WULCA

WULCA
A LIFE CYCLE INITIATIVE PROJECT

UNEP · Life Cycle Initiative · SETAC

Barcelona and teleconference meeting
Anne-Marie Boulay, Chair
Stephan Pfister, Co-Chair

Annual meeting
SETAC Europe, Barcelona, Spain
May 7th, 2015

Outline

- Introduction to WULCA
- Framework and Consensual indicator Project
- Updates:
  - activities, publications, upcoming
- Work progress:
  - Stress subgroup (40 min)
  - Human Health subgroup (10 min)
  - Ecosystem subgroup (15 min)
- Final discussion and closing (15 min)

PRESENTATION OF PARTICIPANTS

Name
Organisation
Type of member

1- Introduction to WULCA

WULCA Working group

Water Use in LCA - International initiative for LCA (2007)

Goal

- Guide the scientific development of a **consensual and operational method** which shall be in line with both the **ISO Water Footprint Standard** and the **LCA principles**
- Provide **guidance to practitioners** and **researchers** in their understanding of comprehensive water footprinting.
- **Represent the scientific voice on water footprinting**
  - Provide scientific support and guidance to the ISO 14046 TR
  - Influence international initiatives, present in conferences and trainings

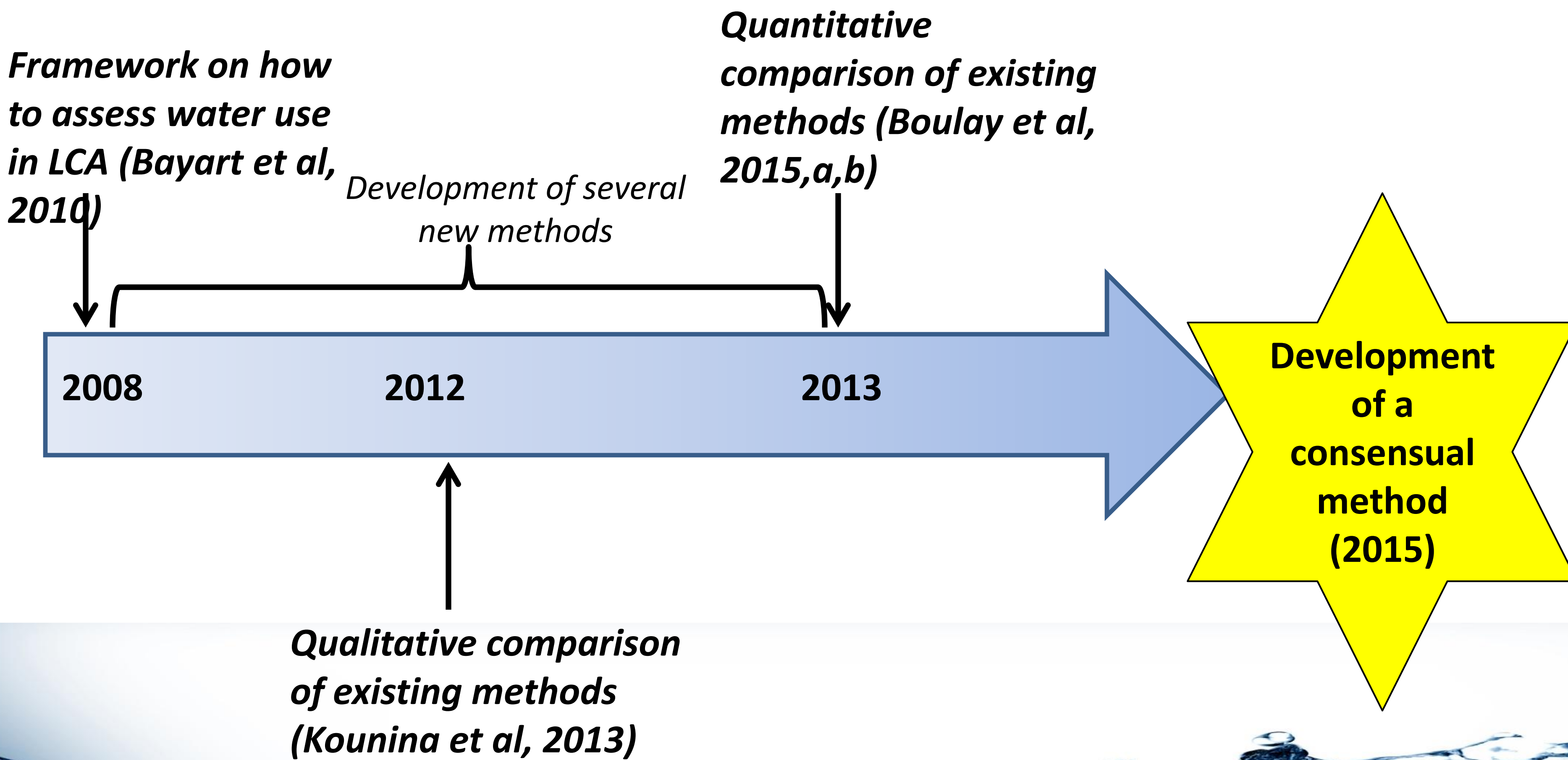
WULCA Working group

Water Use in LCA

Specific Task for the Flagship Project on LCIA Guidance on indicators:

Develop a consensual method for a subset of impact pathways assessing ***water use in LCA*** with priority to midpoint indicators and an area of protection showing sufficient scientific maturity.

Timeline and progress of work



WULCA Phase 3

- Transition into Phase 3 and official acceptance from Life Cycle Initiative in Spring 2013
- Identified in Glasgow as a Flagship category from the Global Guidance Flagship categories from UNEP SETAC Life Initiative

Anne-Marie Boulay
Project Manager, Chair

Stephan Pfister
Deputy Manager, Co-Chair

www.wulca-waterlca.org

Membership

Active (~20 members) approx. 1 day/month

- Involved in water-related methodology development or plan to be
- Contribute to the outcome and deliverables of the working group
- Included in all communications with respect to on-going work and progress

Experts (~100 members) approx. ½ day/month

- Knowledgeable on the topic of water and LCA
- Contribute their expert judgment to the outcome of the working group
- Included on communications that are relevant for their expertise

Sponsors (8-9 sponsoring companies)

- Provide 10’000 USD/yr for 2 years
- Individual from sponsoring companies can act as an active, expert or observer member

Link with ISO water footprint process

There is no official link between ISO DIS 14046 on Water footprint and WULCA, however:

-The convener and several delegates of the ISO working group are members of WULCA

- The work of WULCA has served as a basis in the development of the DIS

-The current DIS does not propose one specific method, but rather Principles, Requirements and Guidelines

- **WULCA can propose this method as the result of a consensus** which could be integrated in the next review of the standard

Link with LCIA global guidance flagship project

Goal of the flagship project

- Establish a consensual set of environmental impact category indicators
- For use in
  - Environmental product information schemes
  - Corporate reporting of multinational companies
  - International and/or national environmental policies
  - Common LCA work commissioned by governments and companies

General outline

- **Task 1: Scoping phase** (2012-2013)
  Establish short list of impact category indicators and themes for first and second stage
  → Yokohama 2012 & Glasgow 2013 scoping workshops
  → Stakeholder feedback at events worldwide
- **Task 2: Consensus finding**, stage 1 (2013-2015)
  → Pellston workshop 1 (with output being an agreement)
- **Task 3: Consensus finding**, stage 2 (2015-2017)
  → Pellston workshop 2
- **Task 4: Dissemination** (2018)

Global Guidance on LCIA indicators
Chairs: Olivier Jolliet and Rolf Frischknecht

- Consensus on global warming indicator
- Consensus on other indicators

- Consensus on water use indicator

- Education and training
- Scientific support to other initiatives and events (e.g. ISO TR 14073)
- Guidance to practitioners and researchers

WULCA
Chair: Anne-Marie Boulay
Co-chair: Stephan Pfister

Activities May 2014 – May 2015

Updates: Activities 2015

- Trainings
  - San Francisco, October
- Workshops
  - Zurich, September
  - San Francisco, October
  - Tzukuba, October

Updates: Publications

- Publications
  - Quantitative comparison papers (A and B): published

A.-M. Boulay, M. Motoshita, S. Pfister, J.-B. Bayart, H. Franceschini, I. Muñoz, C. Bulle, and M. Margni, "Water use impact assessment methods (Part A): Methodological and quantitative comparison of scarcity and human health impacts models," *Int. J. Life Cycle Assess.*, vol. 20, no. 1, pp. 139–160, 2015.

A.-M. Boulay, J.-B. Bayart, C. Bulle, H. Franceschini, M. Motoshita, I. Muñoz, S. Pfister, and M. Margni, "Water impact assessment methods analysis (Part B): Applicability for water footprinting and decision making with a laundry case study," Int. J. Life Cycle Assess., 2015.

  - LCA Food 2014: Progress paper on scarcity indicator

A.-M. Boulay, J. Bare, L. Benini, M. Berger, I. Klemmayer, M. Lathuilliere, P. Loubet, A. Manzardo, M. Margni, and B. Ridoutt, "Building consensus on a generic water scarcity indicator for LCA-based water footprint : preliminary results from WULCA," in LCA Food, 2014, vol. 2050, no. October 2014.

  - Expert workshop outcome paper

A.-M. Boulay, J. Bare, C. De Camillis, P. Döll, F. Gassert, D. Gerten, S. Humbert, A. Inaba, N. Itsubo, Y. Lemoine, M. Margni, M. Motoshita, M. Núñez, A. V. Pastor, B. Ridoutt, U. Schencker, N. Shirakawa, S. Vionnet, S. Worbe, S. Yoshikawa, and S. Pfister, "Consensus building on the development of a stress-based indicator for LCA-based impact assessment of water consumption: outcome of the expert workshops," Int. J. Life Cycle Assess., Mar. 2015.

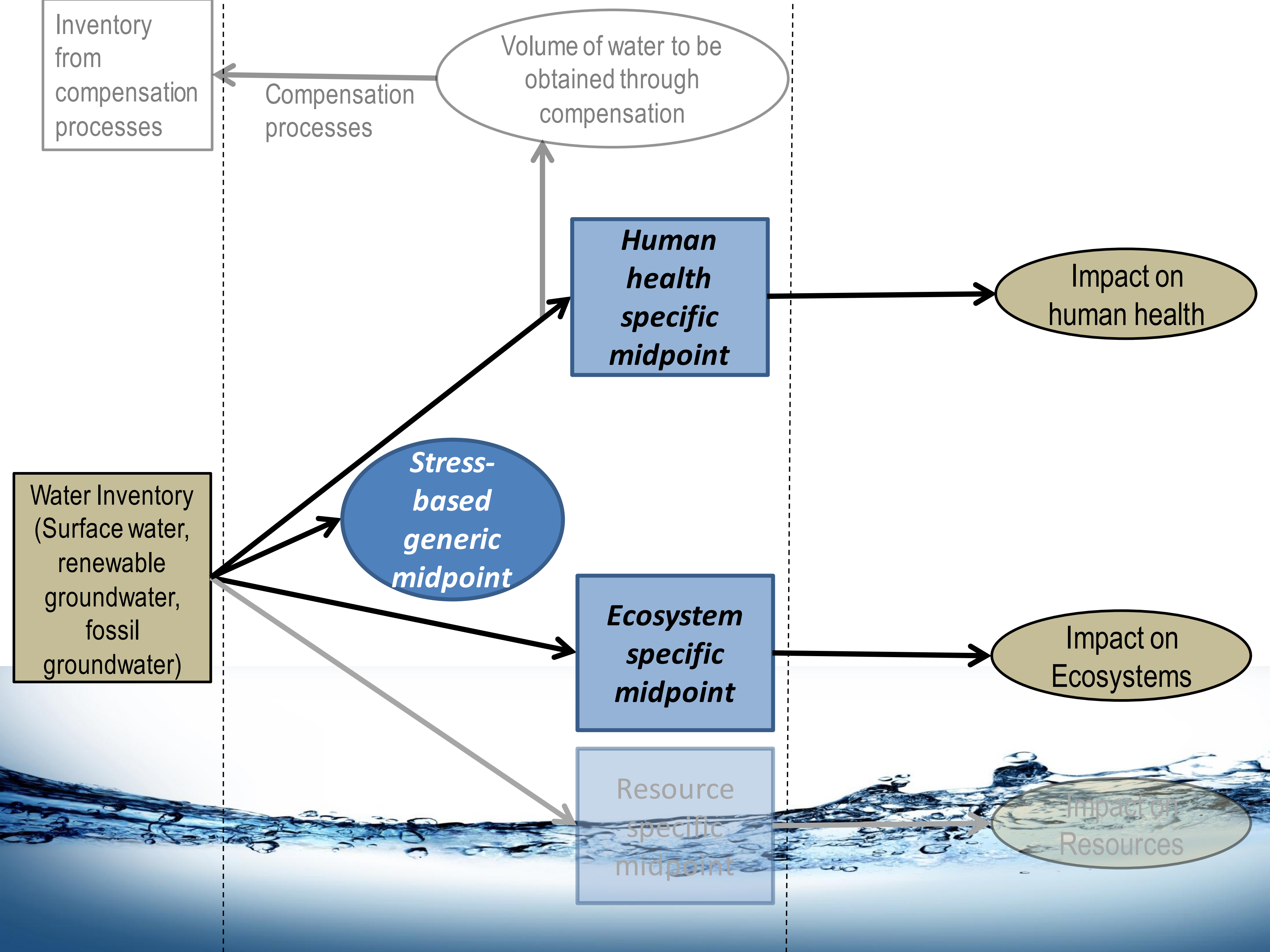
Past Presentations

- Hydro-Vision (July, Nashville)
- World Water Week (September, Stockholm) (2)
- LCA Food (October, San Francisco)
- LCA XIV (October, San Francisco)
- Ecobalance (October, Tzukuba)
- Carbon Disclosure Project (November, London)
- FAO (April, Rome)
- SETAC (May, Barcelona)

