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Critical Review

 Accounting for Ecosystem Services in Life Cycle Assessment, Part I: A
 Critical Review

 Yi Zhang, Shweta Singh and Bhavik R. Bakshi*
 William G. Lowrie Department of Chemical &
 Biomolecular Engineering, The Ohio State University,
 Columbus, Ohio 43210

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 * Corresponding author e-mail: bakshi.2@osu.edu; tel: 1-614-292-4904; fax: 1-614-292-3769.

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Abstract

If life cycle oriented methods are to encourage sustainable development, they must account for the role of ecosystem goods and services, since these form the basis of planetary activities and human well-being. This article reviews methods that are relevant to accounting for the role of nature and that could be integrated into life cycle oriented approaches. These include methods developed by ecologists for quantifying ecosystem services, by ecological economists for monetary valuation, and life cycle methods such as conventional life cycle assessment, thermodynamic methods for resource accounting such as exergy and emergy analysis, variations of the ecological footprint approach, and human appropriation of net primary productivity. Each approach has its strengths: economic methods are able to quantify the value of cultural services; LCA considers emissions and assesses their impact; emergy accounts for supporting services in terms of cumulative exergy; and ecological footprint is intuitively appealing and considers biocapacity. However, no method is able to consider all the ecosystem services, often due to the desire to aggregate all resources in terms of a single unit. This review shows that comprehensive accounting for ecosystem services in LCA requires greater integration among existing methods, hierarchical schemes for interpreting results via multiple levels of aggregation, and greater understanding of the role of ecosystems in supporting human activities. These present many research opportunities that must be addressed to meet the challenges of sustainability.

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