OCP Policy Center Conference series

Green Water in Dryland countries : Defining feature of the Nexus

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Roadmap

Implications of the New Paradigm

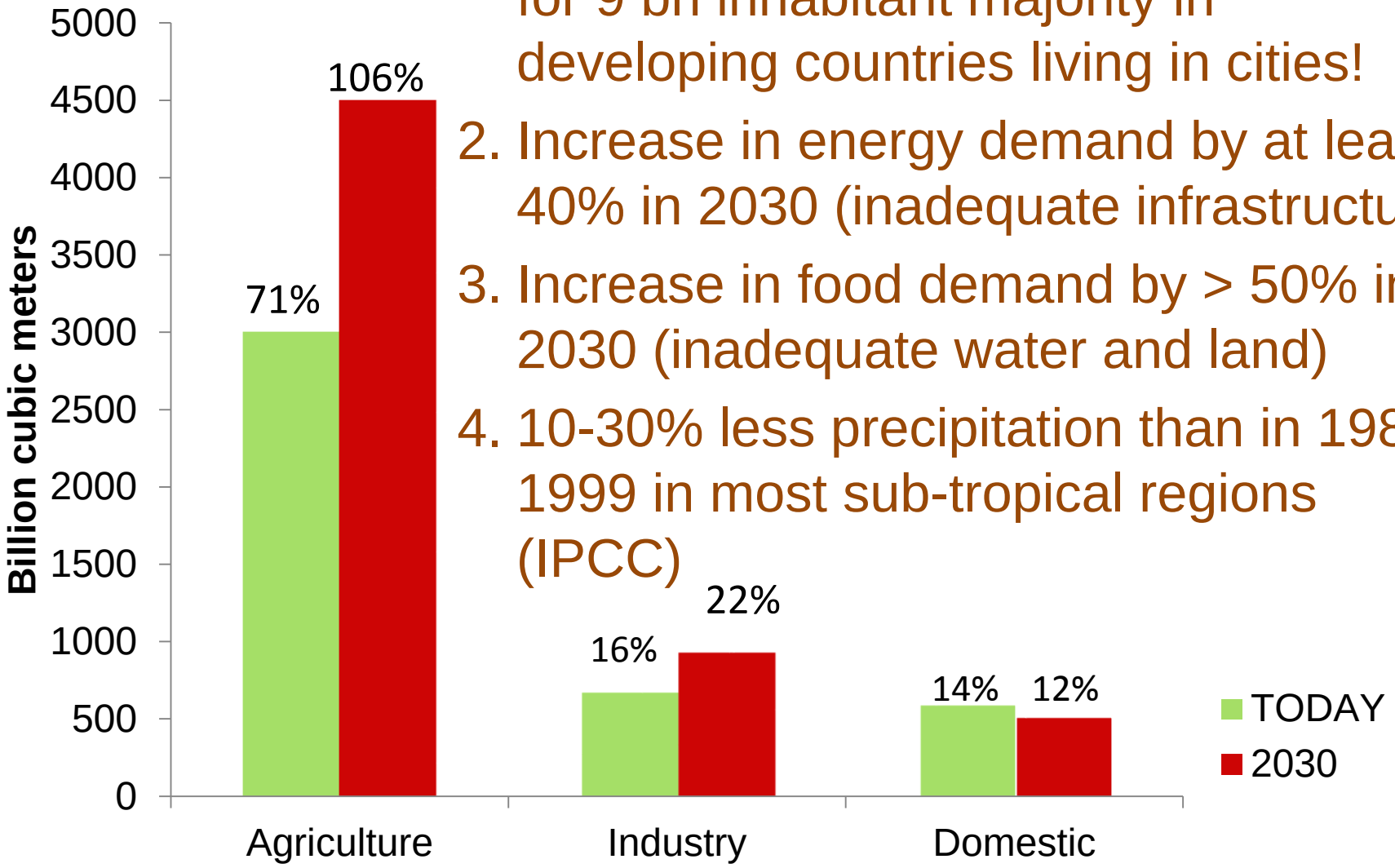
Green Water Resources Potential

Integrative nexus approach to resource allocation

Global Scene: Resource scarcity

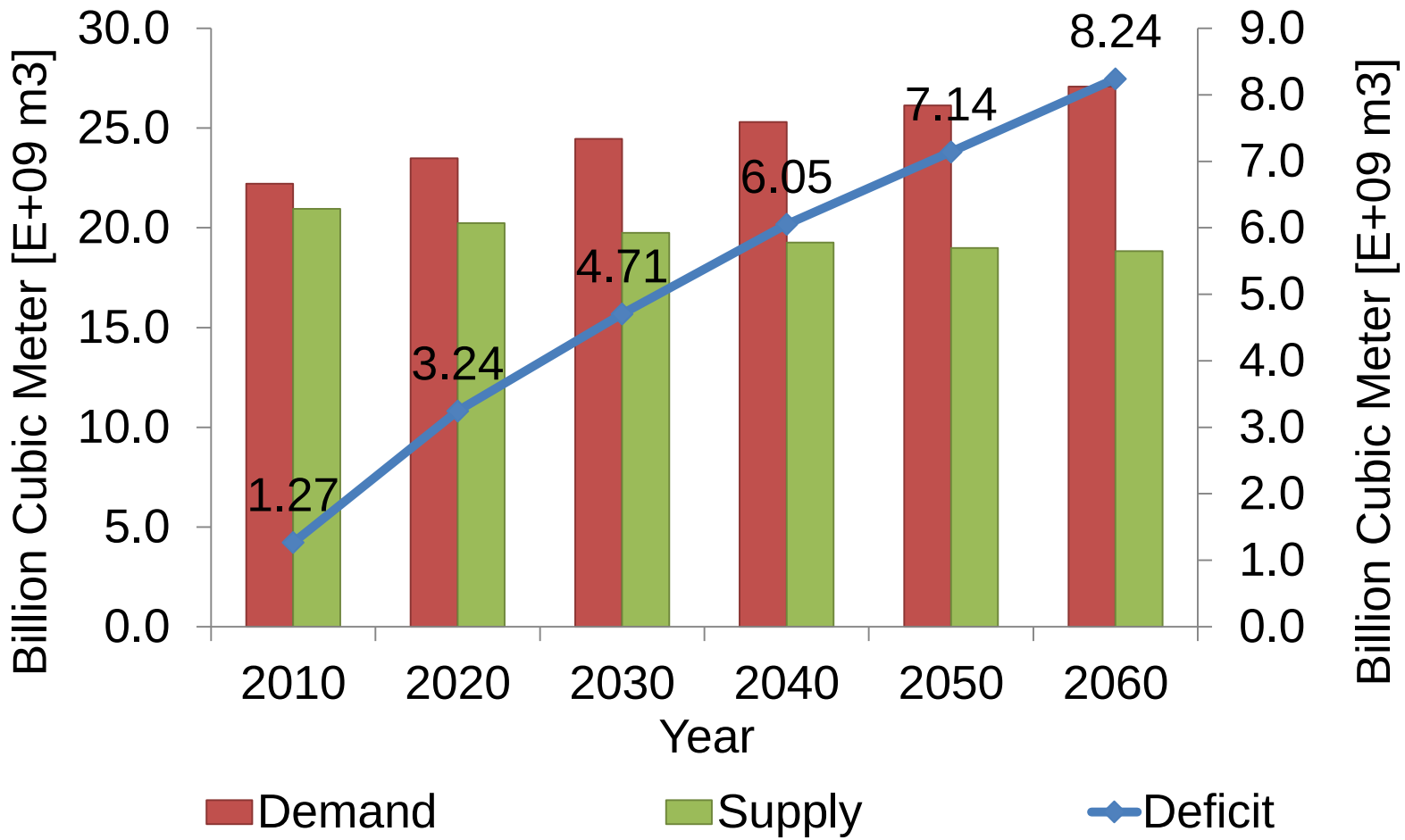
Business as Usual: HEAD-ON CRASH!!

