

Alternative Representations of Ecosystem Models

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Ecosystems are often modeled using weighted digraphs, representing flow of energy or nutrients among compartments [1]. Depending on the model, what a compartment represents may range from dissolved organic matter in a lake, to multiple species with common properties living in a specific area. Flows among compartments may represent predation, uptake, excretion, etc.

Ecological networks can be fairly large and complex. Decomposing an ecosystem model into smaller sub networks for easier analysis is often tempting. However, essential ecosystem behavior may be lost by breaking connections, or excluding compartments. Neither flows, nor compartments can function by themselves.

Therefore we propose two new alternative mathematical representations, that preserve system wide behavior of ecosystems: (1) Pathways (2) Fluxes. A pathway represents the ecosystem from the point of view of a single Carbon atom, or a single energy quantum. A flux represents the smallest process within the ecosystem that can theoretically sustain itself. This can be a material cycle within the ecosystem, or a simple food chain in a complex ecosystem.

In this talk, I will discuss the mathematical properties of these two representations, demonstrate how current models are mapped into these representation spaces, and provide examples of how useful they can be for ecological studies.

References

- [1] C. Kazanci, *EcoNet: A new software for ecological modeling, simulation and network analysis*, Ecological Modelling. 208:3–8, 2007.