

Environmental Impacts of Food Products Investigated in Life Cycle Assessment

Dr. Niels Jungbluth, Sybille Büsser
ESU-services Ltd., Uster, Switzerland



Institute of Food, Nutrition and Health
Swiss Federal Institute of Technology Zurich - ETH
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ESU-services
fair consulting in sustainability

Food and Environmental Impacts

The illustration shows a central figure holding a document, surrounded by thought bubbles and icons representing environmental impacts. A green bubble contains '37 MJ of Energy for 1 kg of Tomatoes' with a tomato and cans. A purple bubble contains '3500 Litre of Water for 1 kg of Chicken' with a chicken and a bathtub. A yellow bubble contains '7695 km for a Strawberry Yoghurt' with a truck and strawberries. An orange bubble with a question mark is also present.

37 MJ of Energy for 1 kg of Tomatoes

3500 Litre of Water for 1 kg of Chicken

7695 km for a Strawberry Yoghurt

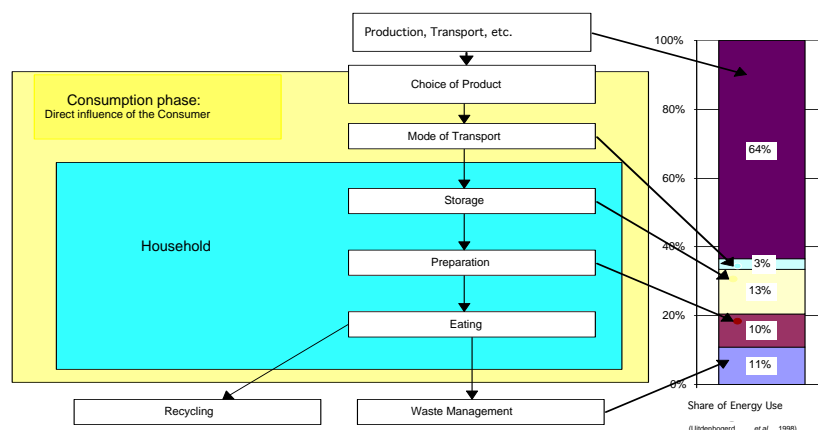
Page 2

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Contents

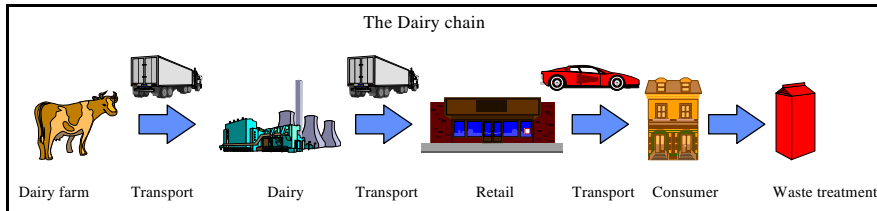
- Research questions and goals
- The method of life cycle assessment (LCA)
- Environmental impacts of food consumption
- Conclusions concerning food purchases from the consumers point of view
- Public interest
- Collaboration possibilities with ESU-services

Consumer Choices in the Life Cycle of Food Products



- Pre-consumption often dominates the environmental impacts
- Life cycle thinking necessary

