

ZERO ENERGY DESIGN



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Energy Conservation

<http://ngm.nationalgeographic.com/>



It Starts at Home

By Peter Miller

Photography by Tyrone Turner



Energy Saving in Exist Homes

Air Sealing

Proper Insulation

Passive Solar

Daylighting

Natural Ventilation

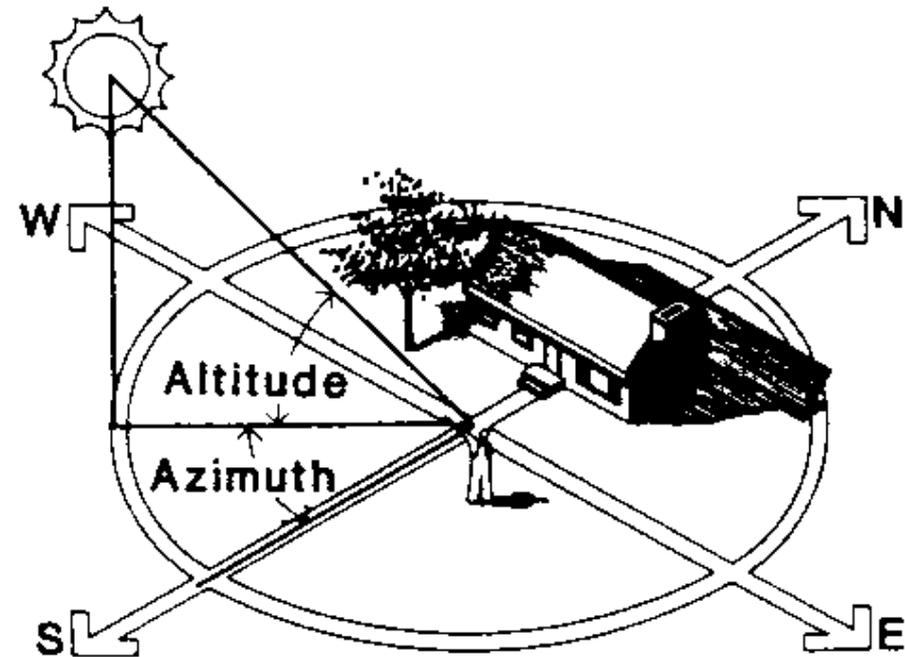
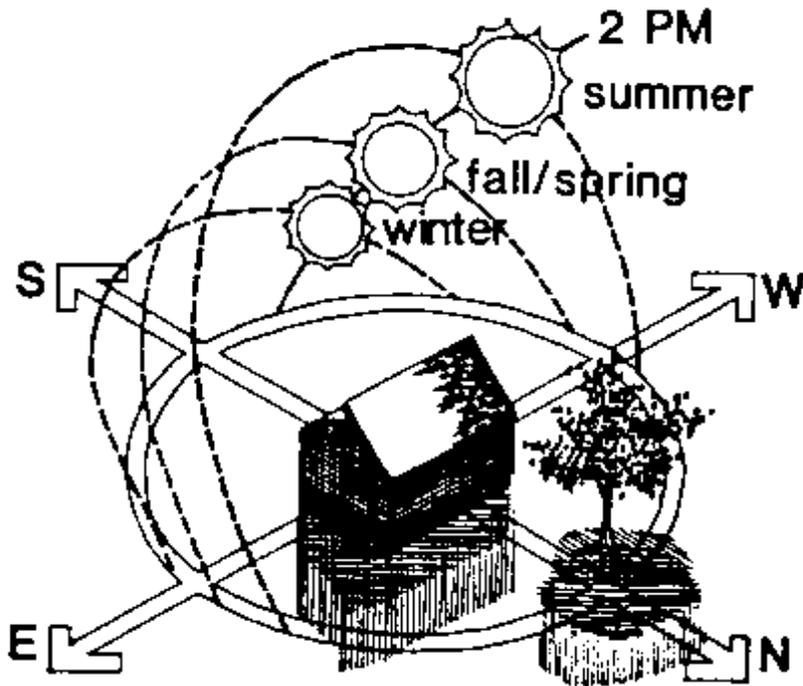
Landscaping

Material Selection



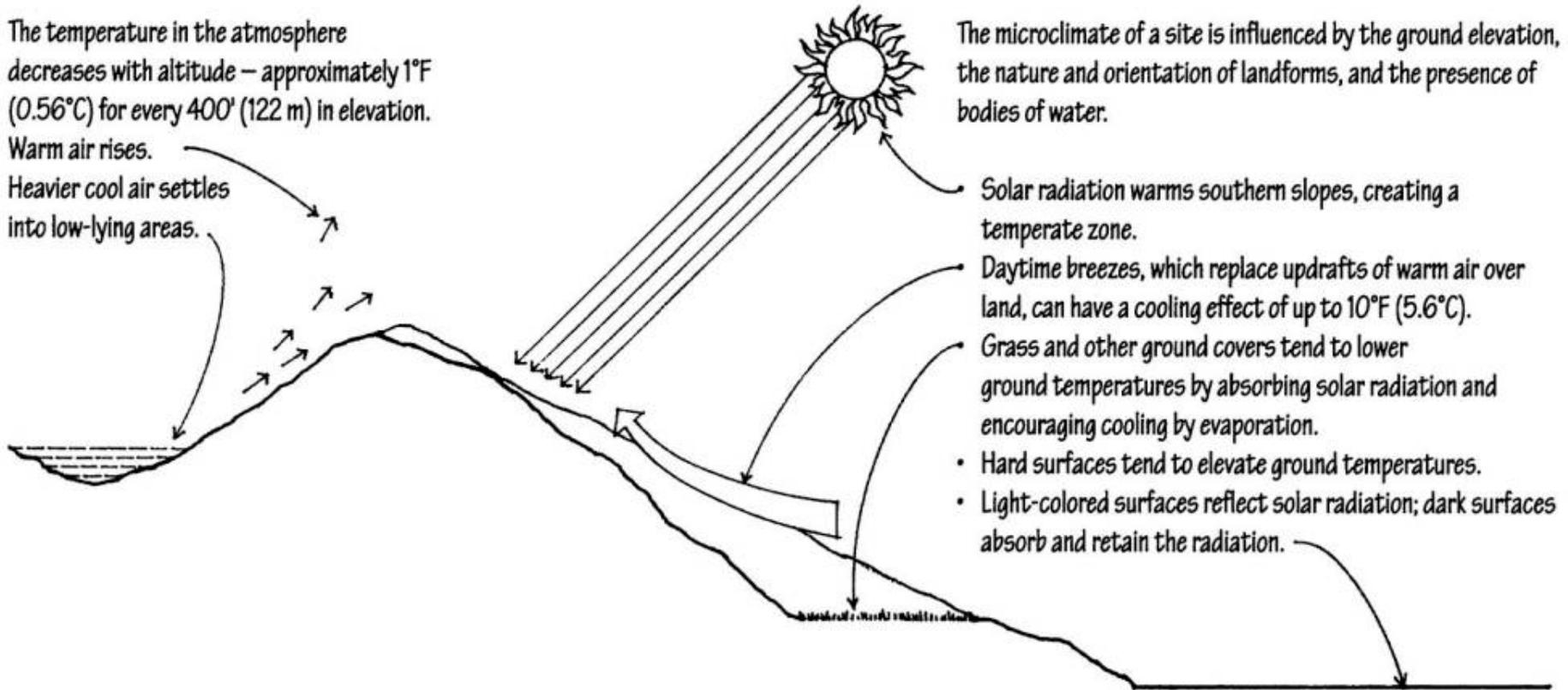
Site Considerations

- Building Orientation – Design for the Sun
 - Seasonal and time of day



Topography

- The temperature in the atmosphere decreases with altitude – approximately 1°F (0.56°C) for every 400' (122 m) in elevation.
- Warm air rises.
- Heavier cool air settles into low-lying areas.

