35th Discussion Forum:
Assessment of Water Use within LCA
ETH Zurich, 5th June 2008

Freshwater use in Life Cycle Assessment

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Based on:

Milà i Canals L, Chenoweth J, Chapagain AK, Orr S, Antón A, Clift R. *Assessing Freshwater Use Impacts in LCA Part I: Inventory Modelling and Characterisation Factors for the Main Impact Pathways*. Int J Life Cycle Ass Submitted

Unilever at a glance

- 65 % of our raw materials come from agriculture.
- 337 manufacturing sites across six continents
- around 19 000 suppliers
- € 15.9 bn spent with some 10 000 suppliers of raw materials and packaging and goods purchased for re-sale
- 240 000 employees
- Sales in 100+ countries; 400+ Brands
- Every day 200 million consumers buy a Unilever product

- € 953 m invested in R & D, equivalent to 2.4 % of sales
- 5 169 scientific staff in R & D
- working with UNICEF to reduce child mortality in Asia, Latin America and Africa through better hygiene and improved nutrition
- over 17 000 food products reviewed through our Nutrition Enhancement Programme
- nearly € 5 billion invested in advertising and promotions

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How we are organised

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Household and personal care

Categories Categories

Brands Brands Brands

Food

Categories Categories

Brands Brands Brands

Contents

1. **Introduction**. Assessing Freshwater Use
   - Why?
   - Approaches outside LCA; Virtual water; WF
   - Water in LCA

2. **New framework** for freshwater assessment in LCA
   - LCI (illustration with a case study)
   - LCIA

3. **Conclusions** and way forward

- References

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Why assess freshwater use in the first place?

- Water is a vital resource for humans and life
  - It is often a scarce resource (regional)
  - Water use by humans often leads to impacts on ecosystems

- Possible water-related business questions:
  1. Hotspots in the product's life cycle? Processes driving water use? Likely location of such hotspots?
     - We're more are risk in these processes
     - They are likely foci of attack by external pressure groups
  2. Where to locate a new site / supplier?
  3. Benchmarking and target setting

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Water use in business accounting Initiatives

- WBCSD's Global Water Tool (www.wbcsd.org)
  - Total withdrawals of company minus discharges = consumption
  - Focus on business DIRECT water use, own activities
  - Includes salt water
- OECD's key environmental indicators (OECD 2001)
  - Wastewater treatment in country + gross abstraction per capita
  - Not focused on companies
- UNESCO-IHE Business Water Footprint Accounting (Gerbens-Leenes & Hoekstra 2008)
  - direct and indirect (supply chain: **upstream**) water use
  - Built on WF methods
  - Aims to keep geo-referenced information
  - Same problems as LCA: system delimitation, allocation, ignorance of location in open market…

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Water impacts in LCA: state-of-the-art

- Some water-related impacts are currently included:
  - Eutrophication, Acidification
  - Toxicity (aquatic systems, fresh and marine)
- These are related to QUALITY aspects
- Other qualitative issues that need inclusion (not yet addressed):
  - Heat
  - Microbial contamination (main cause of water-related human deaths)

- So far, no assessment of impacts related to water QUANTITY (physical access to water)

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Why include freshwater use in LCA?

- LCA has the potential to provide a picture of direct and INDIRECT water use over the **whole life cycle** alongside other impacts (i.e. **trade-offs**)
- Clear distinction through LCI and LCIA of volumes and potential impacts related to these volumes
- LCA can help identify gross differences related to freshwater use in product systems that differ significantly
- LCA provides the systems analysis framework

- NOT to derive detailed assessment of local effects on e.g. aquatic ecosystems
- NOT to inform about new locations for factories

