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Accounting for Ecosystem Services in Life Cycle Assessment, Part II:
Toward an Ecologically Based LCAYi Zhang, Anil Baral and Bhavik R. Bakshi*
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Abstract

Despite the essential role of ecosystem goods and services in sustaining all human activities, they are often ignored in engineering decision making, even in methods that are meant to encourage sustainability. For example, conventional Life Cycle Assessment focuses on the impact of emissions and consumption of some resources. While aggregation and interpretation methods are quite advanced for emissions, similar methods for resources have been lagging, and most ignore the role of nature. Such oversight may even result in perverse decisions that encourage reliance on deteriorating ecosystem services. This article presents a step toward including the direct and indirect role of ecosystems in LCA, and a hierarchical scheme to interpret their contribution. The resulting Ecologically Based LCA (Eco-LCA) includes a large number of provisioning, regulating, and supporting ecosystem services as inputs to a life cycle model at the process or economy scale. These resources are represented in diverse physical units and may be compared via their mass, fuel value, industrial cumulative exergy consumption, or ecological cumulative exergy consumption or by normalization with total consumption of each resource or their availability. Such results at a fine scale provide insight about relative resource use and the risk and vulnerability to the loss of specific resources. Aggregate indicators are also defined to obtain indices such as renewability, efficiency, and return on investment. An Eco-LCA model of the 1997 economy is developed and made available via the web (www.resilience.osu.edu/ecolca). An illustrative

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example comparing paper and plastic cups provides insight into the features of the proposed approach. The need for further work in bridging the gap between knowledge about ecosystem services and their direct and indirect role in supporting human activities is discussed as an important area for future work.



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