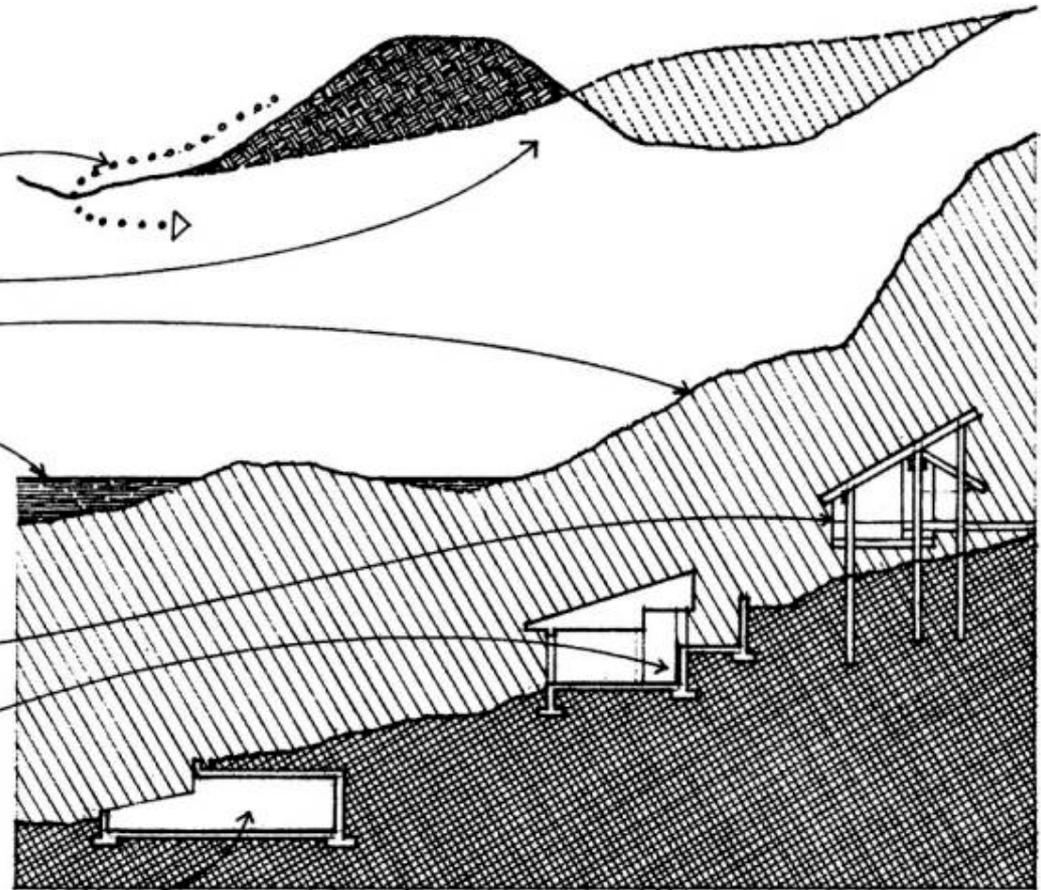


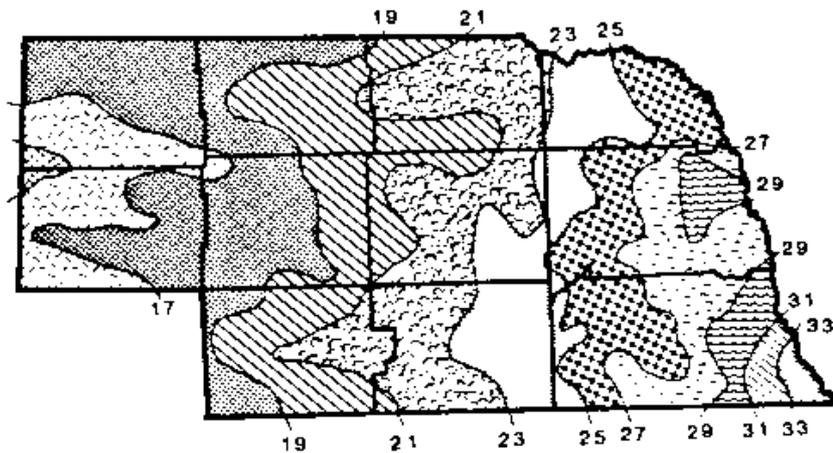
Topography

For aesthetic and economic, as well as ecological reasons, the general intent in developing a site should be to minimize the disturbance of existing landforms and features while taking advantage of natural ground slopes and the microclimate of the site.

- Site development and construction should minimize disrupting the natural drainage patterns of the site and adjacent properties.
- When modifying landforms, include provisions for the drainage of surface water and groundwater.
- Attempt to equalize the amount of cut and fill required for construction of a foundation and site development.
- Avoid building on steep slopes subject to erosion or slides.
- Wetlands and other wildlife habitats may require protection and limit the buildable area of a site.
- Pay particular attention to building restrictions on sites located in or near a flood plain.

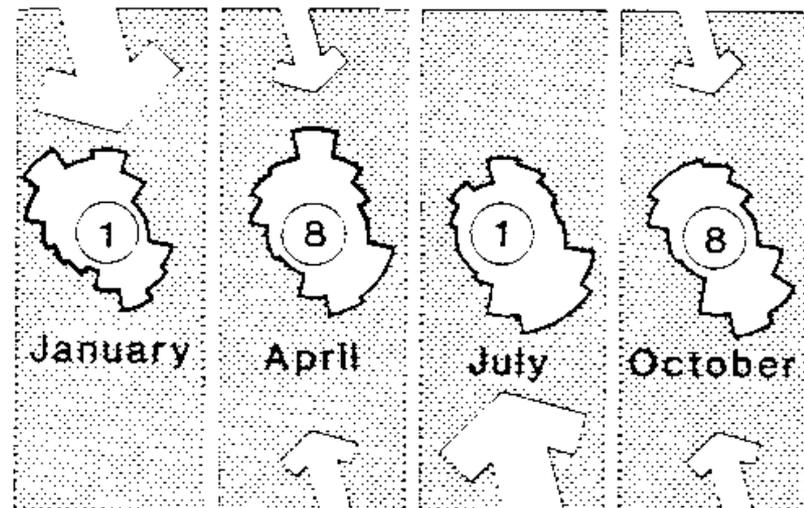
- Elevating a structure on poles or piers minimizes disturbance of the natural terrain and existing vegetation.
- Terracing or stepping a structure along a slope requires excavation and the use of retaining walls or bench terracing.
- Cutting a structure into a slope or locating it partially underground moderates temperature extremes and minimizes exposure to wind, and heat loss in cold climates.





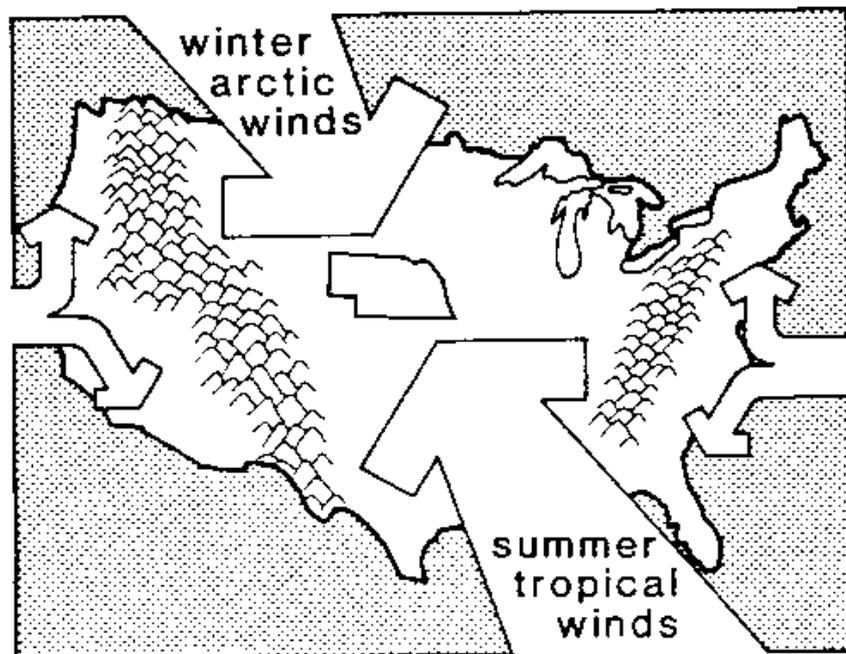
2.3-2 NEBRASKA MEAN ANNUAL PRECIPITATION

