



Lecture 14: Site Design

11.1 Introduction

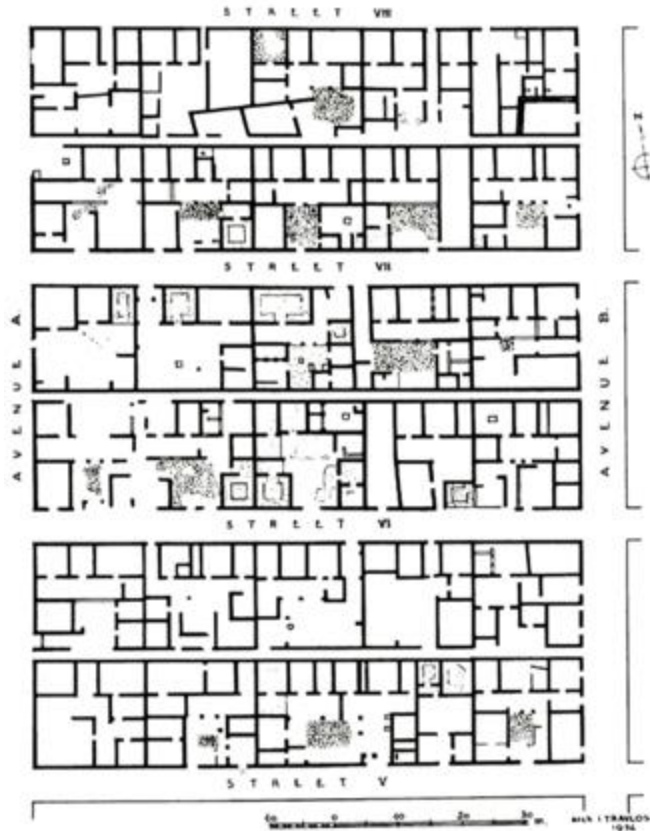


Figure 11.1c Multistory buildings facing narrow streets create desirable shade in very hot climates, as here in Jidda, Saudi Arabia. (Photograph by Richard Millman.)



Figure 11.1d The shading structure over this Moroccan street blocks much of the sun but still allows air and daylight to filter through. (Courtesy of the Moroccan National Tourist Office.)



Figure 11.1e This colonnade in Santa Fe, New Mexico, protects pedestrians from rain as well as sun, and it shades the windows and walls.

11.2 Site Selection

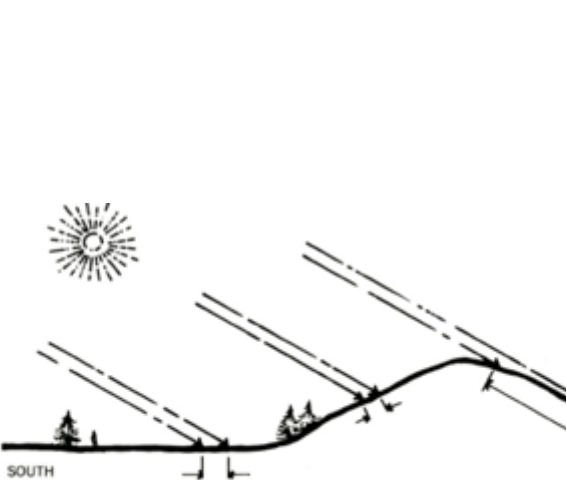


Figure 11.2a In winter, south-sloping land receives the most sunshir of the cosine law. For the same reason, north-facing slopes receive ver solar heating because a given sunbeam is spread over much more lanx