May 2014 – May 2015

- 10 presentations, 3 workshops on 3 continents, 1 training, 4 publications
- Including organisations such as : Food and Agricultural Organisation (FAO), Biological and agricultural engineers (ASABE), Hydropower (HydroVision), World Water Week, Water Footprint Network, etc.
- Collaboration with European Commission (JRC)
- Reaching out to more 500-700 people

Consensual indicator project and work progress



Inventory from compensation processes
Compensation processes
Volume of water to be obtained through compensation
Human health specific midpoint
Impact on human health
Water Inventory (Surface water, renewable groundwater, fossil groundwater)
Stress-based generic midpoint
Ecosystem specific midpoint
Impact on Ecosystems
Resource specific midpoint
Impact on Resources

Generic stress-based midpoint

- No true common midpoint for human health and ecosystems

- Consistent (proportional) results cannot be obtained between a midpoint indicator and the endpoint indicators
  → Regionalization affects both midpoint and endpoint models

- Desire to develop a stress-based midpoint indicator
  →not necessarily correlated to HH and EQ,
  →Provides a simple single indicator to support decision
  → In compliance with ISO 14046

Evolution of scarcity indicators in LCA

At the Expert workshops:
1- question to answer is confirmed
2- inclusion of ecosystem

WTA

WTA: Wit
CTA: Cons
DTA: Dem
AMD: Av

deve

2006

The question the indicator aims to answer

"What is the *potential of depriving* another user of water (human *or* ecosystems) when consuming water in this area"

Three indicator options

1

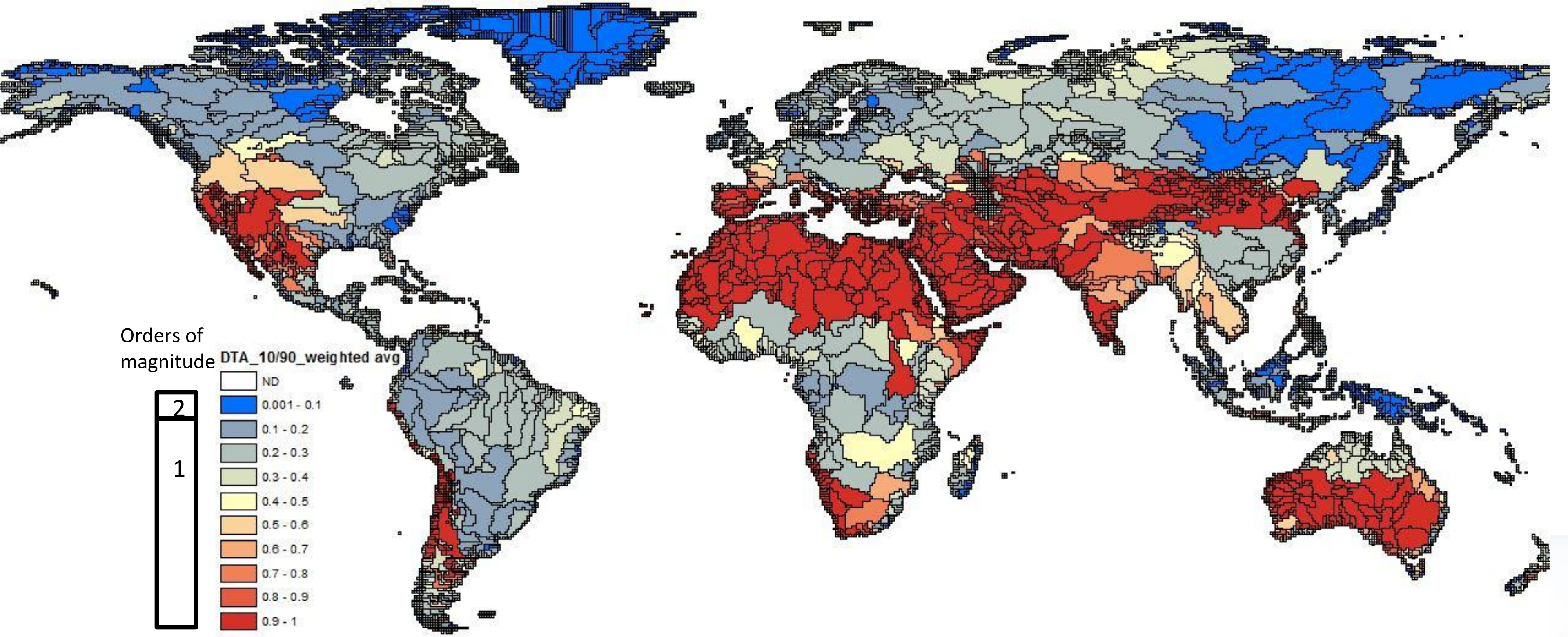
$$DTA = \frac{\text{Demand}}{\text{Availability}}$$

Indicator is maximal for arid regions
Modelled between 0.001 and 1

****Demand = human consumption + environmental water requirement (EWR)***

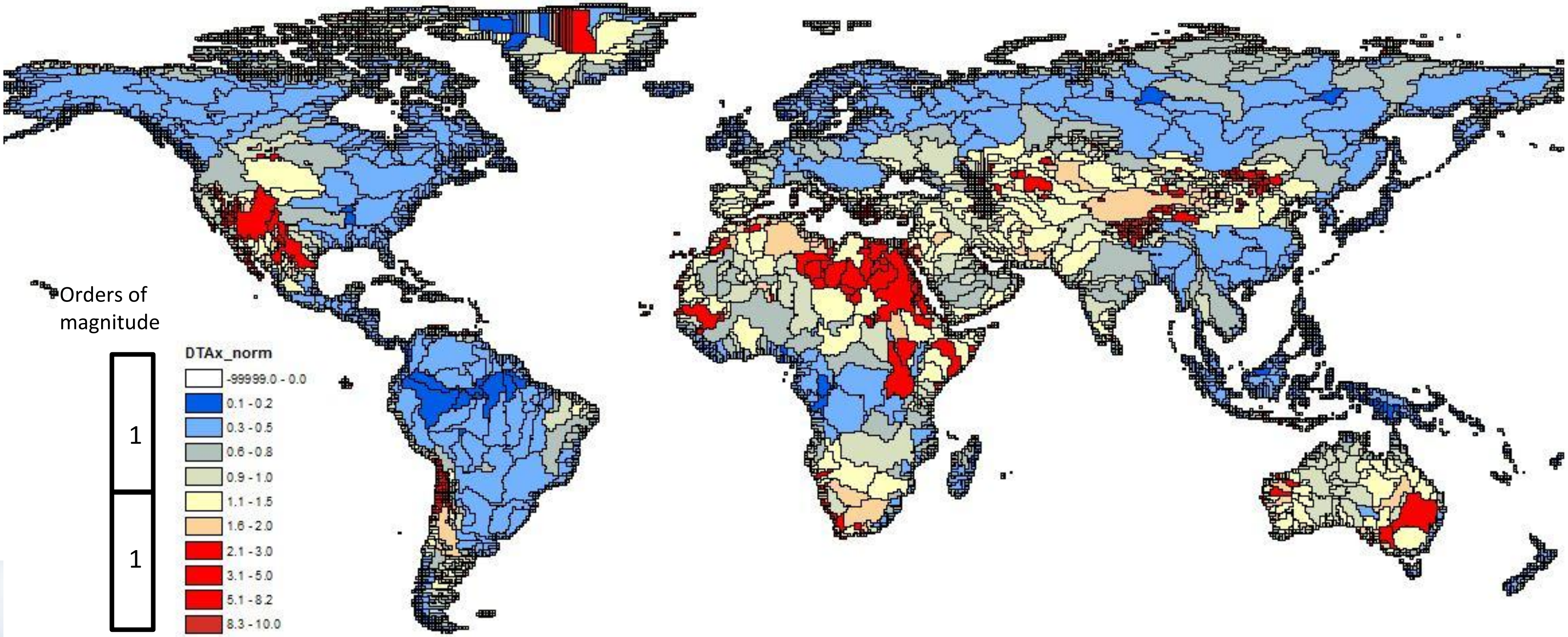
1 DTA

$$DTA = \frac{Demand}{Availability}$$



2 DTAx(0.34)

$$DTAx = \frac{Demand}{Availability} \times \left[\frac{Area}{Availability}\right]^{x}$$

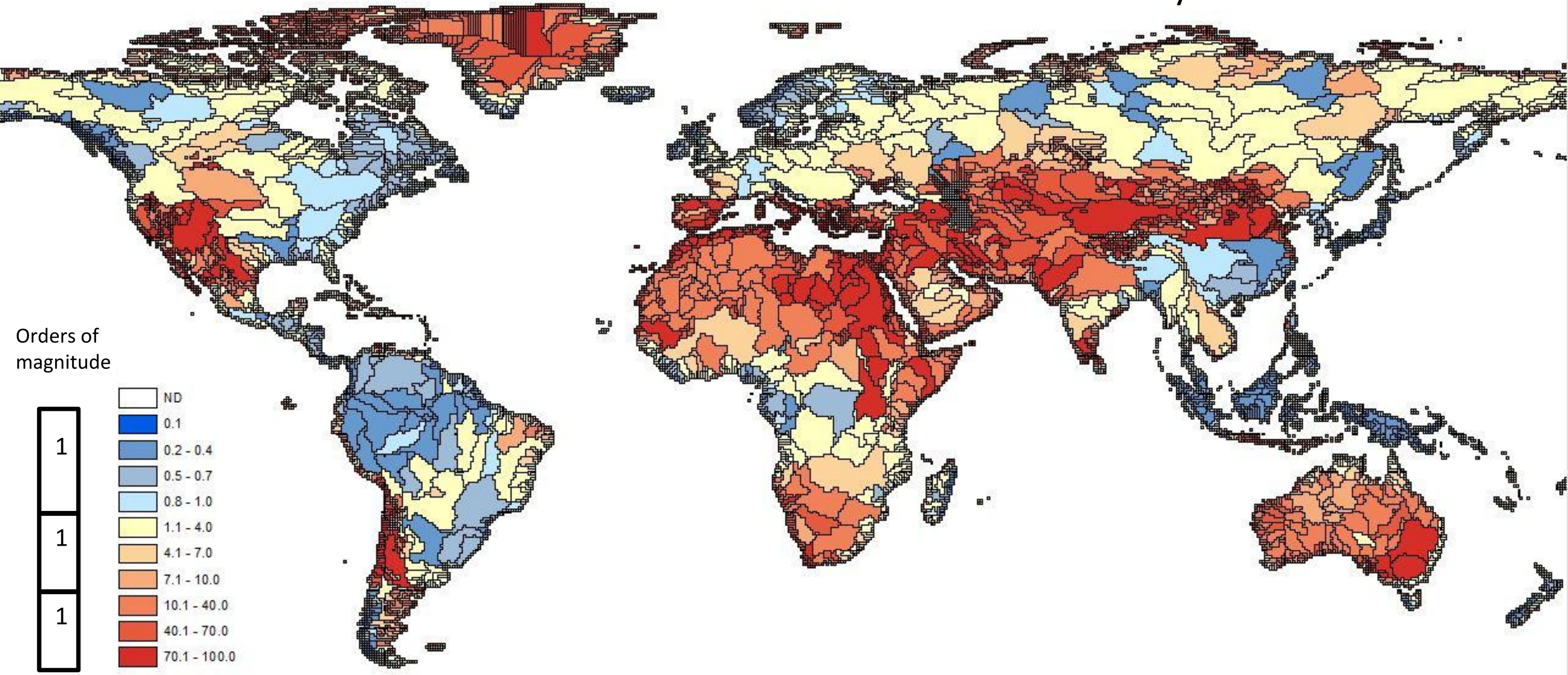


3 AMD – range 0.1 - 100

$$AMD = \left[\frac{\text{Unused water (per area)}_{\text{world avg}}}{\text{Unused water (per area)}}\right]$$