arctic winds



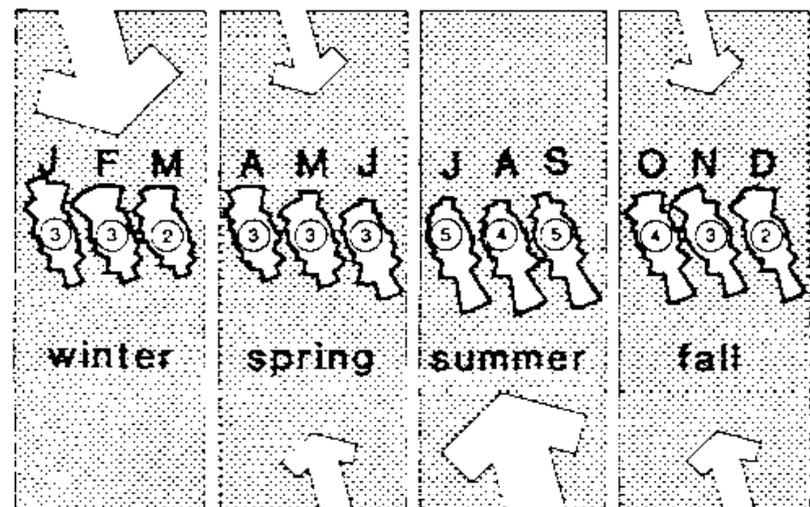
tropical winds

2.3-4 WIND ROSES: NORTH PLATTE



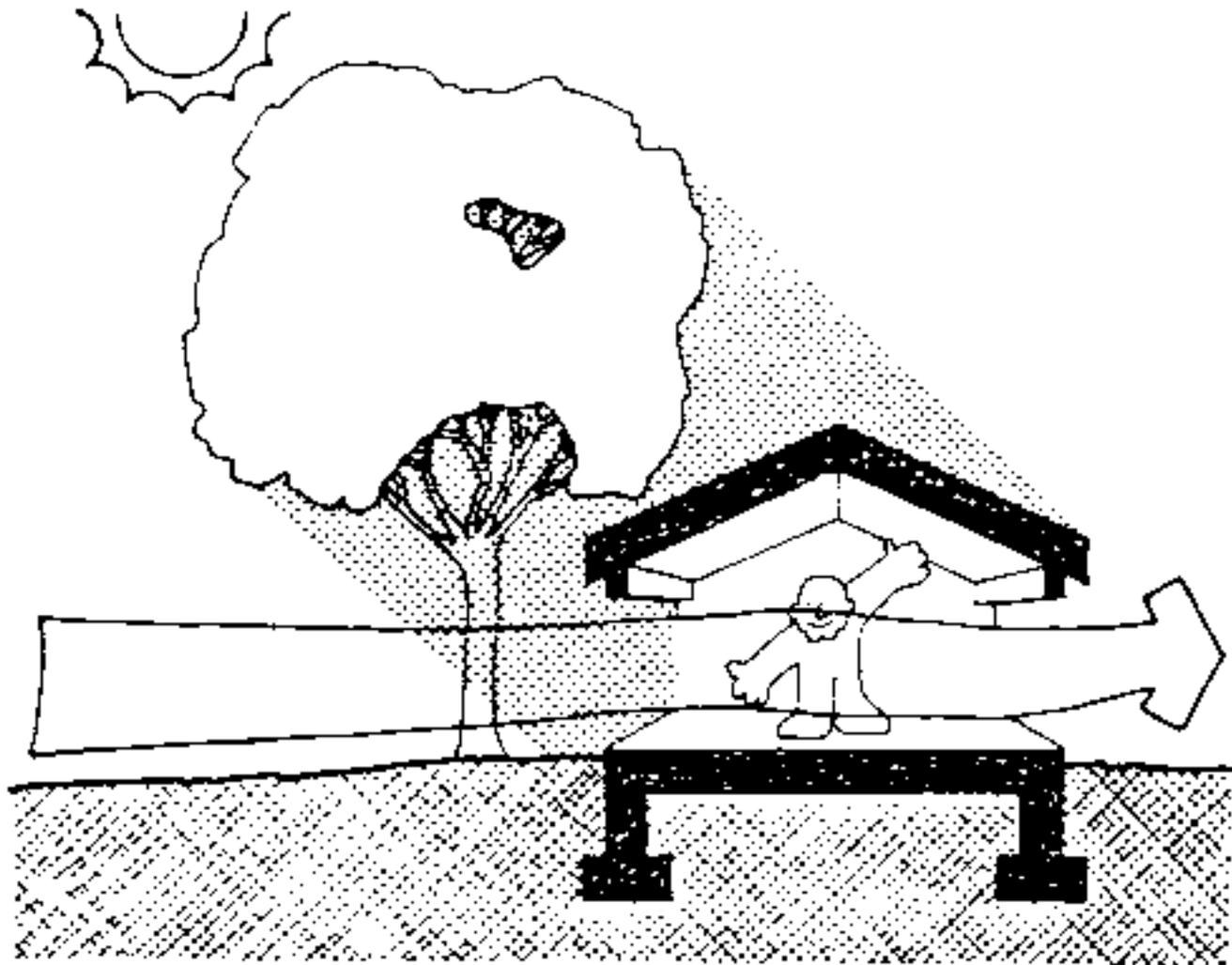
2.3-3 PREVAILING WIND DIRECTIONS

arctic winds



tropical winds

2.3-5 WIND ROSES: OMAHA



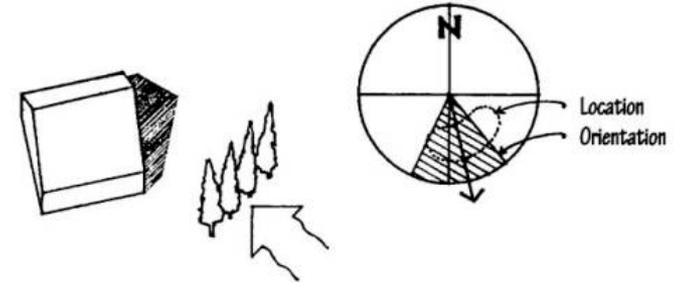
Solar radiation

The following are recommended forms and orientations for isolated buildings in different climatic regions. The information presented should be considered along with other contextual and programmatic requirements.

Cool Regions

Minimizing the surface area of a building reduces exposure to low temperatures.

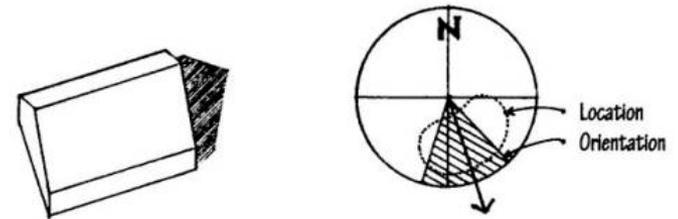
- Maximize absorption of solar radiation.
- Reduce radiant, conductive, and evaporative heat loss.
- Provide wind protection.



Temperate Regions

Elongating the form of a building along the east-west axis maximizes south-facing walls.

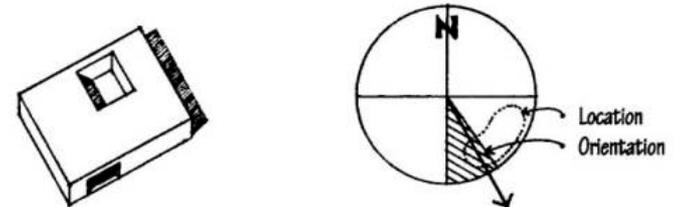
- Minimize east and west exposures, which are generally warmer in summer and cooler in winter than southern exposures.
- Balance solar heat gain with shade protection on a seasonal basis.
- Encourage air movement in hot weather; protect against wind in cold weather.



Hot-Arid Regions

Building forms should enclose courtyard spaces.

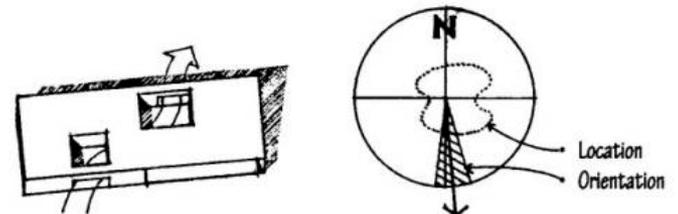
- Reduce solar and conductive heat gain.
- Promote cooling by evaporation using water features and plantings.
- Provide solar shading for windows and outdoor spaces.



Hot-Humid Regions

Building form elongated along the east-west axis minimizes east and west exposures.

- Reduce solar heat gain.
- Utilize wind to promote cooling by evaporation.
- Provide solar shading for windows and outdoor spaces.

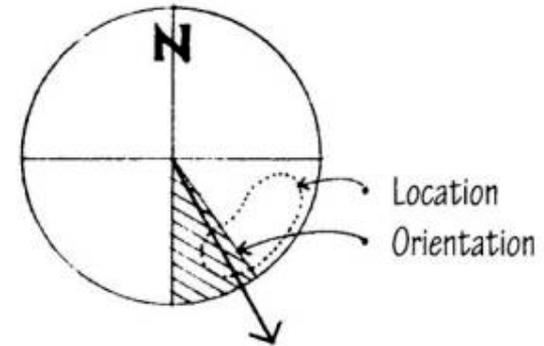
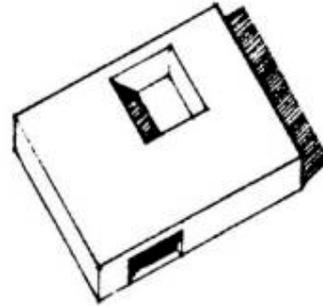


Solar radiation

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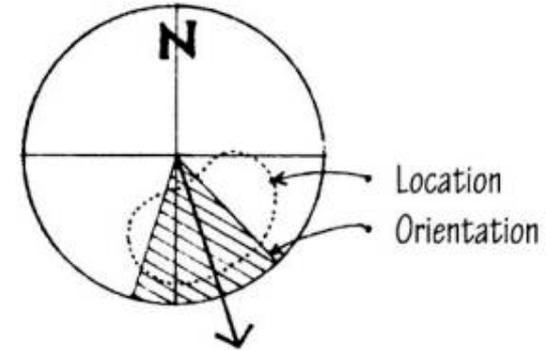
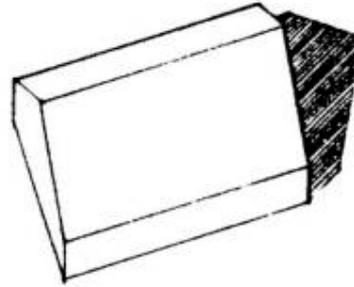


Solar radiation

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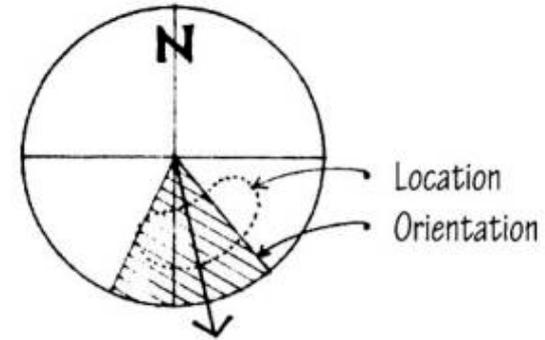
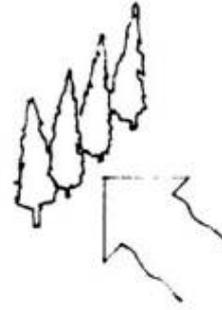
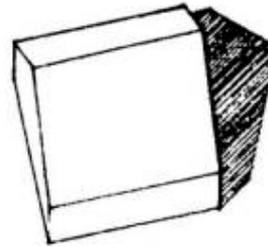


