

## Lecture<sup>^</sup>: Climate



# Introduction

Designing buildings in harmony with their climates is an age-old idea. To design in conformity with climate, the designer needs to understand the microclimate of the site, since all climatic experience of both people and buildings is at this level. In some cases, the microclimate can be quite different from the larger climate.

It is now easy to see how man changes the microclimate by such acts as replacing farmland and forest with the hard and massive materials of cities, irrigating a desert and making it a humid area, and constructing highrise buildings to form windy canyons. Unfortunately, these changes in the microclimate are rarely beneficial, since they are usually done without concern for the consequences.

The area encompassing Yazd first started to gain prominence in the Late antiquity, namely under the Sasanians. Under Yazdegerd I (r. 399–420)

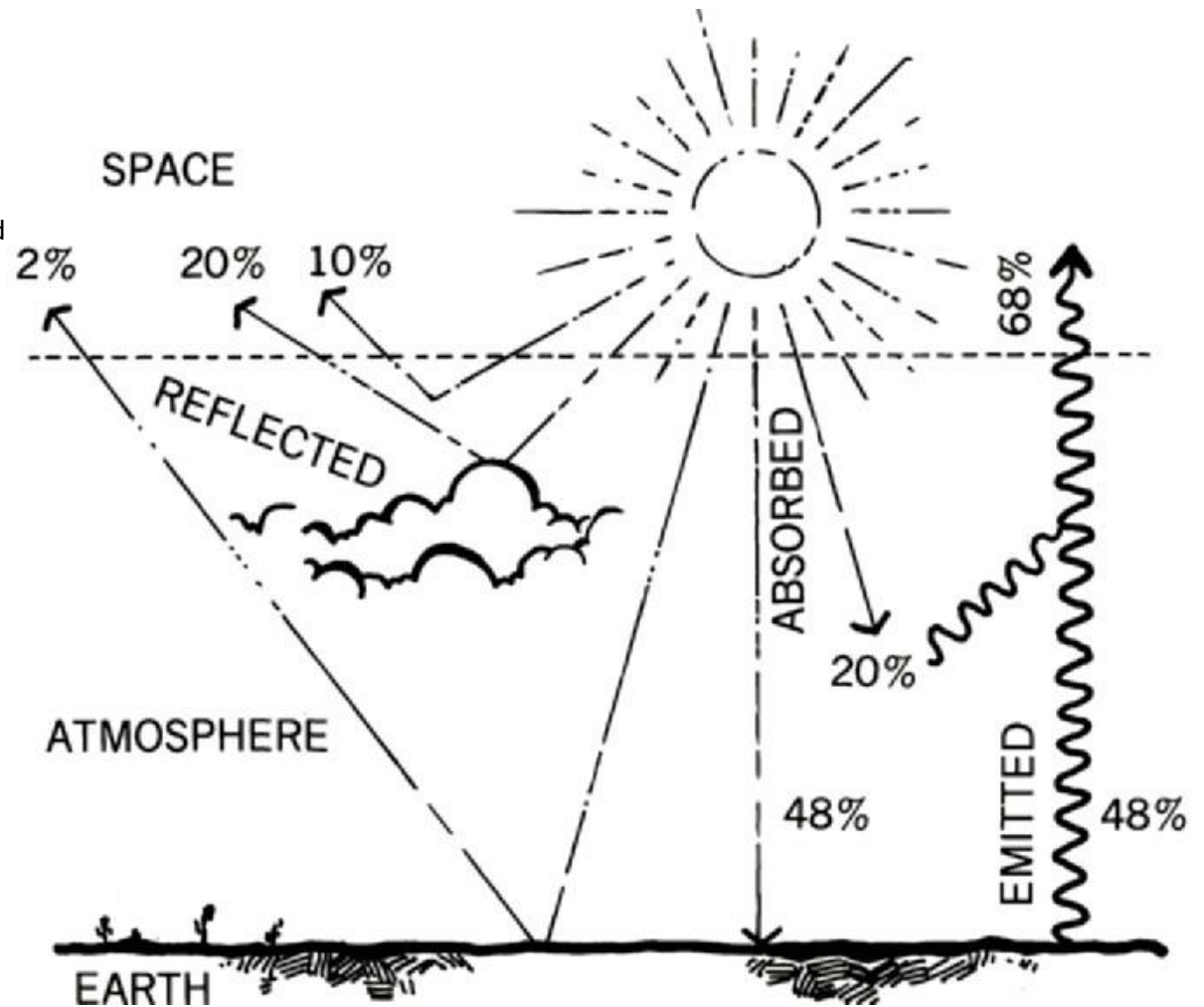


# CLIMATE

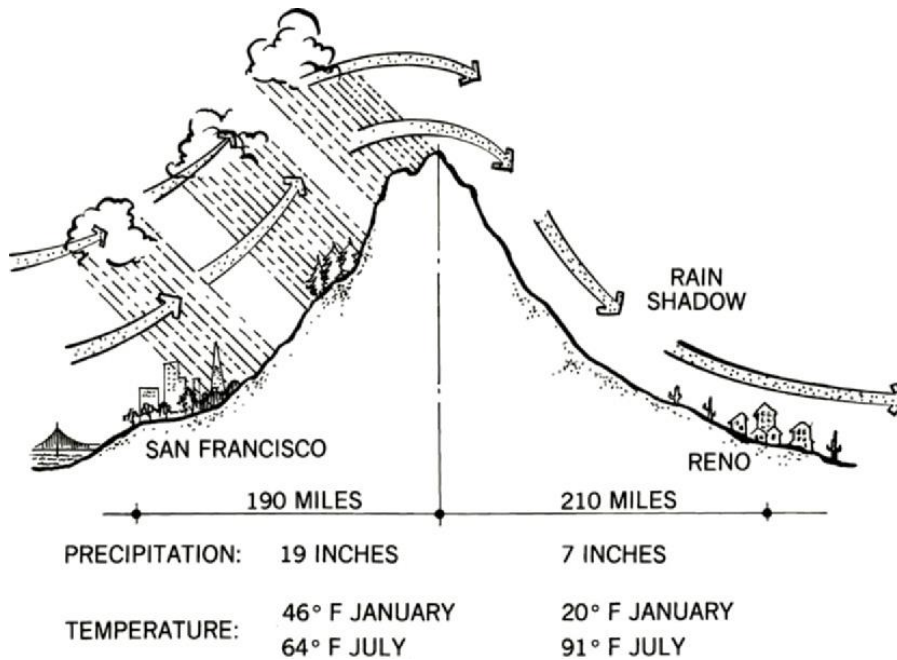
The climate, or average weather, is primarily a function of the sun.

The atmosphere is a giant heat machine fueled by the sun.

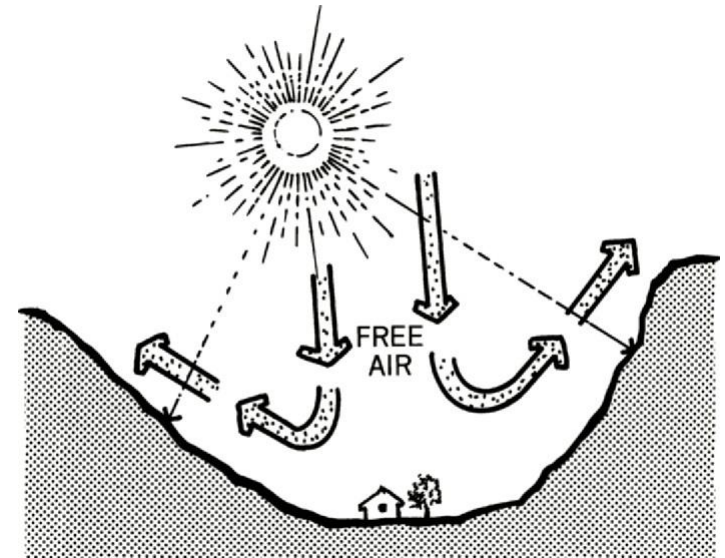
The atmosphere is heated mainly by contact with the solar-heated ground. On an annual basis, the energy absorbed by the earth equals the energy radiated back into space. In the summer there is a gain, in the winter an equal loss. This was true until about one hundred years ago, when human-caused global warming started.