Unused water = Availability - Demand

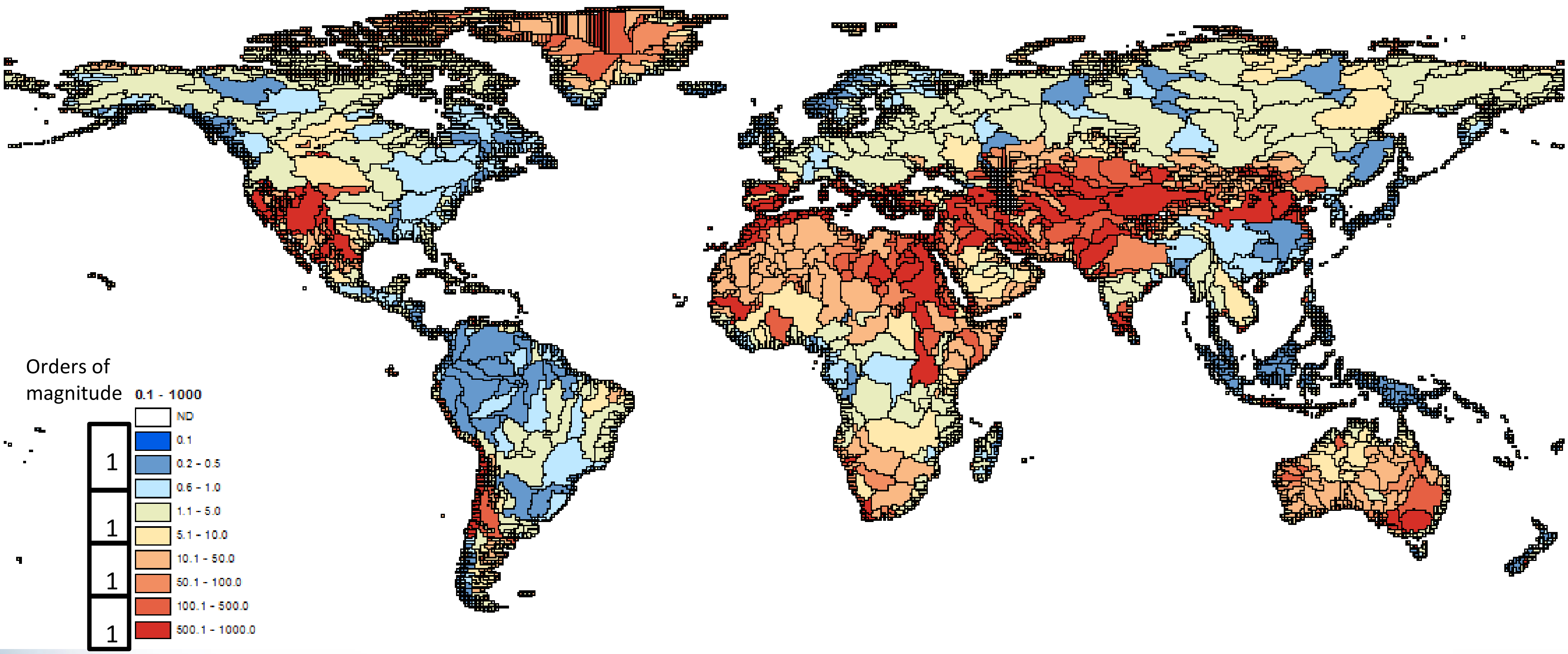
AMD: Availability minus demand



3 AMD – range 0.1 - 1000

$$\text{AMD} = \left[\frac{\text{Unused water (per area)}_{\text{world avg}}}{\text{Unused water (per area)}} \right]$$

Unused water = Availability - Demand

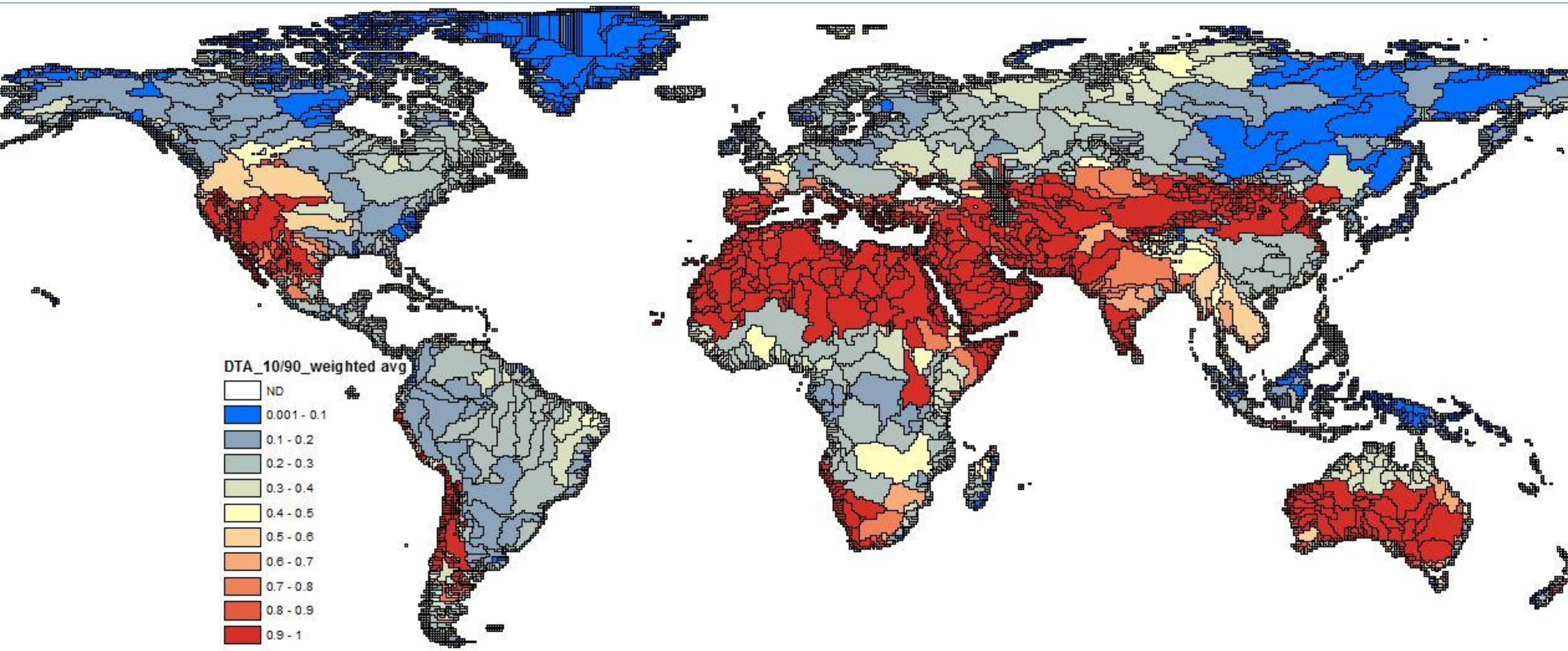


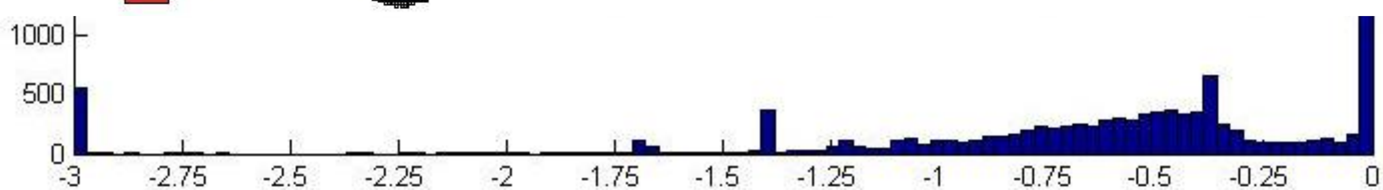
DTA indicator is eliminated first

1

$$\text{DTA} = \frac{\text{Demand}}{\text{Availability}}$$

→Strong influence of arbitrary value choice for arid regions
→ 1 order of magnitude → low discriminatory power





Evaluation Criteria

Criteria	**2 - DTAx**	**3- AMD**
Stakeholders acceptance (in pa	Low (4/23)	Good (12/23)
Ro ca (A		
M	(x=0.34)	(equation is discontinuous)
Physical meaning	Two relatively physical quantities, combined empirically: result is an index with no physical meaning	Physical meaning (available water remaining), up to the point where demand = availability

Which one do we recommend?

New indicator for water scarcity footprint

$$\text{Relative User Deprivation Potential} = \text{Water consumption (inventory)} \times \underbrace{\frac{1}{\text{Unused water remaining}}}_{\text{CF}}$$

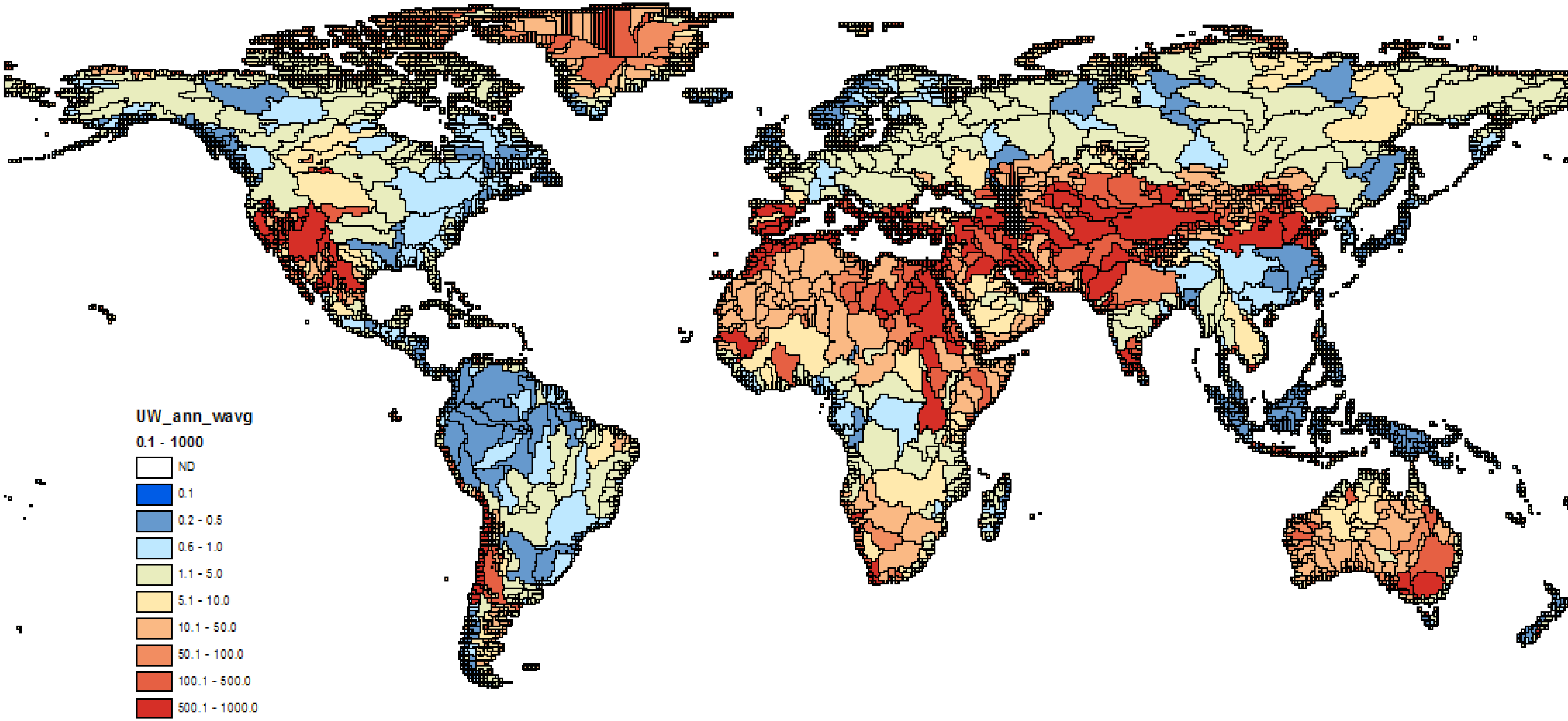
- **Unused water remaining = Availability – Demand (for 1 m^2)**
- Demand includes human and aquatic ecosystems
- The value is normalized with the reference flow of the world weighted value
- Maximal value when Demand ≥ Availability

→ A value of 10 (denominator) means that there is 10 times more unused water available in this region than where the average water “consumption mix” in the world.

- **CF is the inverse of unused water remaining**

→ The more unused water available in an area, the lower the potential to deprive other users!

New indicator for water scarcity footprint Relative User deprivation potential from 0.1 to1000



Limits of both indicators

- Environmental water requirements implies a normative choice on the status of ecosystems to be maintained ("fair condition with respect to pristine conditions", which is taken as a proxy for current state)
- Normative choices in the modeling of the indicator: cut-off values for min and max
- Aquatic ecosystems only (not terrestrial ecosystems)

Regional / temporal resolution

- Indicators calculated at the **sub-basins scale**, available also at the **country scale**
- Indicators calculated at the **monthly scale**, available also at the **annual scale**

→ Aggregation made to represent agricultural use or industrial/domestic uses (one value for each, as well as a default value, aggregating both)

Example	Agricultural use	Non agricultural use	Default
Douero, June	...	...	...
Douero, Annual	...	...	...
Spain, June	...	...	...
Spain, Annual	...	...	...

What we expect to provide

- indicators calculated at the sub-basins scale, available also at the country scale
- indicators calculated at the monthly scale, available also at the annual scale
- aggregation made to represent agricultural use or industrial/domestic uses

→ One value for each, as well as a default value, aggregating both

Example	Agricultural use	Non agricultural use	Default
Douero, June	...	...	...
Douero, Annual	...	...	...
Spain, June	...	...	...
Spain, Annual	...	...	...