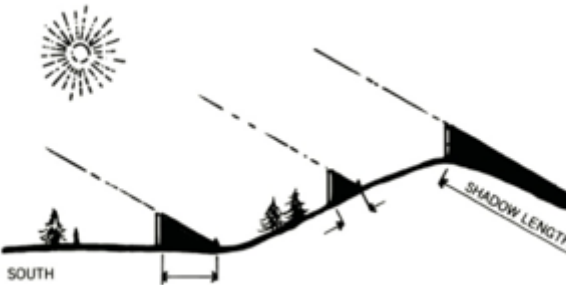
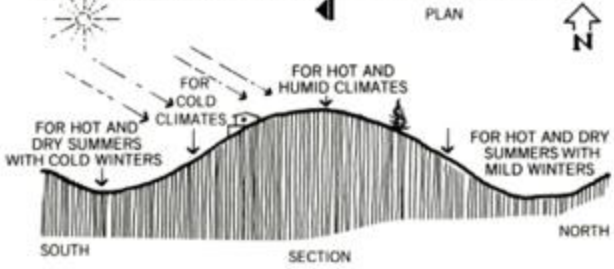
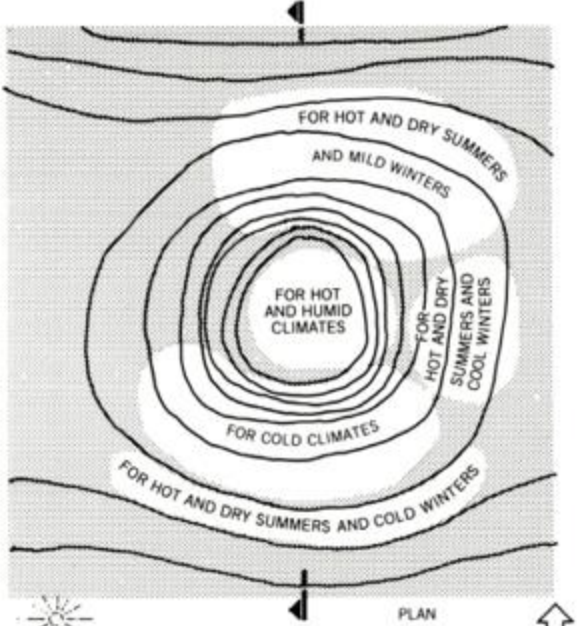
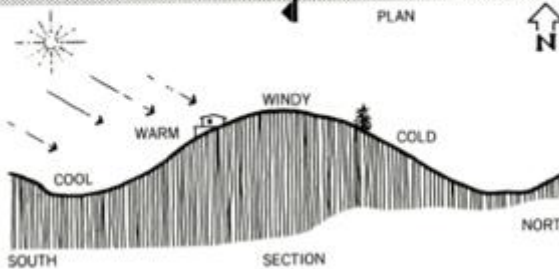
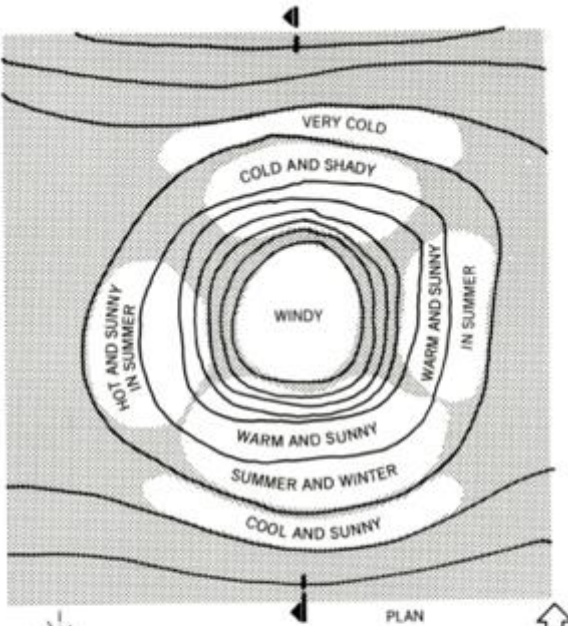


Figure 11.2b South-sloping land also experiences the least shade.



11.3 Solar Access

11.4 Shadow Pattern

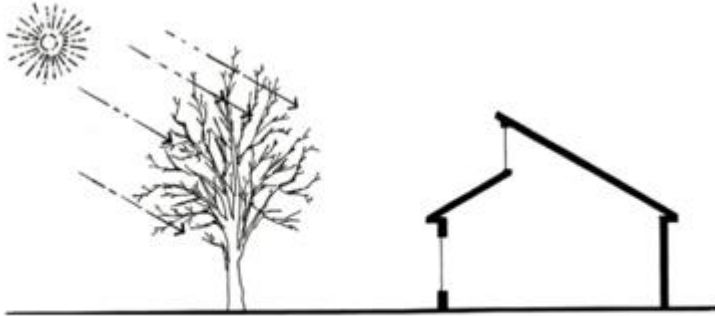


Figure 11.3d Even without leaves, deciduous trees still block 30 to 60 percent of sunshine.

