Water-stress characterization factors for future oriented LCA

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Introduction & objectives

- Water stress indicators in LCA often rely on information of water use/consumption and water availability in a specific area
- These indicators are usually applied to predict impacts of future investments, without considering changed water use patterns and climate change. The latter already affecting regional water availability.
- In this context of continuous change, characterisation factors (CFs) should be updated periodically to correctly reflect water stress
- **Aim: to provide water stress index (WSI) CFs at the sub-watershed scale for three temporal scenarios in Spain**

Materials & methods

- **Methodology**: Pfister et al. 2009. WSI annual: 0.01 (low stress) to 1 (severe stress)
- **Regionalisation units**: 117 sub-watersheds (Fig 1), compared to 51 watersheds in Pfister et al. 2009 (Fig 2)
- **Temporal scenarios**:
  - (i) current situation: current use and availability
  - (ii) Short-term future: projections for 2015
  - (iii) Mid-term future: projections for 2030
- **Data sources**: Watershed management plans and regional reports on potential effects of climate change
- **Uncertainty assessment**: Latin Hypercube procedure (5,000 runs) with the @Risk software

Fig 1)

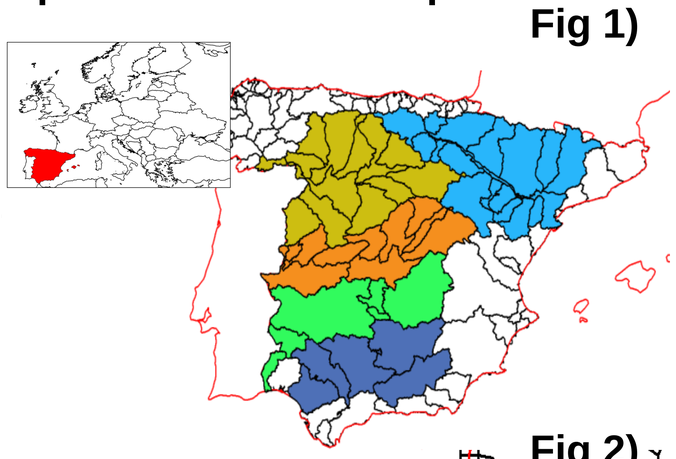
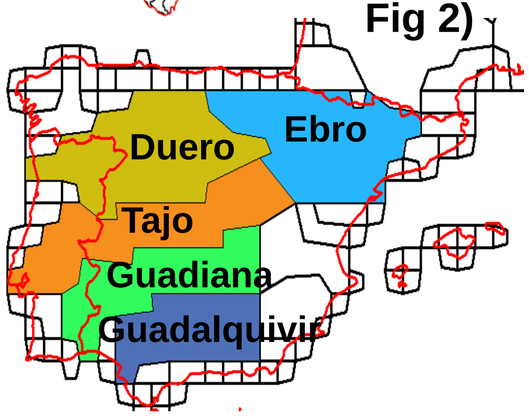


Fig 2)



Regionalisation units to calculate WSI CFs used in: this study (Fig 1); Pfister et al 2009 (Fig 2)

Results & discussion

- **Temporal analysis** of the WSI shows a relaxation of water stress over the short-term (Fig 3, 4) followed by a new increase (Fig 5)
- Short-term future: increase in water availability. Mid-term future: increase in water use and reduction in water availability

