Landscape Design Series 13
Landscaping for Energy Conservation

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Landscaping for Energy Conservation

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Proper landscaping can modify the climate around your home and reduce both heat gain in summer and heat loss in winter.
Sagers Winter Garden
Properly placed plants reduce wind velocity near the home.
The goal of energy-conserving landscaping is to regulate energy flows from the sun and the 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 makes a significantly reduces the energy required to maintain a comfortable home.
Plants and structures modify the home climate to reduce summer heat gain and winter heat loss.
Plants protect your home from winter winds and shade it from summer sun. They can reduce winter heating bills by 25 percent and summer cooling bills 50 percent or more.
Heat exchange in a home occurs through three major processes: air infiltration, heat conduction, and transmission of radiant energy through windows.
Air Infiltration
Air infiltration is the passage of outside air through cracks around windows and doors or other openings in walls or ceilings.
# Building energy use

Wind Protection, Insulation, and Energy Use Reduction for Heating

<table>
<thead>
<tr>
<th>Degree of Protection</th>
<th>Poor Insulation (% Reduction)</th>
<th>Good Insulation (% Reduction)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fence or hedge</td>
<td>10%</td>
<td>23%</td>
</tr>
<tr>
<td>Evergreen trees</td>
<td>13%</td>
<td>29%</td>
</tr>
<tr>
<td>Evergreen trees &amp; fence/hedge</td>
<td>20%</td>
<td>44%</td>
</tr>
</tbody>
</table>
One way outside air is forced through these openings is by pressure differences caused by wind on the outside of the home.
## Building energy use

### Effects of Wind Protection on Heat Loss From Houses in Nebraska

<table>
<thead>
<tr>
<th>Degree of Protection</th>
<th>Infiltration Heat Loss (% of Total)</th>
<th>Annual Heat Cost (% Saved)</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>33 to 74%</td>
<td>---</td>
</tr>
<tr>
<td>Tree WB</td>
<td>23 to 63%</td>
<td>13 to 29%</td>
</tr>
<tr>
<td>WB+Fence</td>
<td>16 to 53%</td>
<td>20 to 44%</td>
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</tbody>
</table>
Air pressure on surfaces that face the wind increase as wind velocity increases so air enters the home through surface openings.
This forces an equal amount of interior air out of the home through openings that face away from the wind.
Heat losses from air infiltration may be half the total heat losses on cold, windy days.
Well placed plants help reduce air infiltration by reducing wind velocity near the home.
Windbreaks and wind chill

Impact of 3-Row Evergreen Windbreak

- Wind Speed 75' Inside Windbreak (mph)
- Wind Chill at 10 F (degrees F)

- Wind speed
- WC-w/out
- WC-with

Open Wind Speed (mph)
Conduction
The second process is conduction through building materials. Heat conduction depends on the insulation of the building materials, surface area, and the temperature difference between the inside and outside of the home.
Landscaping helps control the temperature difference between the inner and outer surfaces of walls and ceilings, and reduces heat conduction.
The outer surface temperature is controlled by outside air temperature, wind velocity and solar radiation.
In summer, plants reduce the solar radiation on the outside home surfaces, reducing heat conduction into the house.
In the winter, solar heating reduces heat loss by raising the outside wall temperature. Blocking cold winter winds also reduces conductive heat loss.
Solar Radiation
The third heat exchange process is solar radiation transmission through windows. Large expanses of east or west-facing glass collect undesirable solar radiation in the summer.
Large expanses of south-facing glass help heat a home in winter. Vegetation around a home regulates solar radiation during different seasons.
Because of Utah's low humidity and cool summer nights, proper house design and landscaping can reduce or eliminate the need for air conditioning.
Provide summer shade by strategically locating plants along the home’s sunny sides. Shade south-facing roof and walls from high direct sunlight during midday.
Shade east or west walls that get direct sunlight in the morning and afternoon. Vegetation intercepts solar energy that otherwise overheats the home.
Providing Shade
The best way to provide shade is by planting deciduous trees in an arc encircling the home on the east, southeast, south, southwest and west sides.
Shade keeps the temperature several degrees cooler than in the sunlight.
Windbreaks and wind chill