Solar radiation

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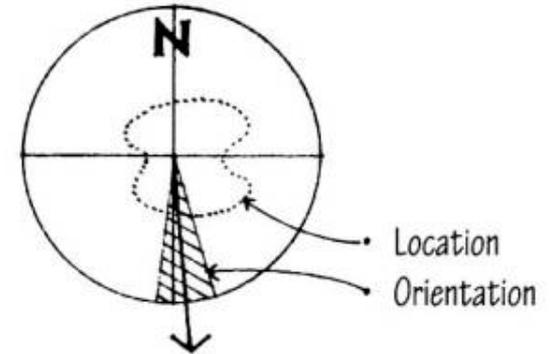
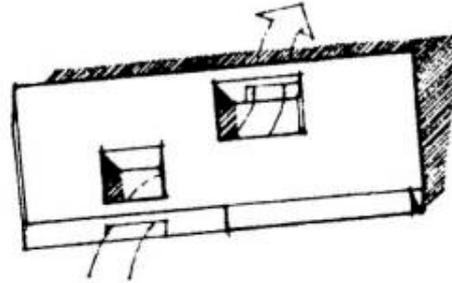


Solar radiation

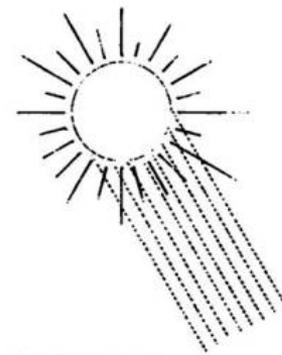
Hot-Humid Regions

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- Reduce solar heat gain.
- Utilize wind to promote cooling by evaporation.
- Provide solar shading for windows and outdoor spaces.



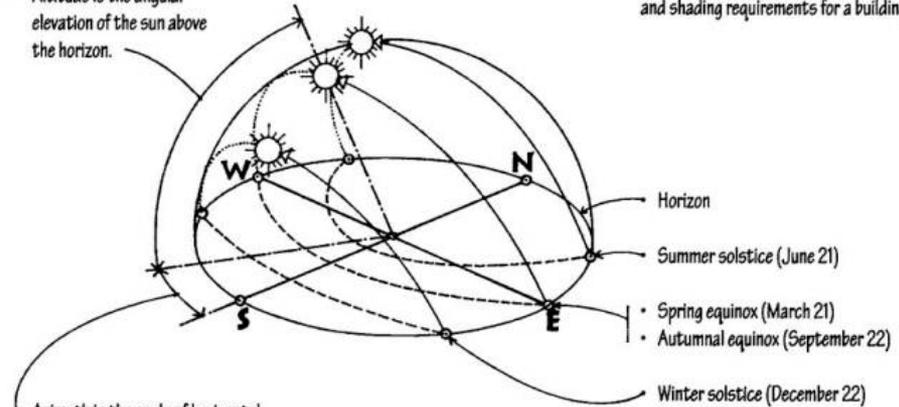
Solar radiation



The location, form, and orientation of a building and its spaces should take advantage of the thermal, hygienic, and psychological benefits of sunlight. Solar radiation, however, may not always be beneficial, depending on the latitude and climate of the site. In planning the design of a building, the objective should be to maintain a balance between overheated periods when solar radiation is beneficial and overheated periods when radiation should be avoided.

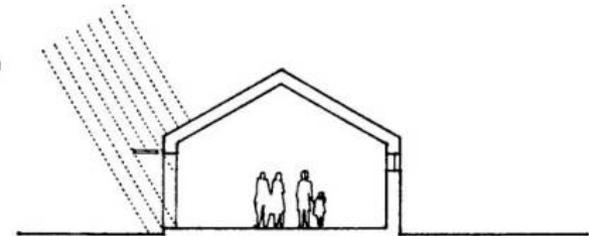
The path of the sun through the sky varies with the seasons and the latitude of a building site. The range of solar angles for a specific site should be obtained from a weather almanac or service bureau before calculating the potential solar heat gain and shading requirements for a building design.

• Altitude is the angular elevation of the sun above the horizon.



Azimuth is the angle of horizontal deviation, measured clockwise, of a bearing from a standard south direction.

