5. 6. 2008, 35th Discussion Forum:
Assessment of Water Use within LCA

Considering the specifics of regional water resources in tomato cultivation

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Goal of the study

- What are the relevant impacts of 1 kg Tomatoes at a Swiss store house?
- Taking into account:
  - Area of cultivation
    - Switzerland
    - Spain
  - Different cultivation practices:
    - Outdoor
    - Green house: early and late
  - Transports

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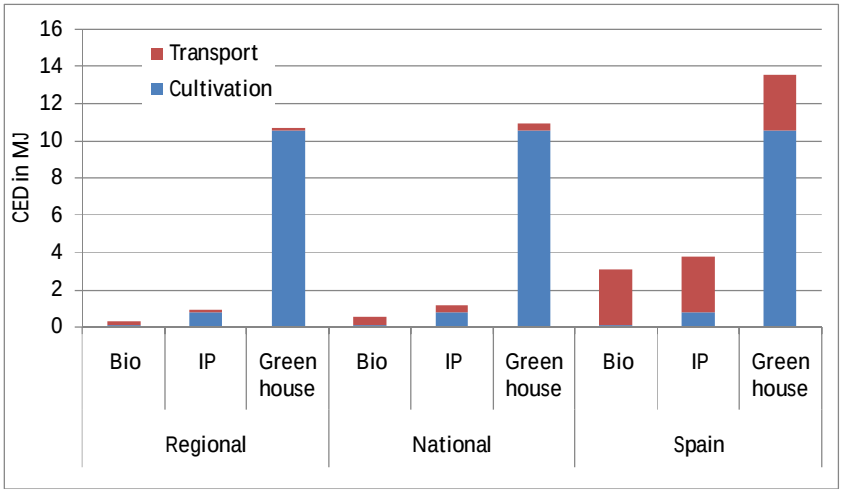
Tomatoes at store in Switzerland
mainly based on literature data (Niels Jungbluth)



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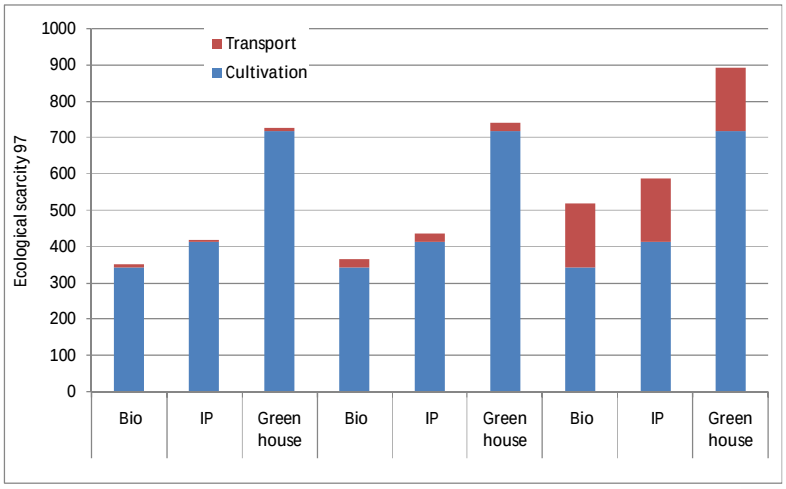

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Conclusions from these data

- It is better to import tomatoes from spain than produce it in a green house in Switzerland
- What about questions like water resources?

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Cultivation of vegetables in south Spain

1974

2004

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Dried see near Alicante in the summer 2005

Introduction

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Water use

Water resources

The water situation has to be taken into account

- This study has been started in the year 2004, before the method UBP 2006 has been published.
- So the water resources have not be taken into account in the valuation methods.
- The use of water can be valuated in the method of ecological scarcity according to the distance to target.
- Based on a work done by Carbotech in valuating water emissions according to the regional situation the method has been adopted.
- This work has given the base for the regional differentiation regarding water resources in the method of ecological scarcity 2006. Some adoption and further developments have been done for the actual method.

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Water used in different regions in Spain

Water resources

	Utilised water resources Mm^3	Renewable water resources Mm^3 (incl. rain, ground and surface water minus evaporation)	Deficit Mm^3	Utilisation in %	
Andalusia 2002	1'053	816	237	129%	
Comunidad Valencia 2004	3'304	3'148	156	105%	
Murcia Cuenca Segura	642	442	200	161%	
Zonas alrededor de V.	944	585	359	145%	
Almeria	433	207	226	209%	
Spain, average	38'544	110'126		35%	

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Valuation of the regional water consumption

Water resources

Eco factor $= 1 / F_k * F_{CH} / F_k * c$ original

$= 1 / F_{CH} * (F / F_k)^2 * c$ UBP 06

According to the UN a utilisation of 20% of the renewable water resources is sustainable. This leads to the critical flow of 20% of the renewable water resources.