1. 40% new water (1669 bn m^3 by 2030) for 9 bn inhabitant majority in developing countries living in cities!
2. Increase in energy demand by at least 40% in 2030 (inadequate infrastructure)
3. Increase in food demand by > 50% in 2030 (inadequate water and land)
4. 10-30% less precipitation than in 1980-1999 in most sub-tropical regions (IPCC)



Source: Water Security: The Water-Energy-Food-Climate Nexus. WEF, 2010

Texas Projected Water Deficit



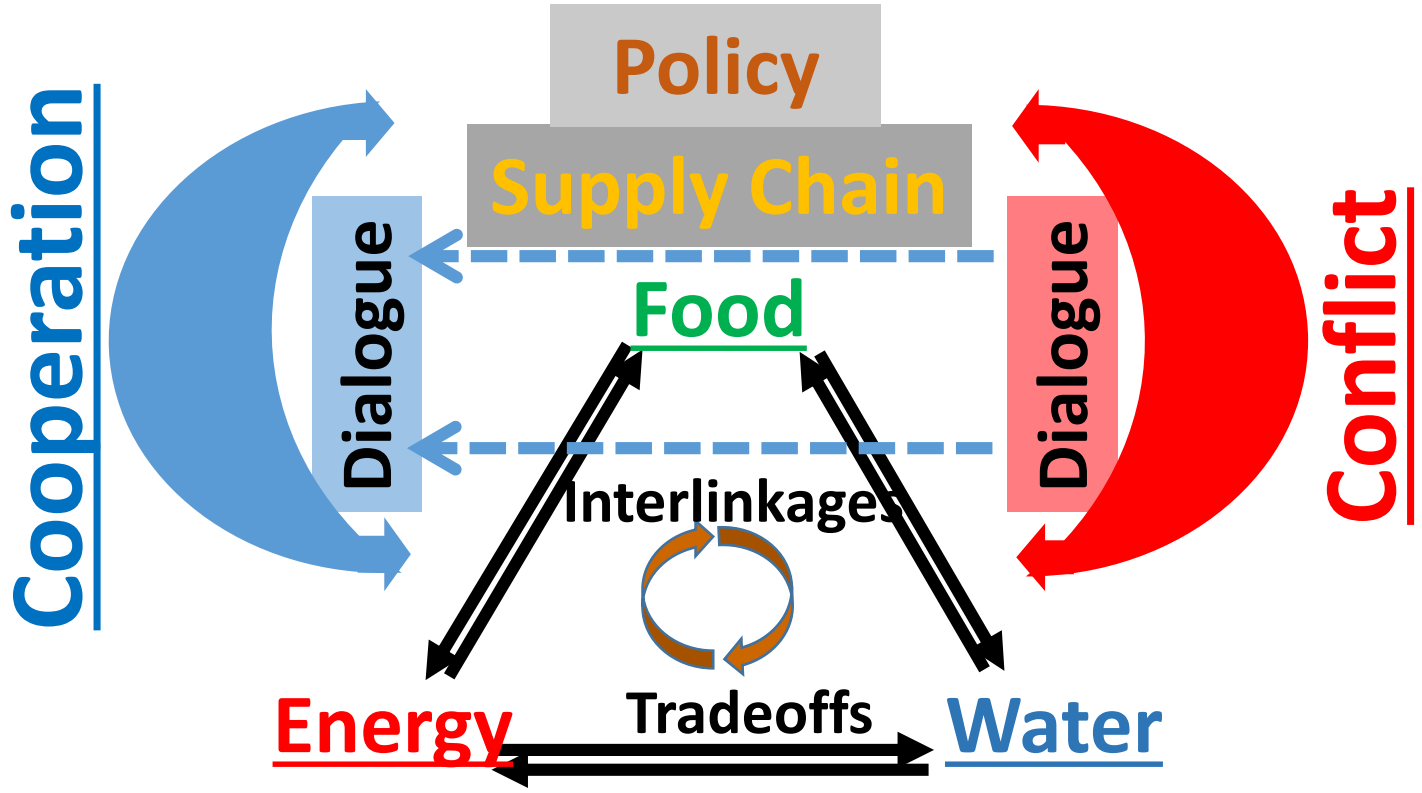
By 2060: **8.24 Billion** cubic meters of NEW water supply is needed.