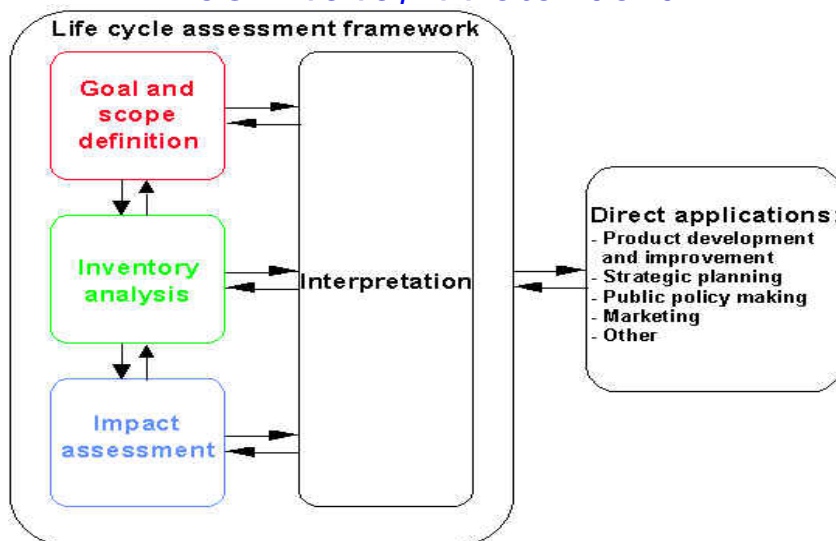
Life Cycle Assessment of Products



© LCA network food, final document

- LCA looks from cradle to grave (to gate)
- It accounts for resources (energy, water, land) and emissions to air, soil and water
- Main stages to be distinguished:
production - distribution - delivery - use phase - disposal

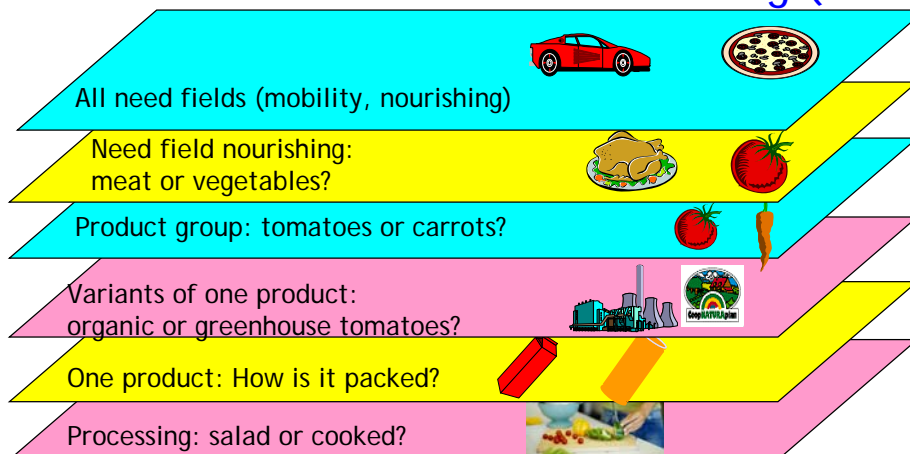
Four stages of Life Cycle Assessment (LCA) ISO-14040, 44 Standard



Research Questions and Goals

- What is a good environmental choice from the consumers' point of view when purchasing vegetables and meat?
- How can the environmental impacts be judged?
- Which characteristics of the products are important?
- Do single consumers differ with regard to the environmental impacts caused by their consumption patterns?

Which questions to be answered? Levels of Consumer Decision Making (DML)



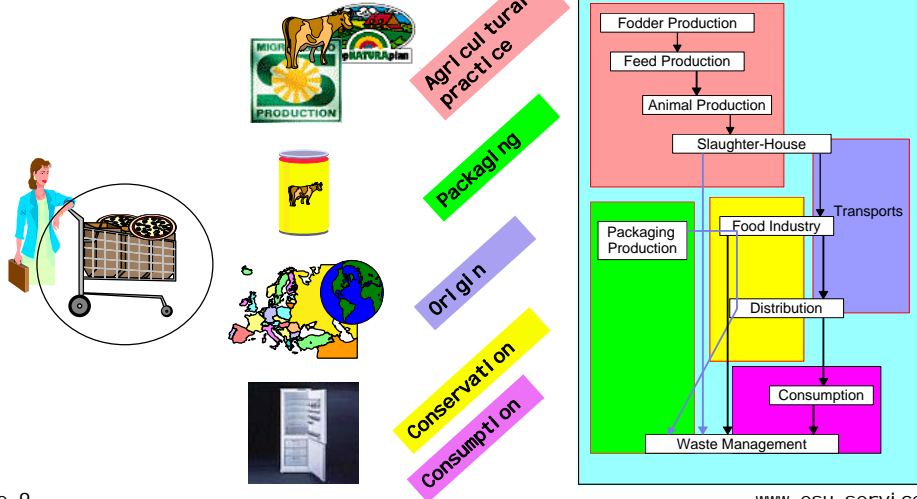
➤ It is possible to address different types of questions, but not with one analysis