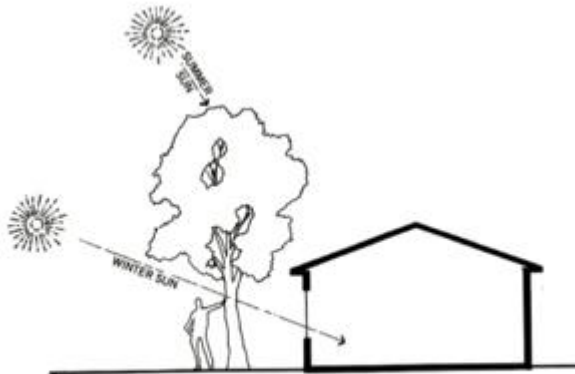


Figure 11.3e If large desirable trees exist on the south side in hot climates, trim the lower branches to form a high canopy.

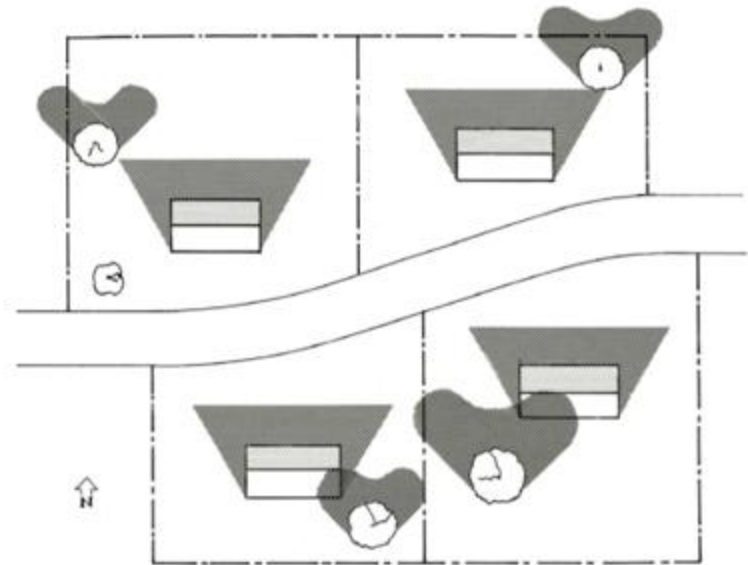


Figure 11.4a Shadow patterns demonstrate conflicts in solar access. Notice that the trees shade the lower two buildings during the winter.

11.4 Shadow Pattern

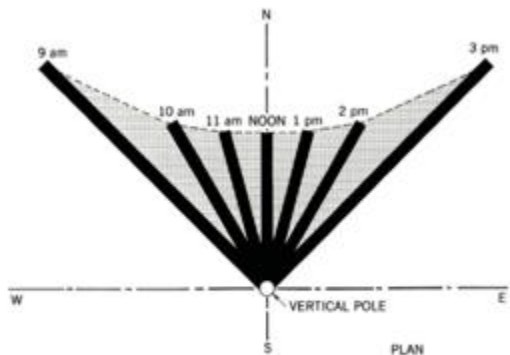


Figure 11.4c Plan view of the shadows cast by a pole at 36° N latitude on December 21 from 9 A.M. to 3 P.M.

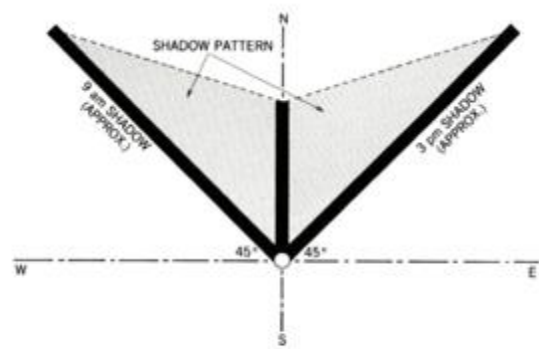


Figure 11.4d The simplified shadow pattern of a pole on December 21 is derived from the pole shadows of 9 A.M., 12 noon, and 3 P.M.

