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# Functionality in Open Dynamical Systems: The Case of Ecology

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## Abstract

Dynamical systems theory applies to anything that changes with time. In mathematics this is interpreted rather broadly, but in physics, and often in other sciences, it applies to systems with forces and flows, often in a network, that are typically open to exchanges with the outside. This makes it well suited to the study of ecosystems. Ecosystems are not only open to outside influences, but are often nested by scale in space and time. One of the first problems in discussing ecosystem function, then, is to give a definition of ecosystem individuation and its consequences. One of the consequences is that it is reasonable to define functionality within an ecosystem in terms of contributions to the maintenance of this individuation, as I have done elsewhere for organisms, using a dynamical notion of autonomy. I will briefly argue that common etiological accounts of function are not suitable for discussing ecosystem function. We don't typically think of ecosystems as autonomous, but autonomy comes in degrees, so even if the word is not apt, the idea is. I will distinguish between ecosystem role in general and functionality in particular. Ecosystem role, which is sometimes identified with function, can actually undermine ecosystem functionality. I will also distinguish between ecosystem functions and ecosystem services. The latter serve some larger or separate systems (whence again the importance of individuation). They are important for understanding how nested ecosystems are related to each other through functional dependence.

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