Source: TWDP – 2012 State Water Plan

Principles of Holistic Multi-Scale Multi-Stakeholders Nexus Approach

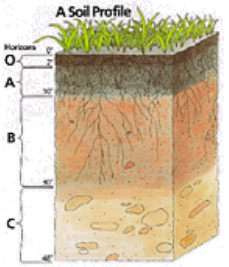
- **Integrative view** of water, energy and food resources management must prevail at **all levels**, based on **inclusiveness** for all sectors of the economy including: governance, academic, civil society, & private sector.
- **Define** and **quantify** interconnectivity between water, energy, and food, on the basis of which they can used for policy and planning.
- Private sector role in promoting conservation and **responsible investment** and in RD to further business opportunities and **technology development** & enhancement.

From Science to Politics of the Nexus



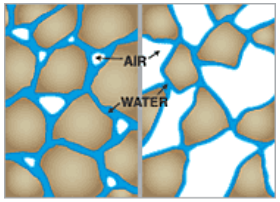
Mohtar 2014

What is Green water?



- Rainwater **stored** in the soil as soil moisture (wikipedia).
- The precipitation water **stored** in the soil and eventually transpired by natural and agricultural vegetation (Gerten et al., 2005) **(i.e. storage and actual transpiration)**
- Green water according to Falkenmark and Rockström (2006) consists of two parts:
  - **Green water resource (storage)** which equals the moisture in the soil, and
  - **Green water flow**, which equals the sum of the actual evaporation (the ***nonproductive part***) and the actual transpiration (the **productive part**). **(i.e. storage and actual evapotranspiration)**

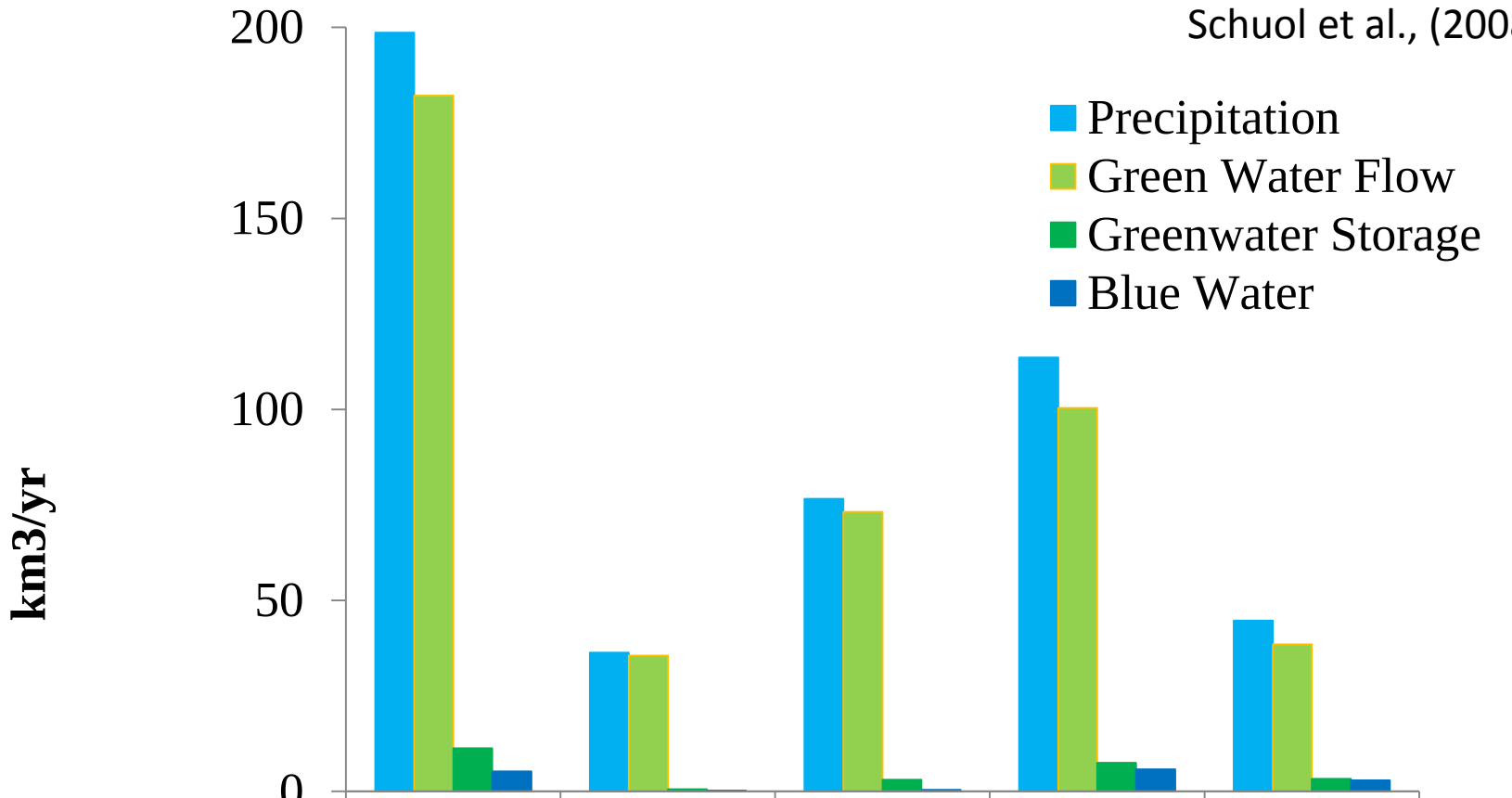
Why Green Water is Important?