Impact of 3-Row Evergreen Windbreak

Wind speed
WC-w/out
WC-with

Wind Speed 75' Inside Windbreak (mph)

Open Wind Speed (mph)

Wind Chill at 10 F (degrees F)
Plant shade trees based on their mature height for proper spacing and desired shade.
Tree location depends on the tree shape, the position of the sun, the roof or wall height, desirable views, overall landscape appeal overhead wires and underground pipes.
Plan for the mature tree height and shape to avoid future problems.
Summer shade for south-facing roofs depends on overhanging tree crowns.
Trees that do not overhang the roof do not shade it at midday because the sun is high in the sky.
Plant shade trees as close to the home as practical but choose species that are resistant to breakage.
Leaves in gutters are an unwanted but controllable consequence of large deciduous trees near the home. Promptly remove diseased, damaged trees or limbs to avoid damage to the home.
Tree that provide shade in summer may block solar heating in the winter. Leafless deciduous trees reduce the sunlight reaching the home by one-third.
Winter sun is less than 45 degrees above the horizon, so shading is largely from tree trunks. Plant only trees needed for summer shade on the south. Prune lower branches to allow maximum winter solar heating of walls and roofs.
Two or three large deciduous trees with well-developed crowns may provide the shade.
If a home has a solar heating device that needs summer and winter sun, plant so no shade is hits the collectors between 9 a.m. and 3 p.m. any time of the year. Leave a gap in the tree canopy to allow the sun to shine on collectors during those hours.
Shade trees take time. To provide faster shade, mix fast-growing trees among slower growing, more desirable trees. As the slower-growing trees mature, remove the fast-growing trees.
Shade house walls that face east or west with vegetation or attached structures.
Use deciduous or evergreen shrubs or small trees that grow high enough to shade the wall.
Vines can grow directly on masonry walls, but grow them on a trellis on wooden walls. Train vines to grow over the structure to create arbors.
Wind Protection
One important climatic element controlled by landscaping is the wind. Research on the Great Plains shows a 25 percent heat savings from windbreaks.
Evergreens divert cold winds away from the home when planted upwind from the home. In Utah, this generally means protecting the north and east side of the home.
Distance from the home depends on tree height. The optimum distance for reducing wind velocity is one to three times tree height.
A windbreak can provide reasonable protection at a distance of six times tree height.
Windbreaks that catch snow drifts are a nuisance if a driveway is located between the trees and the home. If possible, extend trees 50 feet beyond the ends of the protected areas.
Design and composition of the windbreak depend on the space available and the species and size of trees. Where space is limited, use a single row of evergreens.
Up to five rows of several evergreen species is more effective. Make spacing in one-, two- and three-row windbreaks 6 feet between trees. Consider the mature shape of the tree when developing a landscape plan for a windbreak.
Most windbreaks serve other purposes. They provide a visual privacy screen and are aesthetically pleasing. Animals are attracted to trees for protection and food.
For immediate wind relief, construct a fence with an open weave pattern (e.g., basket weave). This creates a larger, protected downwind area than a solid fence.
A solid fence provides greater shelter immediately behind the fence.
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.
Observe the wind during a winter storm. Note the patterns made by drifting snow from the winter winds. Add windbreaks to your plan to block this wind flow.
Observe where the winter sun strikes the house between 9 a.m. and 3 p.m. South-facing solar heating devices (including windows) receives most solar radiation during these hours.
Notice the sun patterns during the summer, particularly in the early morning and late afternoon. This lets you plan appropriate shade. In summer, block the sun, except on solar heating devices.
Choose vines and shrubs in a similar fashion. Add man-made structures appropriate for immediate shade.
Use fences, windbreak plantings and trees to provide a sun pocket on the south side of your home for outside activities during sunny but comfortable winter days.
A sun pocket makes an excellent location for a patio or greenhouse.
Although it is not possible to control temperature, wind and other weather elements, landscaping significantly modifies the climate in and around homes.
Properly placing trees, shrubs, vines and landscape structures reduces the energy required to keep homes and surrounding areas comfortable winter and summer.
A well planned landscape is one of the best investments a homeowner can make. Well done landscaping adds beauty and increases real estate values.