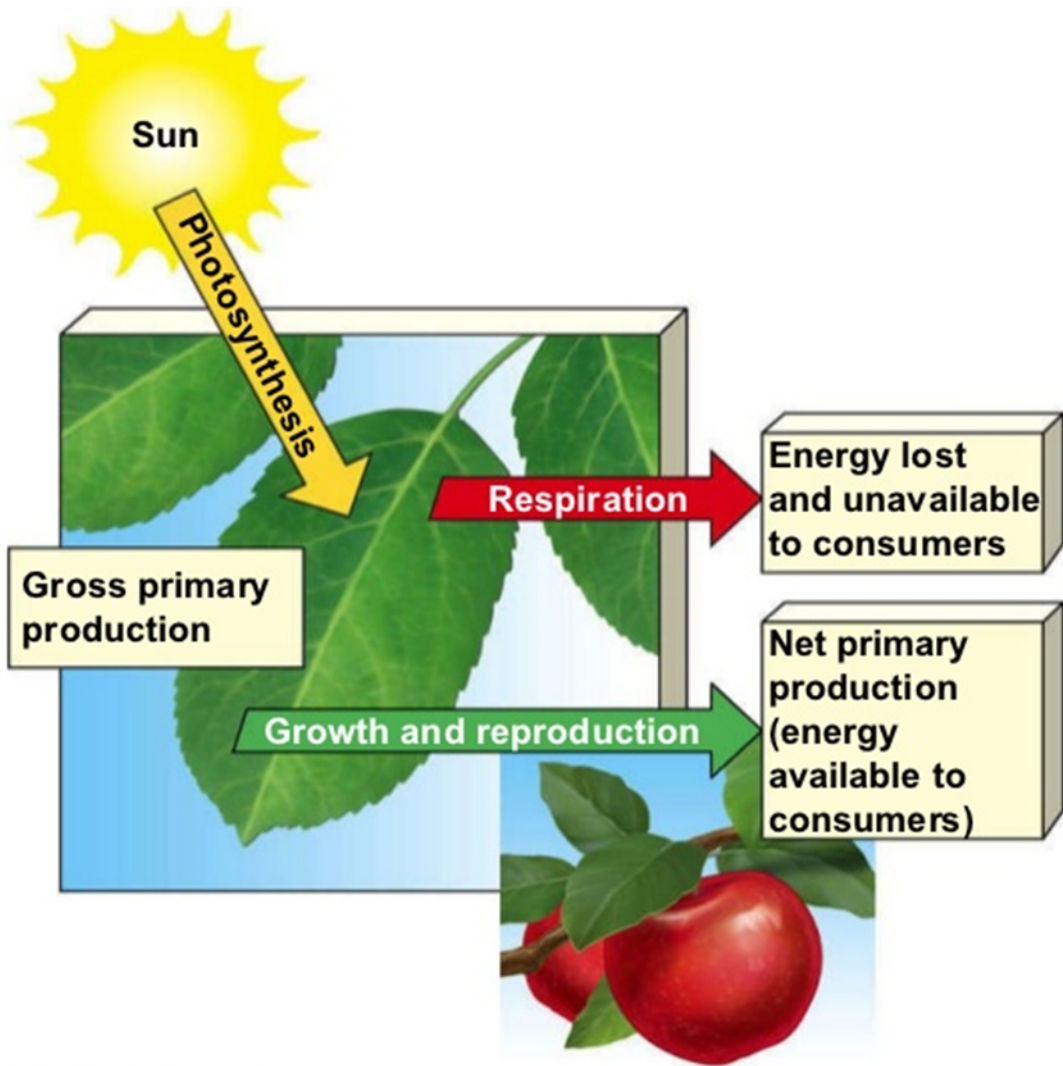


# ECOSYSTEM PRODUCTIVITY: GPP & NPP

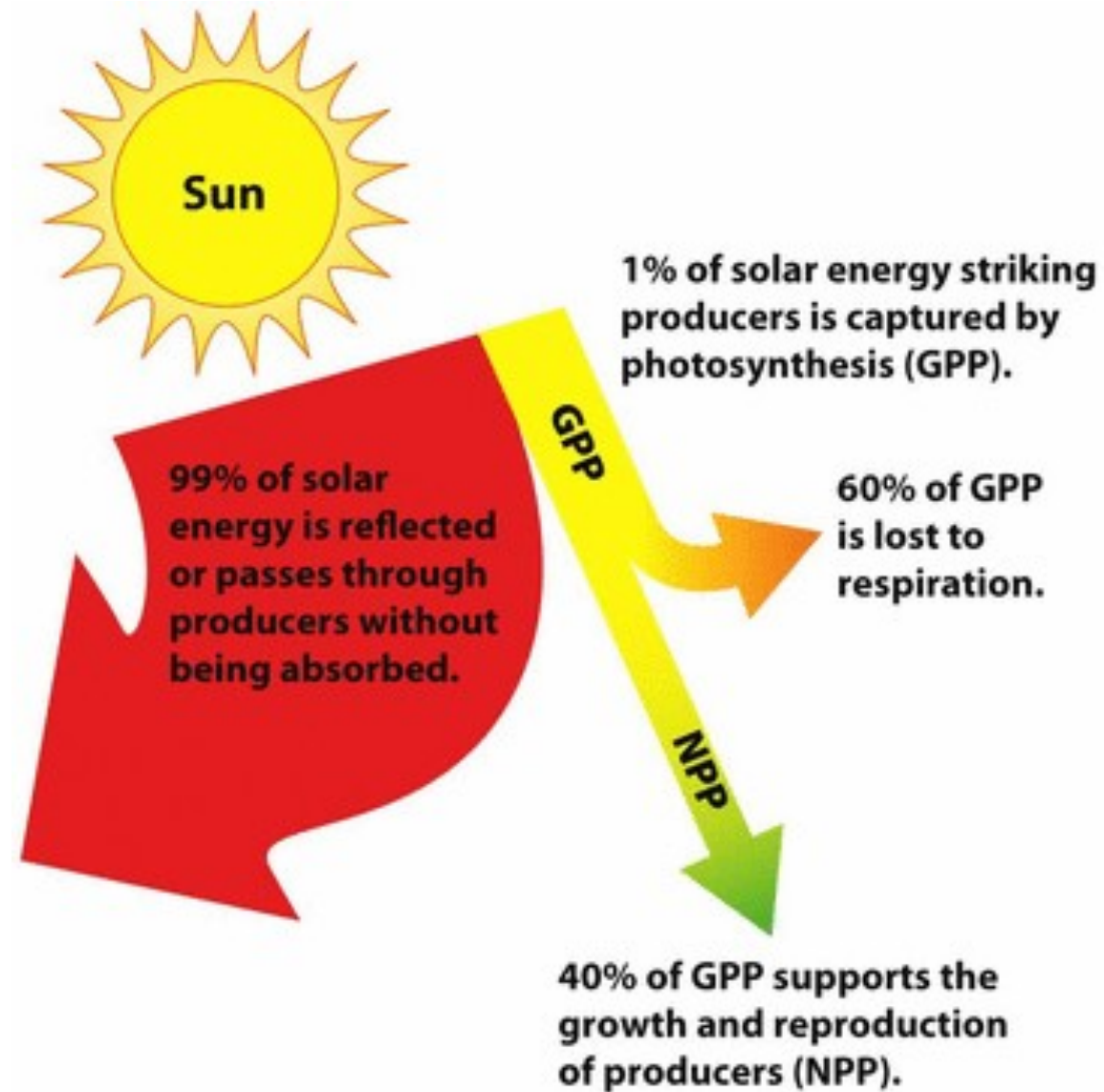


# ECOSYSTEM PRODUCTIVITY

- ❖ The amount of energy available in an ecosystem determines how much life it can support.
  - Ex: Amount of sunlight → how much algae → number of zooplankton → number of fish
- ❖ In studying ecosystems, it is important to know where the energy is and how it is transferring via food webs.
  - Look primarily at capture of solar energy via photosynthesis
- ❖ Productivity depends on light intensity, temperature, nutrient availability, H<sub>2</sub>O supply, & nutrient availability.
- ❖ The most productive ecosystems have high temperatures, plenty of H<sub>2</sub>O, non-limiting supplies of soil N.



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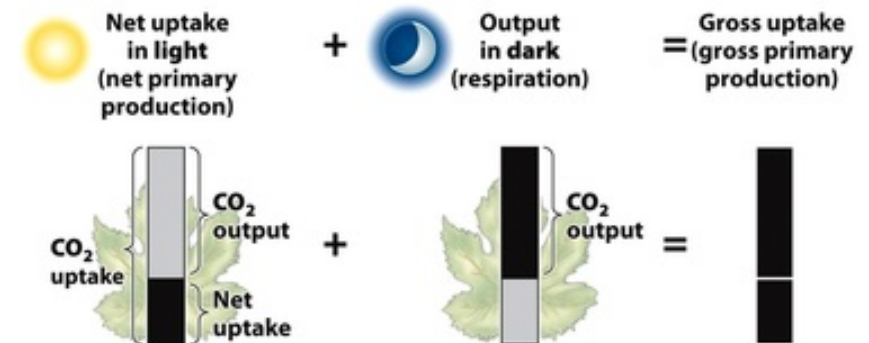


# GROSS PRIMARY PRODUCTIVITY (GPP)

- ❖ The total amount of solar energy that the producers within an ecosystem capture and store energy via photosynthesis over time
- ❖ Measured as energy production per unit of area per unit of time (ex: kcal/m<sup>2</sup>/yr)
- ❖ Gross
  - Total amount captured
  - Does not account for amount used by producers during respiration
  - Challenge to determine experimentally (plants rarely photosynthesize without respiring)
- ❖ Varies with types of producers
- ❖ ~1% of solar radiation reaching an ecosystem

# DETERMINING GPP

- ❖ Derived rate of photosynthesis
  - Measure rate of  $\text{CO}_2$  production in the dark (respiration w/o photosynthesis)
  - Measure rate of  $\text{CO}_2$  taken up in the light (photosynthesis & respiration)
- ❖  $\text{CO}_2$  taken up during photosynthesis =  $\text{CO}_2$  taken up in sunlight +  $\text{CO}_2$  produced in the dark



# NET PRIMARY PRODUCTIVITY (NPP)

- ❖ The  $GPP - R_{\text{(energy of respiration)}} = NPP$
- ❖ Net
  - Measures amount of energy available to other trophic levels
- ❖ Ranges from 25-50% of GPP
- ❖ Varies between ecosystems and life zones
  - Land: generally decreases from equator to poles (Earth's tilt)
  - Aquatic:
    - Estuaries are most productive (nutrient influx via rivers & agitation of sediments)
    - Open ocean is least productive (by rate) except where upwelling occurs but produces the most biomass per year due to sheer size