Modular LCA to assess Food Products

Purchase

Product characteristics

Modular LCA



Page 9

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Inventory for the modular LCA

- Balance of all emissions and resource uses
- Investigation of the most important product groups meat and vegetables
- Use of existing LCA studies as far as possible
- Agricultural inventory based on economic data
- Simplifications at all stages by modular approach
- Combination of module results for the full LCA

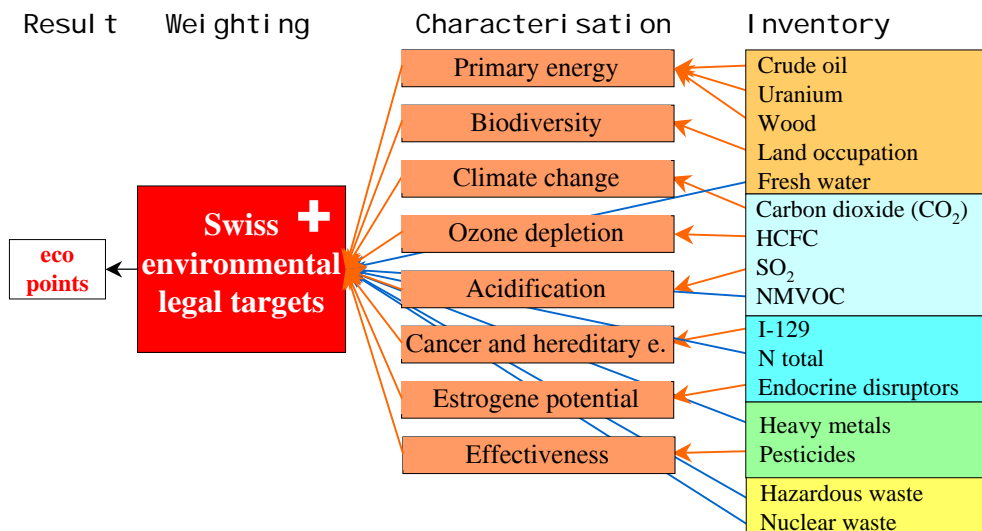
➤ Easy environmental assessment with a modular LCA for a range of food products

Life cycle impact assessment (LCIA) methods

environmental impacts	carbon footprint (kg CO ₂ -eq)	ecological footprint (m ² a)	ecological scarcity 2006 (UBP)	
resources	abiotic resources, incl. water	∅	∅	√
	nuclear energy	∅	∅	√
	fossil energy	∅	∅	√
	land occupation	∅	√	√
	land transformation	∅	∅	∅
emissions	climate change	√	√	√
	ozone depletion	∅	∅	√
	toxicity	∅	∅	√
	summer smog	∅	∅	√
	acidification	∅	∅	√
	nutrification	∅	∅	√
	endocrine disruptors	∅	∅	√
	noise, odour, litter	∅	∅	∅
	ionising radiation	∅	∅	√
	waste (incl. radioactive waste)	∅	∅	√