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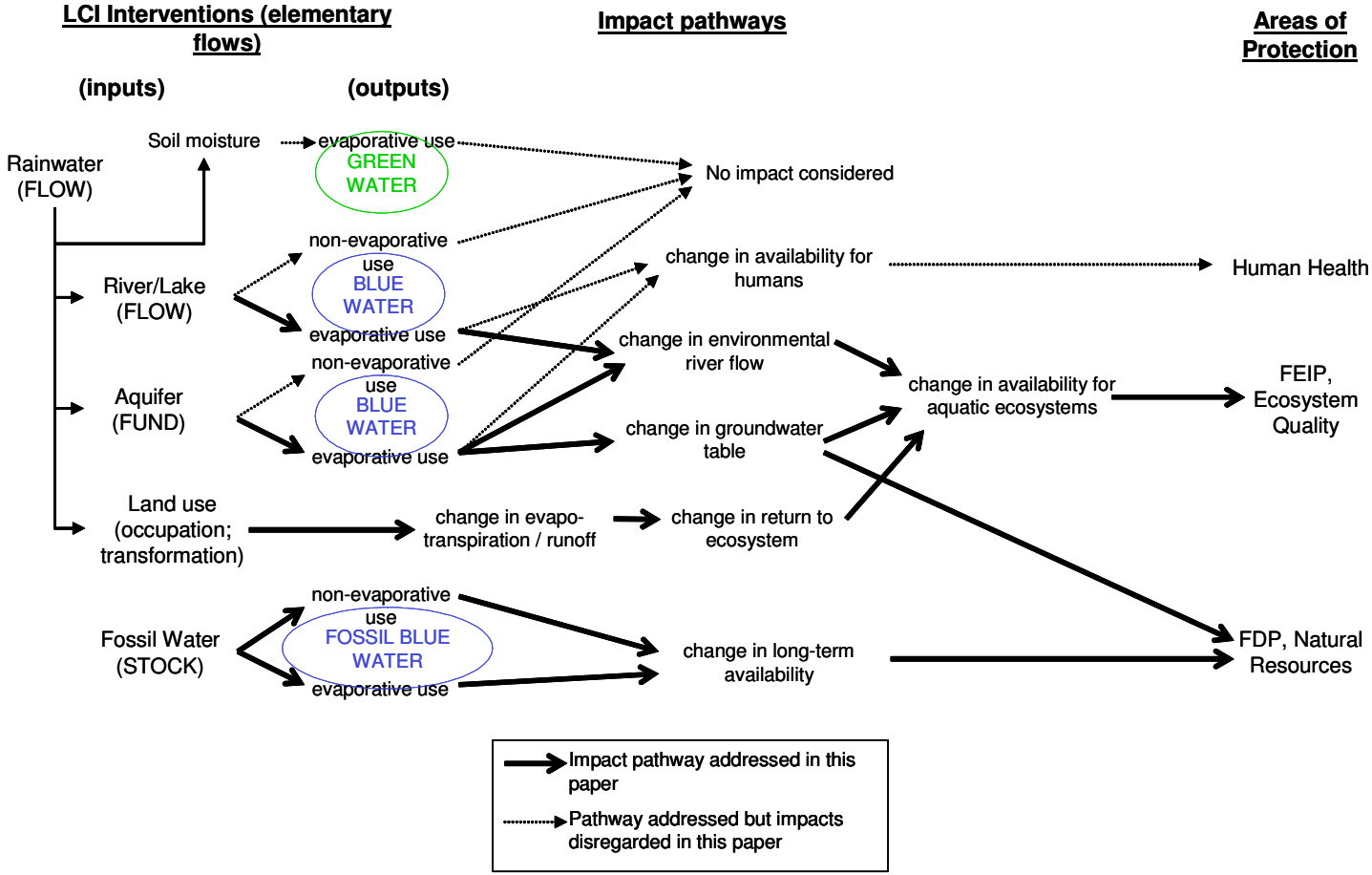
Which impact pathways could/should we include?

