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# Analysing LCIA methods for water use impacts

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## introduction

This work carries out an **analysis of the coherence, complementarity and compatibility** of the LCIA methods covering damage of freshwater use on ecosystem quality at the endpoint level.

## materials & methods

In the context of global harmonisation and consensus building, every method has been analysed against criteria related to the four issues on the left of the table. In the results and discussion section, we focus on the two criteria **highlighted** in the table.

issue	criteria
<b>Covered impact pathway</b>	<ul style="list-style-type: none"> <li>Characterisation factor (CF) starts where inventory (LCI) ends</li> <li><b>Complementarity of covered pathways</b></li> </ul>
<b>Characterisation model and factor</b>	<ul style="list-style-type: none"> <li><b>CF split into a fate factor (FF) and an effect factor (EF)</b></li> <li>Sound selection of stressor indicator (<i>see the definition in the figure to the right</i>)</li> </ul>
FF modelling	<ul style="list-style-type: none"> <li>Coherent with the nature of the intervention in the LCI</li> <li>Initial level of stress in the environment (ie: background conditions) considered</li> </ul>
EF modelling	<ul style="list-style-type: none"> <li>Consistent with the CF and the FF</li> <li>Severity of impacts appropriately included</li> <li>Sub-steps (exposure, incidence, damage) addressed</li> <li>Initial level of effect in the environment considered</li> </ul>