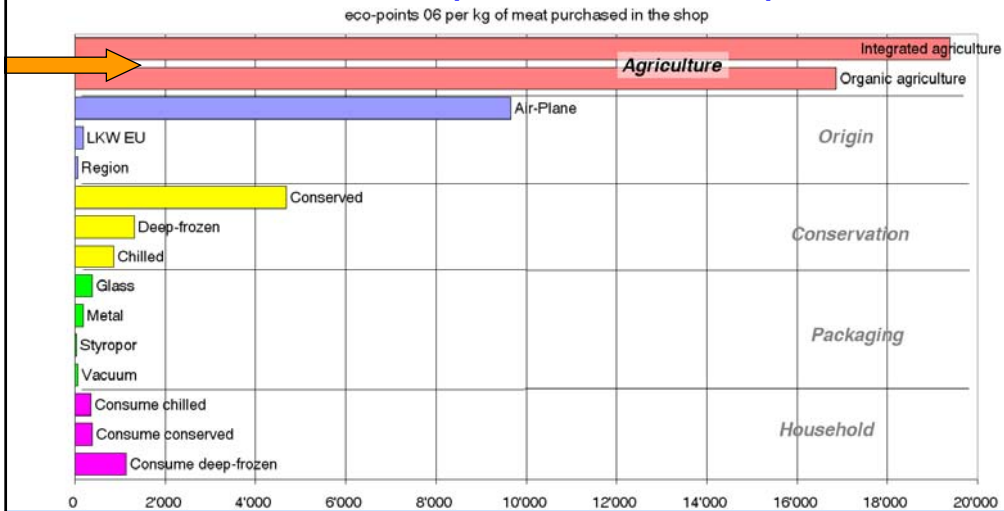
- The BAFU has developed the Swiss ecological scarcity 2006 for assessing environmental impacts of products, services and companies

Ecological Scarcity 2006



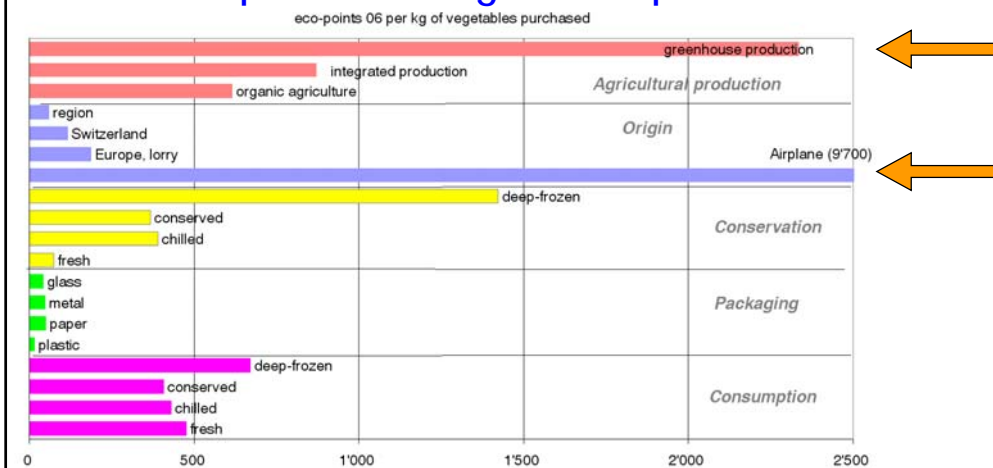
- Assessment of emissions to air, water and soil as well as resource uses
- Aggregation of exchanges according to the environmental scarcity defined in Swiss politics