Eco factor for regions:

Weight = (current flow / critical flow)^2

$$= \left(\frac{\text{water consumption in region A}}{\text{renewable water res. * 20\%}} \right)^2$$

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Water resources and water use

Water resources

Category					
Water scarcity	example	Actual flow (m^3/cap*a)	Relation supply and demand	Critical flow (m^3/cap*a) 20% of flow	Eco factor (UBP/m^3)
low	Canada	1'420	0.01	14'200	4
Moderate	Switzerland	350	0.07	1'000	50
Middle	Poland	300	0.22	270	480
high	Spain, Italy	970	0.33	570	1'150
Very high	Valencia	3'300	1.05	630	11'000
Extreme	Almeria	433	2.1	42	44'000

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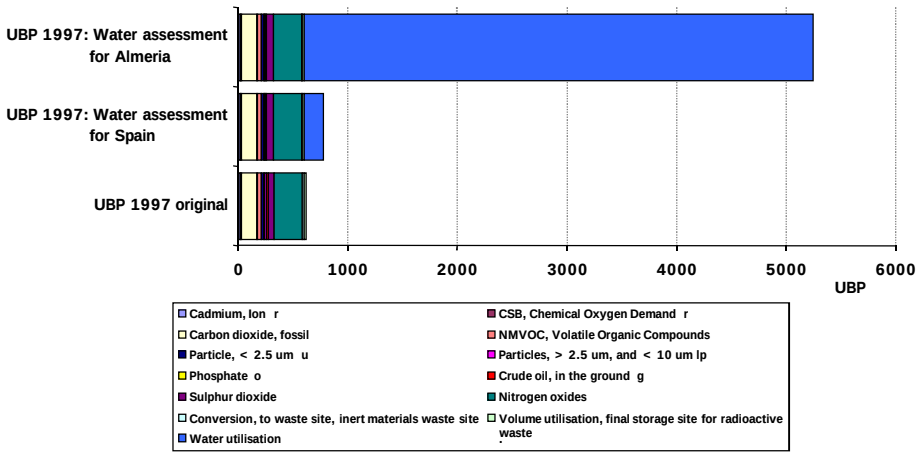
Tomato cultivation in Almeria field-grown

Results with UBP 97, water



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Another consequence of the water use

Results with UBP 97, water

- The ground water in the coast regions is fed by salted water
- A part of the water hast to be desalinated
  - Average in Spain 4% has to be desalinated
  - In Almeria up to 24% has to be desalinated
- The question arise what are the environmental impacts of desalination?
  - The energy need for a multi stage flash desalination is about 350 MJ / m^3

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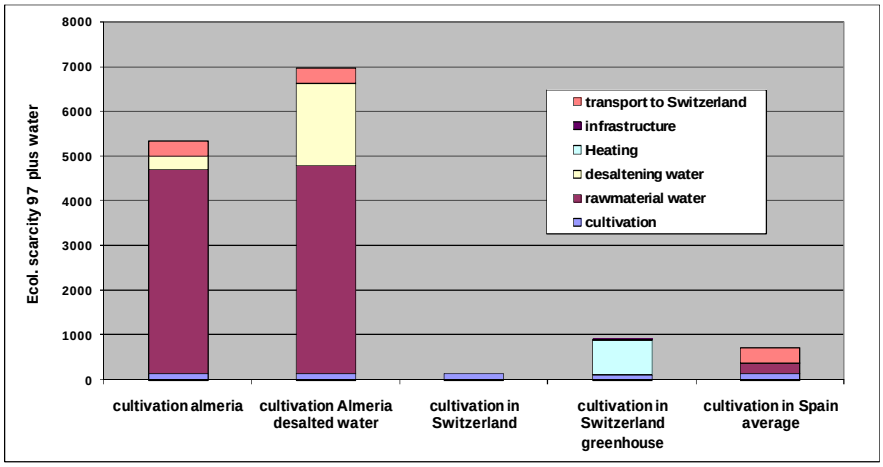
Tomato cultivation with valuation of the raw material water