- Resources (very region-specific)
- Ecosystems (region-specific)



- I.e.: effects on Human Health are not driven by lack of water

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LCI: quantification of flows

- Cropping (86% of global water use): useful guidance from Virtual Water (VW) publications (FAO's CROPWAT; support from WWF?); mostly evaporative (70-90%)
- Electricity (major use of indirect water use): guidance is offered in paper; 10-20% evaporative (guesstimate)
- Other processes (textile and food drying, chemical processing): minor compared to previous uses?
- Land use: this may be linked to rainwater rendered unavailable for ecosystems (due to evaporative use / and rapid non-evaporative return: sealed land)
  - Non-sealed land: evapotranspiration = loss
  - Sealed land: evapotranspiration + runoff = loss

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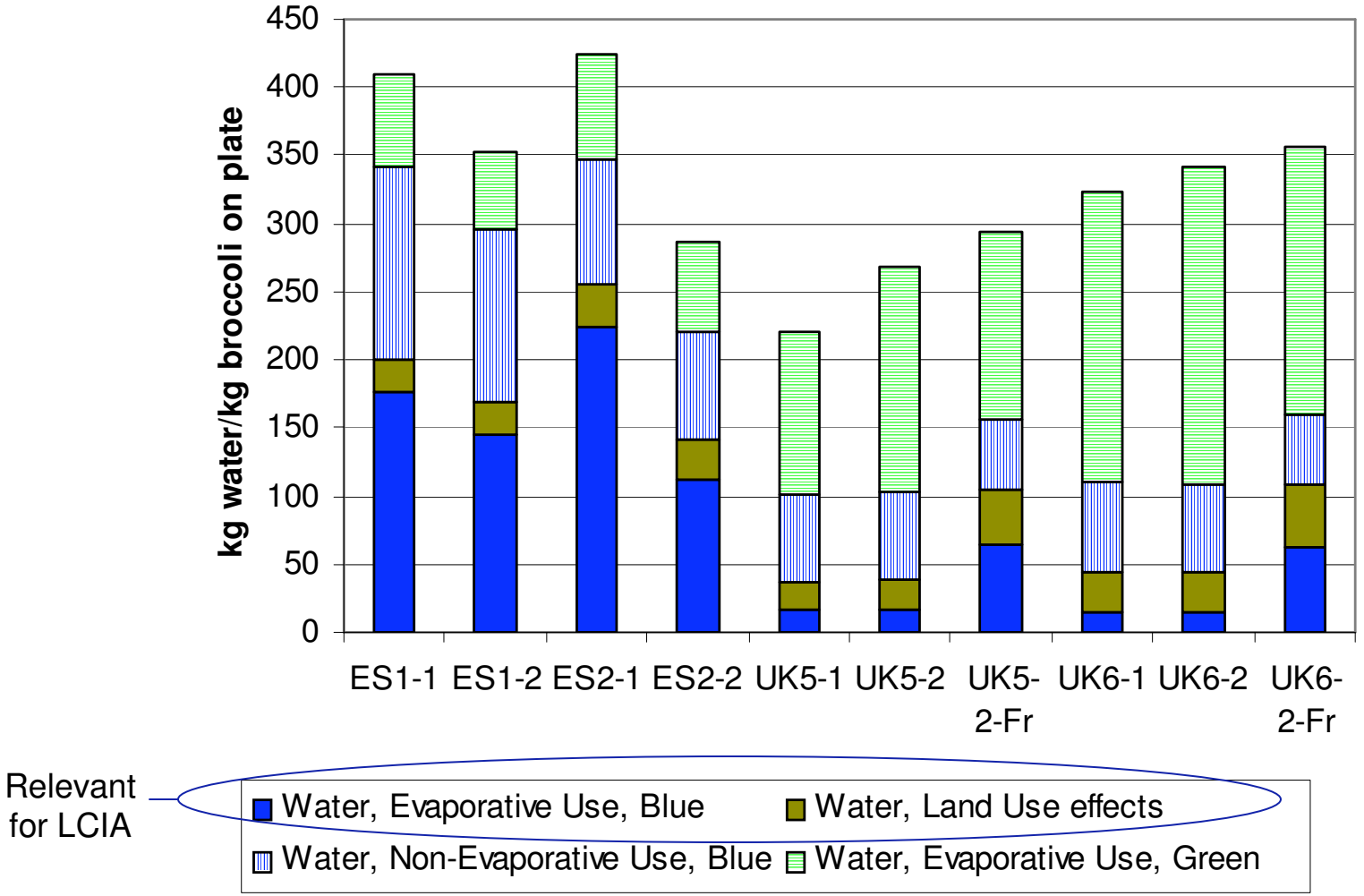
Preliminary results for a 'qualified' LCI: Spanish and British broccoli