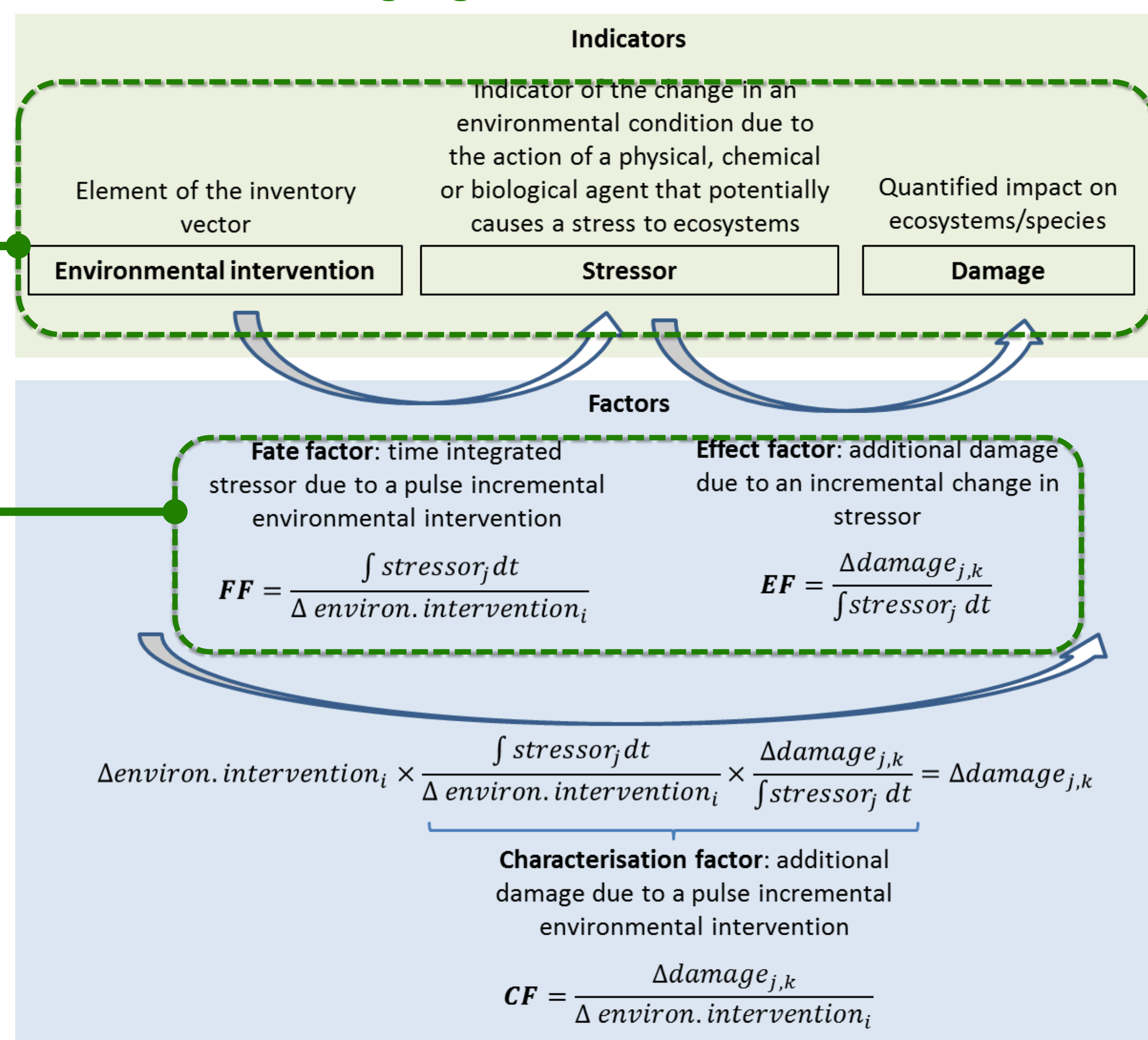


Figure: general structure of a characterisation factor

## results & discussion

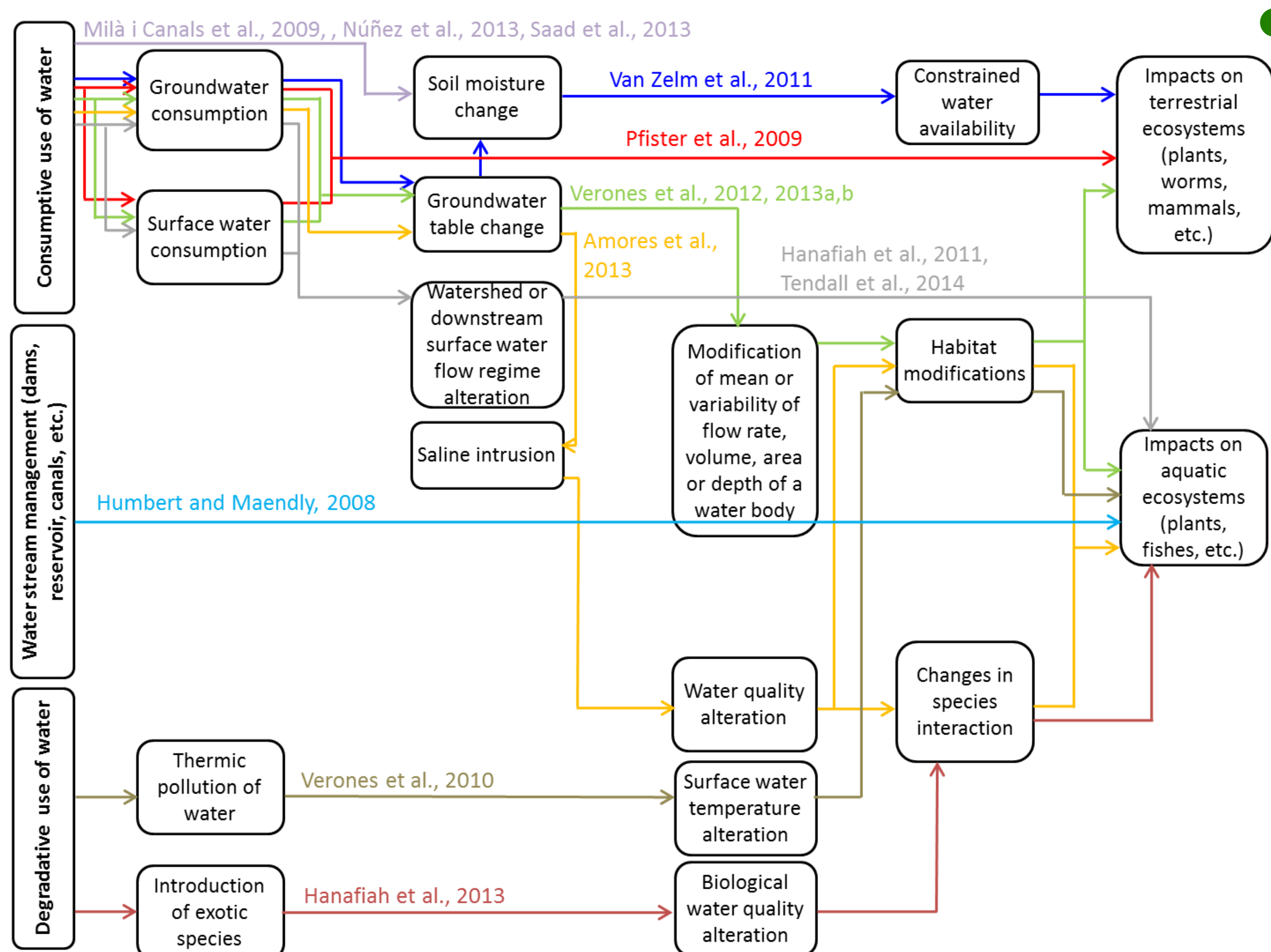


Figure: impact pathways covered by existing LCIA methods for water use

### Complementarity of covered pathways:

- **Exhaustiveness of every pathway varies** from one method to another: from a shortcut (Pfister et al 2009) to detailed pathways (Verones et al 2012).
- Surface-groundwater link addressed by three methods, only one globally applicable (Verones et al. 2013).
- Research has focused on modelling surface and groundwater consumption:
  - Effects of soil moisture change covered only in the LCI or with midpoint indicators (Milà i Canals et al 2009, Núñez et al 2013, Saad et al 2013).
  - Water consumption–water degradation link limited to salinity (Amores et al 2013).

### CF split into a FF and an effect factor EF:

- **CF=FF\*EF in almost all the methods** (except Pfister et al 2009, Humbert & Maendly 2008).
- Some methods make an **artificial adjustment of the EF** to ensure the connection with the FF.

## take home message

Methods addressing freshwater use impacts on ecosystems are incompatible in their current form. Harmonisation is required before integration into a single indicator.

### References

Amores et al 2013 ES&T 47:6384-6392. Hanafiah et al 2011 ES&T 45: 5272-5278. Hanafiah et al 2013 ES&T 47: 13934-13940. Humbert & Maendly 2008 35<sup>th</sup> LCA discussion forum. Milà i Canals et al 2009 Int J LCA 14: 28-42. Núñez et al 2013 ES&T 47: 12258-12265. Pfister et al 2009 ES&T 43: 4098-4104. Saad et al 2013 Int J LCA 18: 1253-1264. Tendall et al 2014 ES&T 48: 3236-3244. Van Zelm et al 2011 ES&T 45: 629-635. Verones et al 2012 ES&T 46: 4966-4974. Verones et al 2013a ES&T 47: 9364-9369. Verones et al 2013b ES&T 47: 9799-9807. Verones et al 2013c ES&T 47: 12248-12257.

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