Environmental impacts of meat purchases



➤ Agricultural production dominates total impacts of meat products

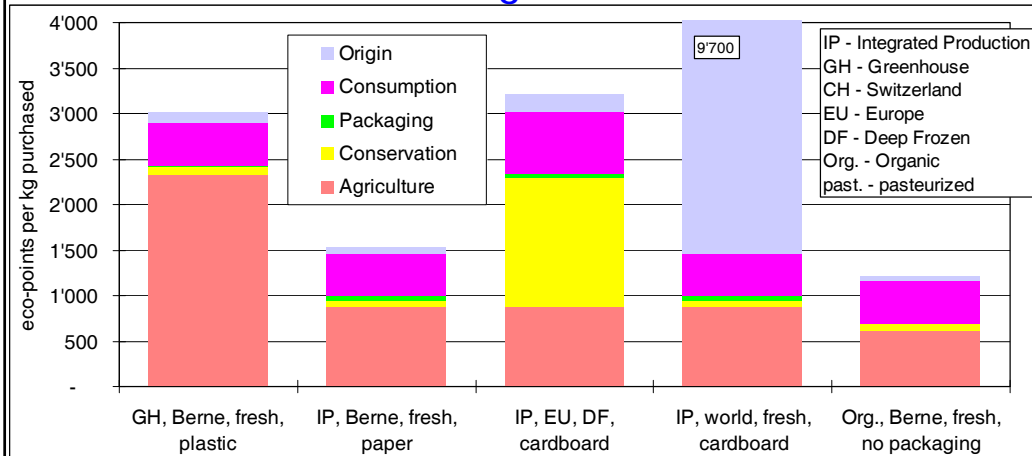
Impacts of vegetable purchases



➤ All characteristics are important

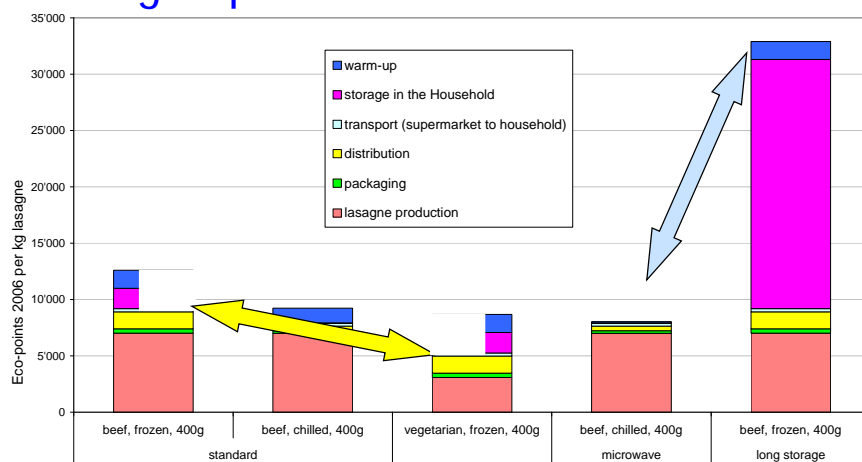
➤ Air transports and heated greenhouse cause highest burdens