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LCI: sophistication in flows reporting

- Source (surface, groundwater, etc.): **AVAILABLE**
- Region (Country; continent; river basin…): a **MUST** for Ecosystem effect (FEIP)
  - This could multiply water flows by 100s
  - Appropriate/feasible classification? (Biome? Eco-region? Continent? Country? Sub-country?)
- Dissipation (evaporative vs. non-evaporative use): **NICE** to have (e.g. egalitarian vs. individualistic approach)
  - This would multiply water flows by 2
  - Alternative: immediately returned / not immediately return to natural system (e.g. river); this is the approach followed for land use effects

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LCIA: indicators for scarcity (Freshwater Ecosystem impact Potential, FEIP)

- WUPR (Water Use Per Resource): **AVAILABLE** per country (FAO's AQUASTAT data)
  - WUPR = WU (country) / WR (country)
- WSI (Water Stress Indicator): **AVAILABLE** per basin (IWMI: Vladimir Smakhtin)
  - WSI = WU / (WR-EWR)
  - EWR: Environmental Water Requirements

- WSI more relevant than WUPR

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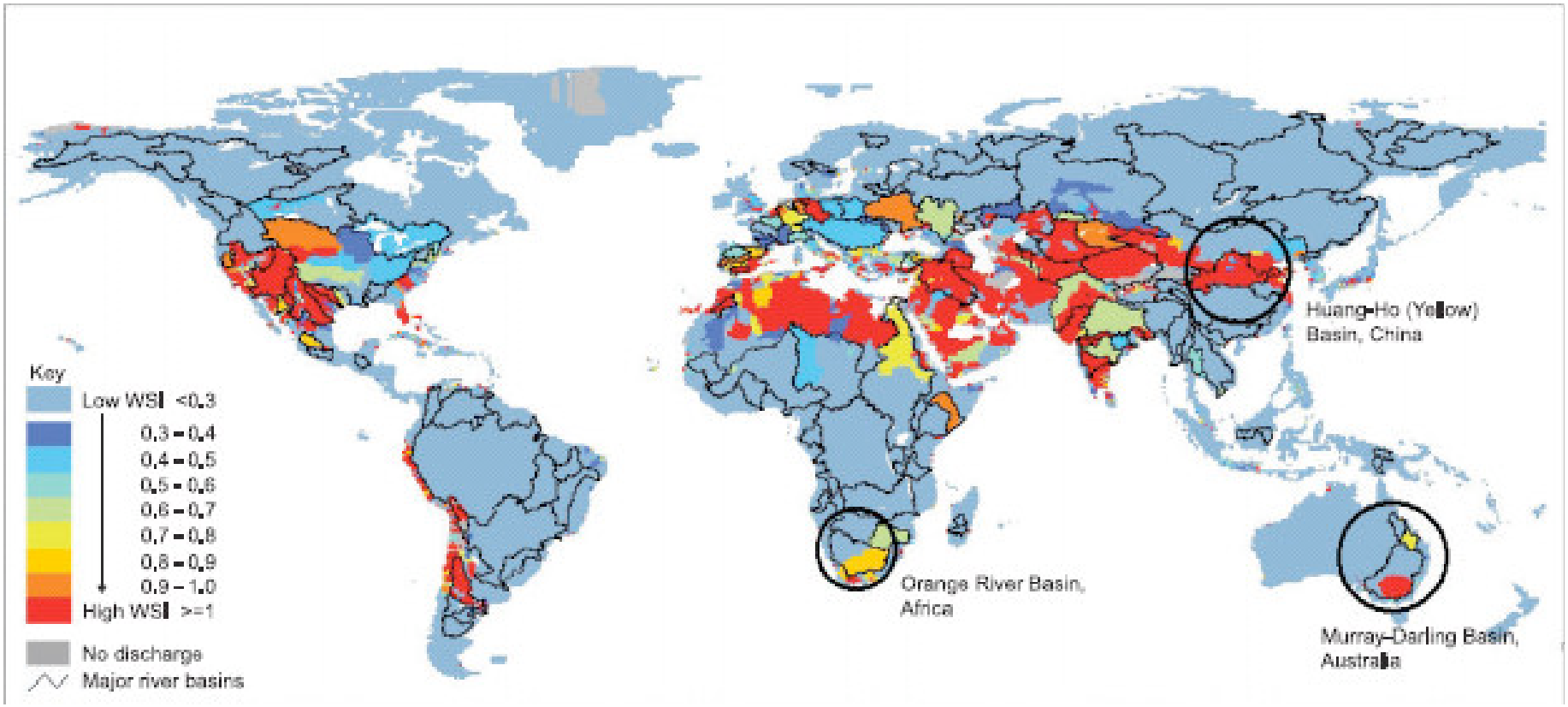
WSI for the main world river basins
(Smakhtin *et al*. 2004)



