DEPARTMENT OF AGRICULTURAL SCIENCES
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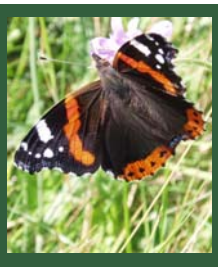

How to include on-farm biodiversity in LCA on food?

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Objective To assess current approaches to include biodiversity aspects in Life Cycle Assessment and search for an approach to include biodiversity aspects in LCA on food.

Introduction

Life Cycle Assessments (LCA) of food and agriculture generally include potential effects on global warming, eutrophication, ecotoxicity and acidification some of which again affect biodiversity. However, LCA most often does not include specific indicators of the product's or agricultural system's impact (negative or positive) on biodiversity. Using LCA methodology on agricultural products makes it highly relevant to assess the impacts of land use. Some LCA's include a simple category of land use. This is sometimes interpreted as "nature occupation". However, if this is the only impact category addressing land use related biodiversity, the LCA cannot distinguish between different forms of agricultural systems, which may differ in their biodiversity impact (e.g. organic versus conventional products). Biologists as well as policy makers consider some agricultural land use, such as grazing semi-natural grasslands, is actually considered beneficial for biodiversity preservation.

Is land use always negative for biodiversity?

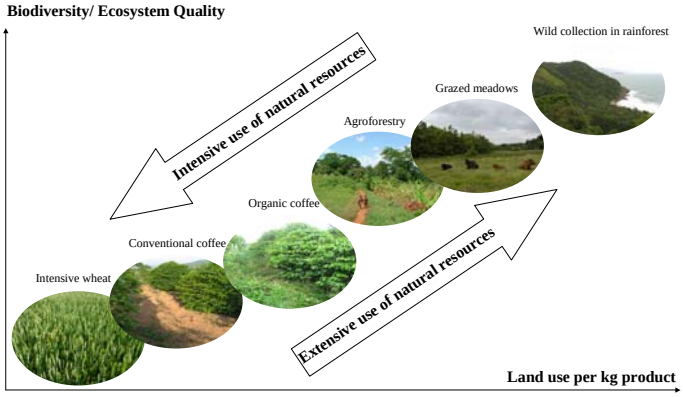
Does untouched nature automatically have higher ecosystem quality?

How can LCA account for biodiversity preservation effects of some agricultural systems?

Current approaches to include biodiversity in LCA

Indicators of biodiversity	Suggested by
Land use (ha year per kg product)	Current common LCA approach
Intactness, integrity, fragmentation, endemism, scarcity	Mila i Canals et al. (2006)
Indicators based on ecosystem thermodynamics	Wagendorp et al. (2006)
The biotope method (four categories of biotopes)	Kyläkorpi et al. (2005)
Species richness indicator (SRI) and ecosystem rarity indicator (ERI)	Vogtländer et al. (2004)
The Hemeroby Concept (scale of use intensity, %)	Brentrup et al. (2002)
Several indicators especially on farmers uncultivated area	Schenck (2001)
Species richness (SR), Inherent ecosystem scarcity (ES), Ecosystem vulnerability (EV) – combined in Quality ($Q_{biodiversity}$)	Weidema & Lindeijer (2001)
Qualitative descriptions only	Mattsson et al. (2000)
Species-pool effect potentials (SPEP)	Köllner (2000)
Species diversity of vascular plants (S)	Lindeijer (2000)
Area, number of listed rare species, number of species, number of individuals	Cowell (1998)

Land use per kg product can be difficult to interpret



How to select an appropriate indicator of biodiversity ? – to account for those differences?

Conventional coffee plantation, Brazil - with bare soil

Organic coffee plantation, Brazil - with wild vegetation

The selection of indicators

- Using DPSIR approach (pressure indicator)
- Using the most important factors affecting biodiversity, instead of direct estimations of e.g. species diversity
- Operational approach
- Using questionnaire for farmers instead of measurements (as suggested by Schenck (2001))

Suggestion for indicators

Several indicators? → **A single indicator?**

% small biotopes
% weeds
% unsprayed area

Ecosystem quality

As suggested by Schenck (2001)

As suggested by Brentrup et al. (2002)

Example of using several indicators

	Dairy farms in Denmark (1994-97)	
	Organic	Conventional
Land use per kg milk (m^2 year)*	2.1	1.4
% small biotopes	4	4
% weeds in small grains	10	1
% unsprayed area	100	35

*LCA Food Database (www.lcafood.dk)

Source: Halberg et al. (1999)

Conclusion Land use in food production systems can have both positive and negative impacts on biodiversity compared to leaving the land untouched by humans. Simple, operational indicators to account for the different impacts on biodiversity in food production systems could take the point of departure in the most important factors affecting biodiversity (easy obtainable pressure indicators) instead of estimating e.g. species diversity directly.

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