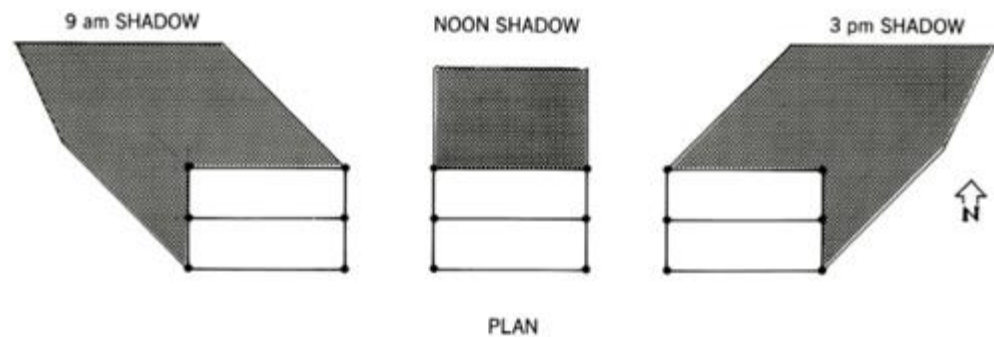


Figure 11.4g The morning, noon, and afternoon shadows on December 21 are constructed by assuming six poles. (After *Solar Energy Planning*, by P. Tabb, 1984.)



Figure 11.4h The shadow pattern is the composite of the morning, noon, and afternoon shadows. (After *Solar Energy Planning*, by P. Tabb, 1984.)

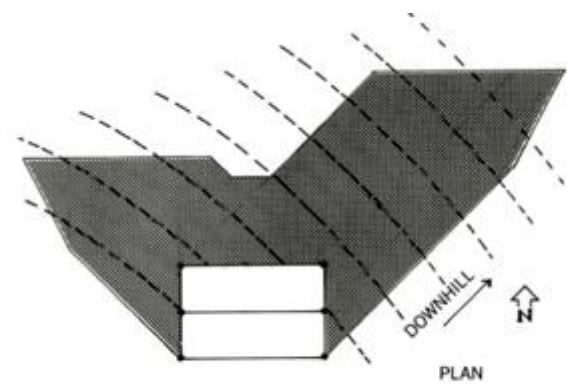


Figure 11.4i Sloping land changes the length and shapes of the shadow pattern. (After *Solar Energy Planning*, by P. Tabb, 1984.)

11.5 Site Planning

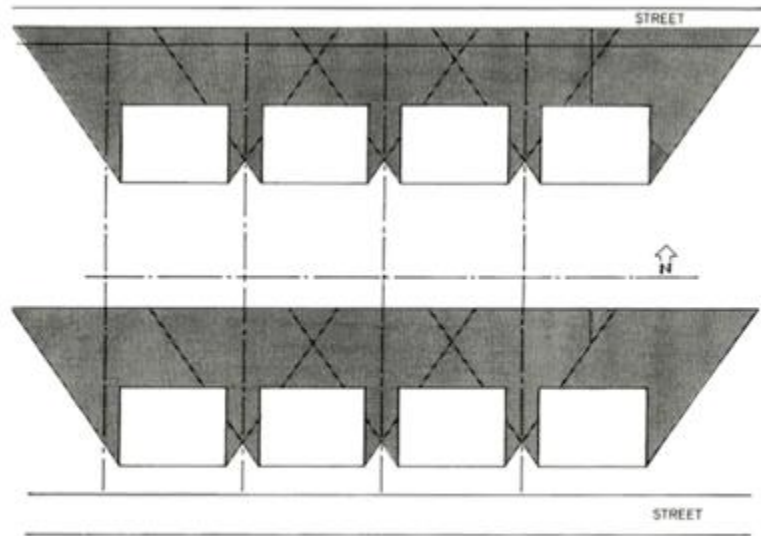


Figure 11.5a East-west streets are ideal for both winter solar access from the south and summer shading from the east and west.