Smakhtin V, Revenga C, Döll P (2004): *Taking into Account Environmental Water Requirements in Global-scale Water Resources Assessments*. Comprehensive Assessment Report 2. http://www.iwmi.cgiar.org/assessment/FILES/pdf/publications/ResearchReports/CARR2.pdf

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LCIA: indicators for depletion (ADP)

- Only makes sense for FUNDS and DEPOSITS (fossil water)
- (FLOWS cannot be depleted)
- Use the ADP formula adapted for replenishment:

$$ADP_i = \frac{ER_i - RR_i}{(R_i)^2} \times \frac{(R_{Sb})^2}{DR_{Sb}}$$

- Effectively, few aquifers are reportedly over abstracted

- … but if water from over abstracted aquifers is used it may dominate the ADP results!
  - Large volumes used
  - And ADP may be orders of magnitude higher than other resources

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Next steps?

- All blue water use (direct and indirect) may be assessed in LCA studies
  - Agree / Adapt WF methods with WWF/UNESCO-IHE for LCI. Excluding green water
  - (report info also on evaporative/non evap? Returned?)
- For LCIA, regional information is necessary
  - Level of detail? Regions? Countries? Basins? Bio-geographical regions / eco-regions?
    - Follow work from UNEP/SETAC Life Cycle Initiative on land / freshwater use?
  - Work with IWMI for updated / tailored WSI
  - Or, in the interim, use WUPR from Aquastat

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So what?
Will this help addressing business questions?

- Hotspot analysis: **YES**. Including relevant water volumes in the LCA studies is as strong as WF methods (in fact, these can be included in LCI), **AND avoids trade-offs**
  - Attempts may be made to assess likely locations (marginal supplier?) but gross assumptions needed
- Deciding new locations for sites/suppliers: **NO**. Other tools including future water availability more relevant; WSI reports available and helpful for this
- Benchmarking and target setting: **YES**. LCA (or WF) will help defining where water is being used and where it may be more efficient to target reductions **avoiding trade-offs**

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References

- Gerbens-Leenes PW, Hoekstra AY (2008): *Business Water Footprint Accounting*. UNESCO-IHE Research Report Series No. 27
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THANK YOU!

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