Sustainable Ecosystems: Self-Sustaining, Adapting and Thriving

What Are Sustainable Ecosystems and how do they work?

Maintaining sustainable ecosystems depends on multi-faceted components and their ability to interact in unity (Chapin, Torn, and Tateno, 1996); Like many small pieces of a puzzle, fitting together to form a larger picture. Many natural ecosystems are self-sustaining, consisting of complex layers that operate on multiple spatial and temporal scales, for example, the microclimate provided by a mature tree to support a sapling's growth, also contributes to the whole forest's climatic condition (Tielbörger and Kadmon, 2000).

During their cycle, sustainable ecosystems are capable of maintaining their own characteristic diversity and productivity, even during natural disturbance events (Chapin, Torn and Tateno, 1996). Like the Australian *Banksia*, that has adapted its seeds to utilize events of recurrent fire, opening only after they are exposed to heat or smoke. Therefore, ensuring the new generation will fall on well-cleared, recently fertilized soil and continuing its survival in the ecosystem (He, Lamont and Downes, 2011). In this way, an ecosystem's normal cycle anticipates change and therefore is much more resilient and flexible, allowing it to survive.

Although it is normal for ecosystems to fluctuate in species composition, nutrient cycling, resource production and efficiency, the difference between sustainable and unsustainable ecosystems is that sustainable ecosystems only fluctuate within its natural bounds (Chapin, Torn and Tateno, 1996). Therefore, they maintain a feedback loop that keeps their factors in check, whether that be erosion, waste production or predator-prey interactions (Rietkerk and Van de Koppel, 2008).

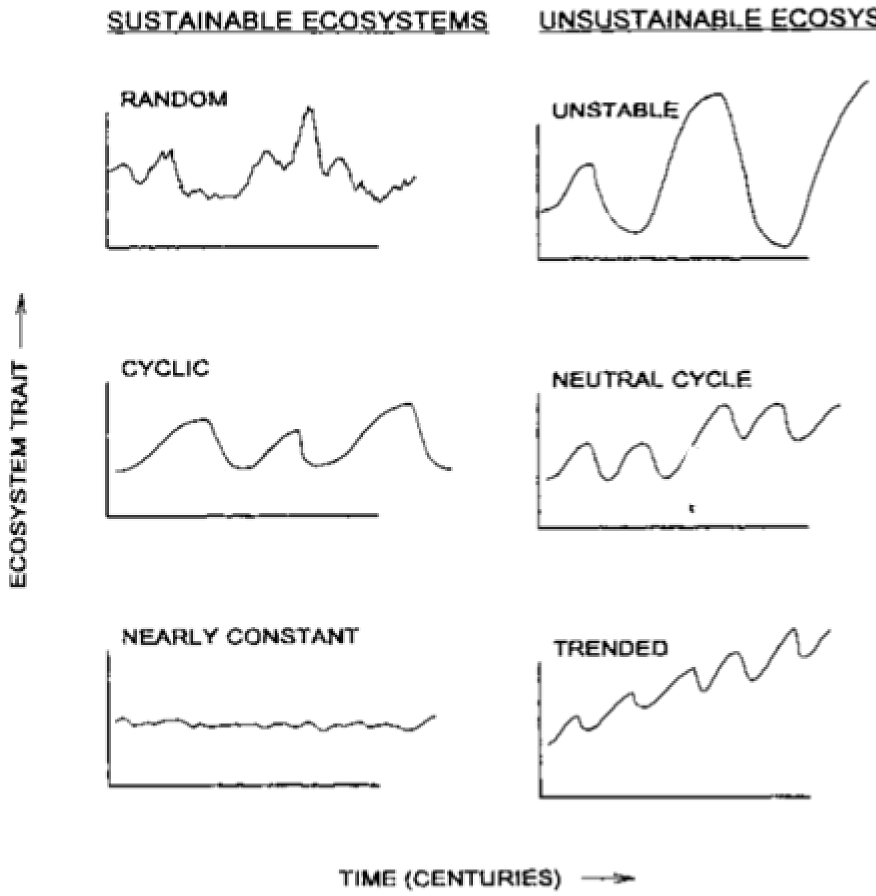

Figure 1: Sustainable and unsustainable ecosystem fluctuations over a temporal scale (May, 1973; Holling, 1986).

Ecosystems Change Over Time

However, it is naïve to think of ecosystems as static. No specific ecosystem is sustainable indefinitely, this is because the internal and external factors that shape ecosystems fluctuate over long periods of time, like climate or species genetic diversity (Chapin, Torn, and Tateno, 1996). Every ecosystem around you is transitioning and changing into another on a time scale usually too slow for humans to see, this is what makes nature truly sustainable, its ability to change with the conditions rather than attempt to change the conditions around them.

What is Carrying Capacity?

Carrying Capacity within an ecosystem is the largest population size that an ecosystem can cope with before it starts to be degraded (Del Monte-Luna et al., 2004). Population size is regulated by an equilibrium between births and deaths within the ecosystem; therefore a population's growth rate at carrying capacity is equal to zero, it stops fluctuating. Carrying Capacity demands that resource limitation in an ecosystem will eventually constrain the growth of a population (Del Monte-Luna et al., 2004). Considering this, humanity as part of a global ecosystem is undeniably exceeding its sustainable population growth rate (Ehrlich and Holdren, 1971).

Society as Resilient Ecosystems

Viewing cities and urban areas as socio-ecological systems that are in ecological balance with each other is a vital component of achieving a sustainable world. The concept of industrial ecology encourages this, by using ecosystems as a model to transform industrial systems into an interrelated, efficient process that is compatible with all surrounding systems (Jelinski et al., 1992). Using the principles of ecosystem sustainability in the management of human systems inspires an alternative way of living, one that fosters growth and success within the bounds of humanities own sustainable ecosystem. To learn more about sustainability please visit THRIVE Project.

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