- The global soil moisture (**green water**!!) is about 16,500 km^3. It is only 0.05% of the total fresh water on the Earth. But,
  - It is accessible to the plants.
  - **60 %** of all food globally is produced in the rainfed areas (**green water**!!).(Cosgrove and Rijsberman, 2000).
- The global crop consumptive use was **5938 km^3/yr** in year 2000, where **87%** of this amount was **green water** contribution (Liu and Yang, 2010).
- Rainfed (**green water**) areas currently account for **58** percent of world cereal production. (Rosegrant et al., 2002).

Average Available and Renewable Water for North Africa Arab Countries (km^3/yr)

Schuol et al., (2008)



	Algeria	Egypt	Libya	Morocco	Tunisia
Precipitation	198.6	36.3	76.6	113.6	44.7
Green Water Flow	182.1	35.6	73.1	100.3	38.5
Greenwater Storage	11.3	0.6	3.1	7.5	3.3
Blue Water	5.2	0.1	0.4	5.7	2.9

Hydrostructural Pedology A New Discipline in Agro-Environmental Science [Physical "Local Scale" Modeling]

HYDRO-STRUCTURAL PEDOLOGY | **HYDRO-PEDOLOGY** | **HYDROLOGY**

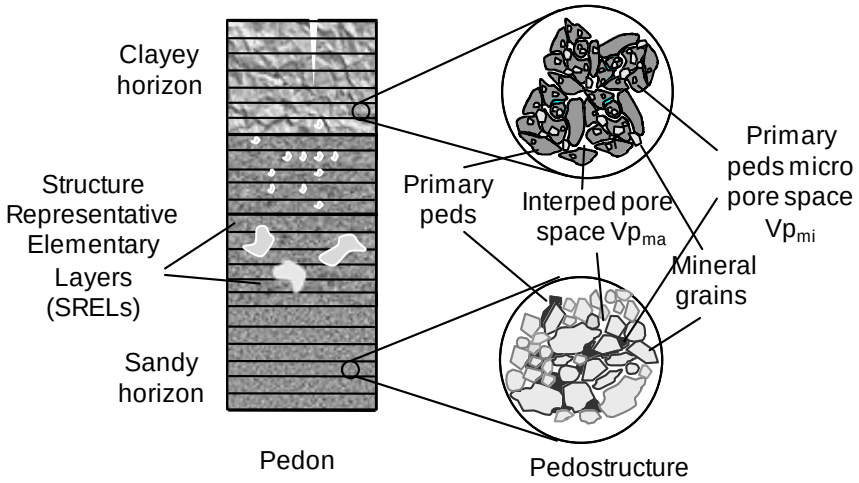
Soil hydro-structural dynamics characterization and modeling

