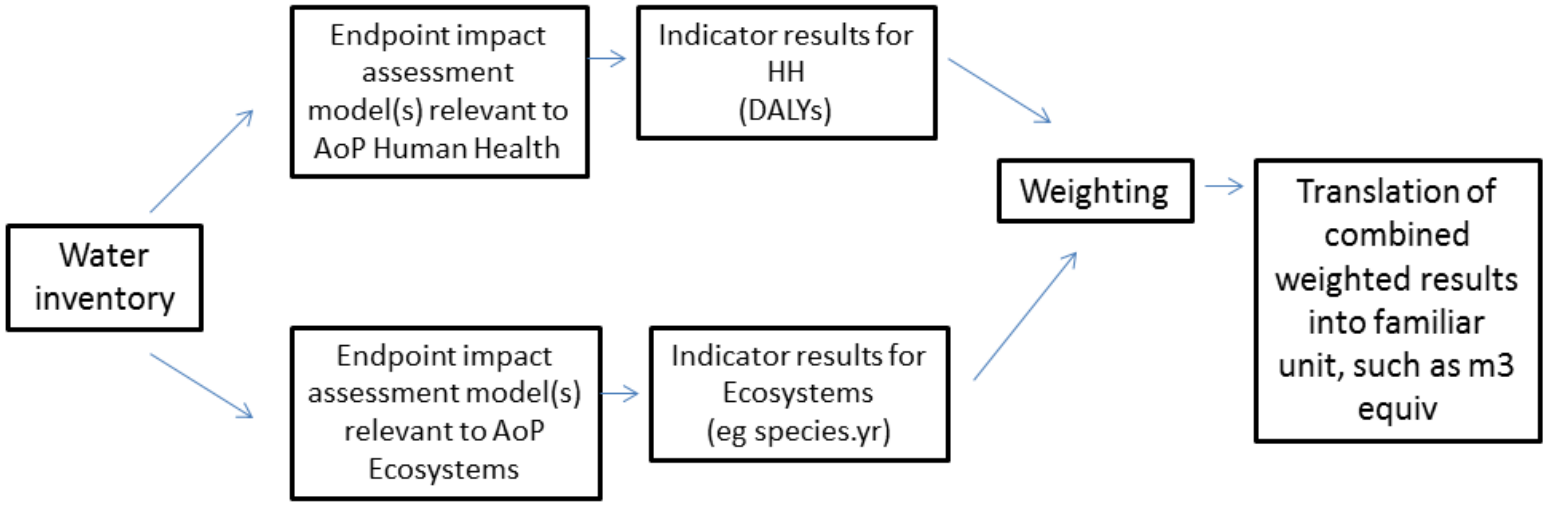
WULCA midpoint suggestion

For discussion – stress meeting of Feb.18th 2014

Approach (a): From endpoint to midpoint:

Single indicator for water use

(see Ridoutt and Pfister 2013 IJLCA 18:204-207 for example, also discussion in Ridoutt and Pfister 2013 JIE 17:337-339)



Note: consensus needed on which model (s) are preferred (where more than one model exists for a particular impact pathway) and whether models for new impact pathways are mature enough to include. This fits in with other WULCA activity to reach consensus on models for HH impact of water use, etc

Approach (b): generic midpoint

- Include Vulnerability Factors for HH (VF_{HH}) and EQ (VF_{EQ}) based on endpoint modelling
  - The general structure could be:

$$WIF_{midpoint} = f\left[\frac{\text{Consumption}}{\text{Availability}} \times VF_{HH} \times VF_{EQ}\right]$$

  - The factors need to account for regional specific cirsumstances

Approach (b1): generic midpoint

- Existig ideas for VF can be
  - For VF_{EQ}
    - Based on environmental water requirements (EWR):

      $VF_{EQ} = 1/(1-EWR)$
    - Based on ecosystem vulnerability (EV):

      $VF_{EQ} = EV$
    - The result would be combination:

