Concept and law of limiting factors

A limiting factor is a variable of a system that causes a noticeable change in output or another measure of a type of system. The limiting factor is in a pyramid shape of organisms going up from the producers to consumers and so on.

All the limiting factor require the existence of at least one non-limiting factor. There are several different possible ways of limitation when more than one factor is present.

1. Firstly, called single limitation occurs when only one factor, the one with maximum demand, limits the System.
2. Secondly, Serial co-limitation is when one factor has no direct limiting effects on the system, but must be present to increase the limitation of a second factor. A third scenario, independent limitation, occurs when two factors both have limiting effects on the system but work through different mechanisms.
3. Thirdly, synergistic limitation, occurs when both factors contribute to the same limitation mechanism, but in different ways.

In 1905 Frederick Blackman defined the role of limiting factors as follows:

"When a process is conditioned as to its rapidity by several separate factors the rate of the process is limited by the pace of the slowest factor." In terms of the magnitude of a function, he wrote, "When the magnitude of a function is limited by one of a set of possible factors, increase of that factor, and of that one alone, will be found to bring about an increase of the magnitude of the function.

Ecology

In population ecology, a regulating factor, also known as a limiting factor, is something that keeps a population at equilibrium (neither increasing nor decreasing in size over time). Common limiting factor resources are environmental features that limit the growth, abundance, or distribution of an organism or a population of organisms in an ecosystem. The concept of limiting factors is based on Liebig's Law of the Minimum, which states that growth is controlled not by the total amount of resources available, but by the

scarcest resource. In other words, a factor is limiting if a change in the factor produces increased growth, abundance, or distribution of an organism when other factors necessary to the organism's life do not. Limiting factors may be physical or biological.

Limiting factors are not limited to the condition of the species. Some factors may be increased or reduced based on circumstances.

Example:

of a limiting factor is sunlight in the rain forest, where growth is limited to all plants on the forest floor unless more light becomes available. This decreases the number of potential factors that could influence a biological process, but only one is in effect at any one place and time. This recognition that there is always a single limiting factor is vital in ecology, and the concept has parallels in numerous other processes. The limiting factor also causes competition between individuals of a species population. For example, space is a limiting factor. Many predators and prey need a certain amount of space for survival: food, water, and other biological needs. If the population of a species is too high, they start competing for those needs. Thus the limiting factors hold down population in an area by causing some individuals to seek better prospects elsewhere and others to stay and starve. Some other limiting factors in biology include temperature and other weather related factors. Species can also be limited by the availability of macro- and micronutrients. There has even been evidence of co-limitation in prairie ecosystems. A study published in 2017 showed that sodium (a micronutrient) had no effect on its own, but when in combination with nitrogen and phosphorus (macronutrients), it did show positive effects, which is evidence of serial co-limitation.

1. **Keystone species** – a top-down limiting factor that impacts the whole ecosystem structure
2. **Predation** – a top-down limiting factor of a trophic level from the higher trophic levels
3. **Energy** – a bottom-up limiting factor that affects the population of producers and in turn higher trophic levels
4. **Space** – a bottom-up limiting factor that impacts the maximum biomass an ecosystem can support in it's area
5. **Food supply** – a bottom-up limiting factor impacting each trophic level from the trophic levels below