# PASSIVE SOLAR DESIGN IN LANDSCAPING

When people think of solar design, they usually picture solar panels. Solar panels use the sun's energy to produce electric
ity, which is then used to power heaters and air conditioners. However,
passive solar design uses the potential energy of the sun to either heat or cool an area by collecting, storing, and distributing solar energy[1] . In passive solar design, the house uses walls, floors, and windows to collect heat[2] .

A branch of passive solar design is the use of landscaping such as trees, bushes, vines, and other plants to control the amount of heat that enters a house[3]. Using landscaping is popular because it
is natural, organic, and aesthetically pleasing. Passive solar landscaping's main purpose is to improve the efficiency of a passive solar house, but it can also be used to improve the efficiency of a non-passive solar house by using the placement of specific plants to control heat in an area outside and inside of a house.

## The History of Passive Solar Landscaping

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The first use of passive solar design goes back as far as 5th century Greece [4] . However, as far as researchers can tell, the Greeks only used the angle of the sun in passive solar design. The first instance of passive solar landscaping can be seen in the placement of saltbox houses in New England[5] . These homes have large windows on the south side of the facade with large, open spaces in front of the windows. The back and side of saltbox houses are surrounded by deciduous trees to provide shade in the summer and allow sun penetration in the winter. Passive solar design in landscaping became most popular in the 1970's during the oil crisis[6] . The oil crisis drove many people to become eco-conscious and to start investigating more ways of improving energy efficiency in homes. The main obvious source of improvement is the use of more accurate measurements of the sun's location and the use of better precision equipment such as surveying tools.

## Precision Placement

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Precision placement is the most common method of passive solar landscaping and involves the angles of placement relative to the house, the types of plants used, and plant height[7] .

### Heating

The main purpose of passive solar design is to control the amount of heat in an area[8] . Therefore, the placement of plants is the most vital element in passive solar landscaping.

#### Deciduous Tree Placement

Deciduous trees provide shade in the summer. In the winter, they lose their leaves and provide adequate sunlight penetration. However, the location of the trees is vital to providing adequate cooling in the summer and heating in the winter. The east and west sides of the house are the best place for deciduous trees because of the rising and setting sun[9] [10] . Deciduous trees should also be placed in sequence so that the house receives shade in the summer all day (Image 1)[11] . Tree growth is also considered during the design. For the most efficient shading, a tree should be placed a distance of 3-4 times its mature height away from the house[12] .

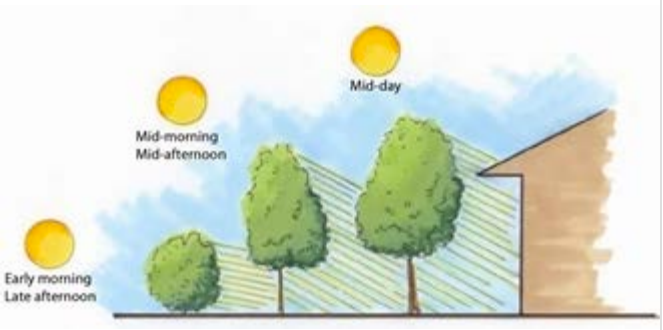

Image 1 - Energy Conservation Arrangement

### Ground cover

Thick grasses or vines on the ground prevent light reflection into the house[13] . Covering the ground with plant life keeps the house cooler in the summer and prevents overheating[14] . In the winter, the plants will die and light reflection occurs which heats the house more.

## Windbreak

Cold wind in the winter blows through cracks in the walls of a house and decreases the indoor temperature[15] . Trees and bushes can be used to prevent wind from reaching the house or to direct the wind toward the house for a summer breeze[16] .

### Evergreen Tree Placement

Evergreens keep their leaves all year, so they are best placed on the north side of a house because in most cases, the prevailing winds come from the north[17] . Planting trees in groups will provide the best windbreak. If there is a spacing between the trees, the wind will be channeled[18] . The purpose of channeling the wind is to provide a breeze and to increase ventilation, which is a vital part of passive solar design.

### Bush Placement

Bushes that are placed near windows can misdirect the wind from hitting the side of the house[19] . If a house is in a location where the prevailing wind is from the south-east, such as Florida, a bush placed adjacent and to the west of a south-facing window will direct the wind away from the house when the window is closed and towards the house when the window is open (Image 2)[20] .

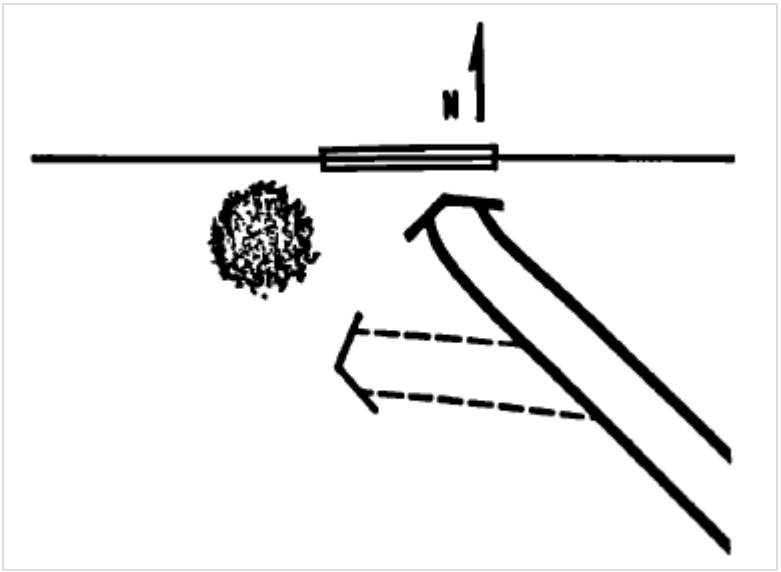

Image 2 - Shrub Valve System

## Passive Solar Landscaping Homes

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### The GO Home

The GO Home in Portland, Maine faces the south and utilizes large windows. The row of trees in the background is used as a windbreak. No trees on the east or west were used because of the awning on the east and no windows on either side of the house (Image 3)[21] .

Image 3 - The GO Home

### Ponzil Energy Home

The Ponizil Energy Home in California was modified to become a passive solar home. Because the house was not already passive solar, Ponzil Energy used landscaping to increase the efficiency of the house. Trees were planted in strategic locations as windbreaks and were also planted to provide shade to the house. All of the trees used were deciduous due to the climate of California (Image 4)[22] .

Image 4 - The Ponzil Energy Home

## The Future of Passive Solar Landscaping

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There is not much research that can be done in regards to precision placement passive solar landscaping. However, many energy companies have started charging more money during "peak periods[23] ." These periods occur most often in the summer when people are using air conditioners for most of the day[24] . Research in this area can be conducted to investigate how to utilize precision placement to eliminate the need for energy companies to charge more money during "peak periods."

Research is also being conducted in investigating the effects of wind in the summer. John H. Parker briefly looked into how summer winds may actually increase the inside temperature of a house, but further research is needed to fully understand the effects of summer wind

Source : http://letu-cefs.wikispaces.com/Rainwater+Systems