Results with UBP 97, water



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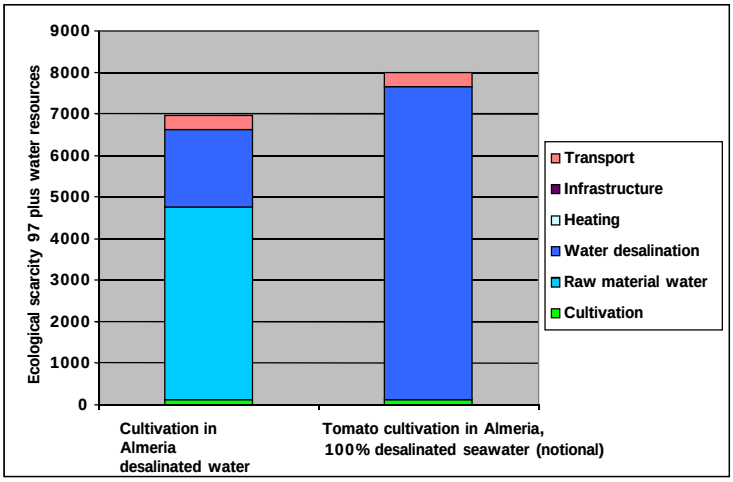
Cultivation with desalinated ground water or desalinated sea water

Results with UBP 97, water



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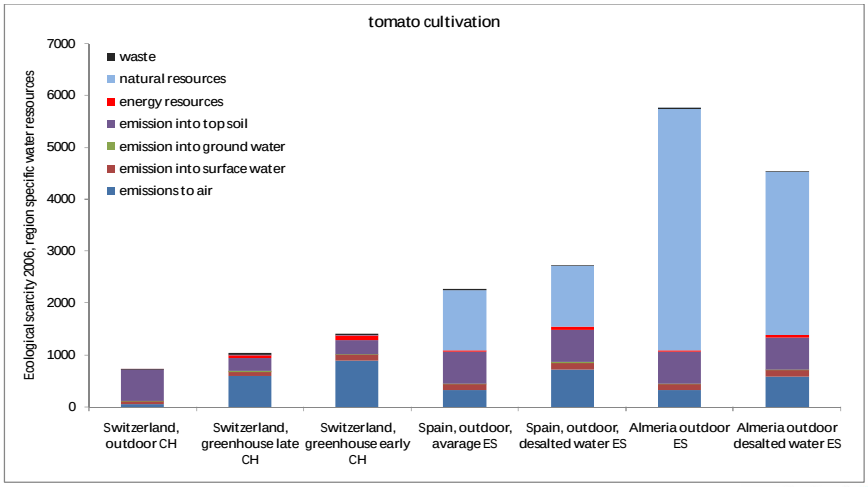
Valuated with region specific water stress

Results with UBP 06, water



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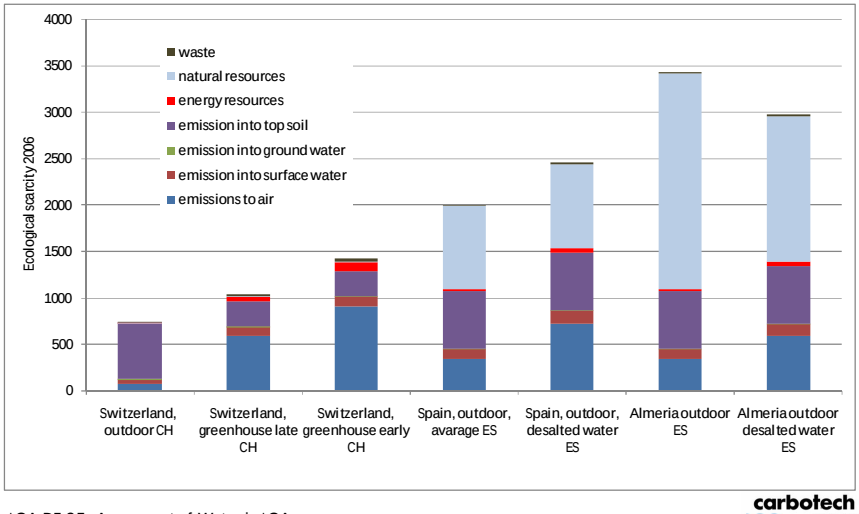
Valuated with classified water stress

Results with UBP 06, water



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Conclusions

- To take into account the water resources can change the results dramatically
- The regional situation has to be taken into account
- Better to make a pragmatic approach e.g. with classification than neglect it
- Desalination of water has a high impact on the environment because of the energy used.
- With newer technologies of desalination (membranes) the environmental impact of desalination can be reduced.

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