Combination of Product Characteristics for Vegetables



➤ Easy evaluation of consumption patterns

Lasagne production and user behaviour

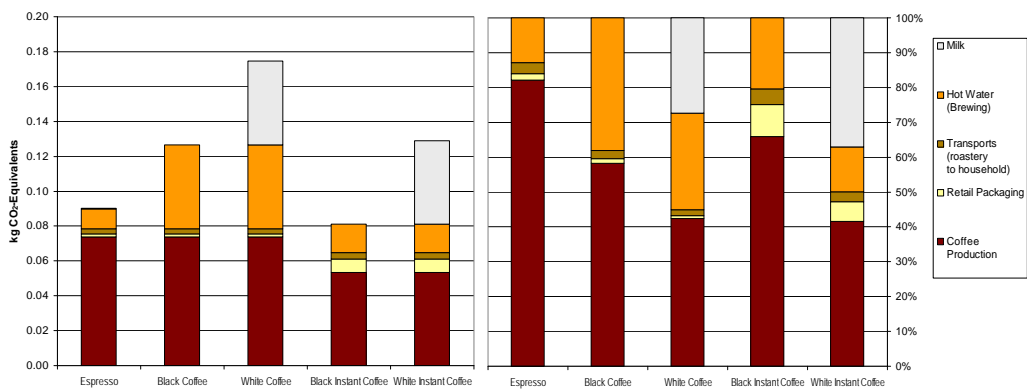


➤ Differences in production less obvious if full life cycle is evaluated

➤ Important differences in the use phase need to be addressed

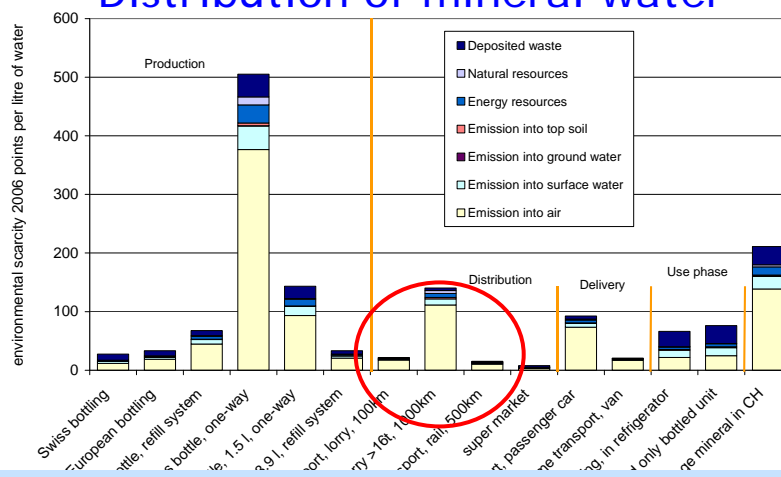
Importance of consumer decisions

Coffee consumption



➤ Packages are often less relevant than other consumer decisions

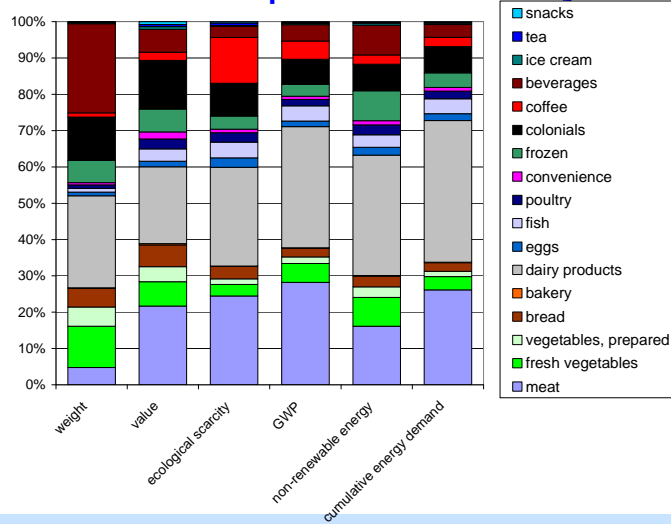
Distribution of mineral water



➤ Impacts of distribution vary considerably by point of sale

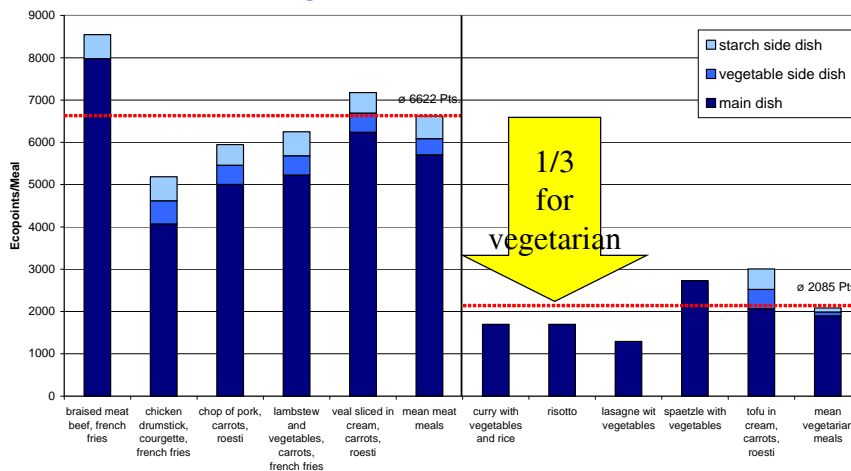
➤ Not feasible to assist comparisons without considering difference

