The Maximum Empower Principle: An Invisible Hand Controlling the Self-Organizing Development of Forest Plantations in South China

Linjun Li, Hongfang Lu, David R. Tilley, Hai Ren and Weijun Shen

ABSTRACT

Derived from the maximum power principle (MPP), the maximum empower principle (MePP) is considered as the foundation of emergy theory and evaluation methods. However, it has often encountered some doubts since proposed, because of lacking sufficient empirical evidence. To test the validity of the MePP in the self-organization of forest ecosystems, this paper applied a process-based ecosystem model (Biome-BGC) to simulate the dynamics of biomass, litter and soil organic matter (SOM) of three forest plantations in south China during 1985–2007, and attempted to replicate their self-organizing processes. The simulated results and input flows were transformed to emergy as a common basis and, from the viewpoint of emergy synthesis, the dynamics of the production efficiency and empower of the three forest ecosystems were revealed along with their self-organizing developments over time. The results showed that three forest plantations had similar dynamic change patterns of energy efficiency and empower, but the production efficiencies of them were not always consistent with their empower performances. The production efficiency firstly increased rapidly to maximums, and then decreased to optimal moderate values. However, the empower came to the maximums after the efficiency peaked and then fluctuated up and down, dependent on weather. These results implied that, a forest ecosystem in its self-organizing process tends toward maximum empower at optimal efficiency. Behind the maximum empower of the forest ecosystem is the desynchrony development of different components, e.g., biomass, litter and SOM; leaf, stem and root; biomass and biodiversity. As a whole, the MePP functions like an invisible hand controlling the general self-organizing development of forest ecosystems and pointing out the direction of their development.

Citation
http://dx.doi.org/10.1016/j.ecolind.2012.12.033