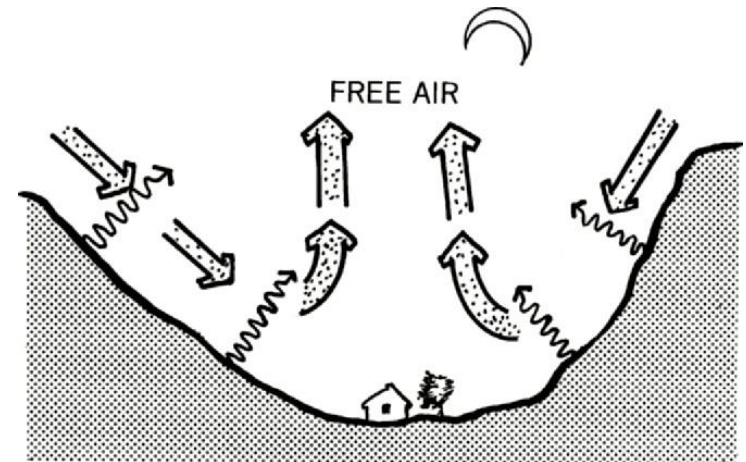
# CLIMATE



*In certain cases, mountain ranges cause rapid changes from relatively wet and cool to hot and dry climates.*

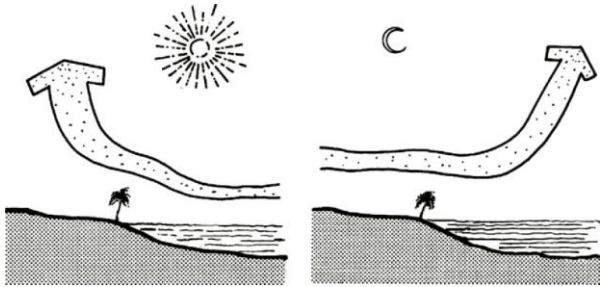


*During the day, the air moves up the mountainsides.*

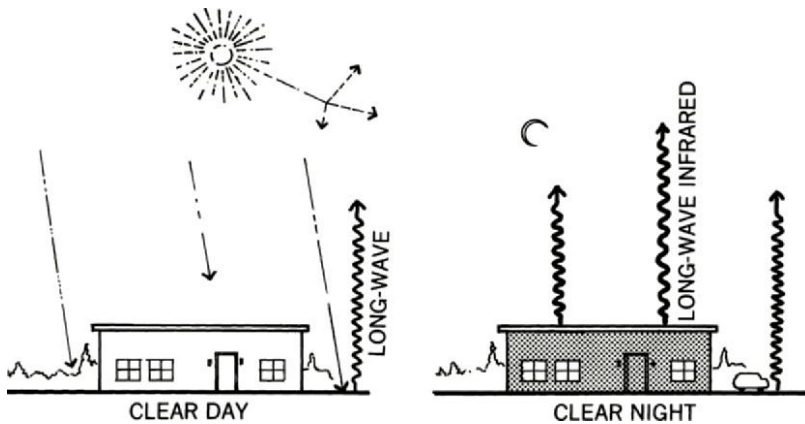


*At night, the land cools rapidly by radiation, and the air currents move down the mountainsides.*

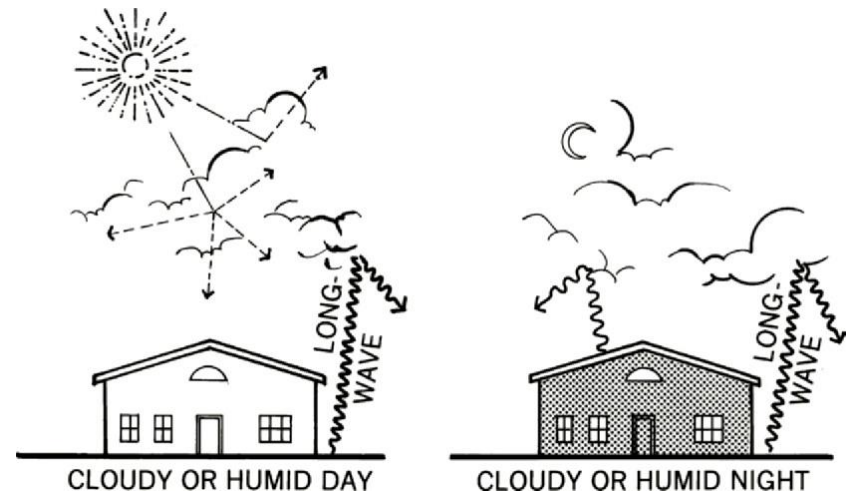
# CLIMATE



The temperature differences between land and water create sea breezes during the day and land breezes at night.



Since dry climates have little moisture to block radiation, daytime temperatures are high and nighttime temperatures are low. The diurnal temperature range is, therefore, large.