Indicators of food purchases City of Zurich



➤ Meat, milk and coffee are a hot spots for environmental impacts

Canteen Meals: comparison of vegetarian and meat based recipes



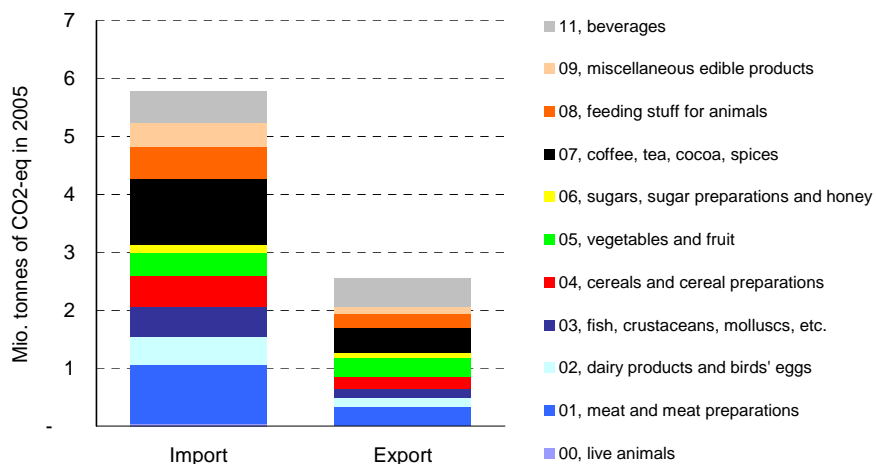
➤ Vegetarian meals have considerable lower impacts

Use of LCA for determining the embodied emissions of Switzerland

- Trade statistics combined with
- Indicator results for single products based on LCA studies

➤ Calculation of embodied emissions for all imports and exports to Switzerland

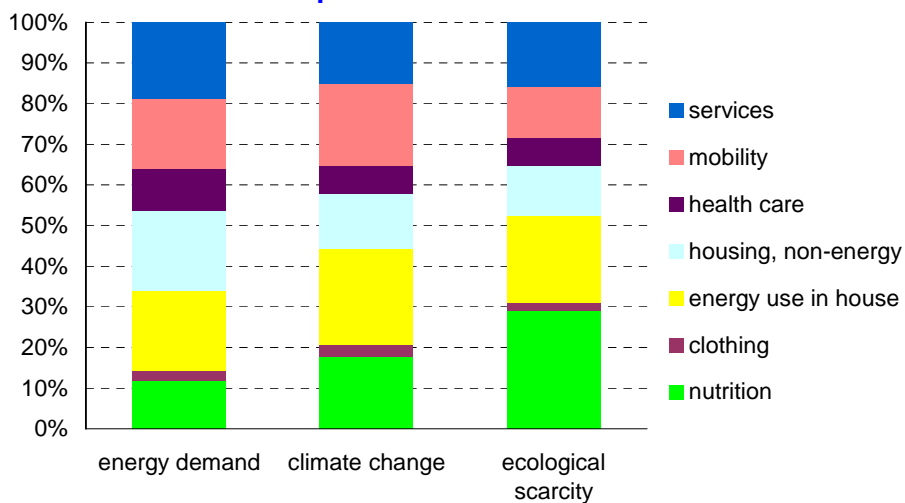
Balance of Swiss embodied emissions for food products



Results for the nourishing sector

- Imports of embodied greenhouse gas emissions are much higher than exports and add 9% to total direct Swiss emissions
- Animal products and transports with the air plane are important

Overall importance of nutrition in total consumption of households



➤ High environmental impacts compared to other consumption fields

Conclusions for Food Consumption

- All stages and environmental impacts of the life cycle should be considered for the assessment
- Eat vegetarian. Consumption of meat and animal products need to be reduced
- Air transported products should be avoided
- Buy seasonal. Less products from heated greenhouse should be bought
- Consider energy efficiency in the household
- Reduce wastage and overconsumption

Public interest on LCA studies of food

- High public interest allows to teach life cycle thinking
- Many people mix health aspects and environmental aspects when looking at food
- Sensations, even if wrong, are more interesting than confirmation of former research
- Detailed comparisons should be more interesting for producers and distributors than for consumers

Influencing consumers behaviour

- Knowledge is available for consumers
- LCA studies sometimes confusing if no clear result
- Lower options for reducing environmental impacts compared to other fields like mobility and housing
- People tend to follow the easy things and not the important things, e.g. recycling of packages instead reducing meat consumption