Next steps for this indicator

- Google layer → need support!
- Publication
- Testing
- Approval / modifications at Pellston workshop (January 2016)

Questions and discussion (15 min)

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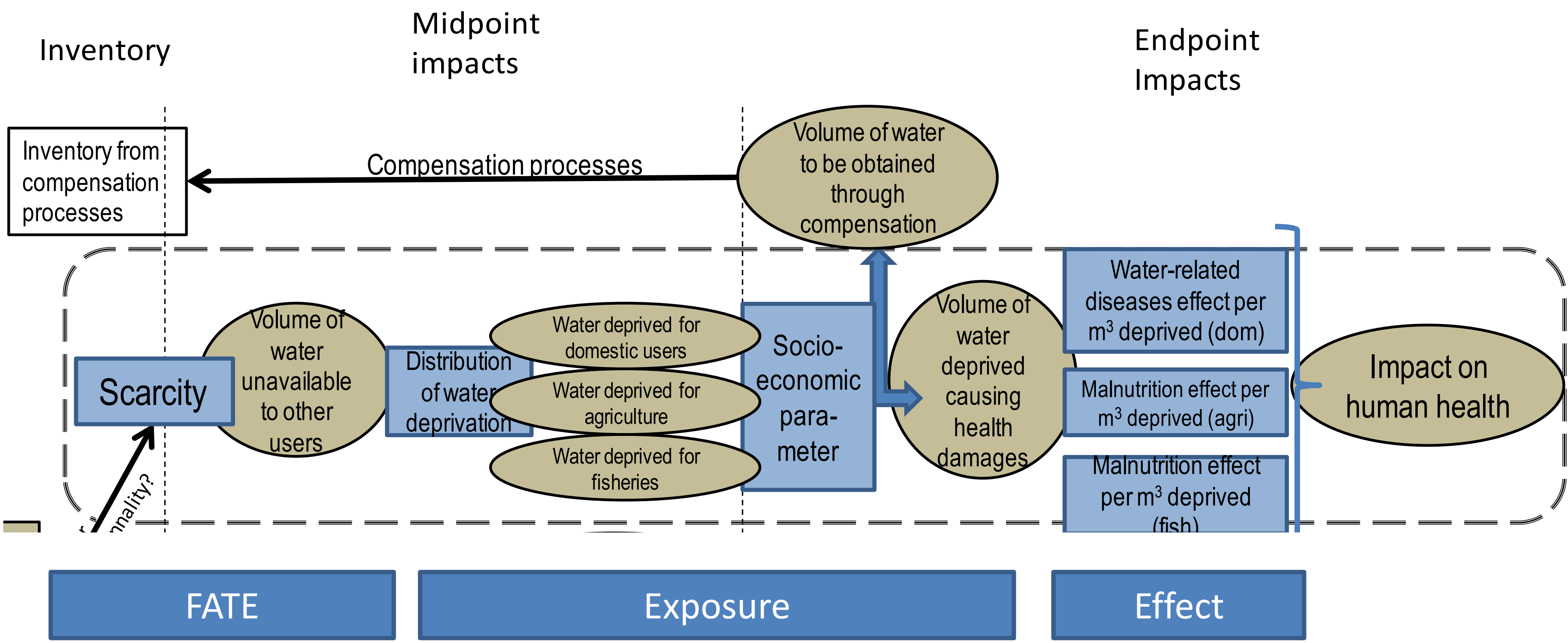
Human Health

Human Health



Human Health

- Expert Workshop held in Barcelona May 3rd
- 10 participants (FAO, WRI, Unilever, Quantis, etc.)
- 7 questions are discussed:
  - Surface / ground water
  - Water quality
  - Inclusion of domestic users
  - Trade effect
  - Adaptation capacity
  - Effect factor from domestic deprivation
  - Effect factor from malnutrition

Preliminary outcome of discussion

- Trade effect: to be included, Motoshita et al. (2014) or other?
- Inclusion of domestic users, further discussion on how
- No differentiation of surface / ground
- Water quality: nice to have but perhaps not feasible in the short time available
- Adaptation capacity: GDP-based plus possibly other indicators *if relevant*, and secondary adaptation as part of the effect factor
- Malnutrition effect: in DALYs per kcal deprived

Next steps

- The group will further work on these questions
- Additional group members welcome
- Preliminary proposal(s) to be provided on time for the Pellston workshop (January 2016)

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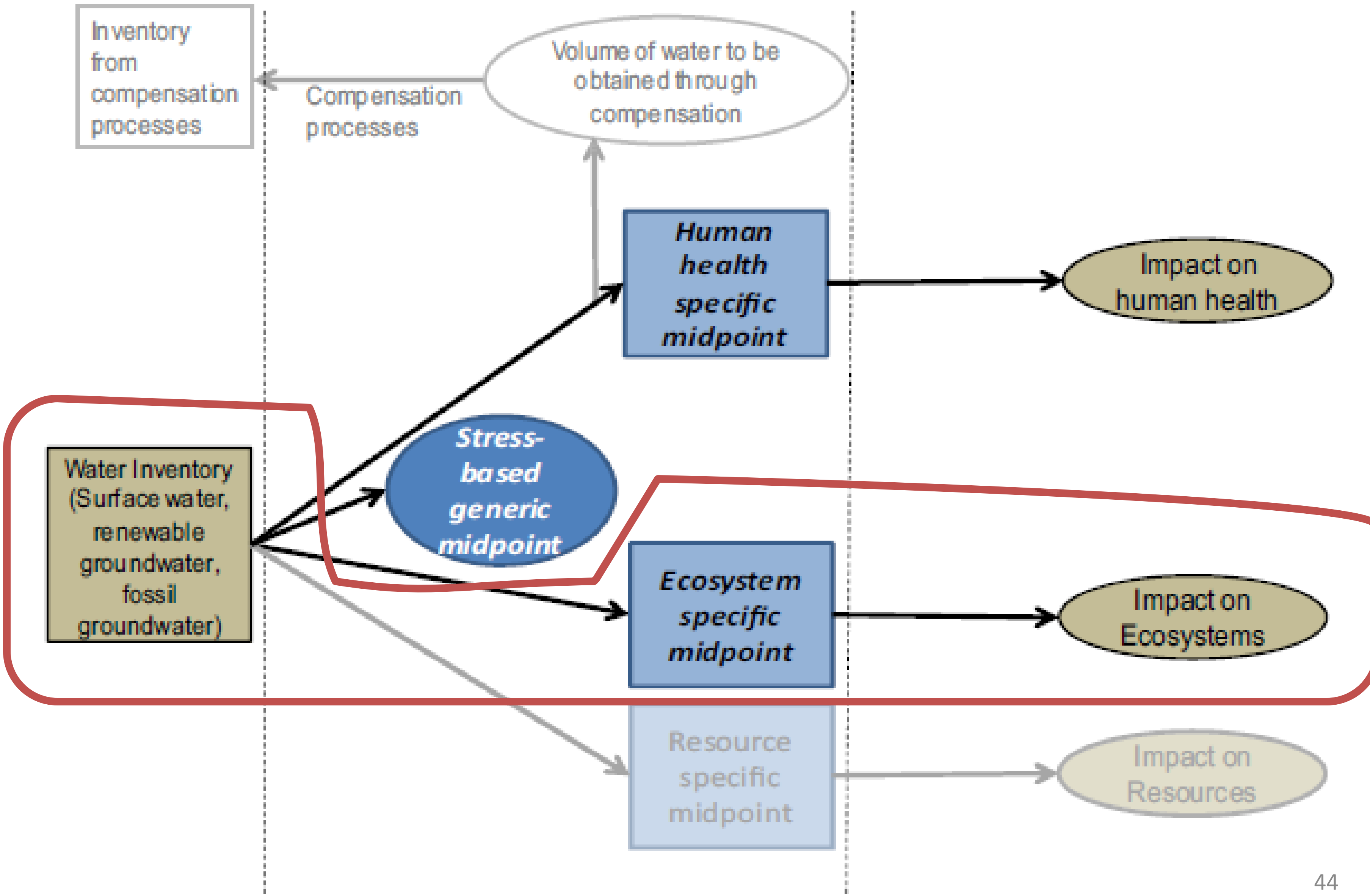
Ecosytems quality

Scope of the discussions



Current members

- Christian Bouchard (Université Laval, Canada)
- Manuele Margni (CIRAIG, Canada)
- Cecile Bulle(CIRAIG, Canada)
- Anne-Marie Boulay (CIRAIG, Canada)
- Michael Lathuilliere (University of British Columbia, Canada)
- Jane Bare (EPA, U.S.)
- Francesca Verones (NTNU, Norway)
- Stephan Pfister (ETH, Switzerland)
- Lorenzo Benini (JRC, European Union)
- Montse Núñez (Irstea, ELSA, France)

The group is open and warmly welcomes new participants

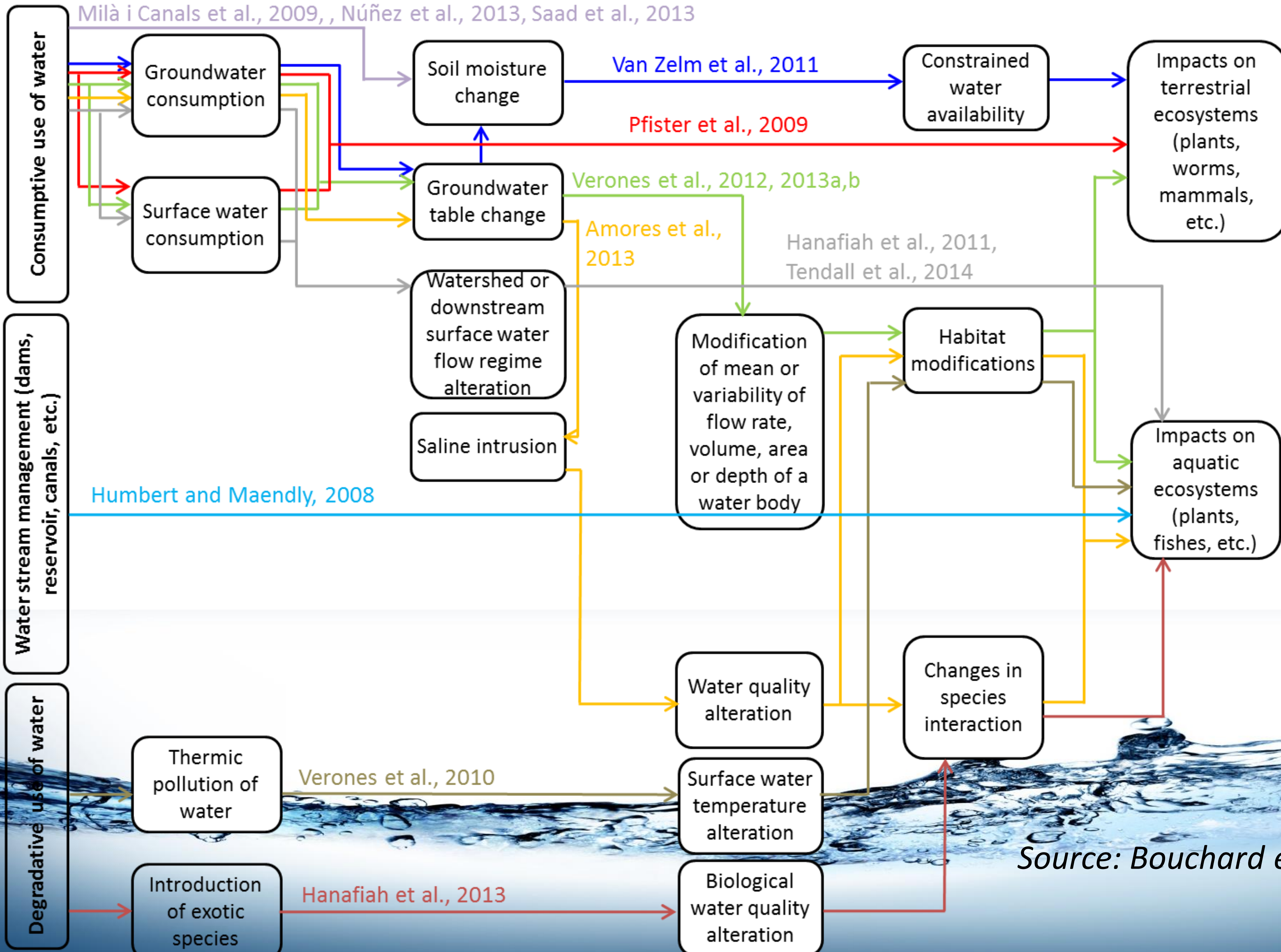
Organisational aspects

- 8 teleconference meetings from last SETAC in May 2014
- Consensus-building on the Ecosystem Quality indicator(s) is an activity of the 2nd part of the flagship project (2016 – 2018), therefore recommendations are for after the Pellston workshop of January 2016

Objective

- <u>General Objective</u>:
  Development of a framework linking water use to ecosystem quality Area of Protection
- <u>Specific objectives</u>:
  1. Analyze consistency, complementarity and comparability of the existing impact pathways
  2. Propose a framework based on a mechanistic approach (FF, XF and EF ?) and filling in existing methods
  3. New research works to fill in existing gaps

