

# Water Facts

State of California  
The Resources Agency  
Department of  
Water Resources



California Water Management

## Evapotranspiration and Crop Requirements

**W**ater is essential for crop growth and development. Crops also need the sun's energy, nutrients, and a favorable soil environment to develop and thrive. The amount of water a crop requires depends on growth stage, development, and atmospheric demands. The amount of water needed for atmospheric demands is usually larger than that needed for growth and development.

There is a balance, occurring at the crop surface, between energy coming from the sun and water leaving the plant system. The transfer of water out of the plant system to satisfy this balance is called evapotranspiration. ET refers to evaporation of water from plant and soil surfaces (E), and transpiration (T) the transfer of water through the plant to the atmosphere.

### Evapotranspiration

Evaporation is the conversion of water from a liquid into a vapor. Transpiration is the transfer of water through plants to the atmosphere. The combination of this process is called ET.

Evapotranspiration is part of the energy occurring at the plant's surface. Water is transferred from a plant according to the plant's needs and atmospheric demand. If these needs are not met, the plant will dry up and die. As an illustration, think of a dish of water left standing in a warm room—it soon dries up—just as damp clothes hung on a line in the sunshine lose their moisture quickly. Energy from the sun changes the water to vapor.

### Transpiration

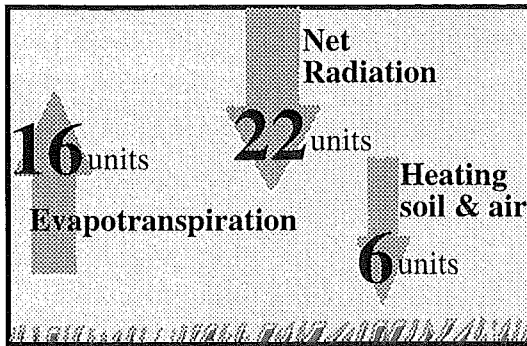
Plants release water vapor into the atmosphere through pores (called stomata) mostly on the backs of their leaves. Transpiration causes water to move from the soil to plant leaves. During this process, nutrients are delivered to plant leaves. This water can originate from deep in the soil. For example, corn can have roots that are about six feet deep, while some desert plants have roots more than 60 feet deep.

Through evapotranspiration the plant cools itself to a temperature suitable for growth by consuming energy that would have gone into heating the air and soil. Consider a green car parked on a sunny driveway for a few hours in the summer. The car would be too hot to touch, but nearby grass is cool and pleasant to walk on with bare feet because of evapotranspiration.

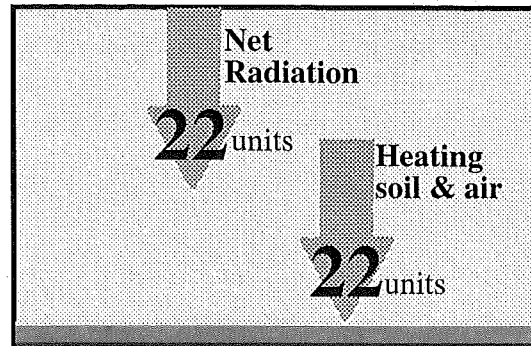
About 70 percent of the sun's energy on land goes into evapotranspiration, the remaining 30 percent of the energy goes into heating the air and soil. The energy received on an area slightly more than a square yard is enough to light three 60 watt bulbs for a day. If there were no water loss, more than three times as much energy would go into heating the air and soil. This is why the air and soil temperature is sweltering in the desert or bare soil where there is little water to evaporate as illustrated on page 2.

*Water Facts are short reports on water resources issues of general interest. They are published periodically by the California Department of Water Resources and can be obtained free by contacting DWR Bulletins & Reports, P.O. Box 942836, Sacramento, CA 94236-0001; 916/653-1097.*

## Irrigated Grass



## Bare Soil



*For simplicity, energy units are not shown. The size of and number on arrows represents accurate proportions of incoming and outgoing energy under irrigated grass and bare soil conditions.*

## How Crops Differ in Water Needs

In many areas of California, evapotranspiration demand is supplied through irrigation, with the rest being supplied by rainfall. Irrigation water, even good quality water, contains dissolved salts. When the water evaporates, the salt collects in the soil. Crops have limits above which the salt will affect growth and yield. To prevent excessive salt from accumulating, extra water is applied to flush the salt beyond the root zone.

Evapotranspiration demands during growth periods and water needed for salt balance are known as the "crop water requirements." Because irrigation systems do not distribute water uniformly over a field, some areas get less water. The amount of irrigation applied is determined by the need to meet the crop water requirement of the areas that receive the least amount of water. As a result, applied water is normally greater than the crop water requirement. There is a small difference in evapotranspiration for different crops that are planted and harvested at the same time within the same climate. For example, corn uses about six percent more water than tomatoes planted and harvested at the same time. This information can help the irrigation manager understand the effects of varying conditions on the water demands of a crop.

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## Where To Get More Information

**For more information on Evapotranspiration, consult one of the following:**

Statewide Conservation Office  
Department of Water Resources  
Division of Planning  
and Local Assistance  
1020 Ninth Street  
Sacramento, California 95814

Baryohay Davidoff  
Telephone: (916) 327-1788  
e-mail: [baryohay@water.ca.gov](mailto:baryohay@water.ca.gov)

Simon Eching  
Telephone: (916) 327-1836  
e-mail: [seching@water.ca.gov](mailto:seching@water.ca.gov)

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## Other Water Facts

DWR has other Water Facts that deal with California water management. The subjects include:

- Groundwater in Fractured Hard Rock (No. 1)
- 7 Steps for Managing Groundwater Supplies (No. 2)
- Adjudicated Groundwater Basins in California (No. 3)
- Groundwater Management Districts or Agencies in California (No. 4)
- California Well Standards—Questions and Answers (No. 5)
- Groundwater—Management and Assistance (No. 6)
- Groundwater—11 Groundwater Facts (No. 10)
- Water Conservation (No. 12)
- Financing Local Projects (No. 13)
- Water Recycling (No. 14)
- Drainage Management (No. 15)
- Water Quality (No. 17)
- River Restoration/Protection (No. 18)
- The California Water Plan (No. 19)
- Salt Balance in the San Joaquin Valley (No. 20)
- The California Irrigation Management Information System—CIMIS (No. 21)

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