

Review of the processes

- Primary production = rate of biological formation of organic matter from inorganic carbon.
 - Photosynthesis/Photoautotrophy
 - $6\text{CO}_2 + 6\text{H}_2\text{O} + \text{light} \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2$
 - Units = C or energy per area (or volume) per time
- Chemosynthesis/chemoautotrophy
 - $\text{CO}_2 + \text{chemical energy} \rightarrow \text{C}_6\text{H}_{12}\text{O}_6$
 - No O_2 produced
 - Examples:
 - Nitrification: $\text{NH}_4^+ \rightarrow \text{NO}_2^- \rightarrow \text{NO}_3^-$
 - Iron, sulfur oxidation

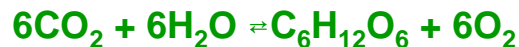
Review of the process

- Respiration = use of organic matter for maintenance, growth, reproduction
 - Respiration:
 - $\text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2 \rightarrow 6\text{CO}_2 + 6\text{H}_2\text{O}$
 - Autotrophic respiration- respiration by autotrophic organisms
 - Heterotrophic respiration- respiration by heterotrophic organisms

Review of the processes

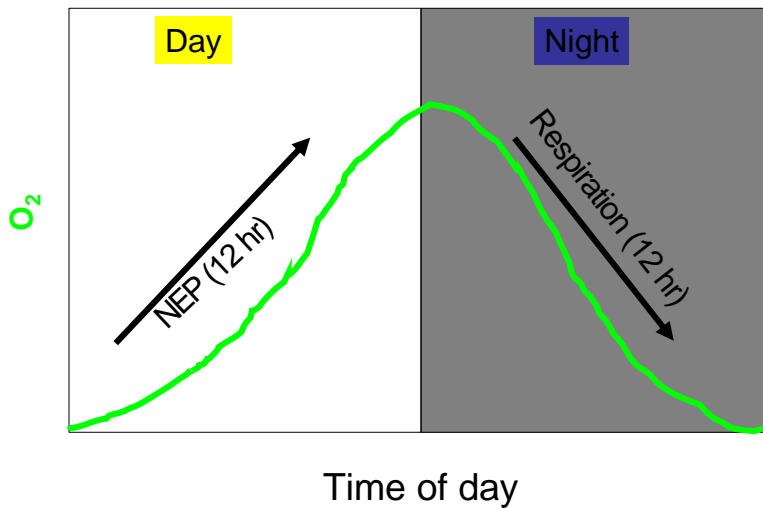
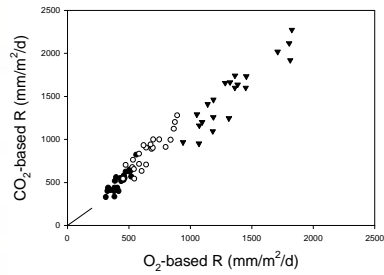
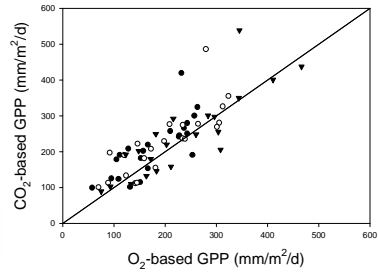
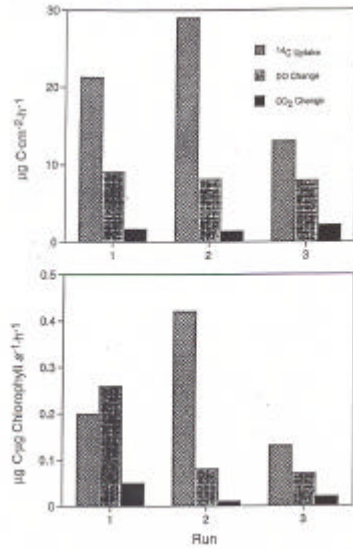
- Gross primary production (GPP or P_G)= rate of primary production alone
- Ecosystem (or community) respiration (CR)= total rate of OM use
- Net primary production (NPP or P_N)= rate of primary production – rate of autotrophic respiration
- Net ecosystem production (NEP) = rate of primary production – ecosystem respiration
 - Net daily metabolism (NDM)

Measuring metabolism



- ? CO_2 (directly or as ? pH)
- Incorporation of $\text{H}^{14}\text{CO}_3^-$ (~ $\text{C}_6\text{H}_{12}\text{O}_6$ production)
- ? in biomass
- ? O_2 = the favorite
 - ? $\text{O}_2 \rightarrow$ units of C via photosynthetic quotient (PQ), respiratory quotient (RQ)
 - PQ = moles O_2 released \div moles CO_2 incorporated- usually ~1.0-1.2
 - RQ = moles CO_2 released \div moles O_2 consumed- usually ~0.85-1.0

Comparison of methods



Gas diffusion rate-

1. Add a tracer gas (propane or SF₆)
2. Monitor its concentration (disappearance) downstream
3. Disappearance due to gas exchange
4. Convert to O₂ exchange with standard conversion factors