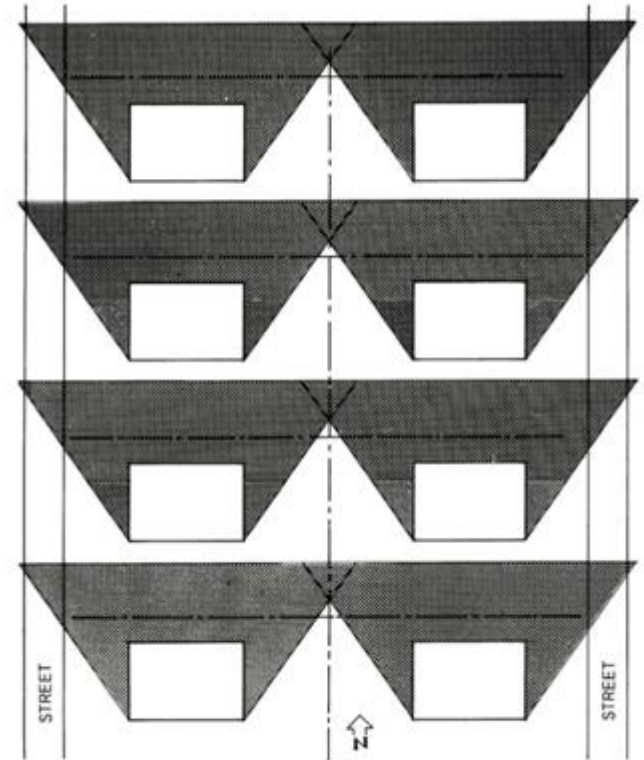


Figure 11.5c Buildings on north-south streets should have their narrow facade face the street.

11.5 Site Planning

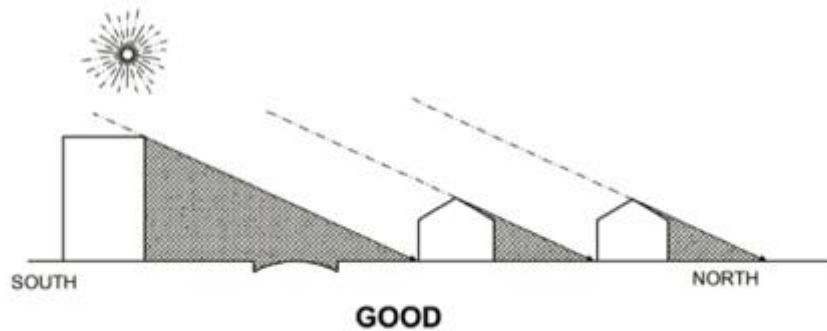
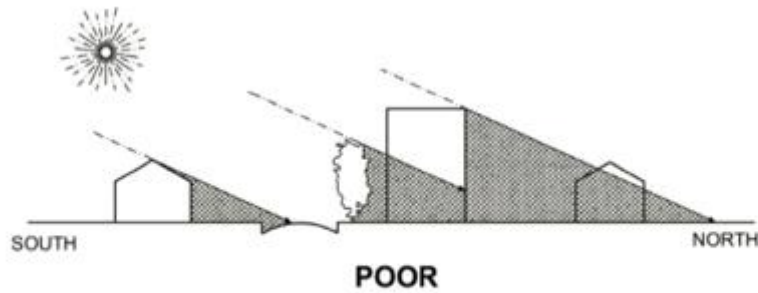


Figure 11.5k Place taller buildings and trees on the south side of east-west streets to take advantage of the wide right of way of the streets.

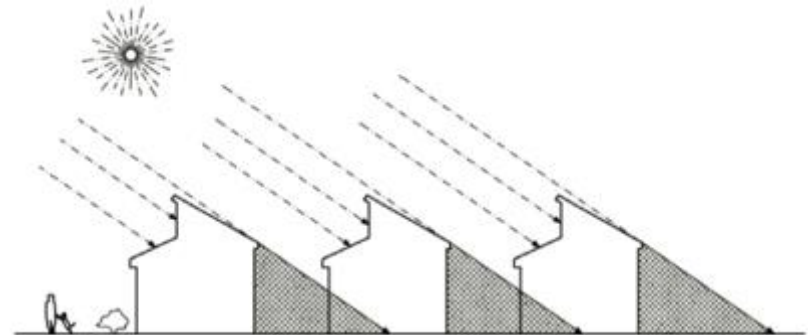


Figure 11.5l When solar access is not possible for the whole building, clerestories and active roof collectors should be used.

