

Development of impact assessment methodologies for environmental sustainability

Jane C. Bare

Received: 30 June 2011 / Accepted: 30 October 2013
© Springer-Verlag Berlin Heidelberg (outside the USA) 2013

Abstract Despite years of discussion on the merits of sustainability, there is still no consensus on how to determine if environmental sustainability is achieved or even if progress is made. The Brundtland Commission statement that sustainability “meets the needs of the present without compromising the ability of future generations to meet their own needs (World Commission on Environment and Development, *Our common future*, Oxford University Press, New York, 1987)” establishes the long-term focus of sustainability goals. Impact categories, such as land and water use, that can cause large spatial and long-temporal scale impacts are important for sustainability assessments, and may require detailed spatial analysis to capture all the important input parameters. Environmental sustainability impact assessments can use life cycle impact assessment methodologies, but can also be supplemented with impact assessments conducted from a variety of perspectives. Having this flexibility of perspective can allow more detailed site-specific assessments that may represent unsustainable situations. While it is necessary to provide decision support with a comprehensive assessment, aggregation of impact categories has the disadvantage of obscuring the individual vulnerabilities of each impact category, which can be critically important to the overall sustainability picture. An outline of a sustainability assessment case study focused on biomass-based alternatives required under the renewable fuel standard will be provided to demonstrate a more comprehensive view of sustainability.

Keywords Life cycle impact assessment · Life cycle assessment · Sustainability · LCA · LCIA · Impact assessment

J. C. Bare (✉)
US EPA, Cincinnati, OH, USA
e-mail: bare.jane@epa.gov

Introduction

Environmental sustainability assessments are essential for revealing the full spectrum of consequences of management practices. Unfortunately, decisions that have a large potential for environmental impact are often made without a thorough assessment of potential impacts to the environment and the many repercussions of these decisions. For example, moving from petroleum-based gasolines to corn-based ethanol in the United States has the potential to shift many environmental impacts related to land and water use to various farms, aquifers, and downstream locations across the Midwestern US.

Numerous tools exist that may be useful in sustainability assessments, including: LCA, benefit-cost analysis, risk assessments, and place-based assessments (Hofstetter et al. 2002). The selection of the appropriate tool to inform the decisions depends on the goal and scope of the problem, the limitations of the analysis, and the circle of influence of the stakeholders. LCA has been recognized as being particularly useful in sustainability assessments, but in many cases, LCAs must be supported with more site-specific tools that can more appropriately address issues of land use and water use.

Sustainability’s relationship to life cycle impact assessment

Several groups have recognized the value of conducting LCIA in conjunction with sustainability decisions. The United Nations’ World Summit on Sustainable Development: Plan of Implementation (United Nations General Assembly 2002) “calls for the adoption of tools, policies, and assessment mechanisms based on life-cycle analysis to promote sustainable patterns of production and consumption