➤ Stress the points that are really important and not what is scientifically surprising

ESU-services LCA food database

- First work on cooking in India (1994-1995)
- Further development with Ph.D. thesis of Niels Jungbluth on meat and vegetable consumption in CH (1996-2000)
- Several projects of ESU-services for extension
- Today more than 700 datasets related to food
- Background data and methodology according to ecoinvent
- Data are sold for SimaPro or other software

Overview on contents

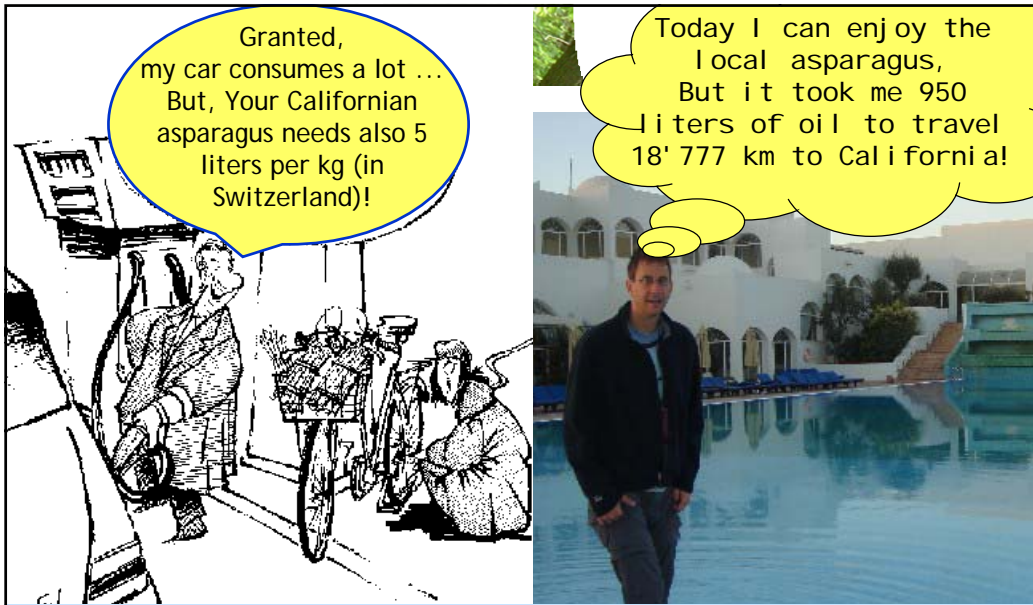
- Simplified agricultural production services: application of fertilizers
- Vegetables: spinach, salad, tomatoes, lettuce, potatoes, onions, asparagus, etc.
- Fruits: apples, strawberries, cherries, grapes, oranges, vine
- Animal products: pork, veal, beef, lamb, poultry, eggs
- Dairy products: butter, milk, milk powder, yoghurt, cheese

Contents (Part 2)

- Drinks: apple & orange juice, mineral water, tap water, beer, wine, milk, coffee
- Sweets: chocolate, ice cream
- Meals: roast, lasagne, goulash soup, comparison of domestic vs. imported or meat vs. vegetarian
- Household appliances: cooking stoves and ovens, microwaves, refrigerators, carbonisation devices, coffee machine
- Food consumption: packages, transports, cooking, consumption patterns
- Pet food: cat food

Cooperation possibilities

- Case studies on single food products
- Environmental management in food industry
- Evaluation of food consumption patterns
- Assessment of total environmental impacts in the food sector
- Review of LCA studies



Granted, my car consumes a lot ...
But, Your Californian asparagus needs also 5 liters per kg (in Switzerland)!

Today I can enjoy the local asparagus,
But it took me 950 liters of oil to travel 18'777 km to California!

- Keep the relevance of decisions in mind and do not get lost in details!
- Download of the Ph.d. thesis www.jungbluth.de.vu
- Calculate the environmental impacts of Your food consumption www.ulme.ethz.ch