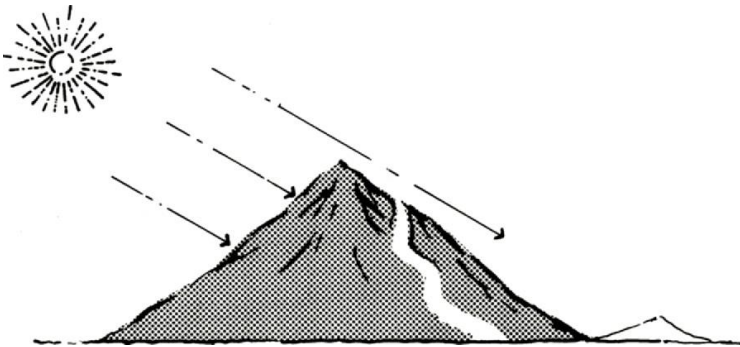
Water in the form of humidity and especially in the form of clouds blocks both solar and long-wave radiation. Thus, in humid or cloudy climates, daytime temperatures are not as high and nighttime temperatures are not as low as in hot and dry climates. The diurnal range is, therefore, small.

# MICROCLIMATE

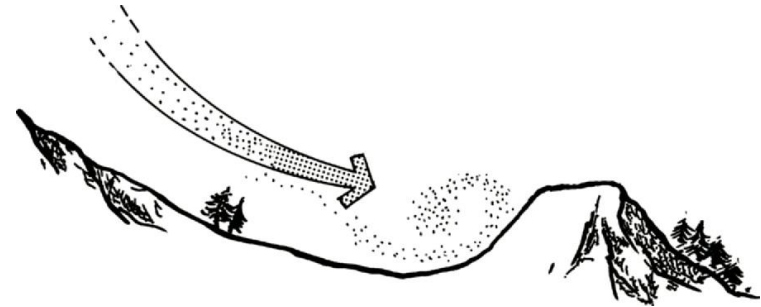
For a number of reasons, the local climate can be quite different from the climate region in which it is found. If buildings are to relate properly to their environment, they must be designed for the microclimate in which they exist. The following are the main factors

responsible for making the microclimate deviate from the macroclimate:

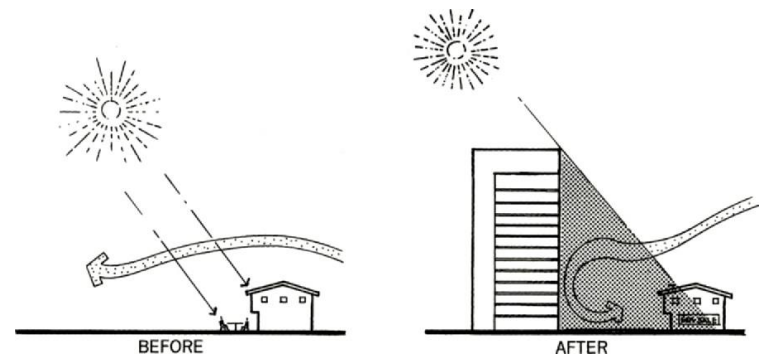
1. Elevation above sea level.
2. Form of land.
3. Size, shape, and proximity of bodies of water.
4. Soil types
5. Vegetation.
6. Man-made structures.



*South-facing slopes can receive more than one hundred times as much solar radiation as north-facing slopes.*



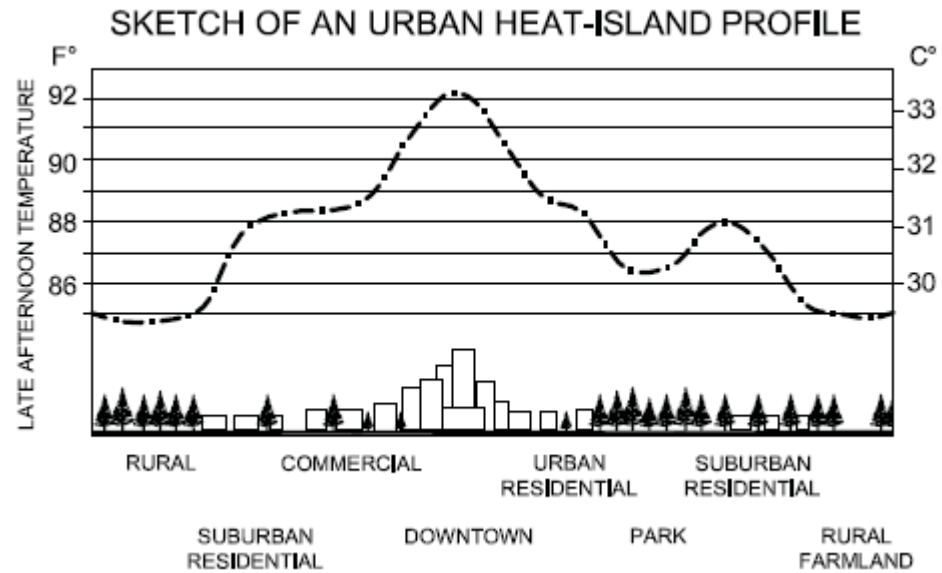
*South-facing slopes can receive more than one hundred times as much solar radiation as north-facing slopes.*