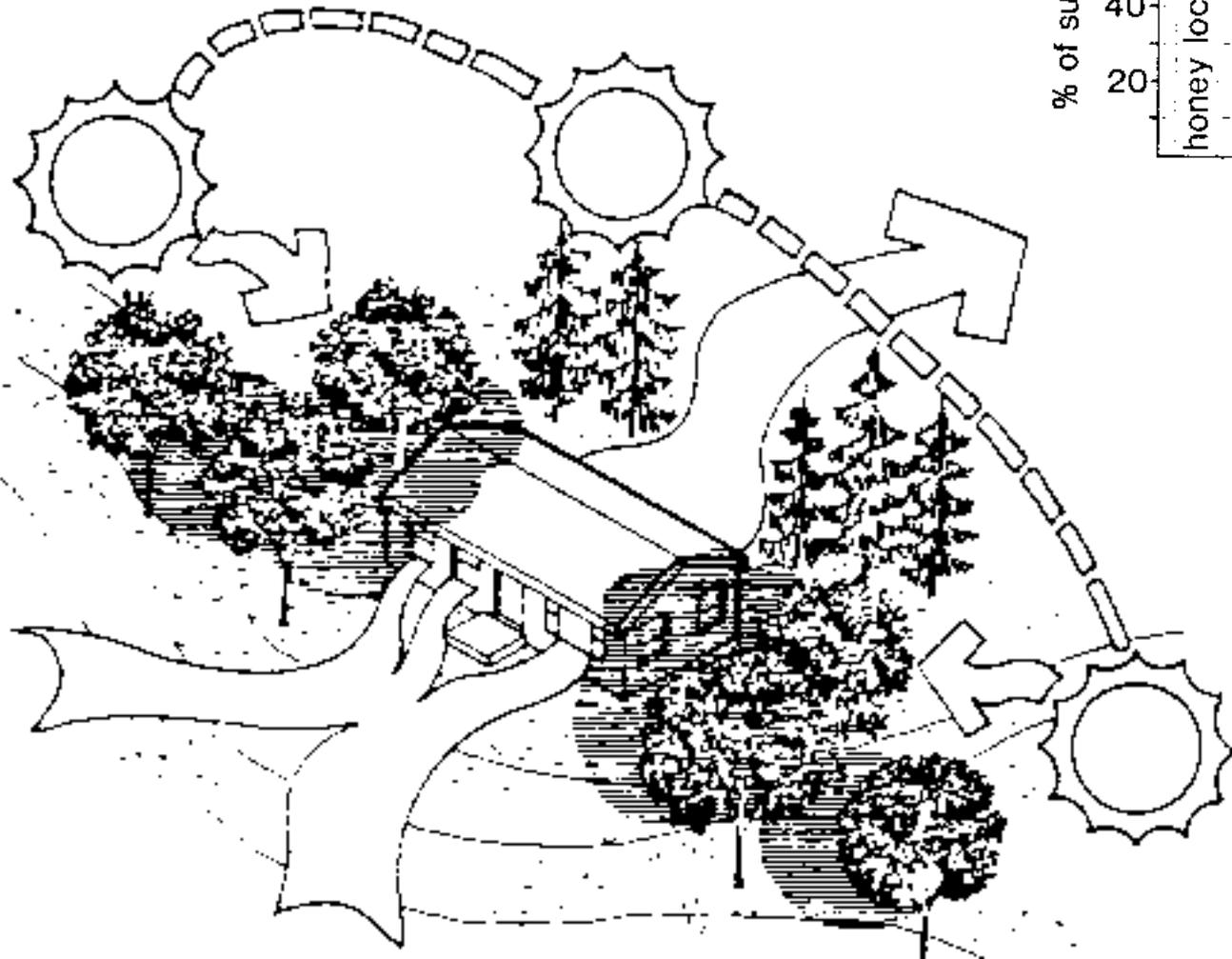
Solar Path Diagram



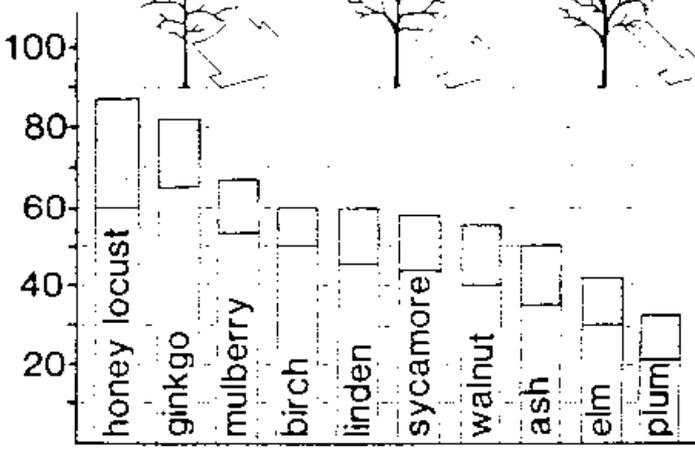
Representative Solar Angles

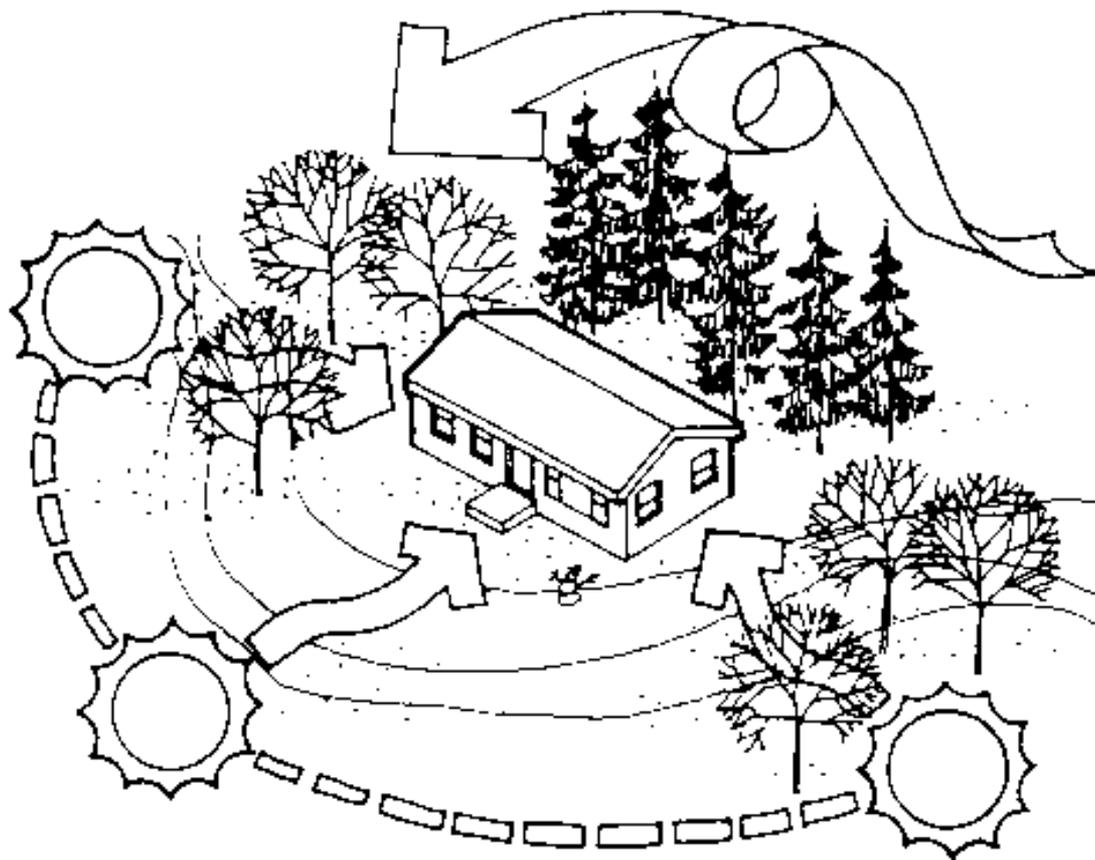
North Latitude	Representative City	Altitude at Noon		Azimuth at Sunrise & Sunset*	
		Dec. 22	Mar. 21/Sept. 22	Dec. 22	June 21
48°	Seattle	18°	42°	54°	124°
44°	Toronto	22°	46°	56°	122°
40°	Denver	26°	50°	58°	120°
36°	Tulsa	30°	54°	60°	118°
32°	Phoenix	34°	58°	62°	116°

* Azimuth is east of south for sunrise, and west of south for sunset.

