

## **ECOLOGICAL STOICHIOMETRY AND IT USES:-**

Some branches of ecology are oriented toward understanding the **dynamics of individual species** while others focus on **the fluxes of matter and energy among collections of species in ecosystems**. Ecological Stoichiometry fits between these two approaches because it deals with the patterns and processes associated with the chemical content of species. Numerous ecological phenomena such as the success or failure of populations to the carbon storage of whole ecosystems have a stoichiometric component.

*The balance of multiple chemical substances in ecological interactions and processes, or the study of this balance.” In addition, ecologists interested in stoichiometry often consider the availability of solar or chemical energy relative to the availability of one or more chemical substances.*

Ecological Stoichiometry is concerned with the contents of multiple elements in living and dead organic matter. **There are approximately 90 naturally occurring elements of which eleven predominate in living organisms. Only four of these (C, H, O and N) make up about 99% of living biomass;**

the other seven (Na, K, Ca, Mg, P, S and Cl) are essential to all living things. About ten others, metals and non-metals, are required by most but not necessarily all species.

Finally, about eight other elements are required by more limited numbers of species.

Some elements, especially C, H, O and N, provide the atomic-level skeletons for biomolecules. Others are involved in materials providing structure at the organismal level, for example the Ca and P in vertebrate bone.

These elements all are generally required in high amounts. Other elements are used in energy transduction processes, where electrons are energized and de-energized. These elements, such as Fe and Mg, are just as necessary for life, but they are required in lower quantities. Though the theories and tools of Ecological Stoichiometry could be applied to any of these elements, most studies to date concern C, N and P.

## **STOICHIOMETRY OF AUTOTROPHS:-**

The wide range of autotroph C:N:P ratios in ecosystems reflects contrasts in the abiotic and biogeochemical conditions that supply CO<sub>2</sub>, light, and nutrients to photoautotrophs in different ecosystems.

### **LAKE ECOSYSTEM**

For example, in broad cross-sections of both North American and Norwegian lakes, seston C:P ratio has been shown to be positively correlated with ecosystem light:nutrient ratio, which itself is determined by local conditions affecting light intensity (mixed layer depth, light attenuation) and external P supplies.

### **TERRESTRIAL ECOSYSTEM**

In terrestrial ecosystems, local soil conditions, canopy development, and water supply interact to affect plant C:N:P stoichiometric ratios. It is also increasingly recognized that various anthropogenic perturbations, such as atmospheric N deposition and increased CO<sub>2</sub> concentrations can also affect autotroph C:N:P ratios in both aquatic and terrestrial ecosystems.

For example, a doubling of CO<sub>2</sub> concentration reduces plant N-content by about 16%, on average. There are also broad-scale patterns in the N:P ratio of plant biomass in which N:P ratio decreases moving towards the poles. This pattern may reflect differences in edaphic conditions (e.g. differences in soil age that affect soil P supply) or effects of selection operating on plant growth rate. Despite the wide intra-specific variation in C:N:P ratios that can be produced by differences in growth conditions, there also are significant differences in plant stoichiometry due to phylogenetic affiliation. For example, legumes that harbor N-fixing symbionts generally have higher N:P ratios than other taxa.

## **STOICHIOMETRY OF HETEROTROPHS :-**

Heterotrophs such as bacteria and metazoans also exhibit substantial variation in C:N:P ratios but physiological variation due to growth or dietary conditions is thought to be relatively minor compared to such effects in autotrophs. Heterotrophs are much more homeostatic in their element content than are autotrophs. Variation in element content in different heterotrophs reflects differences in organismal allocation to major biochemical and structural components. For microbes and small invertebrates (Figure 2), C:N:P variation is tied to growth-related allocation to P-rich ribosomal RNA (the "Growth Rate Hypothesis"), as the content of rRNA generally increases with growth rate, comprising a significant fraction of overall biomass, and containing 8.6% P by mass. Indeed, in the bacteria, zooplankton, and insects shown in Figure 2, on average ~50% (and sometimes over 90%) of total organismal P was contributed by the P contained in RNA. However, because growth rate decreases with increasing body size, the contribution of P in RNA to overall body C:N:P stoichiometry also declines with body size, becoming relatively in-significant (<10% of total P) for animals larger than ~0.1 g dry mass.