Soil cover organization mapping and GIS interface

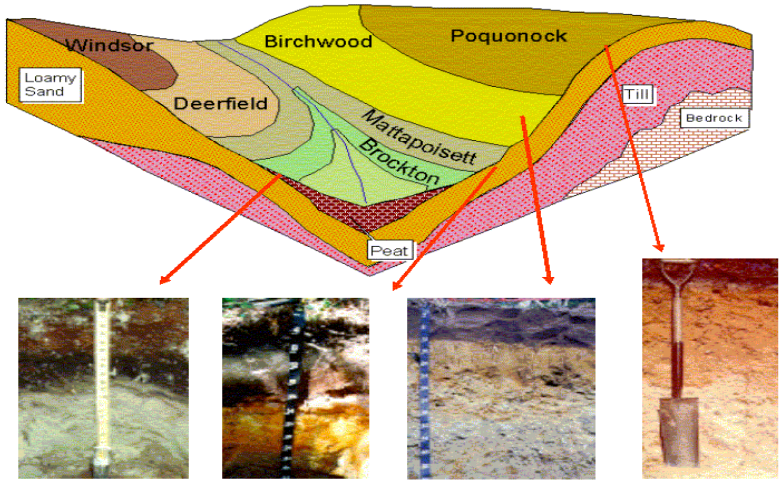
Soil surface water dynamics characterization and modeling

- Plasmic organization
- Hydro-structural
- Horizons
- Pedon
- Pedon mapping unit

- Pedologica map 1/20 000
- Geomorpho-logical map 1/50 000
- Watershed; landscape



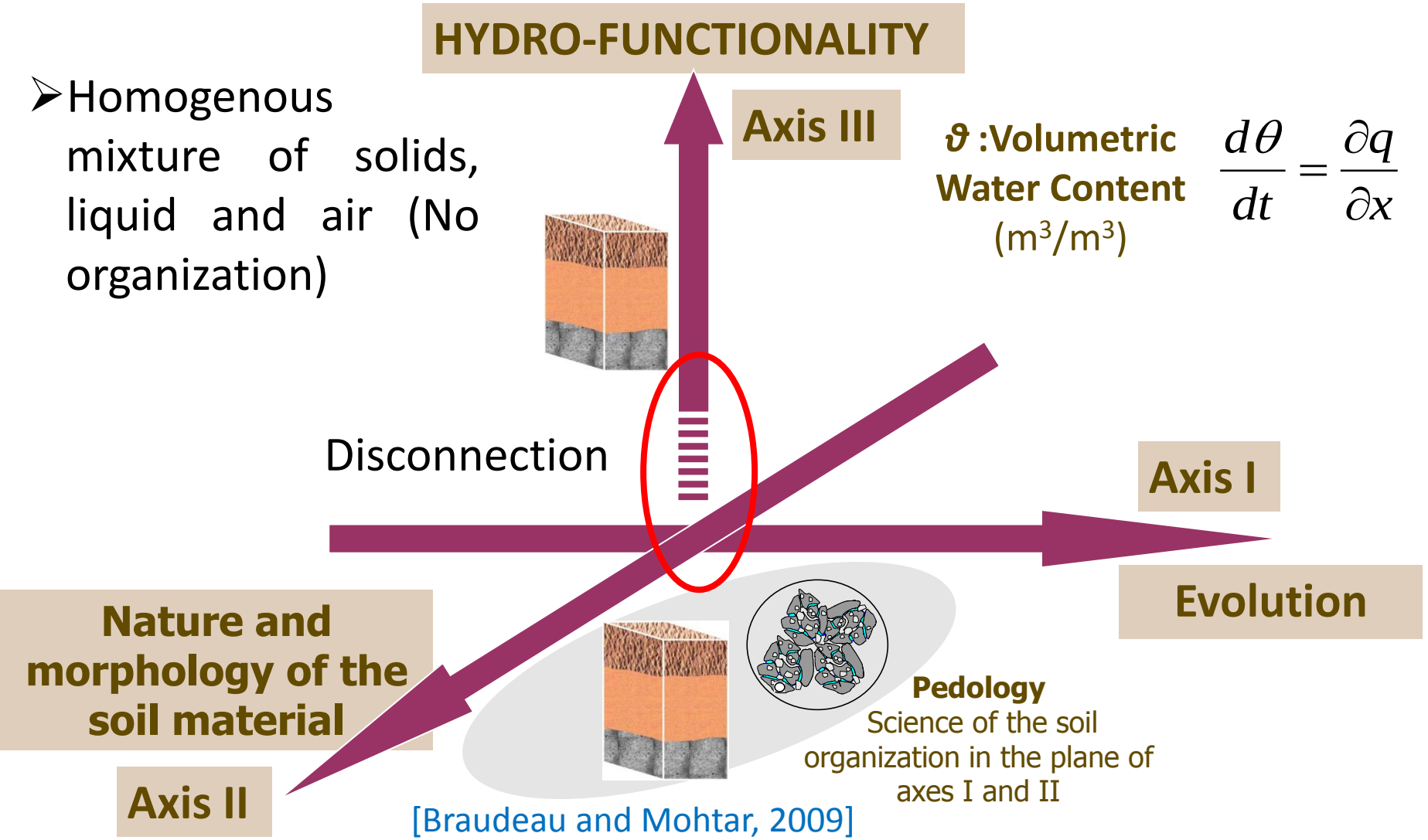
Kamel® is a multi-scale « soil water» computer model based on the Pedostructure Concept