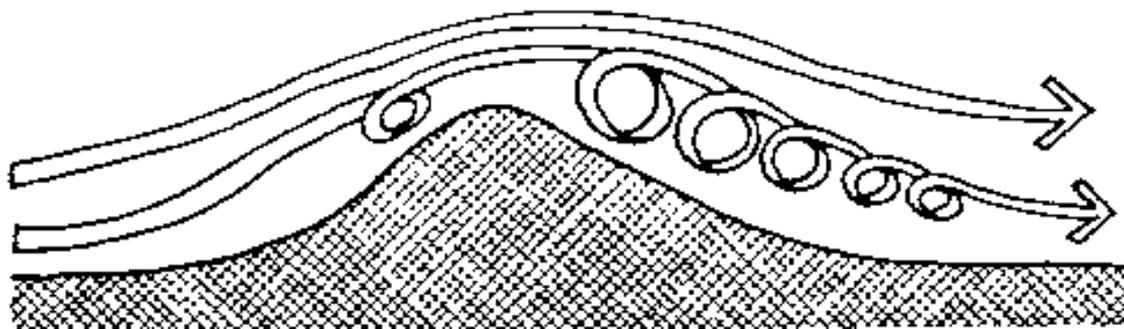


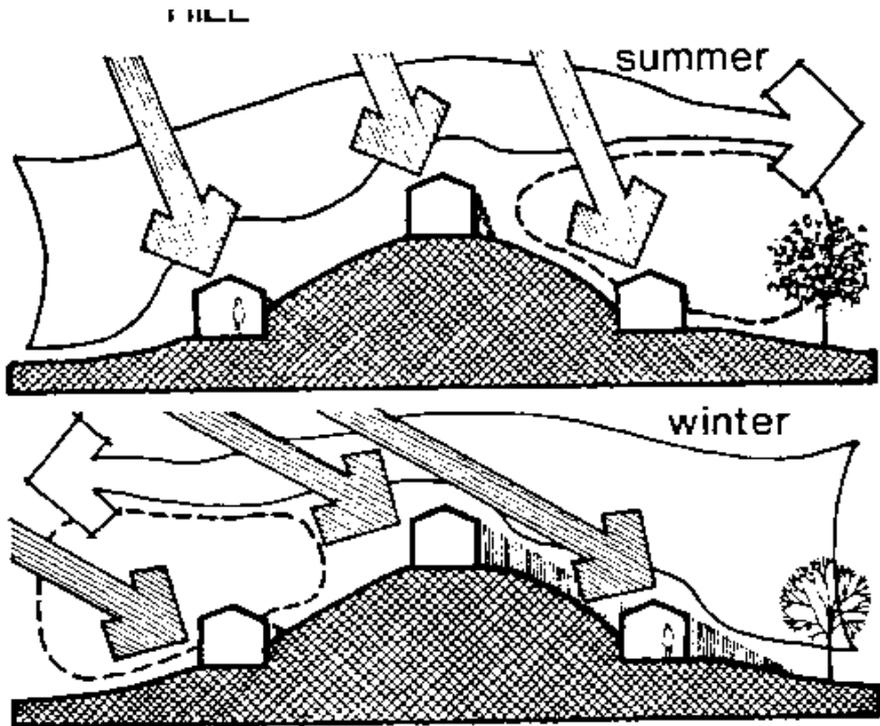
% of sunlight penetration



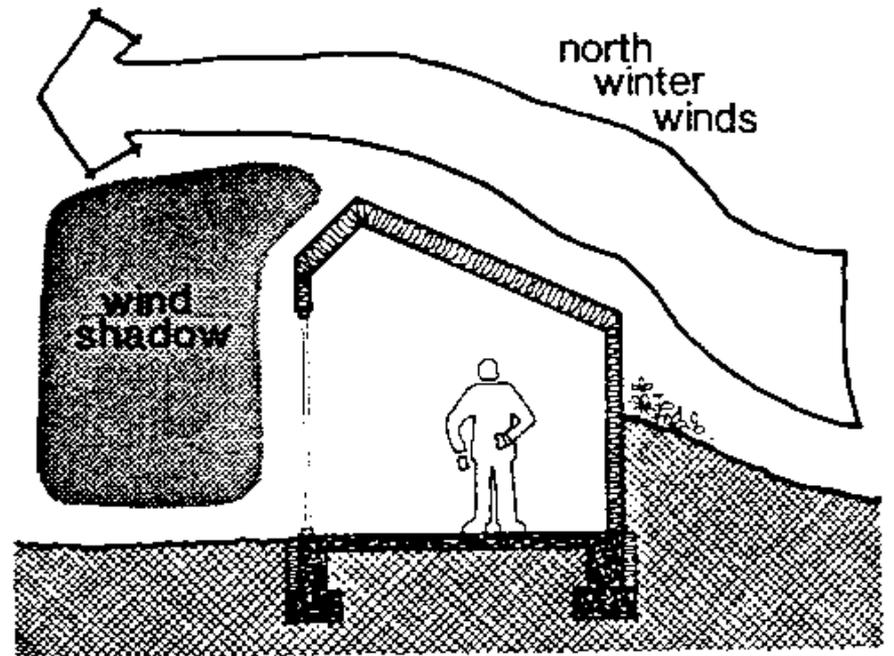


2.3-9 PLANTING STRATEGY: WINTER





2.3-11 HILL MICROCLIMATE

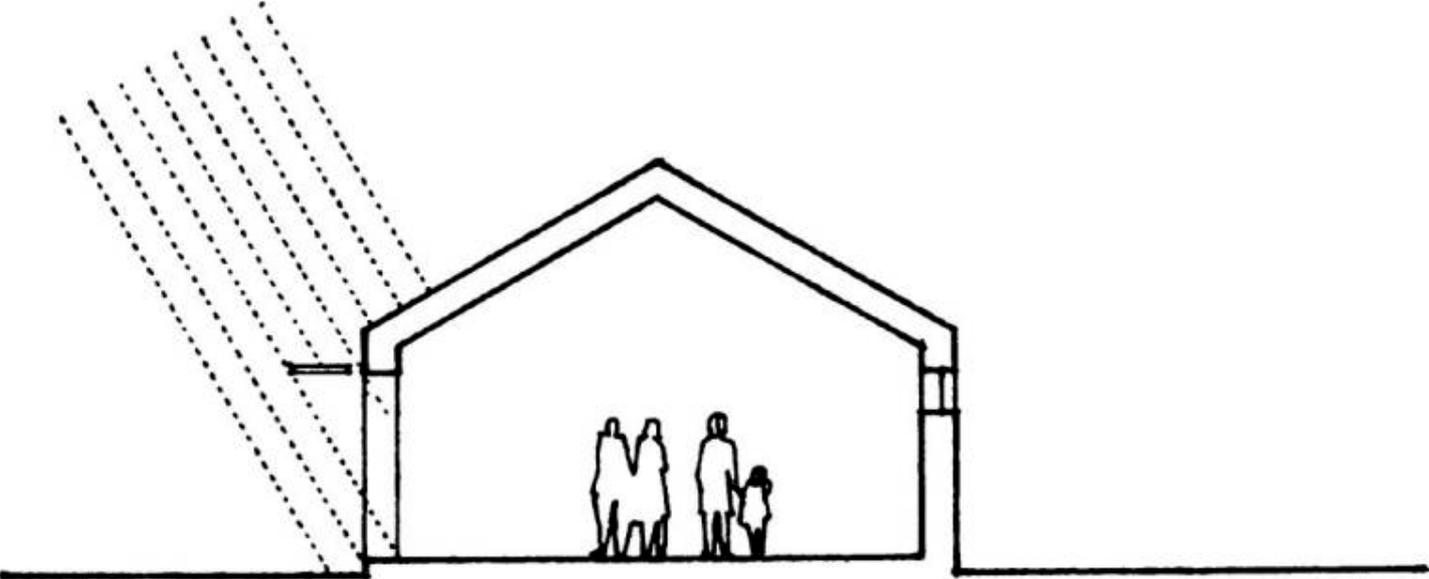


2.3-12 BUILDING MICROCLIMATE

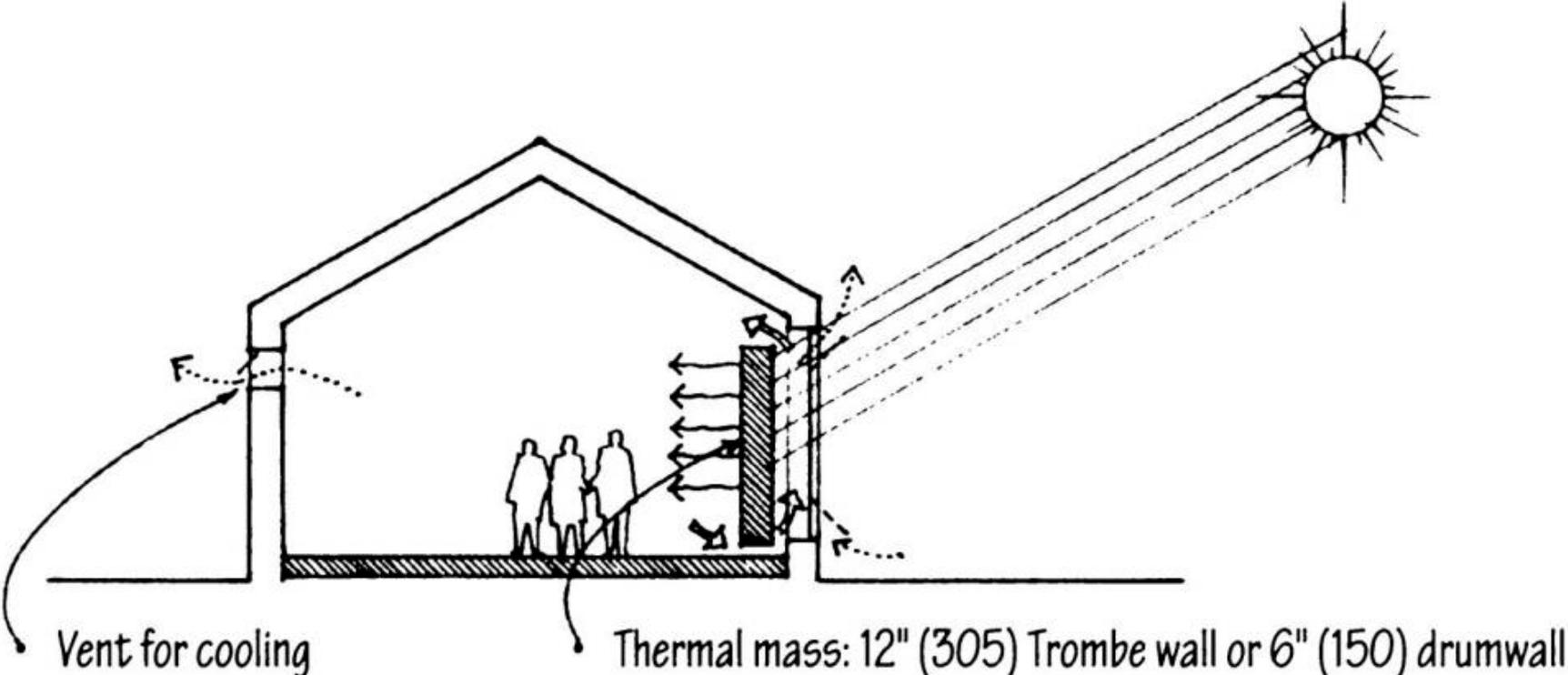


Solar radiation

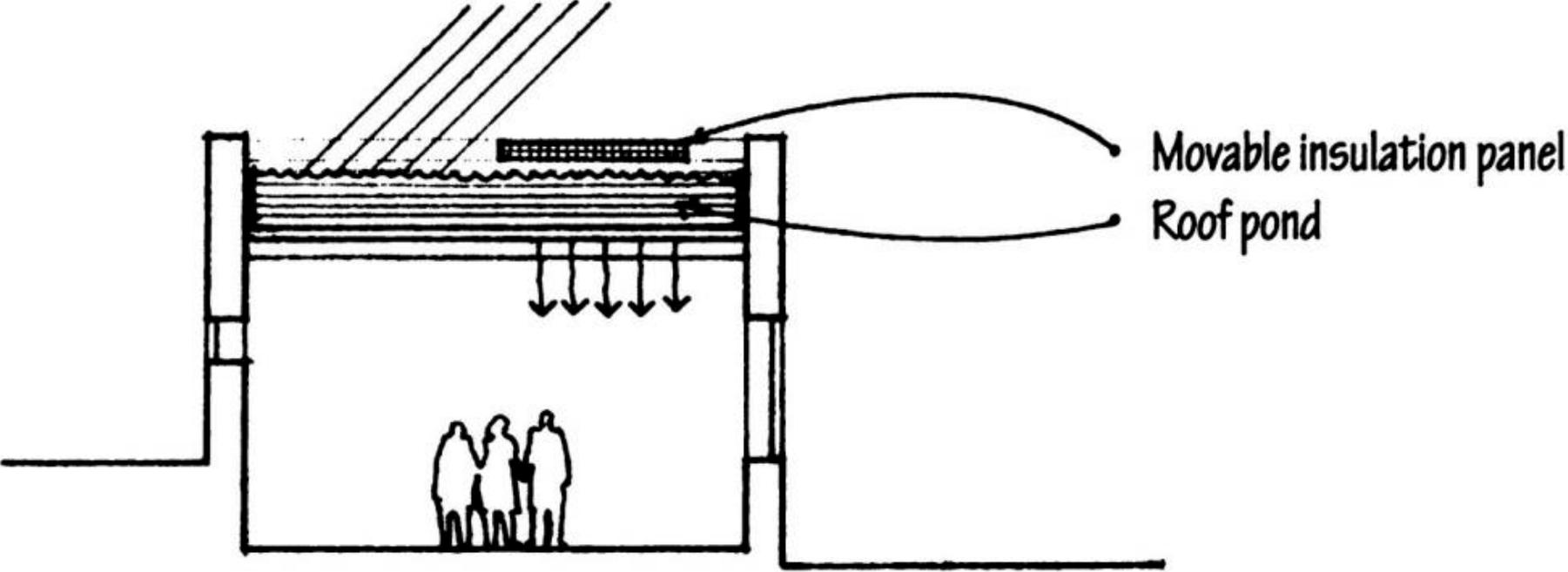
Solar Path Diagram



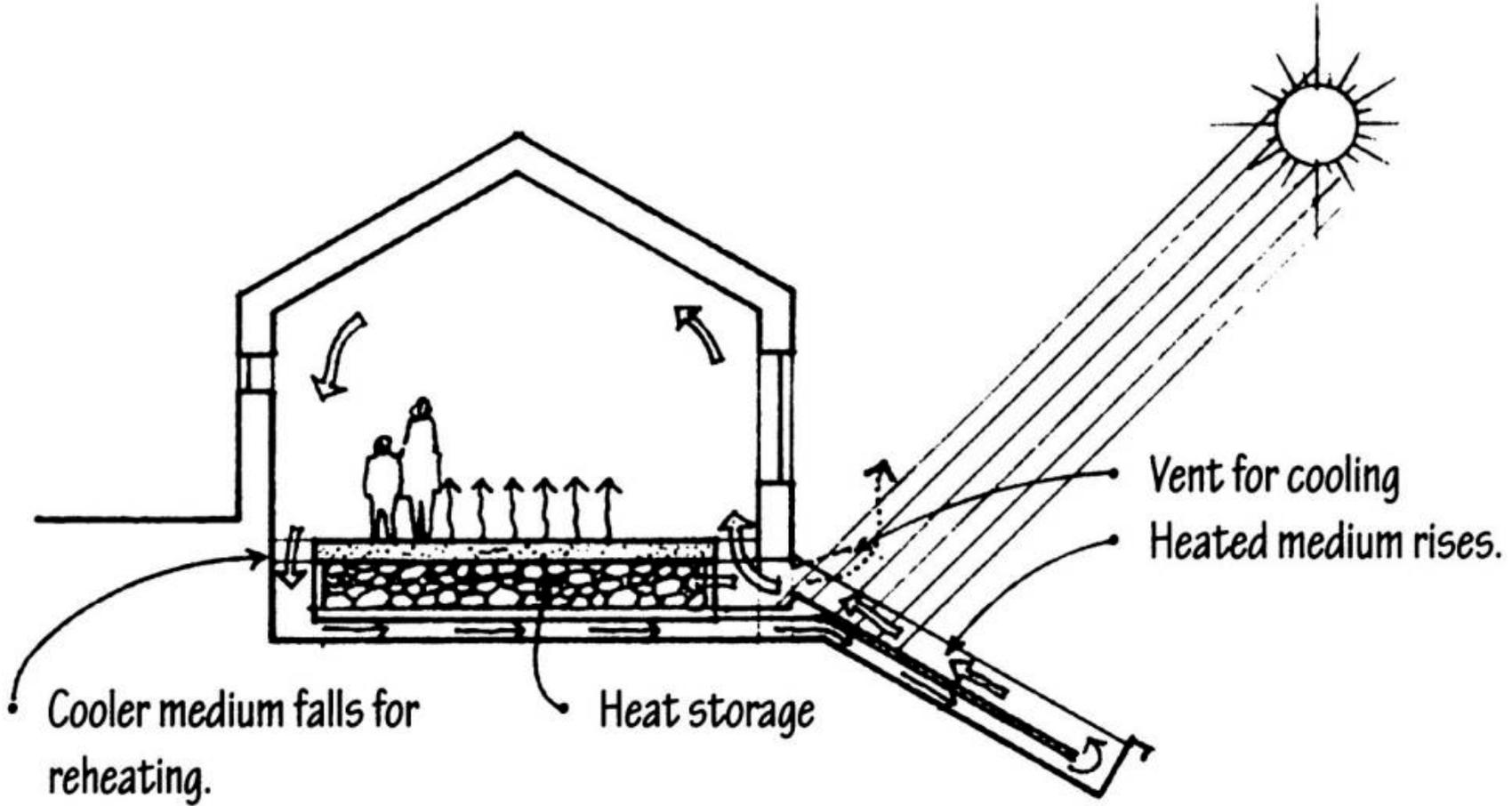
Passive solar design



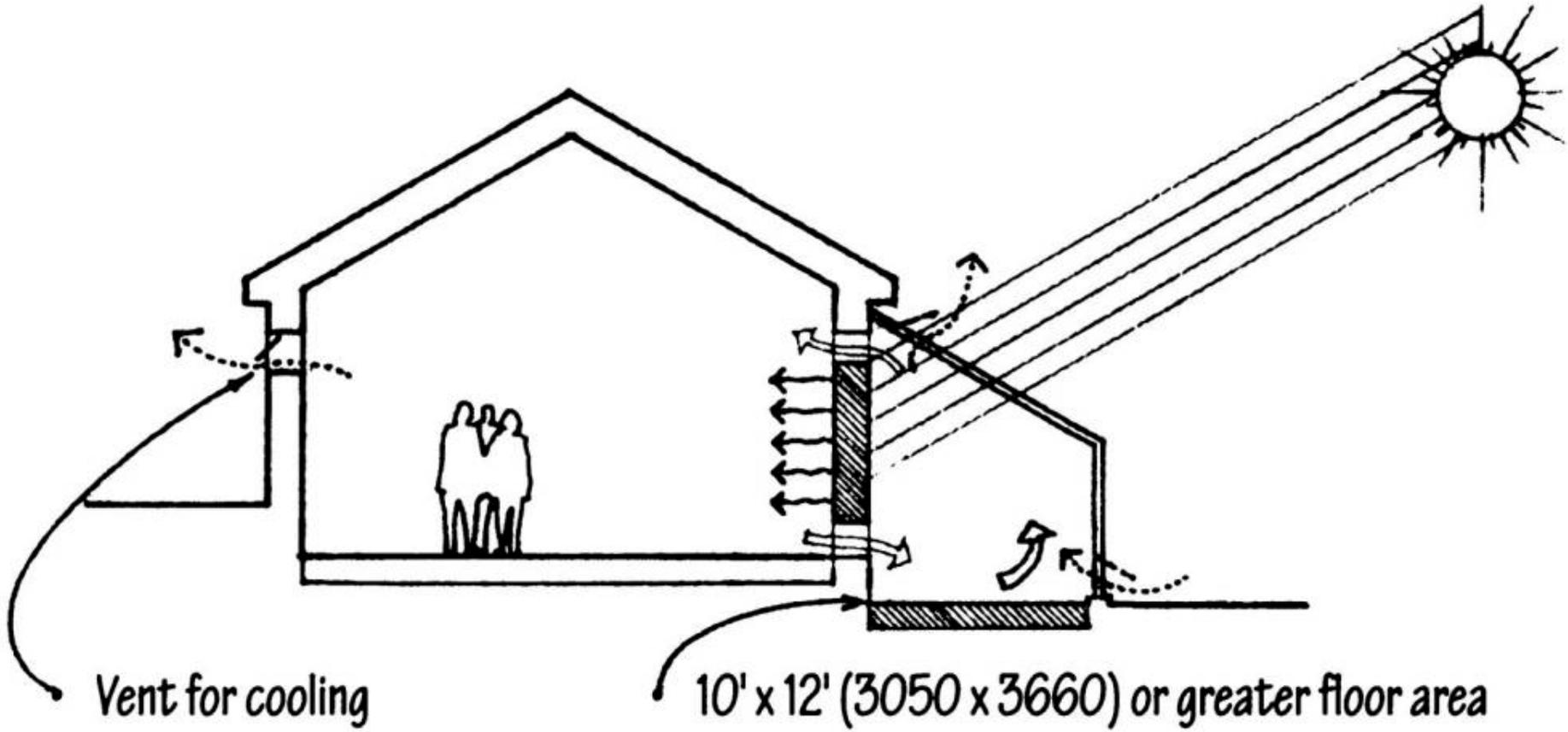
Passive solar design



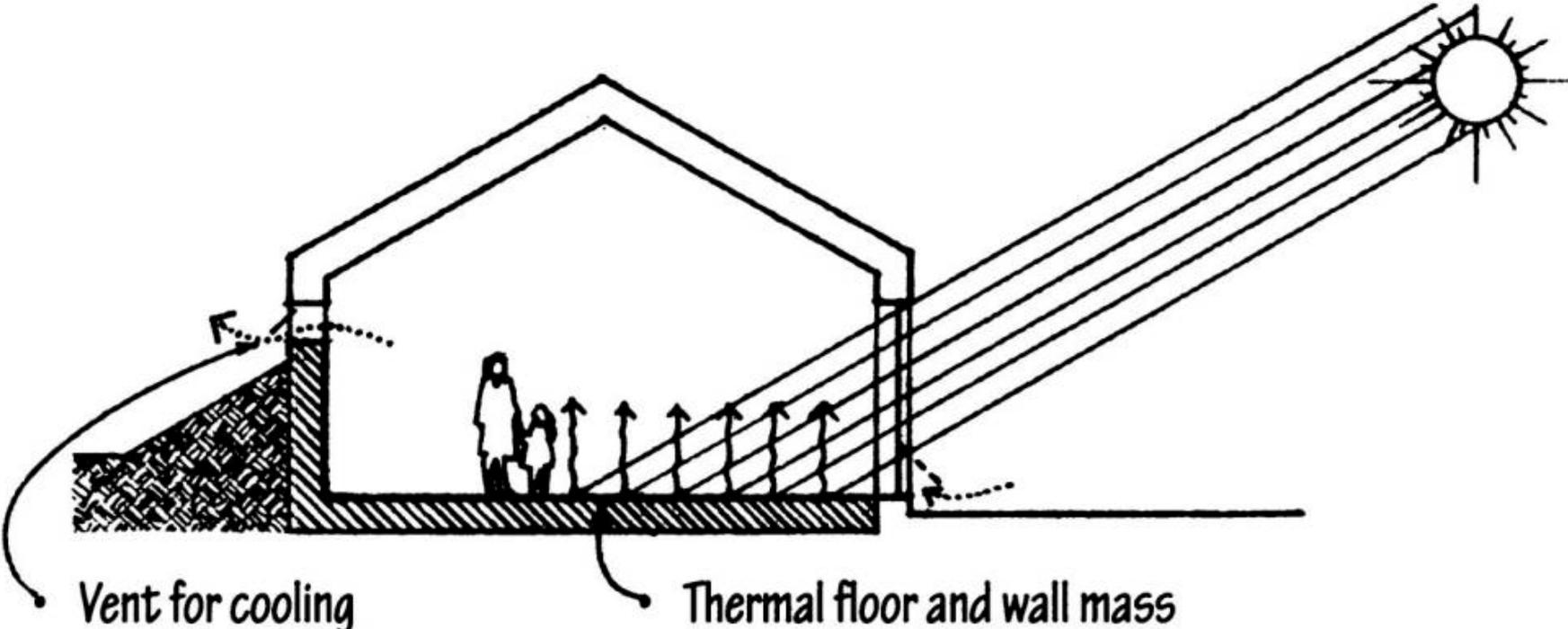
Passive solar design

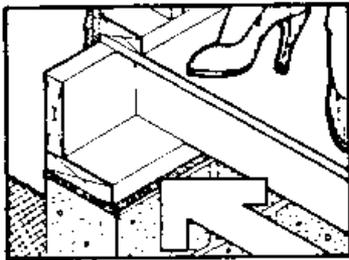


Passive solar design

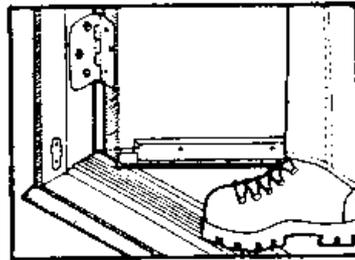


