term windbreak, select species that keep their lower branches such as spruces, firs, arborvitae, and eastern red cedar. In the event your windbreak trees lose their lower branches, you can plant a row of dense evergreen shrubs at the base of the trees.

Norway, white, and Colorado blue spruce are among the best windbreak trees; blue spruce usually provides the most protection, but is slower-growing than the others. Consult your local Extension agent or garden center personnel to determine which conifers and broadleaf evergreens are suited to your area.

**Spacing.** In regard to the number of rows of trees, the effectiveness of a windbreak generally increases with each added row, up to five rows. With dense trees such as spruce, two rows are usually the most cost-effective. The distance between rows depends on the mature height of the tree species. More northerly tree rows will cast shade onto trees of adjacent row(s) to the south. Since most conifers only tolerate a small amount of shade, your rows should be far enough apart to avoid the shading phenomenon.

In regards to the spacing between trees, it will, in part, depend on the mature width of the tree species. Trees can be planted at a distance less than their mature width to decrease the time to form a solid barrier. Spacing also depends on how quickly you desire the plants to grow together. Deciding how close to place plants is a compromise between planting plants at a close spacing (having plants grow together quickly) versus the cost of buying more plants which will be required for close spacing. Conversely, a wider spacing will take longer to fill in, but you will be buying fewer plants and spending less money.

**Preparation and Planning.** Soil preparation prior to planting should include testing the soil and applying nutrients and lime as recommended. Tilling will be necessary for compacted soils. Early spring is a good time to plant windbreak trees, as it allows plants to grow roots into the surrounding soil before the first winter.

## Shade for Summer Savings

Well-placed trees and shrubs can also help cut air-conditioning costs. Trees, shrubs, ground covers, and grass affect solar radiation more than structural devices, such as awnings. This is because plants transpire (release water vapor from leaves) during the day, which serves an evaporative cooling function. Deciduous plants drop their leaves in winter and have the advantage of allowing sun to reach buildings in the winter for warmth, yet providing shade during the summer.

Shade trees can significantly reduce air temperatures in and outdoors in the summer, as trees intercept and absorb the sun's heat while transpiring cooling moisture into the air. The shade of trees, placed on the south side of a house, can significantly cool a house in the summer



with estimates of up to 30 percent lower air-conditioning bills compared to an un-shaded house. In the summer, the temperature under a tree can be 9°F lower than an adjacent area, and up to 25°F lower than air above nearby blacktop. We intuitively know the value of tree shade when we search for the shade of a tree in the desert-like expanse of an asphalt parking lot. If you want to shade a particular portion of your house during the summer, such as a deck or porch, remember that the sun tracks from the northeast to the northwest in the summer. Thus, if your deck is on the west side of your house

and you desire afternoon shade, then you must place the tree on the southwest side of the deck during the hottest part of the day.

Shade trees should be planted mainly to the south and west sides of the house. Publications that cite the benefits of shade trees often suggest planting trees about 15 to 20 feet from a house to cast shade on the house. This recommendation is effective in shading the house, and will result in less need for air-conditioning. In midsummer, a 50-foot tree will cast a shadow 50 feet long shadow at 3 to 4 p.m. However, if a 50-foot tall tree placed 20 feet from a house falls towards the house, then the top 30 feet of the tree will hit the house. Thus, the advantage of tree shade versus the liability of a tree falling on a house must be carefully deliberated. A potential solution to minimize the liability issue is to place small to medium size trees (less than 50 feet tall) within 20 feet of the house. While such trees will not necessarily shade the roof, they will shade the side of the house. The placement of shrubs around an outdoor air conditioner or heat pump also saves energy.

The major considerations for selecting shade-tree species for summer cooling are adaptability to your site, ease of maintenance, and aesthetics. Most broad-leaved, deciduous trees are dense enough to block direct summer sun rays.

Shrubs can also help reduce energy use by shading walls in summer, but don't allow tall-growing shrubs to block the winter sun from your windows. In summer, deciduous vines on trellises can be used to cool walls that face south or west. Behind the trellis, convection current carries warm air away from the wall. Added summer heat reduction can come from the use of lawn grasses and ground-cover plants. Glare can be reduced by lawns, and green ground covers outside of windows also reduce summer temperatures of the immediate area by 10 percent to 14 percent.

## Year-round Effect

In placing shade trees and windbreaks, consider their year-round effect. Deciduous trees will not block the winter sun as much as conifers will. But even deciduous trees can reduce solar radiation by about 20 percent to 50 percent in winter (depending on species and size), since even bare branches block the sun's rays. Properly located shade trees will shade the most important parts of the house in the summer without shading too much in the winter.

In general, trees on the east or west side of the house provide summer shade without excessive winter shade. In cold areas, leave the south clear so the sun is not blocked during the winter, unless you use a species that does not cast a heavy shade, such as honey locust.

A solid row of evergreens next to a wall can create a dead air space, and consequently, a year-round insulating effect, although mold and mildew can sometimes occur. The evergreens can be trees, shrubs, or vines. Evergreen vines or dense-growing deciduous vines can be used on a trellis on a north- or northwest-facing wall to insulate a house from winter winds.

## Additional Benefits

Planting for energy savings also reaps other benefits. A windbreak provides privacy and noise deflection in addition to wind and snow diversion. Shade trees beautify the landscape as well as protect people and homes from sun and wind. Most plantings provide a habitat for wildlife, reduce pollution and soil erosion, and bring us closer to nature. Well-maintained trees and shrubs also increase property values.

Reducing lawn areas can also save energy, by planting ground covers or under-story shrubs, less mowing is required. Plus, if drought-tolerant plants are used, water use can be significantly reduced.

## Learn More

For more information on selection, planting, cultural practices, and environmental quality, contact your local Virginia Cooperative Extension office. If you want to learn more about horticulture through training and volunteer work, ask your Extension agent about becoming a Master Gardener. For monthly gardening information, subscribe to The Virginia Gardener Newsletter by sending your name and address and a check for \$5.00 made out to "Treasurer, Virginia Tech" to The Virginia Gardener, Department of Horticulture (0349), Virginia Tech, Blacksburg, VA 24061. Horticultural information is also now available on the Internet by connecting with Virginia Cooperative Extension's web site at [www.ext.vt.edu](http://www.ext.vt.edu).

The original publication was authored by Diane Relf, Extension Specialist (ret.), Environmental Horticulture, Virginia Tech, and the original development of this series was funded by ESUSDA Smith Lever 3(d) National Water Quality Initiative Funds and the Virginia Department of Conservation and Recreation, Division of Soil and Water Conservation.