

What are leaves & why are they important?

A leaf is a plant organ, exposed to the external environment. Leaves are the primary way plants interact with the atmosphere and take care of their basic needs.

■ **A balancing act:** The area that plants invest in leaves comes down to how much leaf surface they want to expose in order to maximize the rate of photosynthesis, and how much water they can “afford” to lose to the atmosphere through **transpiration**.

FOOD

Plants don't eat food (heterotrophic)—they make it (autotrophic) by taking atmospheric CO₂, water from the soil, and energy from light to make simple sugars in a process called **photosynthesis**.

Chlorophyll* acts as the antennae to initiate photosynthesis

Light excites the chlorophyll molecule and starts a chain reaction:

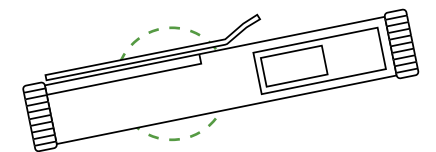
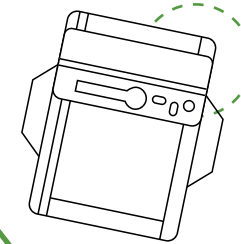
- 1 Atmospheric CO₂ enters the leaf and is “fixed” during photosynthesis to create **simple sugars***
- 2 Light speeds up photosynthetic rate



LEAF AREA

The amount of tissue the plant “decides” to expose to the environment.

Using a Leaf Area Meter, such as the **CI-202 Portable Laser Leaf Area Meter** or the **CI-203 Handheld Laser Leaf Area Meter**, scientists and farmers can observe the ways in which plants are adapting to their environment.

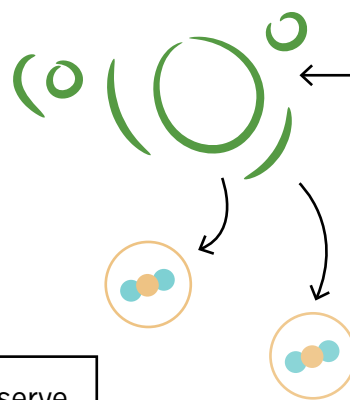


WATER

Water is a critical molecule/substrate in most molecular processes. It's also the main fluid for sugar/carbon transport in the plant.

Pores on the leaf called **stomata** open and close to regulate carbon fixation and water loss.

Air is drier than the inside of a leaf. When stomata open, water molecules evaporate out of the leaf in a process called **transpiration**.

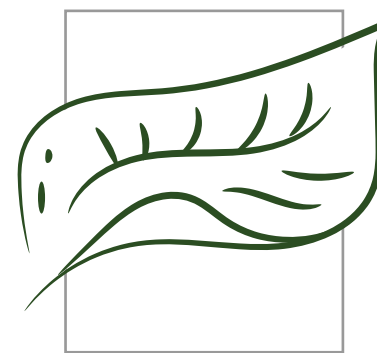


Note: Most plants are water limited, and try to conserve water by closing their stomata during high wind periods or when the soil is dry.

* **Chlorophyll** molecules are made of carbon and nitrogen and are responsible for the green color in leaves.

* **Simple sugars** are used by plants (as well as humans and animals) as building blocks for complex molecules.

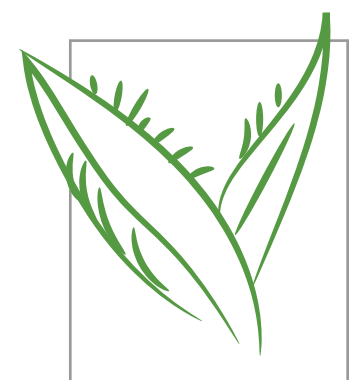
HOW PLANTS ADAPT



Tropical and shade plants

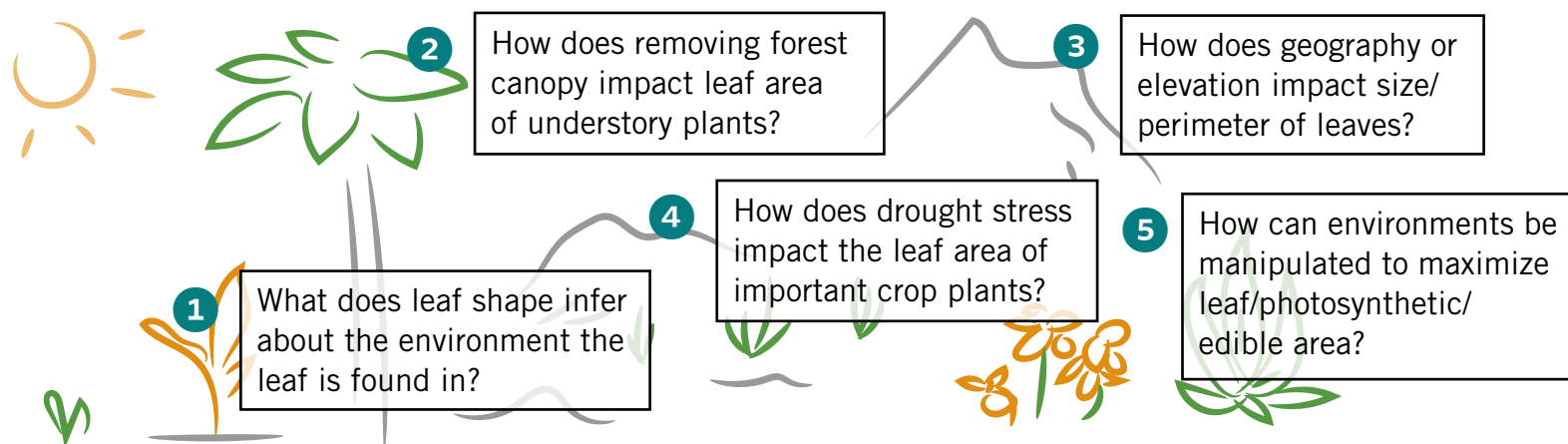
- 1 **Huge leaves** to capture any photons of light that might make it down to the forest floor, through the tall canopy and many layers of vegetation
- 2 Plants are **DARK green**, with tons of chlorophyll so that they can maximize photosynthesis/carbon fixation
- 3 **Thin leaves.** Water is abundant in the tropics, so the leaves can have a large surface area where water can evaporate

- 1 Leaves are **round and long**, and often point upwards in order to limit light exposure and prevent burning in the constant sunlight
- 2 Have **white and grey waxes and/or hairs** over the top of their leaves so they can reflect the light, like sunscreen! These hairs also minimize water loss due to wind blowing over the leaves and sucking water out of the open stomata
- 3 **Thick leaves.** Need to conserve water, so typically leaves are thicker and leaf tissue stores water

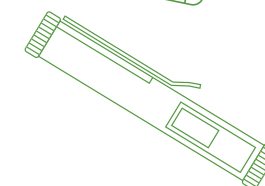
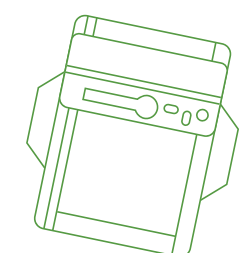


Desert or Mediterranean plants

5 Questions a Leaf Area Meter can help you answer!



Who uses a leaf area meter?



Ecophysicologists use it as a teaching or research tool

Phylogeneticists and Botanists use it to bolster genetic work with data about physical and phenotypic changes in the plant

Agronomists who are trying to maximize yield through increase in photosynthesis use it as a way to measure their efforts