1. Analyse existing methods: Harmonisation is required

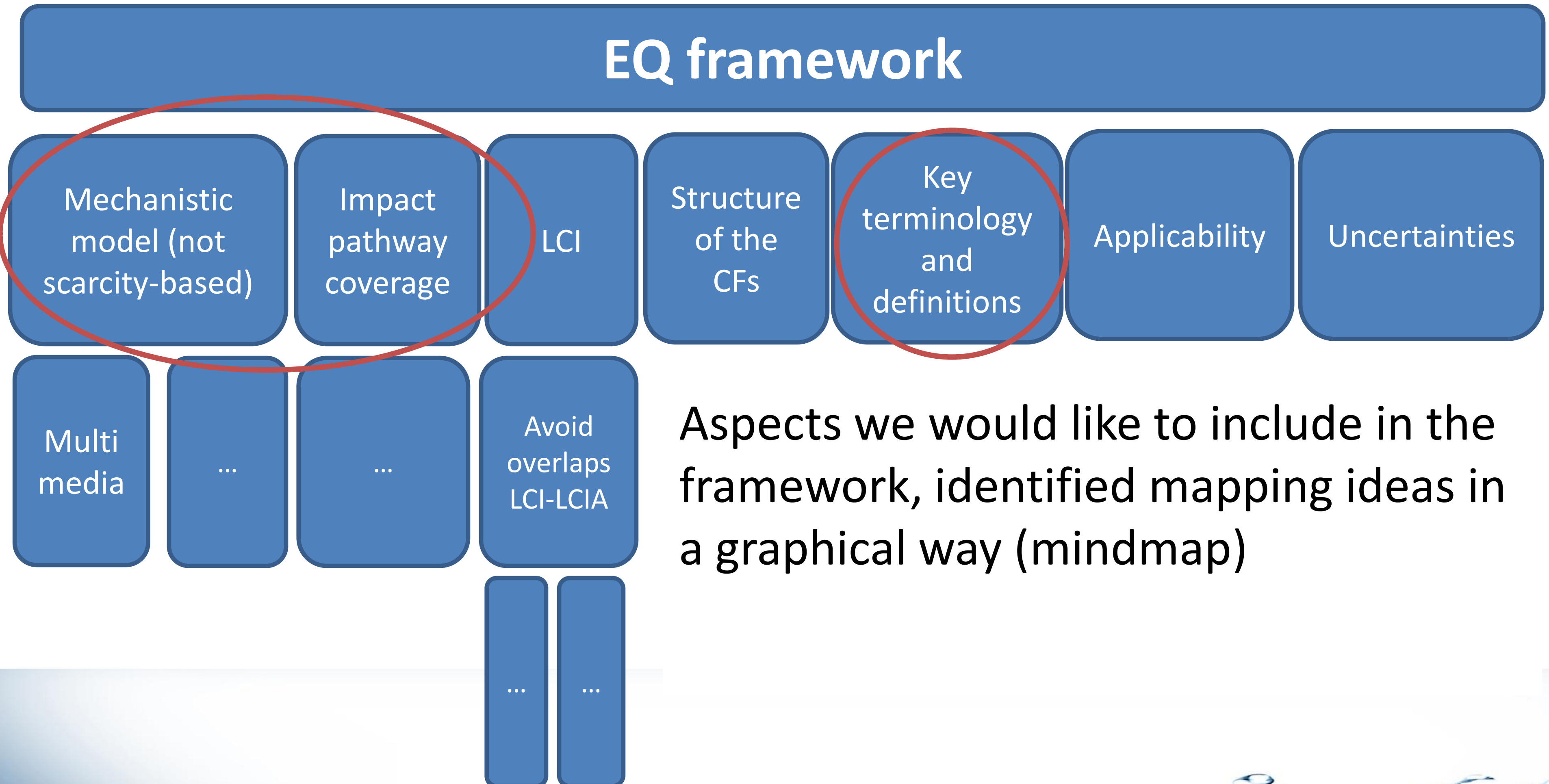


Source: Bouchard et al in prep

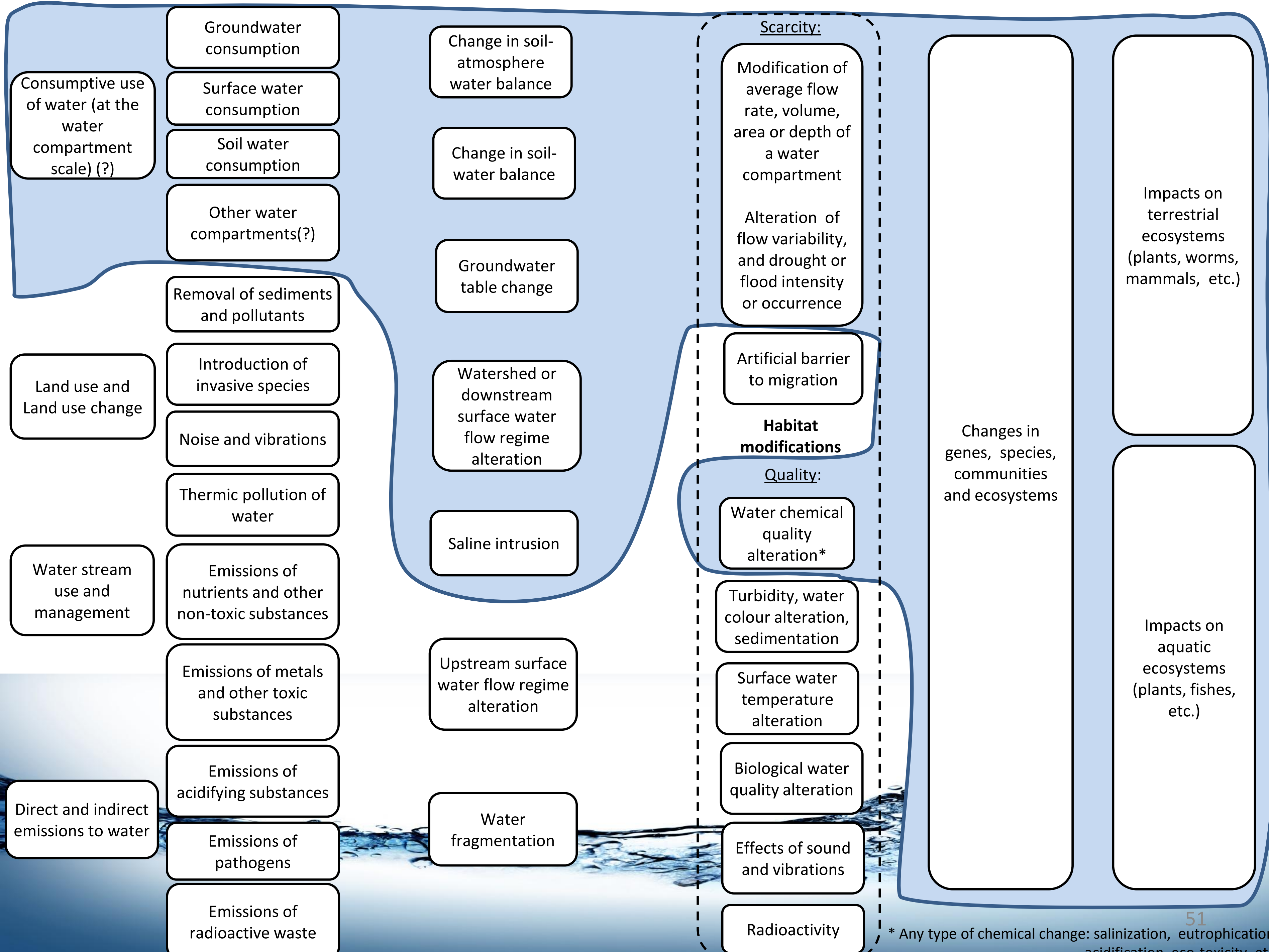
2. Propose a framework based on a mechanistic approach

- Identify key issues
- Define principles for framework development
- Identify a comprehensive set of impact pathways
- Define and update terminology and definitions

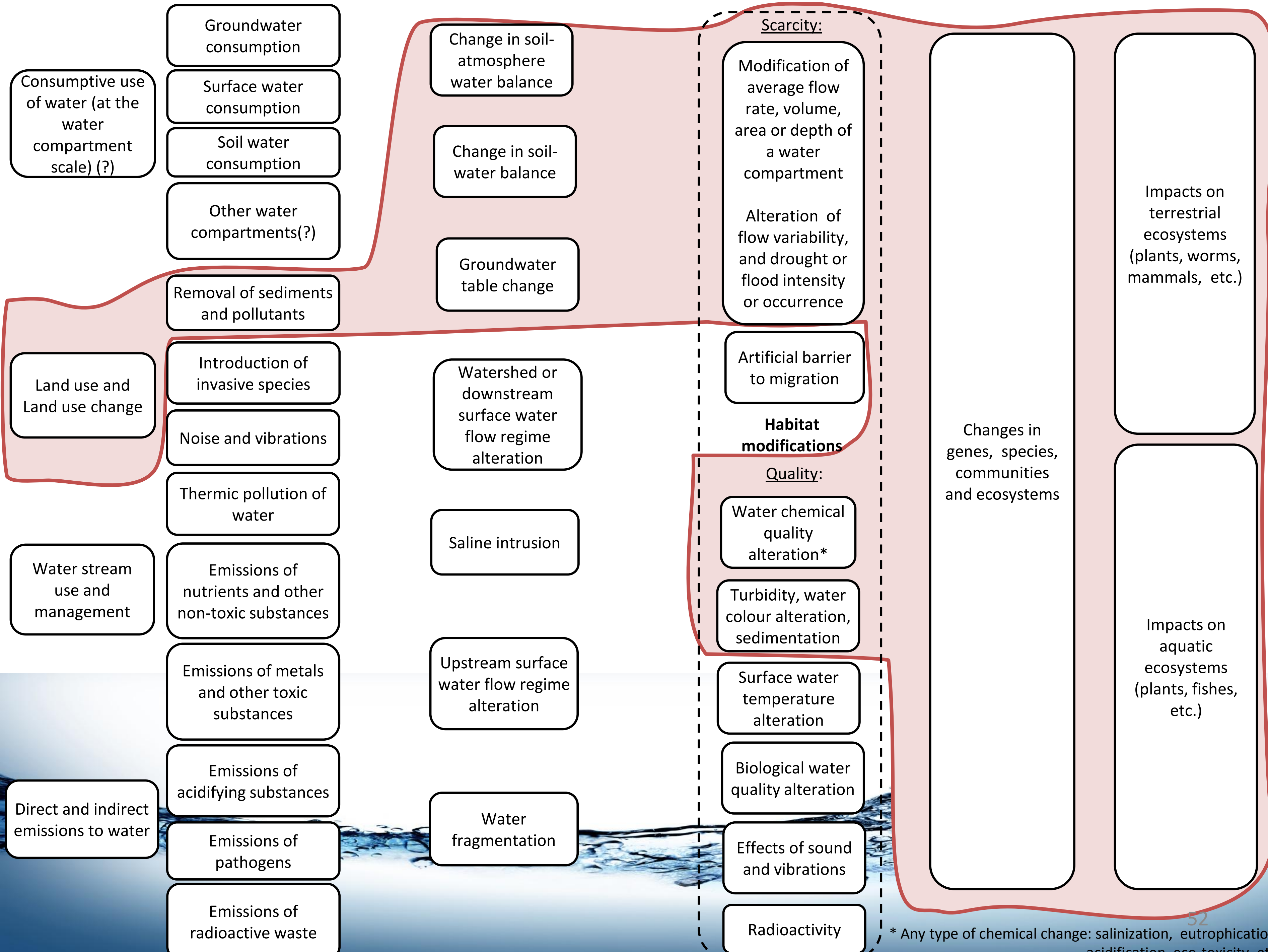
Identification of key issues for the framework



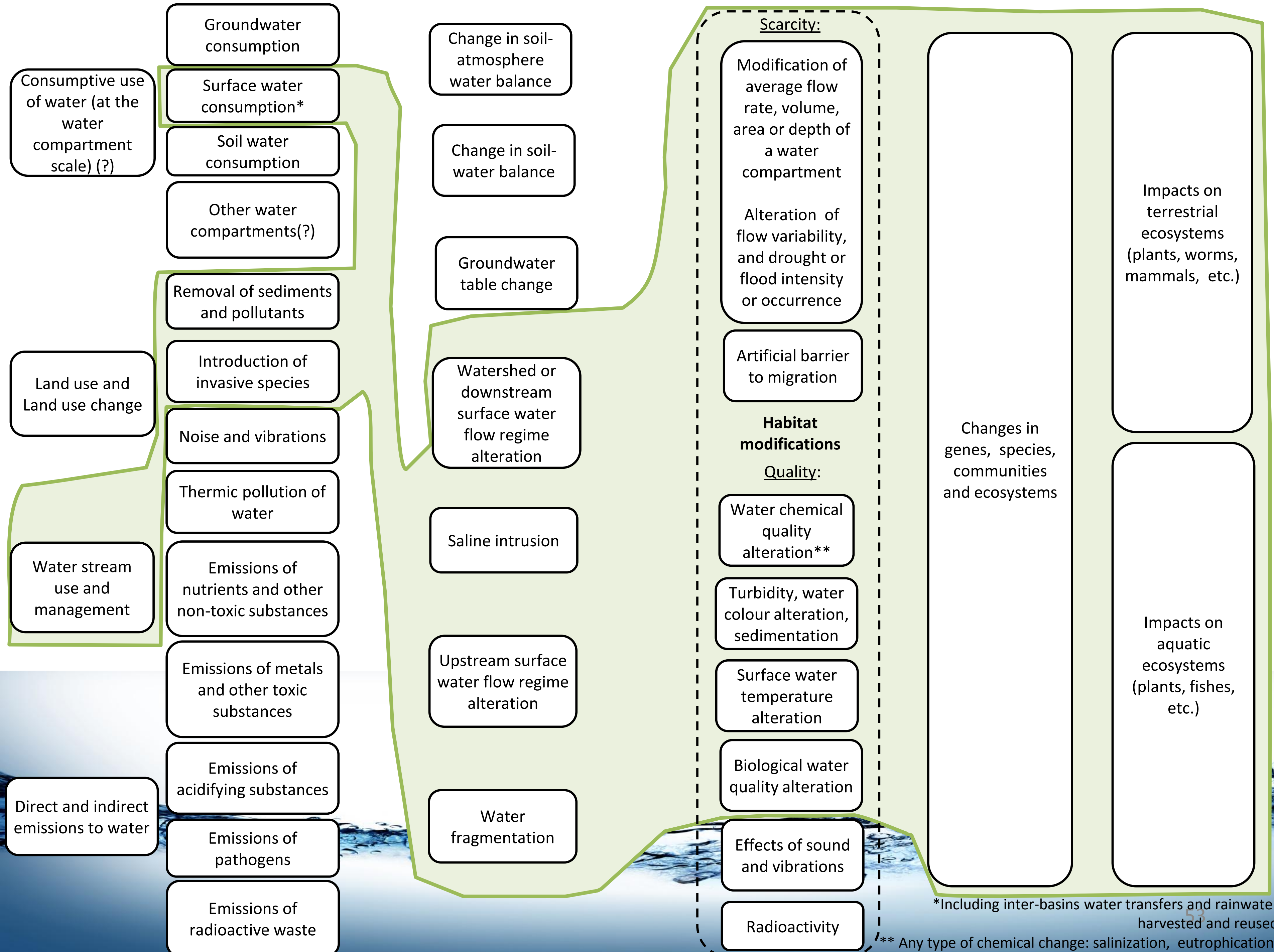
Aspects we would like to include in the framework, identified mapping ideas in a graphical way (mindmap)



* Any type of chemical change: salinization, eutrophication, acidification, eco-toxicity, etc.

