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Environmental consequences of food consumption:

A modular life cycle assessment to evaluate product characteristics

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Abstract

The extent of environmental impacts of food consumption depends on various factors. It is not easy for consumers or even for experts to account for these impacts. The goal of this research work was to assist consumers in considering environmental aspects. Separate LCA's were calculated to assess various aspects of the consumers' choices, e.g., the type of agricultural practice, the origin of the product, the use of packaging material, the type of preservation, and the consumption (including home transport, conservation, and preparation). A *modular LCA approach* was developed to model the impacts of the consumers' decisions. This simplified method allows investigating the ecological trade-offs among different decision parameters (such as assessing a biological product from the Netherlands vs. greenhouse from Switzerland). Most of the decision parameters might have an influence on the overall impacts of a vegetable product. Greenhouse production and products transported by airplane cause the highest environmental impact. The agricultural production determines the overall environmental impacts of meat products. The total impacts for purchased vegetable or meat products might vary by a factor of nine or seven respectively. It could be shown that the environmental impacts of purchases by different consumer subgroups vary. Different hints for consumers were ranked, according to the variation of average impacts, due to a marginal change of consumption patterns.

Summary

A lot of advice is given to consumers about how to buy environmentally sound products. They should buy fresh, organic products from the region, which are available with nearly no packaging. But, in everyday life there exist many difficult situations where a consumer has to decide what is more environmentally sound: A product from a greenhouse in the region or a product cultivated in open air but imported from overseas.

Different levels of decision-making for the consumer were distinguished while judging the environmental impacts of consumption patterns. The consumers can recognise the environmental

burden by considering certain product characteristics, corresponding to the determinants of environmental impacts. Various combinations of the product characteristics are possible when a consumer looks for food in a shop. A diary survey, conducted in collaboration with a group of psychologists, asked for these characteristics.

The aim of this research work was to support consumer decisions and to highlight the characteristics of a product that are most important with respect to the environmental impacts. The following questions should be answered:

How can impacts of food purchases be assessed in a scientific way?

What are the possibilities for an ecological behaviour from the consumers' point of view?

How far do different consumers realise an environmentally sound behaviour?

Which restrictions for an ecological behaviour do different consumers face?

Meat and vegetables where chosen as examples in the necessity field of nourishing. These two product groups together account for about 40% of the total energy use due to food consumption. The environmental assessment for food purchases has been simplified by using a modular life cycle assessment (LCA) approach. In this approach the inventory is split into five modules according to the important product characteristics. At the end, the results of the five separate modules can be aggregated, to assess the total environmental burden of a purchased product.

The Eco-indicator 95 and the Swiss method "Ecological Scarcity" have been used as methods for valuation. Both impact assessment methods do not vary much as to the general messages. The overall impact of meat products is dominated by the agricultural production. Differences from the consumers' point of view arise mainly from differences among meat from organic and from integrated production. The import of fresh products from overseas by air adds significant environmental impacts. Other product characteristics, such as packaging, conservation method and consumption, are of minor importance.

The impacts of animal production vary for the different types of meat. Poultry and pork show the lowest impacts while grazing animals show the highest. This point would merit further investigation (by means of a more detailed, e. g. marginal LCA) because from a top-down perspective it does not seem to make sense to produce more pork instead of meat from grazing animals in Switzerland.

In case of vegetable purchases, all characteristics might have a relevant contribution to the environmental impacts. Production in the greenhouse has much higher impacts than open-air production. The consumption stage adds significant impacts to the inventory. The region of production, and corresponding transports, are important especially if vegetables are flown in from overseas. Packaging, which has gained a lot of public awareness in the past, does not add much to the total environmental scores and thus is not relevant to be considered in consumers' decisions (for this example of vegetables and meat). High differences exist between the products with the lowest and the highest impacts. Purchases of a certain amount of food may differ by a factor of seven or nine in the environmental impacts caused for meat and vegetables respectively. The comparison shows lower scores for organic products, compared to products from integrated production, but this result is unsure and thus needs further research work by LCA.

People do not only differ in their behaviour, but also in their constraints and resources. Acknowledgement of these preconditions has important implications for intervention strategies

aimed at fostering environmental behaviour. Therefore, subgroup differences in consumption patterns were investigated. A sample of 134 consumers reported the characteristics of their meat and vegetable purchases in a diary over a period of four weeks. It could be shown that people from different subgroups do differ with regard to the environmental impacts caused.

The ecological relevance of meat and vegetables for the whole purchases was assessed with energy use as an indicator. The expenses for different product groups, reported in the diary study, were used to calculate this energy use. This broad estimation shows some variances between different consumer subgroups. It also highlights the importance of meat consumption. Reducing the amount of meat consumed, might be an option for minimising the environmental impacts due to nutrification that should be investigated in more detail in forthcoming studies.

Consumers will normally not buy only the less polluting product. However, they can adopt their behaviour to buy more environmentally friendly. Starting from the average purchases investigated in the diary study, different options for these changes were compared. The highest change for a meat or vegetable purchase is caused by a renunciation of fresh products flown in from oversees. A second important option, is a preference for organic products.

The modular LCA, which has been developed in a thesis (Jungbluth 2000, Jungbluth *et al.* 2000), points-up the importance of different product characteristics. The method makes it possible to assess ”environmental behaviour” of persons based on information about their consumption patterns. The LCA approach is simplified if a range of similar products is investigated and if knowledge of LCA studies can be used to identify hot spots and main inputs to the life cycle. Some of the results have been made available on www.ulme.uns.umnw.ethz.ch in order to enable consumers to evaluate the environmental impacts of their food purchases (Epp & Reichenbach 1999).

Links

Calculate the environmental impacts of your food consumption
http://www.ulme.uns.umnw.ethz.ch

Information regarding the "Energy, Greenhouse Gases and Way of Living" project can be found on http://www.uns.umnw.ethz.ch/~jungblu/nj-pdescription.html

Publications are listed on http://www.uns.umnw.ethz.ch/~jungblu/publication.html

The thesis "Environmental consequences of food consumption"
http://www.uns.umnw.ethz.ch/~jungblu/dis.html

The homepage of the Integrated Project Society http://www.ipgesellschaft.ch

Literature

Epp, A. & Reichenbach, A., (8.1999), *Rückmeldung an KonsumentInnen zu den Umweltfolgen ihrer Lebensmitteleinkäufe*. Diplomarbeit Nr. 26/99, Umweltnatur- und Umweltsozialwissenschaften, Eidgenössische Technische Hochschule, 147 Seiten, www.ulme.uns.umnw.ethz.ch, Zürich.

Jungbluth, N., (2000), *Umweltfolgen des Nahrungsmittelkonsums: Beurteilung von Produktmerkmalen auf Grundlage einer modularen Ökobilanz*. Dissertation Eidgenössische Technische Hochschule Zürich Nr. 13499, Umweltnatur- und Umweltsozialwissenschaften, dissertation.de, ISBN/ISSN 3-89825-045-8, 316 Seiten, www.uns.umnw.ethz.ch/~jungblu/dis.html, Berlin.

Jungbluth, N., Tietje, O., Scholz, R., (2000), “Food Purchases: Impacts from the Consumers' Point of View Investigated with a Modular LCA.” In *Int. J. LCA* (accepted), Landsberg, Germany.