      $VF_{EQ} = EV/(1-EWR)$
  - For VF_{HH}
    - Based on GDP or human development index (HDI):

      VF_{EQ} = (1-HDI) or 1/HDI or more complex

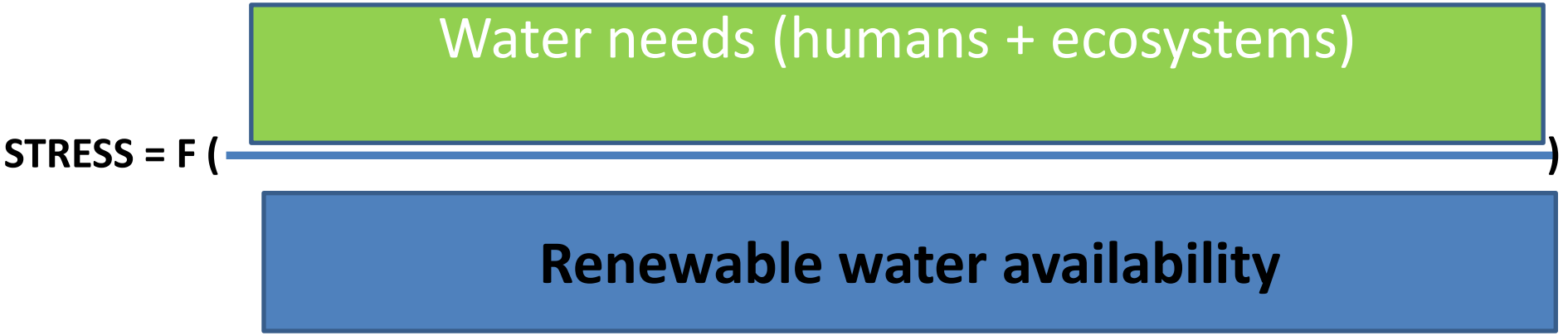
- Simplified first approach:

$$WIF_{midpoint} = f\left[\frac{consumption \times (1 - HDI^{x})}{availability \times (1 - EWR^{y}) \times EV^{z}} \times c\right]$$

x,y,z, c= factor for adjusting impact function

- WSI functions could be applied as done by Boulay et al. 2011 and pfister et al.

Approach (b2): stress based on the ratio of all water user‘s needs to available water



Water needs- humans: water consumption

Water needs -ecosystems: needs to be modeled (see next slide)

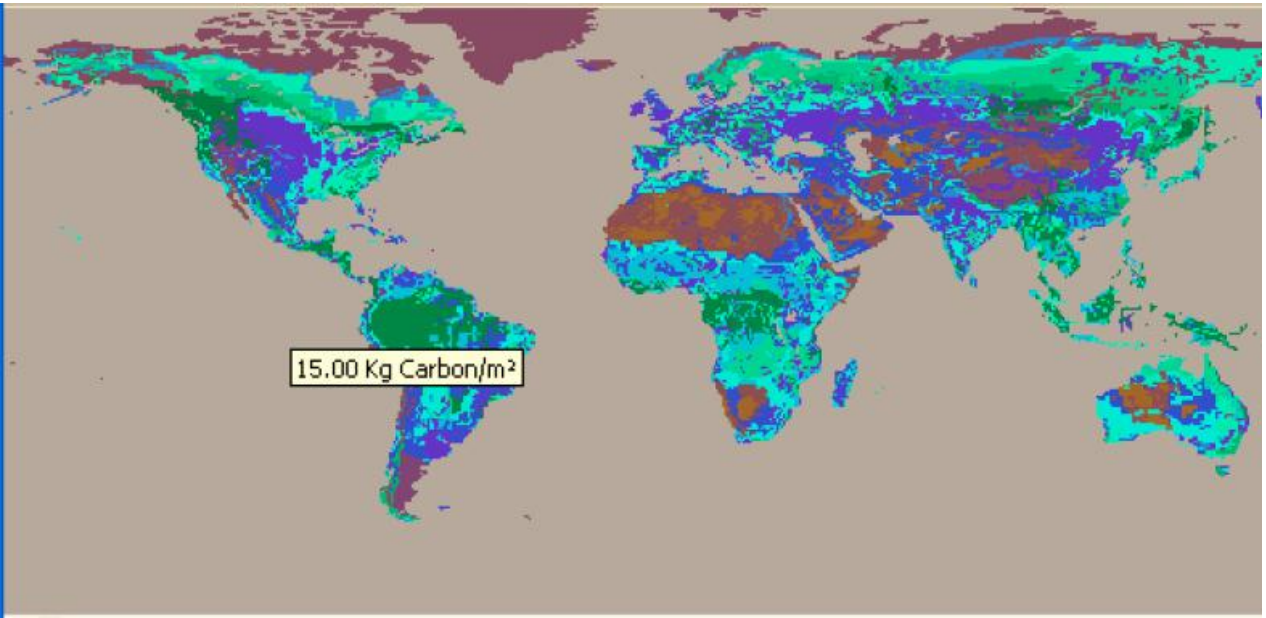
Renewable water availability: considering only renewable water allows to reflect aquifer overuse (to be discussed following Jane’s suggestion)