Fig 3) WSI current situation

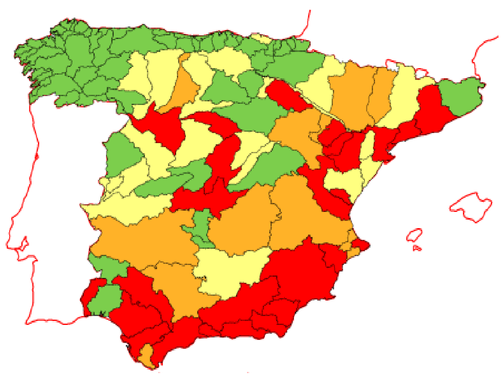


Fig 4) WSI short-term future

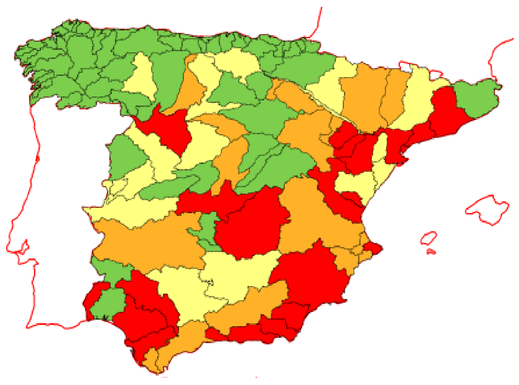
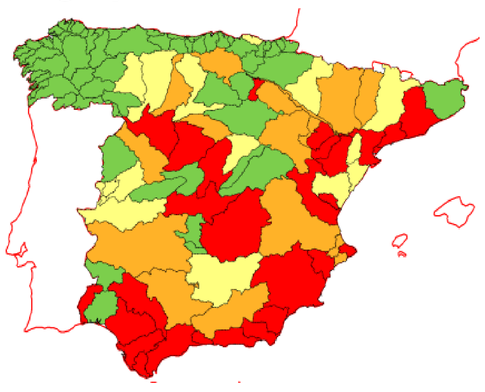


Fig 5) WSI mid-term future

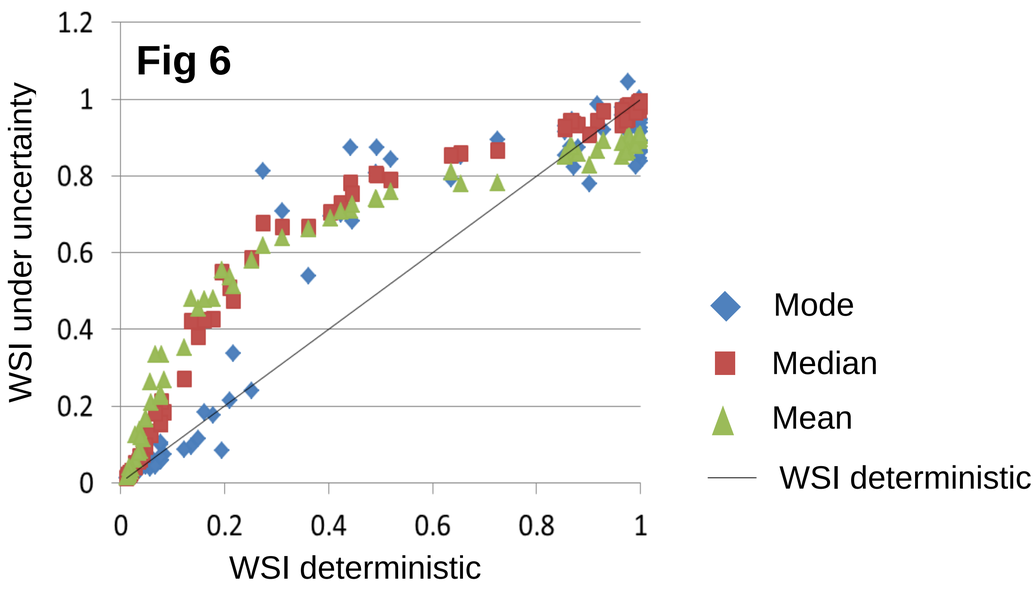


WSI (m^3/m^3)

<0.09	0.09-	0.5-	>0.91

- **Uncertainty**: The WSIs under consideration of uncertainty were higher than the deterministic result for intermediate WSIs (Fig 6)

Fig 6



- **Comparison to Pfister et al. WSIs**: major differences are noticed (Table 1, see legend Figures 3 to 5).

Watershed	WSI [-] Past (Pfister et al.)	Current situation	Short-term future	Mid-term future
Duero	0.17 (n.a.)	0.19 (0.01-1.00)	0.10 (0.01-1.00)	0.20 (0.01-0.98)
Guadiana	0.99 (n.a.)	0.52 (0.01-0.96)	0.53 (0.01-0.96)	0.65 (0.01-0.98)
Tajo	0.53 (n.a.)	0.31 (0.03-1.00)	0.19 (0.02-1.00)	0.25 (0.10-1.00)
Guadalquivir	1.00 (n.a.)	0.93 (0.92-1.00)	0.63 (0.17-0.99)	0.72 (0.50-1.00)
Ebro	0.26 (n.a.)	0.39 (0.02-1.00)	0.38 (0.03-1.00)	0.55 (0.04-1.00)

Table 1: Mean WSIs for the largest watersheds in Spain and four temporal scenarios. In brackets WSI data range for the internal sub-watersheds

Conclusions & outlook

- Different spatial and temporal resolution results in different CFs. Which is the optimal resolution in connection with the LCI?

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