Passive solar design

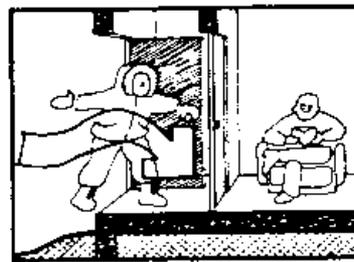




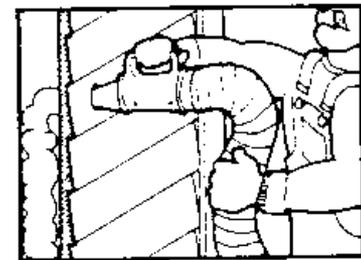
1) SILL SEALER



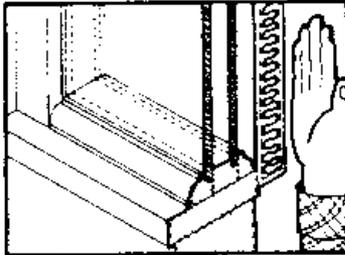
2) WEATHER-STRIPPING



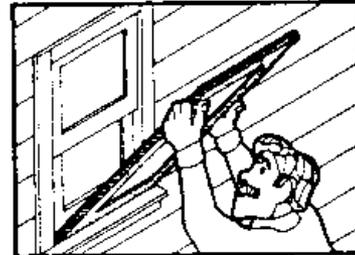
3) AIRLOCK



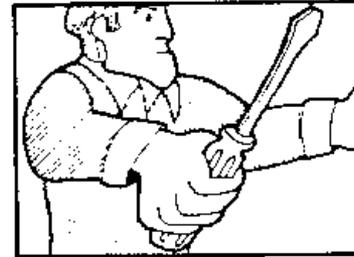
4) WALL INSULATION



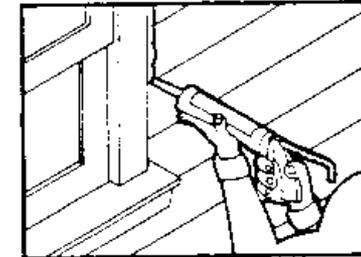
5) MOVABLE INSULATION



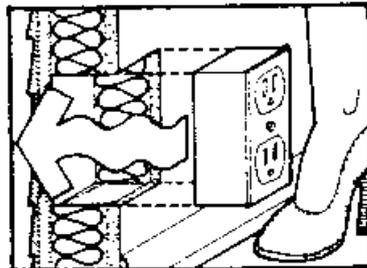
6) STORM WINDOWS



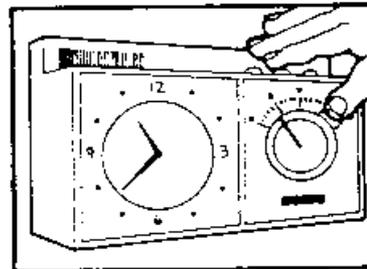
7) MAINTENANCE



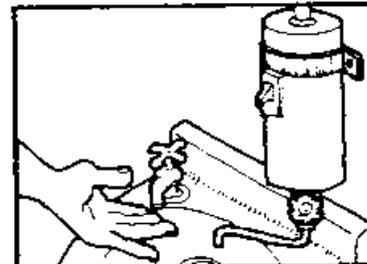
8) CAULKING



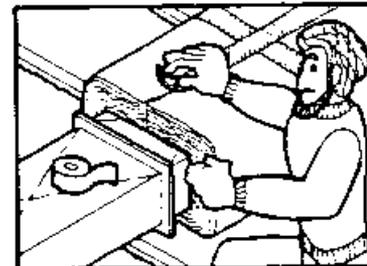
9) EXTERIOR WALL OUTLETS



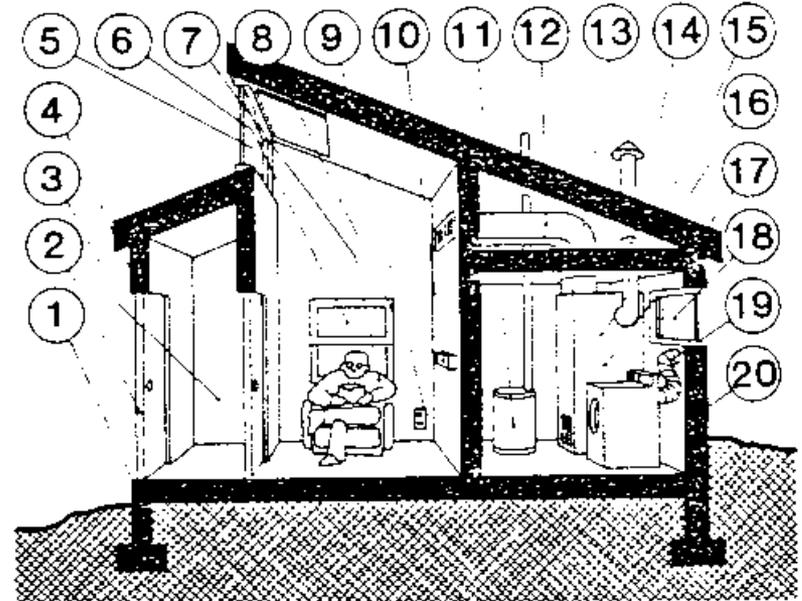
10) SPECIAL THERMOSTAT



11) TANKLESS WATER HEATER