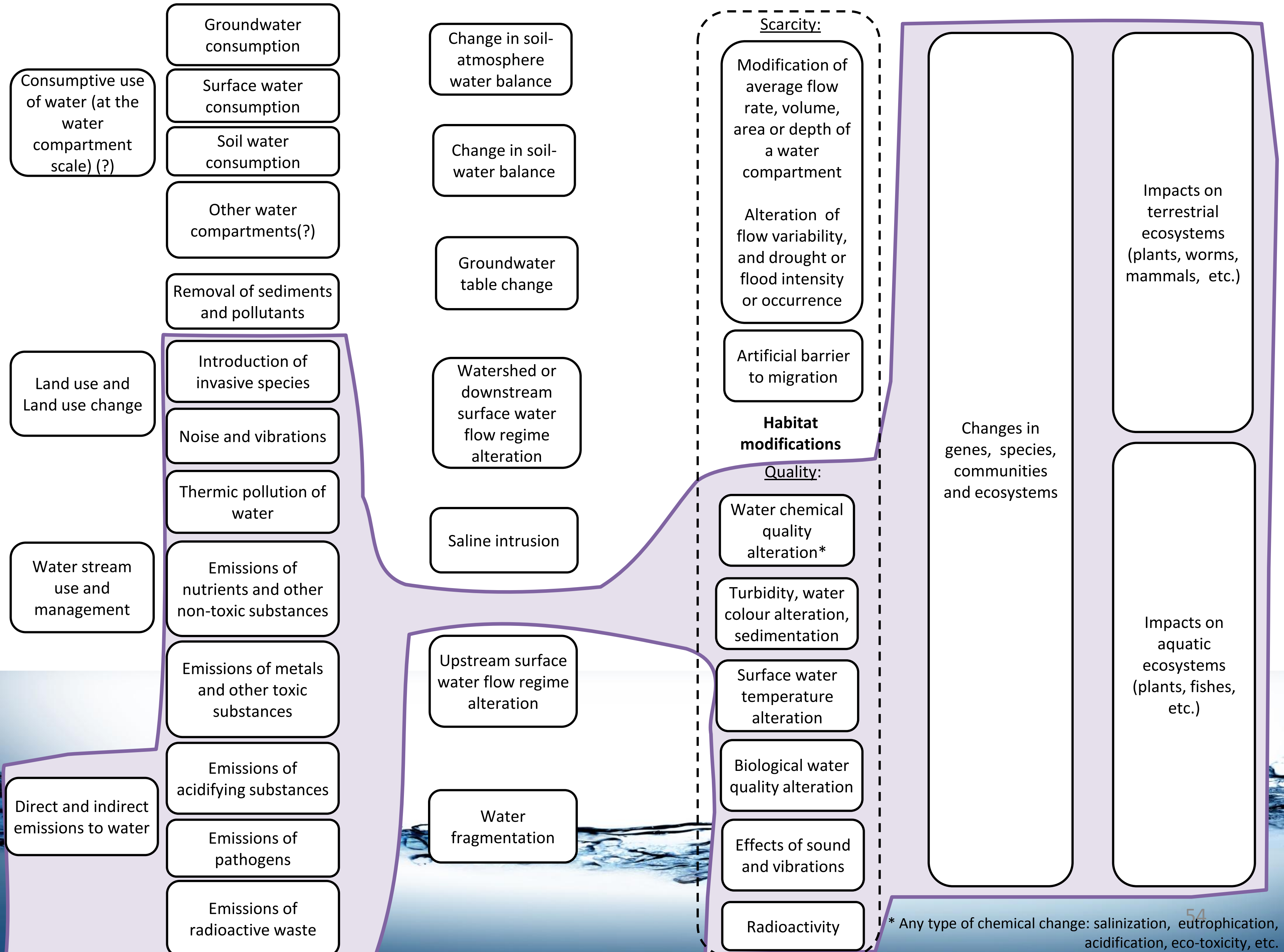


* Any type of chemical change: salinization, eutrophication, acidification, eco-toxicity, etc.



*Including inter-basins water transfers and rainwater harvested and reused

** Any type of chemical change: salinization, eutrophication, acidification, eco-toxicity, etc.



* Any type of chemical change: salinization, eutrophication, acidification, eco-toxicity, etc.

Definition of principles: mechanistic model

Causal relationship from environmental interventions to impacts

LCI → **Fate factor (FF)** → **Exposure factor (XF)** → **Effect factor (EF)**

LCI	Fate factor (FF)	Exposure factor (XF)	Effect factor (EF)
Resource consumption	Physical changes to local conditions	Contact to target organisms	Adverse effects on users

FF × XF × EF = Characterisation factor (CF)

Definition of principles: regionalized multimedia model

With interconnections between water compartments

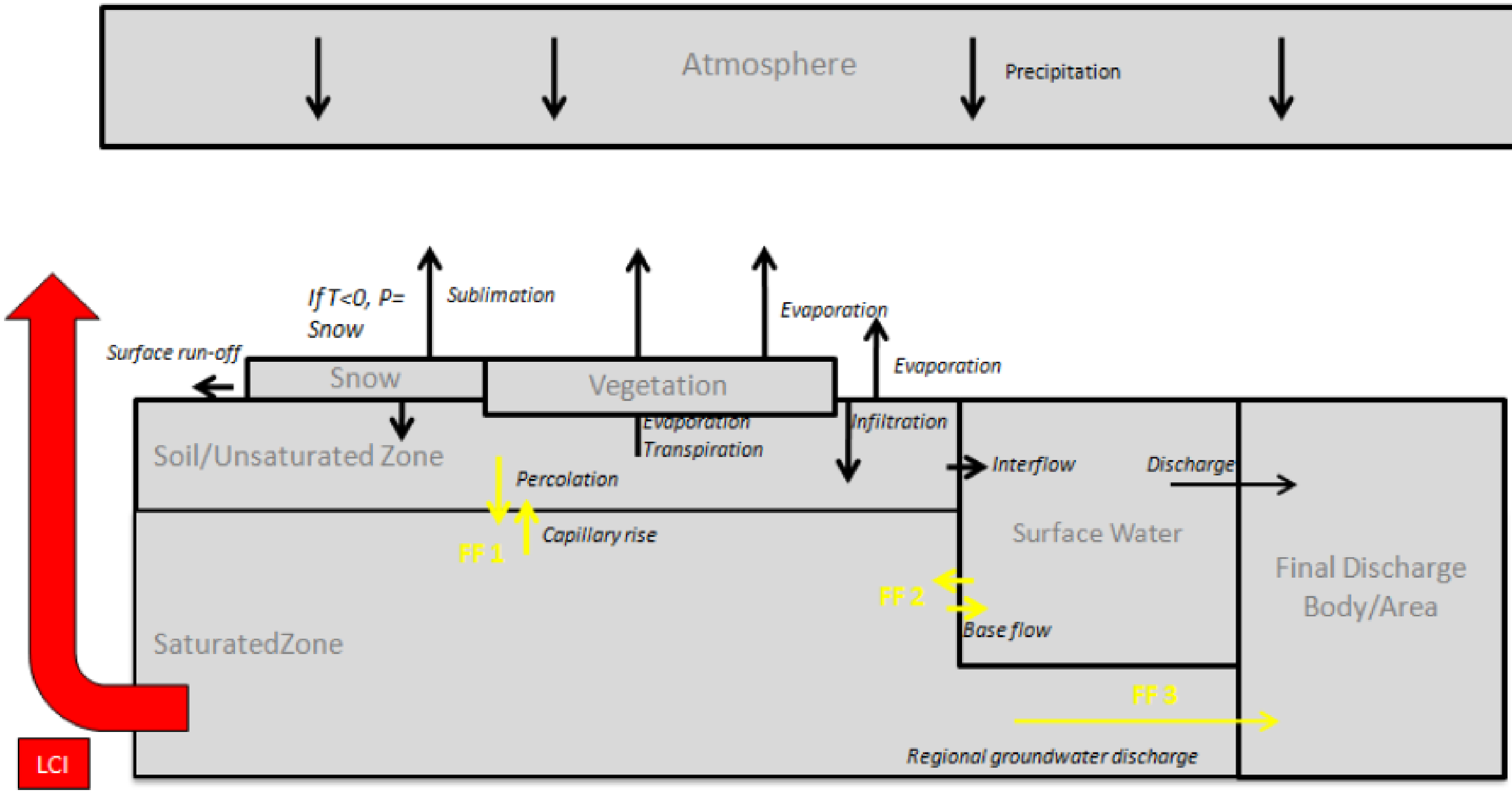


Figure 2: Example of relevant flows between compartments that need to be defined in terms of fate factors (FF) to enable the characterization of impacts due to groundwater abstraction

Next steps

- Regular meeting with the goal to develop a framework linking water use to ecosystem quality Area of Protection (objectives 1 & 2)
- Individual contributions to specific impact pathways (objective 3)

Conclusion and Final Discussion

Upcoming

- LCM, Bordeaux, September 2015 *(poster)*
- Expo Milan, October 2015
- LCA XV, Vancouver, October 2015 *(pending acceptance)*

- Publication planned on scarcity indicator consensus building process
- Publication planned in the next year on ecosystem framework
- Recommendations planned for Human Health (white paper) for Pellston workshop
- Pellston Workshop, January 2016

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Sponsorship serve in financing industrial contribution to Mitacs (for fellowship), organize workshop, dissemination, WULCA participation to conference and events (e.g. SETAC, World Water Week, etc) and other operational costs (website, softwares, etc).

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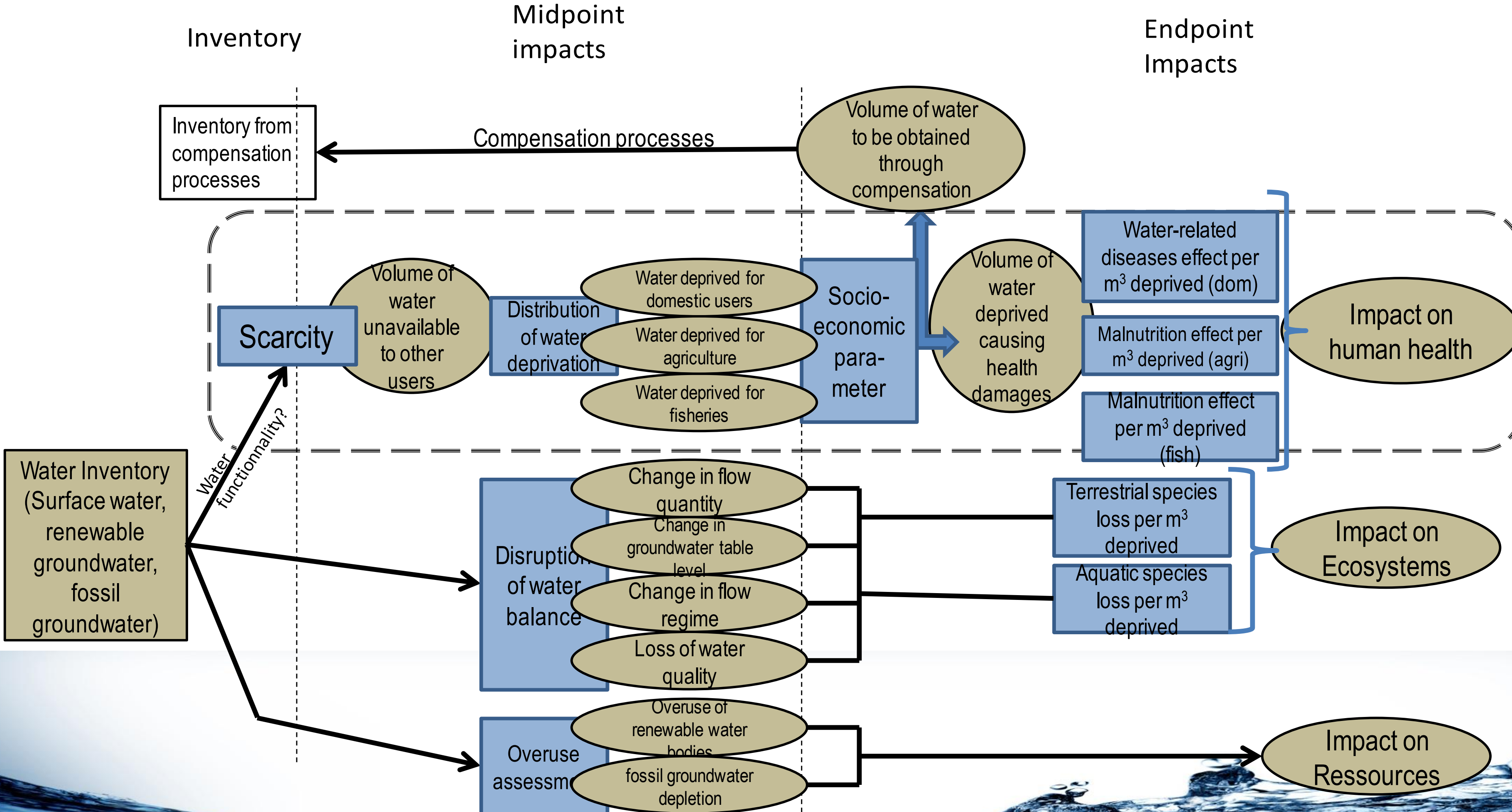
UNEP Life Cycle Initiative SETAC