11.8 Wind and Site Design

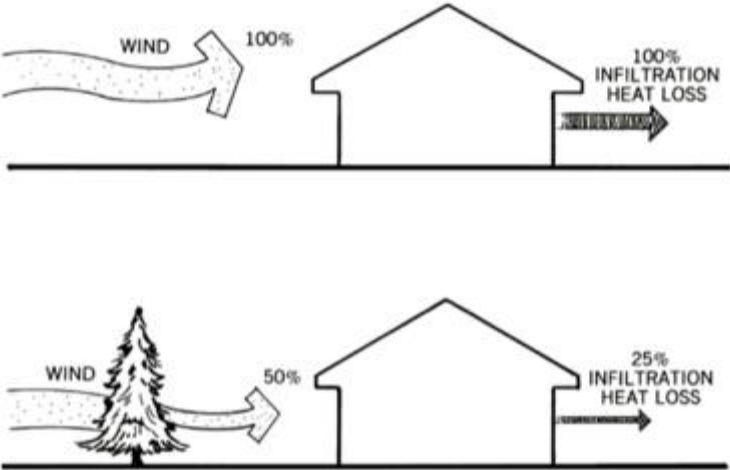


Figure 11.8a A small reduction in wind velocity results in a high reduction in heat loss.

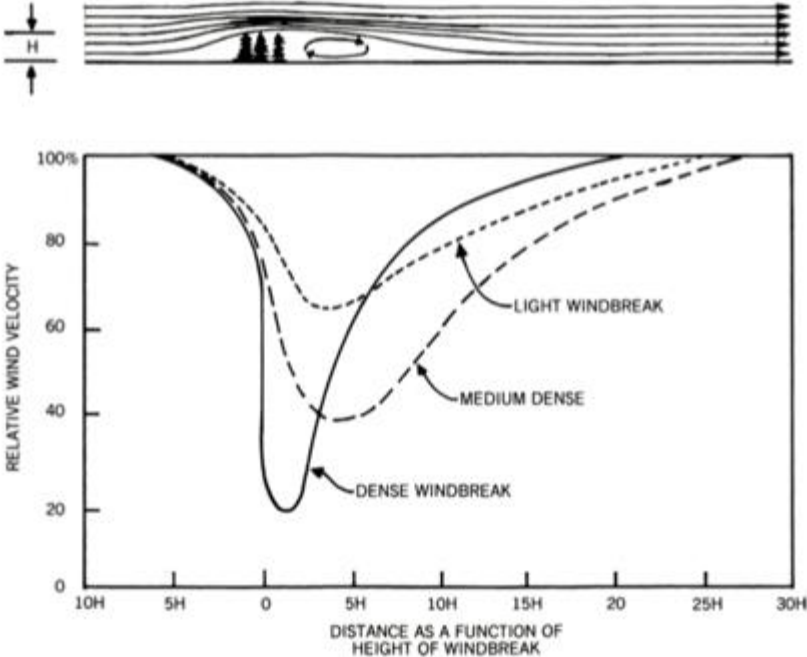


Figure 11.8b Wind protection is a function of both the height of a windbreak and its porosity. Note that the section is aligned with the graph. (After Naegeli (1946), cited in J. M. Caborn (1957). *Shelterbelts and Microclimate*, Edinburgh, Scotland: H. M. Stationery Office.)

11.8 Wind and Site Design

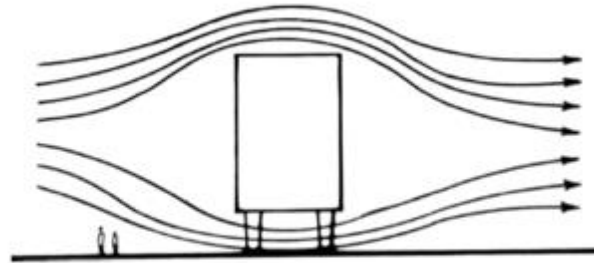


Figure 11.8d Buildings on columns (pilotis) experience very high wind speeds at ground level.

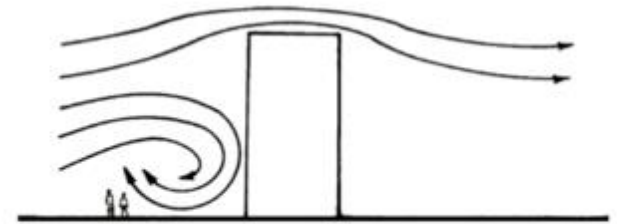


Figure 11.8e Tall buildings often generate severely windy conditions at ground level.