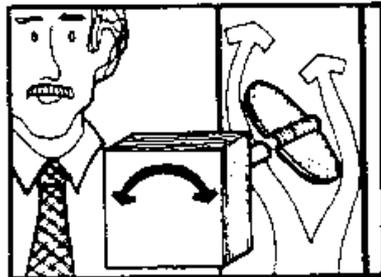
12) DUCT INSULATION



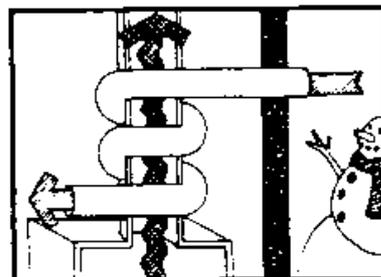
2.2-1 CONSERVATION IDEAS



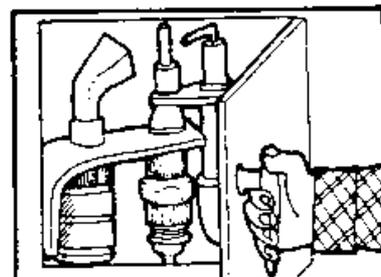
13) ATTIC
INSULATION



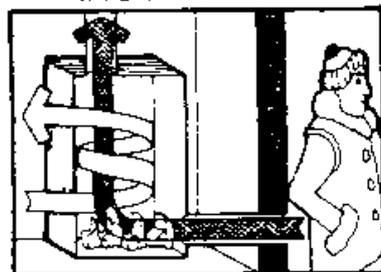
14) FURNACE
DAMPER



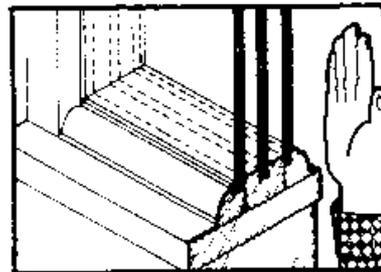
15) HEAT
EXCHANGER



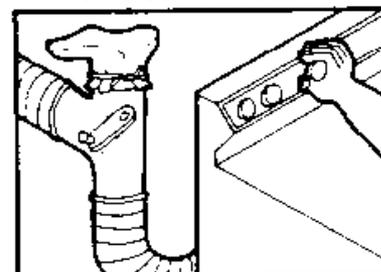
16) ELECTRIC
IGNITION



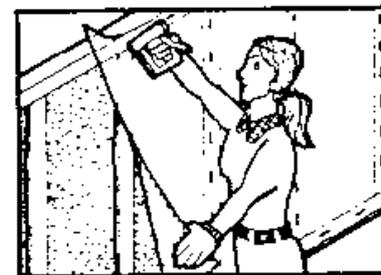
17) OUTSIDE
COMBUSTION AIR



18) TRIPLE GLAZING



19) DRYER HEAT
RECOVERY



20) VAPOR BARRIER

Sources

ARCHITECTURAL GRAPHIC STANDARDS

PATH TO PASSIVE:

**[HTTP://WWW.NEO.NE.GOV/PUBLICATI
ONS/PATHTOPASSIVE.HTM](http://www.neo.ne.gov/publications/pathtopassive.htm)**