THANK YOU FOR YOUR PARTICIPATION

Current General Framework

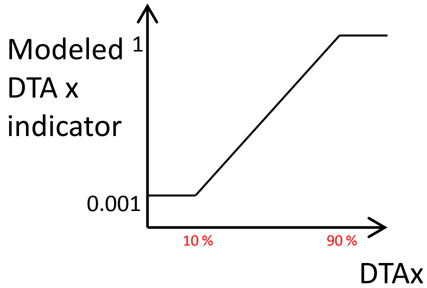


New indicator for water scarcity footprint: Units

Relative User Deprivation Potential = Water consumption (inventory) × $\frac{1}{\text{Unused water remaining}}$ CF

$m^3_{\text{world eq}}$ = $m^3_{\text{region i}}$ × $\frac{m^3_{\text{region i}}}{m^3_{\text{world eq}}}$ → $\frac{m^3_{\text{world eq}}}{m^3_{\text{region i}}}$

Both calculated for the same fixed area



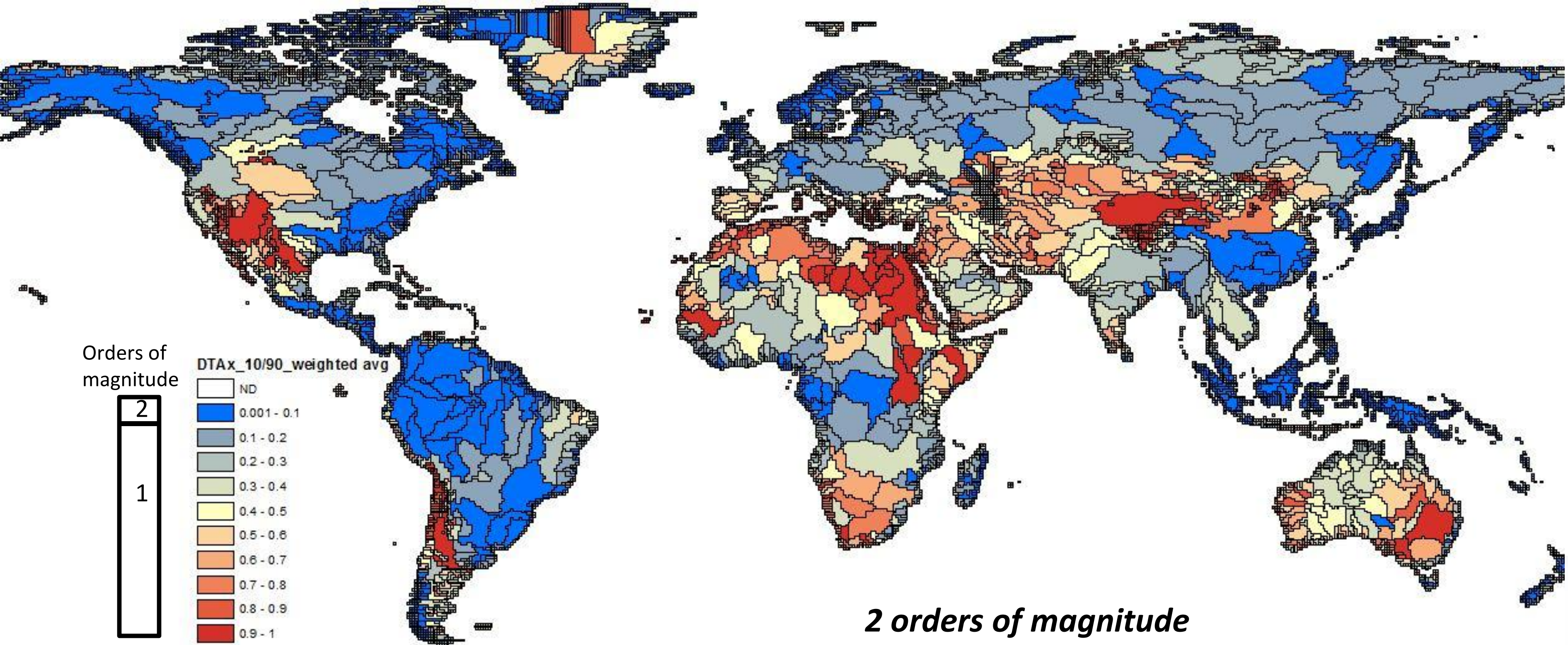
2 DTAx(0.34)

$$DTAx = \frac{Demand}{Availability} \times \left[\frac{Area}{Availability}\right]^{x}$$

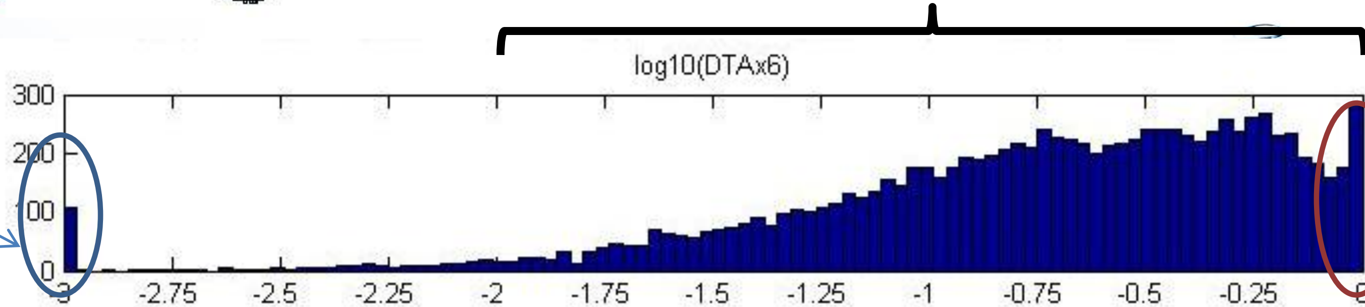
Cutoff 10 and 90 % area

(choice to validate/justify/finalize)

Weighted average



2 orders of magnitude



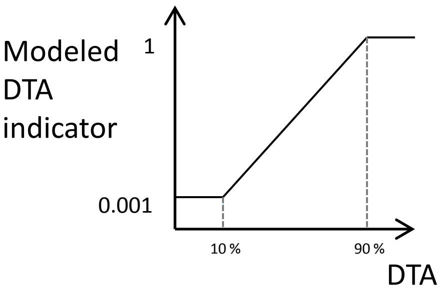
Min value of 0.001

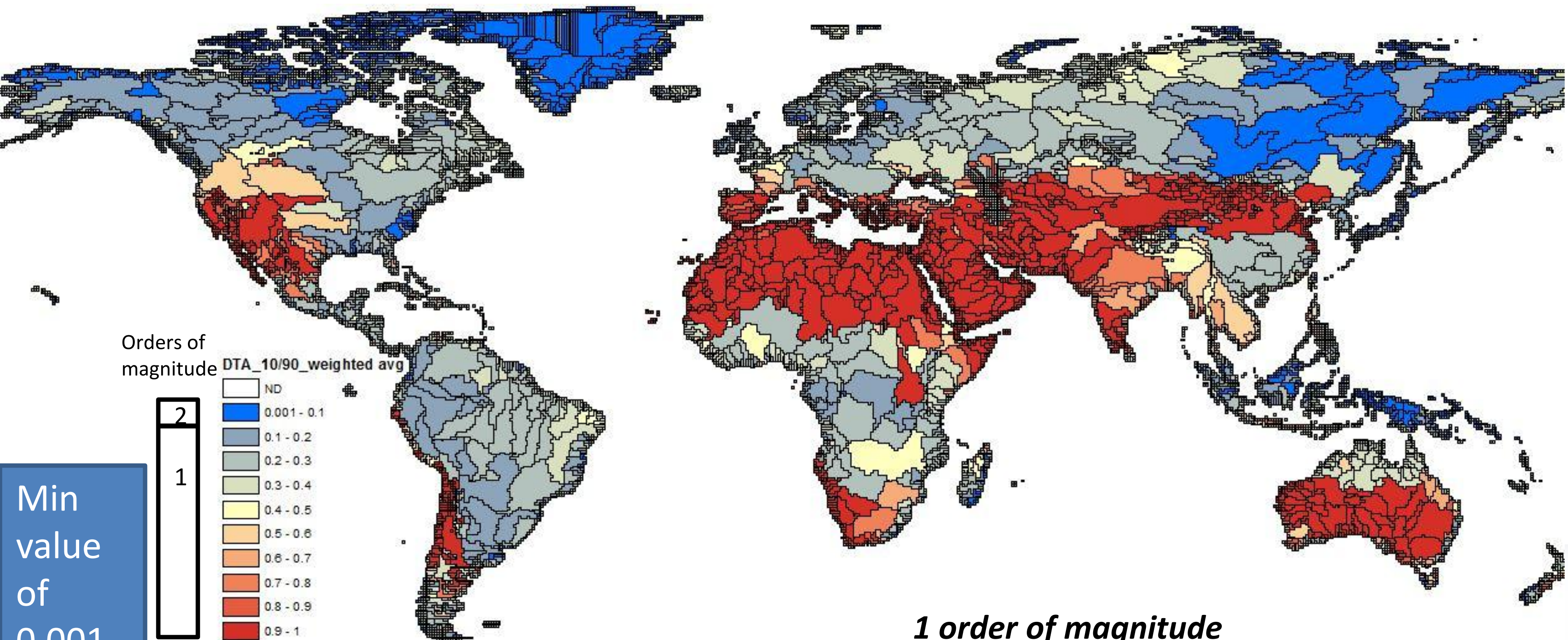
Max value of 1

DTA = $\frac{\text{Demand}}{\text{Availability}}$

1 DTA

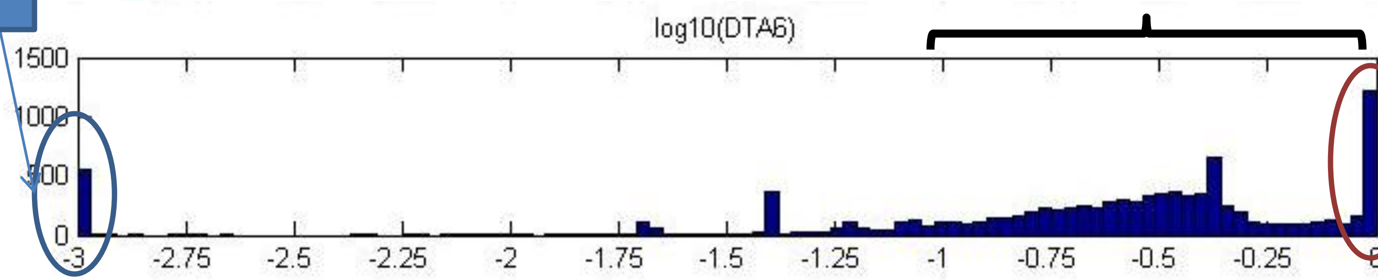
Cutoff 10 and 90 % area
Weighted average