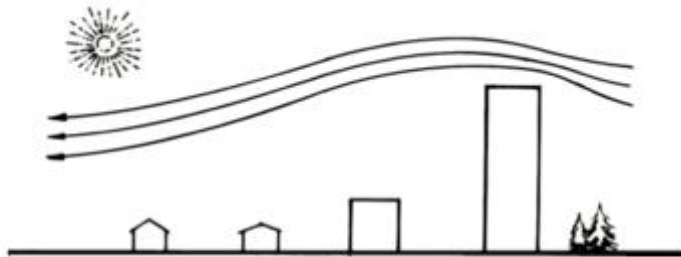


Figure 11.8g Tall buildings placed toward the north of a community not only protect it from the cold winter winds but also permit good solar access.

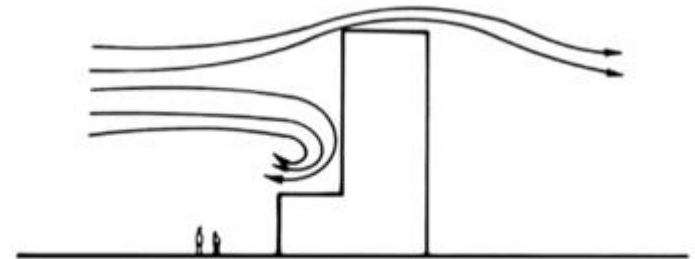


Figure 11.8f A building extension deflects winds away from ground-level areas.

11.8 Wind and Site Design

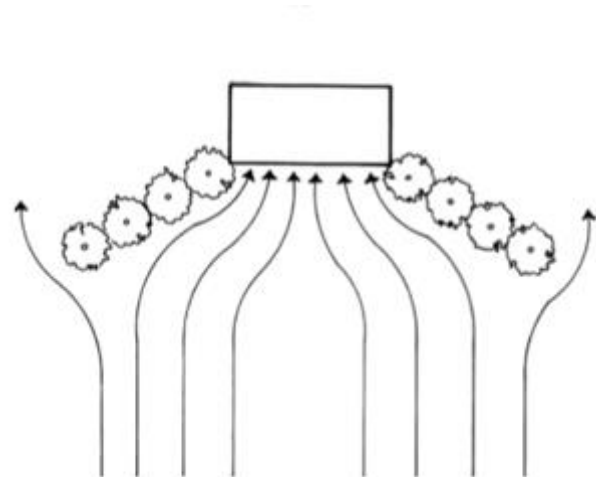


Figure 11.8j Trees and bushes can funnel breezes through buildings.

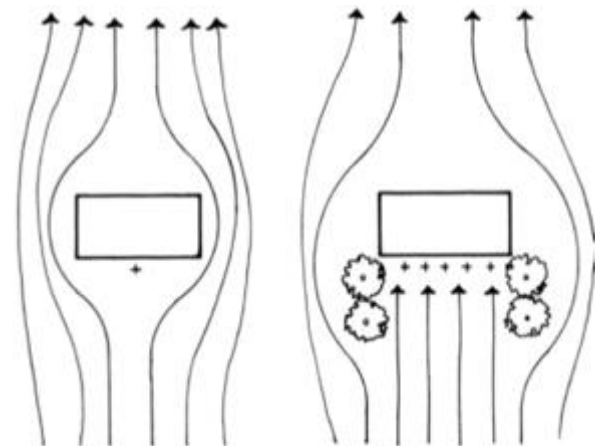


Figure 11.8k By preventing the wind from spilling around the sides of a building, a few trees or bushes can significantly increase natural ventilation.

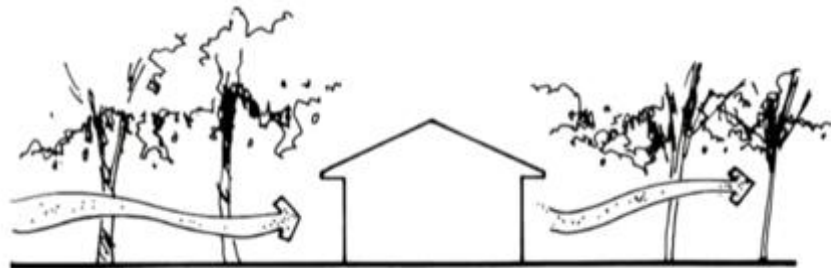


Figure 11.8l To maximize summer winds, use trees with high canopies.

