

Lecture 5 – Limiting Nutrients and Redfield Ratio

READINGS FOR NEXT LECTURE:

- Krebs. Chapter 26. "Ecosystem Metabolism II: Secondary Production"
- Nemani RR *et al.* 2003. Climate-driven increases in global terrestrial net primary production from 1982 to 1999. *Science*. **300**:1560-3. (H,W)

From last class:

A few more thoughts on terrestrial primary productivity

How to integrate all the aspects we talked about?

While one factor may dominate, many factors involved:

$$\mathbf{NPP = f(NPP_{max}, PAR, LAI, T, CO_2, H_2O, NA)}$$

Where:	NPP _{max}	= maximum for given ecosystem/vegetation type
	PAR	= photosynthetically active radiation
	LAI	= leaf area index
	T	= temperature
	[CO ₂]	= atmospheric CO ₂ concentration
	H ₂ O	= soil moisture
	NA	= index of nutrient availability

How does climate change affect each of these parameters?

For instance, atmospheric CO₂. If [CO₂] continues to increase, will this increase global NPP? GPP? Some things to consider:

Experiments have shown increases in plant biomass with increased atmospheric CO₂. Over the past 100 years, the annual rings of tree trunks have not gotten thicker. Leaves from olive branches in King Tut's tomb have a higher density of stomates than leaves of olive trees in modern-day Egypt. Other studies have shown decreased stomatal density since the Industrial Revolution. What does this mean for water use efficiency? Productivity?

If global temperatures increase 1°C, or 3°C, how will this change global NPP? GPP? Consider:

Effect of higher temperature on plants, on animals, and on bacteria that feed on detritus.
Effect of higher temperatures +/- or higher CO₂ on the distribution of C₃ vs. C₄ plants.

What is a limiting factor? On what time scale? Limiting for whom?

REMINDER:

Problem Set 1 Due next
Tuesday during lecture.
No late problem sets please!