Min value of 0.001

1 order of magnitude



Max value of 1

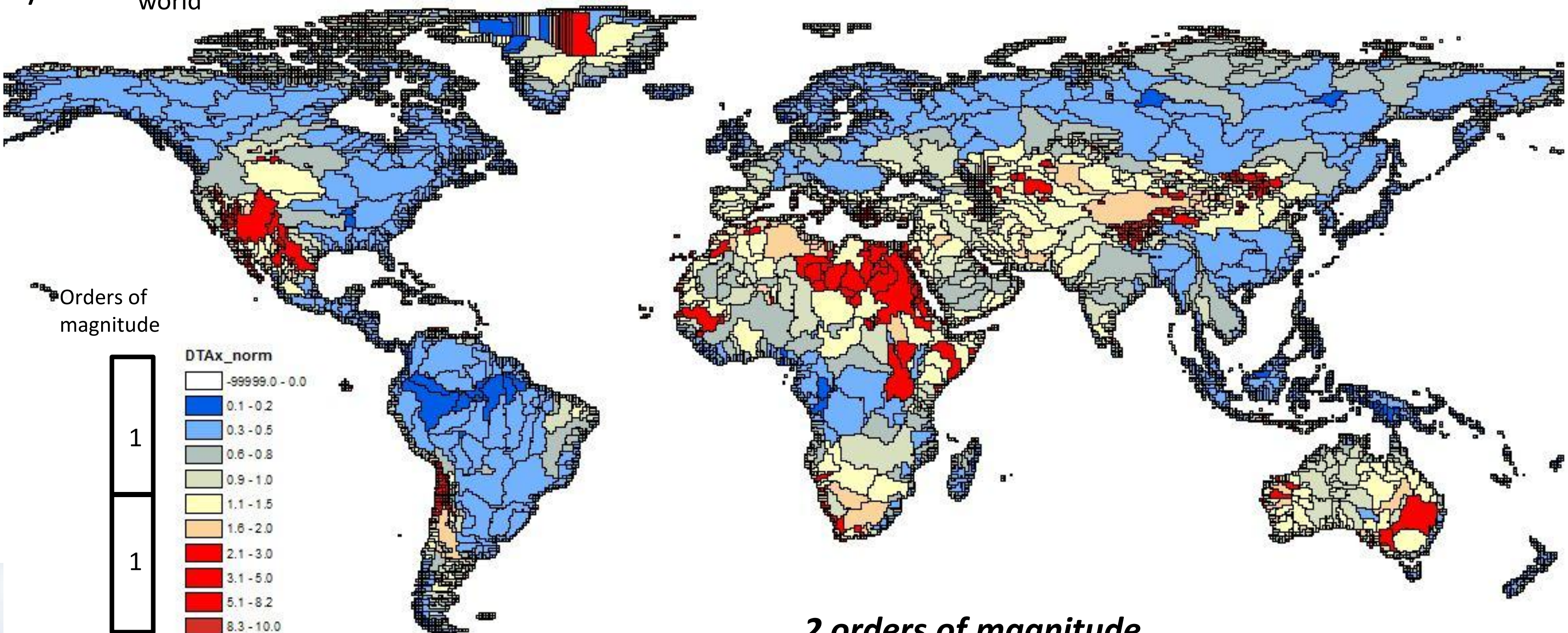
2 DTAx(0.34) – normalized (world average)

$$DTAx = \frac{Demand}{Availability} \times \left[\frac{Area}{Availability}\right]^{x}$$

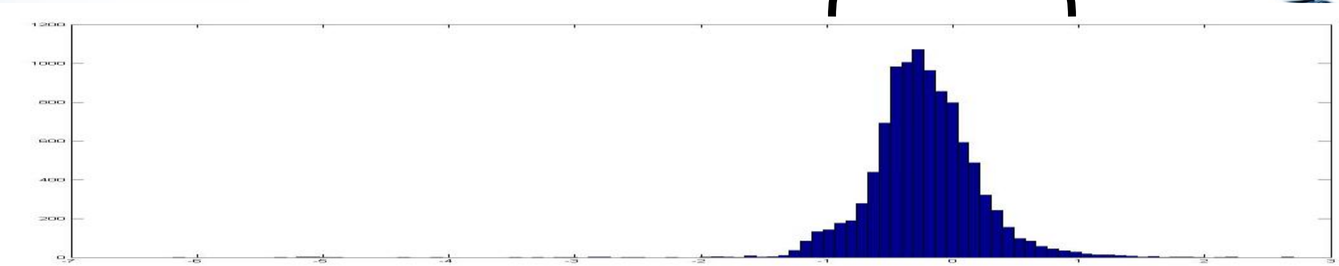
Weighted average

DTAx indicator = DTAx /DTAx $_{world}$

Orders of magnitude



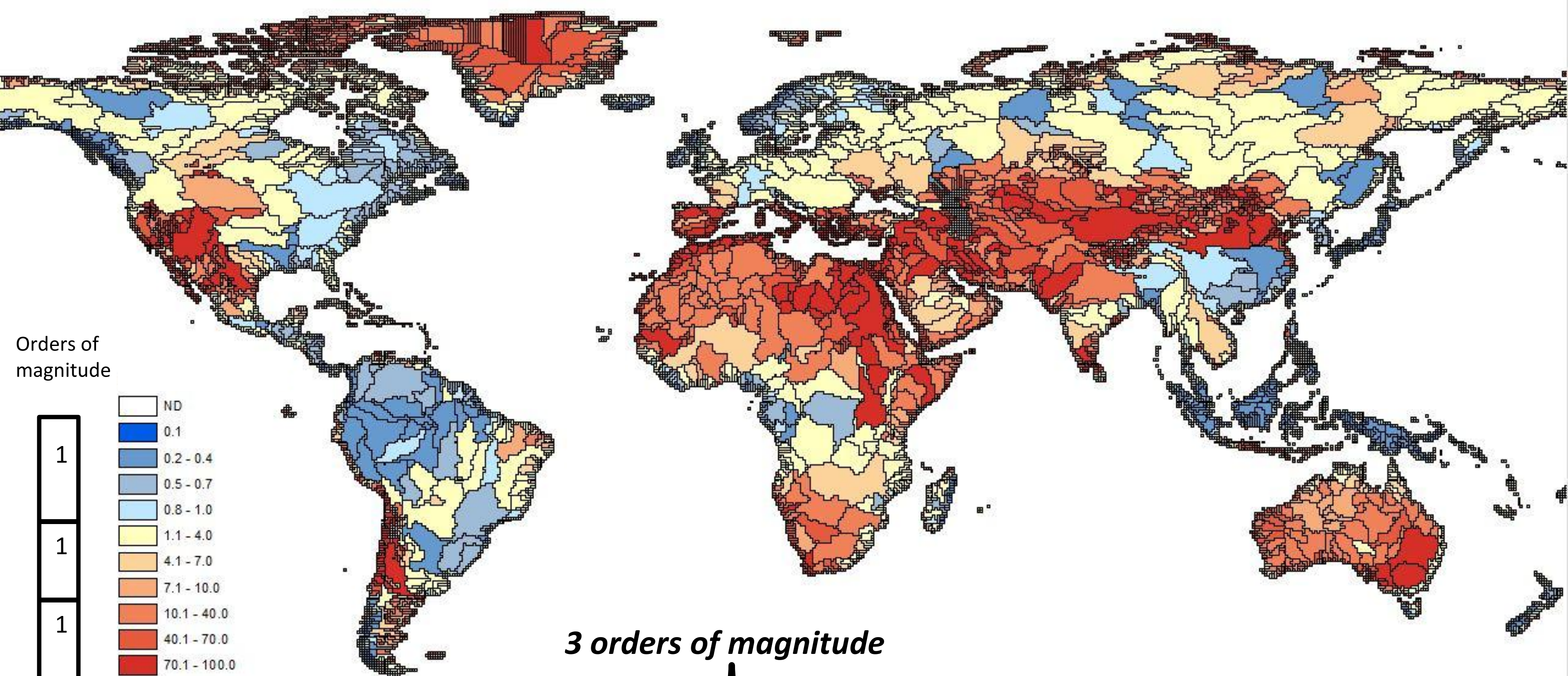
2 orders of magnitude



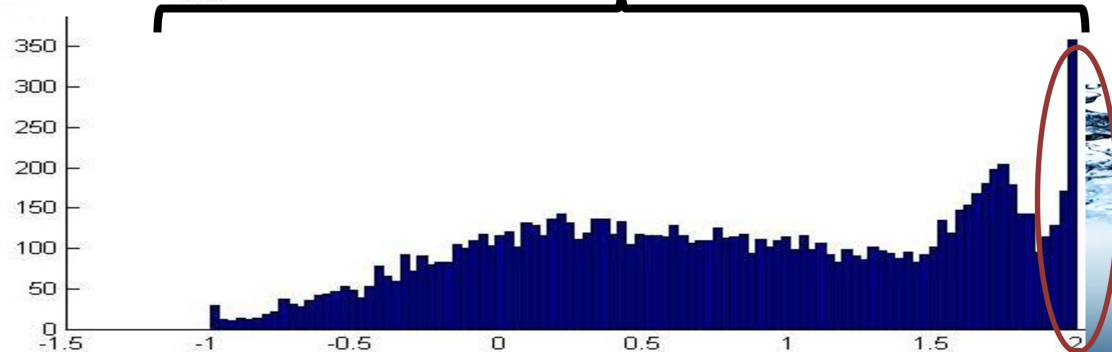
$$AMD = \left[\frac{\text{Unused water (per area)}_{\text{world avg}}}{\text{Unused water (per area)}}\right]$$

Unused water = Availability - Demand

3 AMD – range 0.1 - 100



3 orders of magnitude

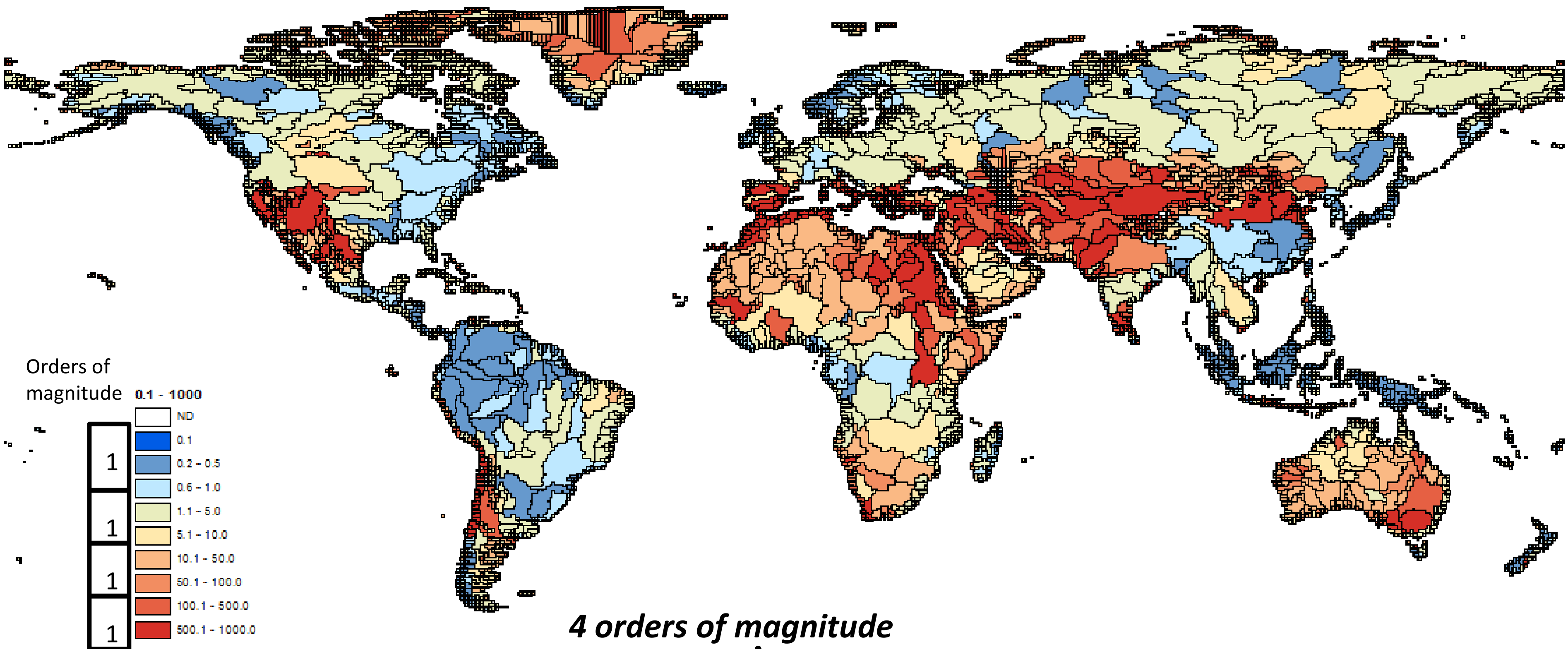


Max value of 100

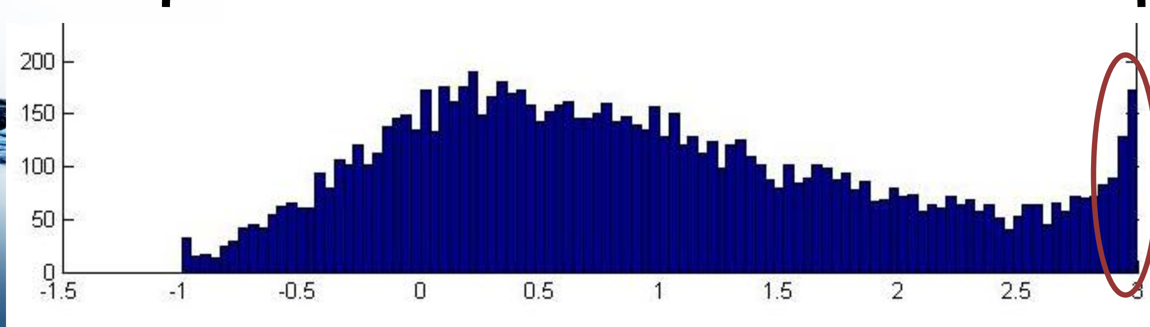
$$AMD = \left[\frac{\text{Unused water (per area)}_{\text{world avg}}}{\text{Unused water (per area)}} \right]$$

Unused water = Availability - Demand

3 AMD – range 0.1 - 1000



4 orders of magnitude



Max value of 1000