Agenda

• Start recording!
• Work planning
• Work advancement:
  – Review of issues to address
  – VMF method from Pastor et al (Inga)
  – Stephan’s proposal
Work planning

• Definition of work inside and outside of WULCA
• Timeline and expected deliverables
• Collaboration with JRC/European Commission
• Timing related to Pellston workshop
• Work leader and contributors
• Expert workshops
Generic stress-based midpoint

\[ \text{Scarcity}_{\text{hydrocentric}} = F_n \left( \frac{\text{Total water demand}}{\text{Renewable water availability}} \right) \]

Discussion points and work to be pursued:

- Research on better data source for Ecosystem water demand (aquatic and terrestrial)
- Possible inclusion of green water
- Neutrality between human demand and ecosystem demand (actual? pristine?)
- Modeling function, limits and thresholds
- Temporal and geographical resolution
- Clear definition of indicator’s meaning
- Change of names “hydrocentric, anthropocentric,...”
EWR: Variable Monthly Flow Method (Inga)

• A hydrological method to assess the water requirements of ecosystems

• Was evaluated against local case studies where EFR were calculated and showed best overall suitability compared to other global methods (e.g. Smakthin, Tessmann)

• Assessment based on ‘Pristine’ conditions, that were modeled with a global vegetation model (LPJml model by Potsdam Climate Institute)
## VMF – Definition of Ecological Flow requirements

<table>
<thead>
<tr>
<th>Flow Season</th>
<th>Definition of flow season</th>
<th>Run-off allocation to ES [in % of MMF] for ‘fair’ conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low-flow season</td>
<td>MMF &lt; 40% of MAF</td>
<td>60</td>
</tr>
<tr>
<td>Intermediate flow season</td>
<td>MMF is 40-80% of MAF</td>
<td>45</td>
</tr>
<tr>
<td>High-flow season</td>
<td>MMF &gt; 80% of MAF</td>
<td>30</td>
</tr>
<tr>
<td>Extremely dry conditions</td>
<td>MMF &lt; 1 m³ s⁻¹</td>
<td>No flow allocation to ES</td>
</tr>
</tbody>
</table>

MMF= Mean Monthly flow, MAF= Mean Annual Flow
VMF - Evaluation

• VMF showed coefficient of correlation $r^2 = 0.91$
• VMF was about 10% above calculated case-study recommended EFR
• Author is willing to share data but has to confirm with project partners
• Data in R CRAN format (0,5° grid), conversion to ASCII/GIS-file should be possible
Variable Monthly Flow Method

• Problems
  • No validation of run-off model (pristine conditions, therefore validation not possible)
  • Unclear how ecosystem condition ‘fair’ is defined (checking with author)
  • Flow allocation based on pristine run-off conditions, not ‘today’s’ state (valid for those, probably few, ecosystems that are still pristine)
Note: Concept of Carrying capacity, also looking to include EWR, and looking into Pastor et al’s method
Inclusion of green water?

Scarcity = \frac{\text{Blue water demand + green water demand}}{\text{Precipitation - evaporation}}

💧 Total green water or delta green water?

Blue and green water demand = WC industry + WC domestic + WC agriculture + WC actual vegetation (− WC potential vegetation?)

(WC agriculture + WC actual vegetation = ETc actual)
Stephan’s suggestion

- Stress is characterized by current demand to availability (DTA)
  - Ecosystem demand: EWR (incl. Water dependent terrestrial water demand) = EWD
  - Human demand:
    current consumption (C) minus «luxury» consumption = HWD

- Availability (natural or actual to be determined) = WA
Equations (A)

- \( \text{CF} = f \left( \frac{EWD + HWD}{WA} \right) \)

- \( \text{HWD} = \begin{align*} & HWR + (C - HWR) \times X & \text{if } C > HWR \\ & C & \text{if } C < HWR \end{align*} \)

or

- \( \text{HWD} = \begin{align*} & C \times X + HWR(1 - X) & \text{if } C > HWR \\ & C & \text{if } C < HWR \end{align*} \)

- \( X \) is the share of «luxury» water actually required (\( X \) might be a function of \( C \)/population and might get higher with higher water consumption per capita)

- \( HWR = \) human water requirements for basic needs = for irrigation and domestic use -> a function of space (irrigation demand) and population density

- Alternatively, \( HWR \) could be used as minimum, but generally it is not
Results; X functions not tested

- Assumption: X = 20% (except last case = 50%)
- HWR = 5, 10 and 50% of available water, EWR = 30%
Next step, work to be done

• Correlation Hannahfiah et EWR/Avail ?
• ..
• ..
• ..
• ..
• ..