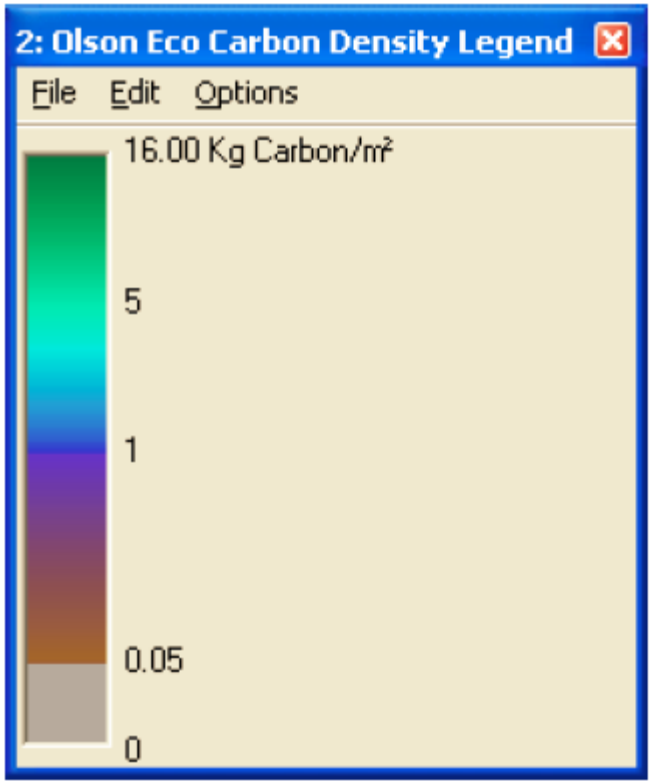
Water needs- ecosystems (suggestion)

- A very detailed and updated (2001) map exists of the world's vegetation coverage and mass of live carbon/m^2 (0.5^o X 0.5^o)

Carbon Dioxide Information Analysis Center. *9 October 2001. Documentation File for NDP-017 Major World Ecosystem Complexes Ranked by Carbon in Live Vegetation: A Database. Online at: http://cdiac.esd.ornl.gov/ftp/ndp017/ndp017.txt.*

Figure 2: Olson Eco Carbon Density Map





Question:

- Can we relate the water requirement of terrestrial ecosystems with the mass of live carbon present?

- If we can, then...

Water needs- ecosystems (suggestion)

- Terrestrial ecosystems water needs:

(A kg carbon/m^2) X (B m^3 water/kg carbon – year) X (Area (m^2))

- Aquatic ecosystems water needs (using area of water bodies from Ohlson map)

Water needed per year = water evaporation from surface (to maintain volume)