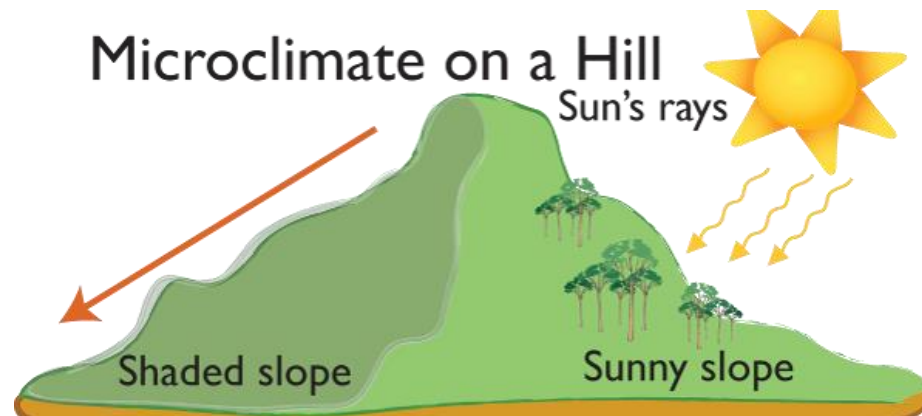
*Man-made structures A delightfully sunny and wind-protected southern exposure can be turned into a cold, windy microclimate by the construction of a large building to the south..*

# MICROCLIMATE

Buildings should be designed for the microclimate, because the microclimate can be quite different!



*A sketch of a typical urban heat-island profile. This profile of a hypothetical metropolitan area shows temperature changes correlated to the density of development and trees.*

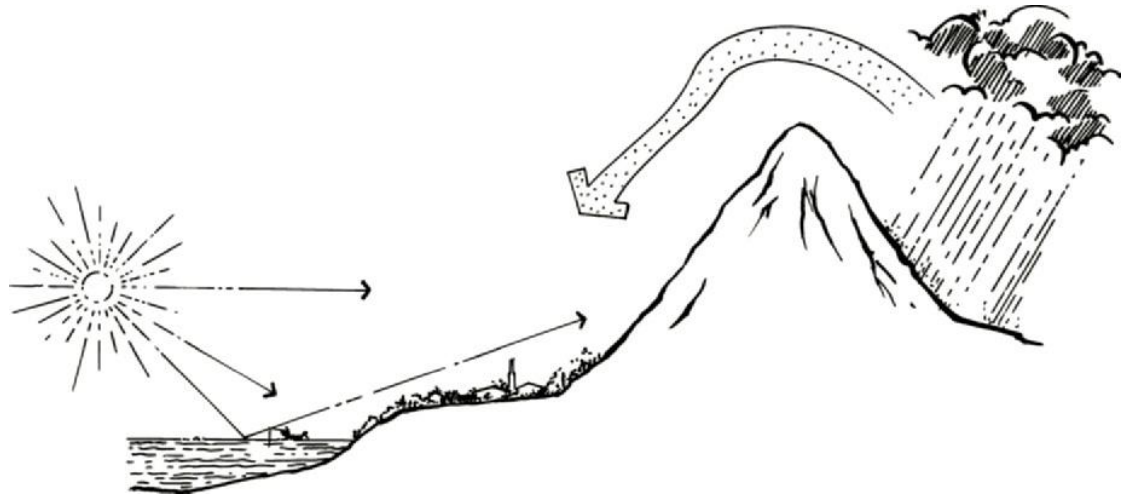


*Proximity Diagram for a house*

# CLIMATIC ANOMALIES

Climates that are radically different from what their location would suggest are called climate anomalies.

For a building to be sustainable it must be responsive to its climate!



*The combination of a low elevation, south-facing slopes, high mountains to the north, and a large lake to the south creates a subtropical climate in Lugano, Switzerland, even though it is as far north as Quebec.*

# References

Norbert Lechner-Heating, Cooling, Lighting\_  
Sustainable Design Methods for Architects-  
Wiley (2014)

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