11.8 Wind and Site Design

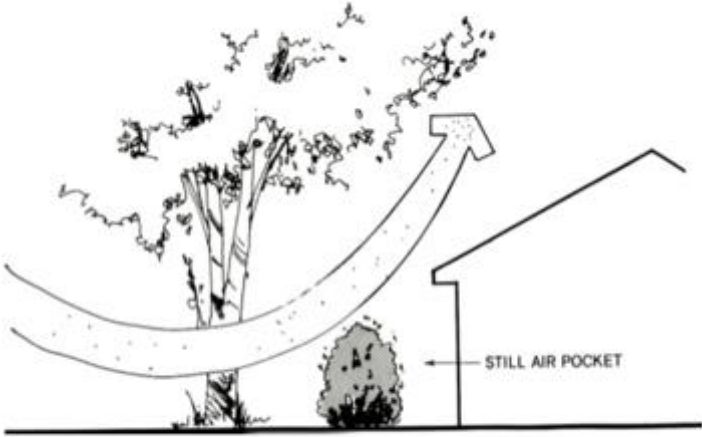


Figure 11.8n Placing bushes between the building and trees is good for winter wind protection but not good for summer ventilation.

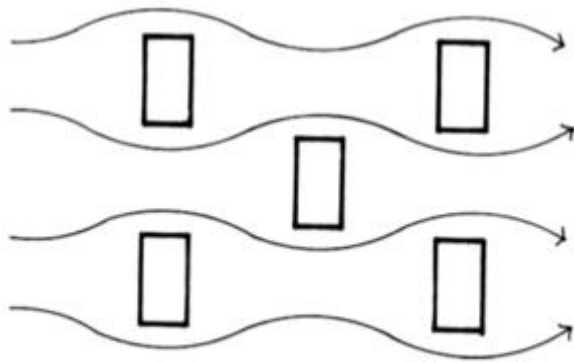


Figure 11.8o In hot and humid climates, buildings should be staggered to promote natural ventilation.

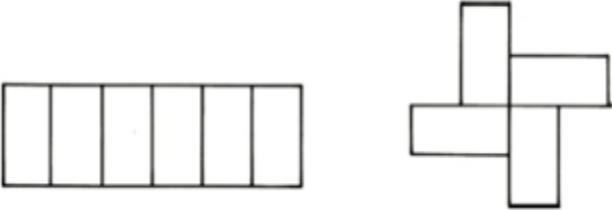


Figure 11.8p Use row or cluster housing for protection against wind in cold climates.

11.8 Wind and Site Design



Figure 11.8s In Taliesin West, near Phoenix, Arizona, Frank Lloyd Wright used pools and fountains to help cool the desert air.

11.10 Vegetated Roofs

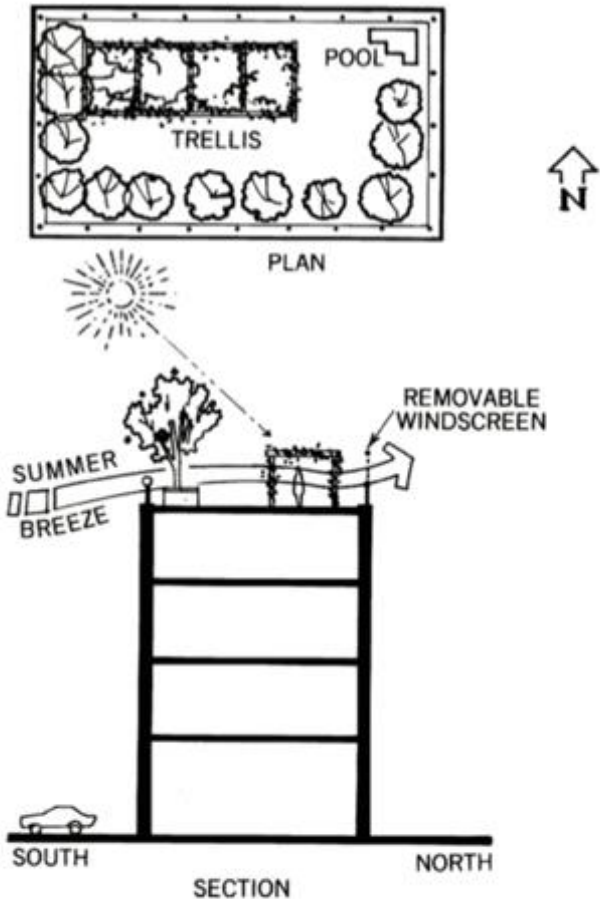


Figure 11.10g A roof-garden design for a hot and humid climate would maximize natural ventilation.