Soil Organization GIS based on the Pedostructure Concept

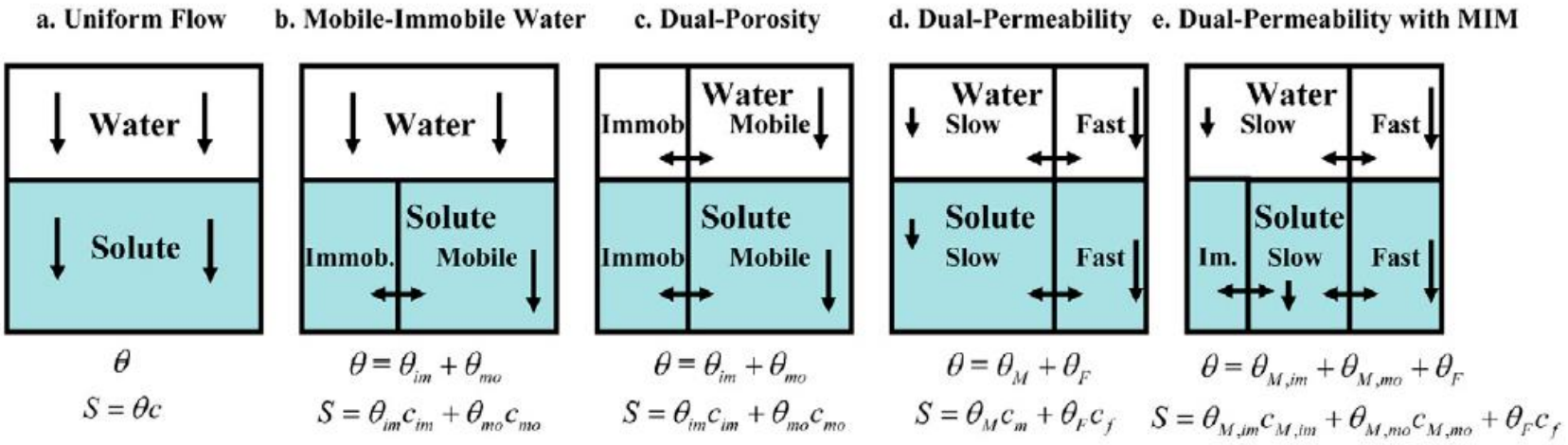
The Representative Elementary Volume Concept in Existing Hydrological and Hydropedological Models

- Homogenous mixture of solids, liquid and air (No organization)



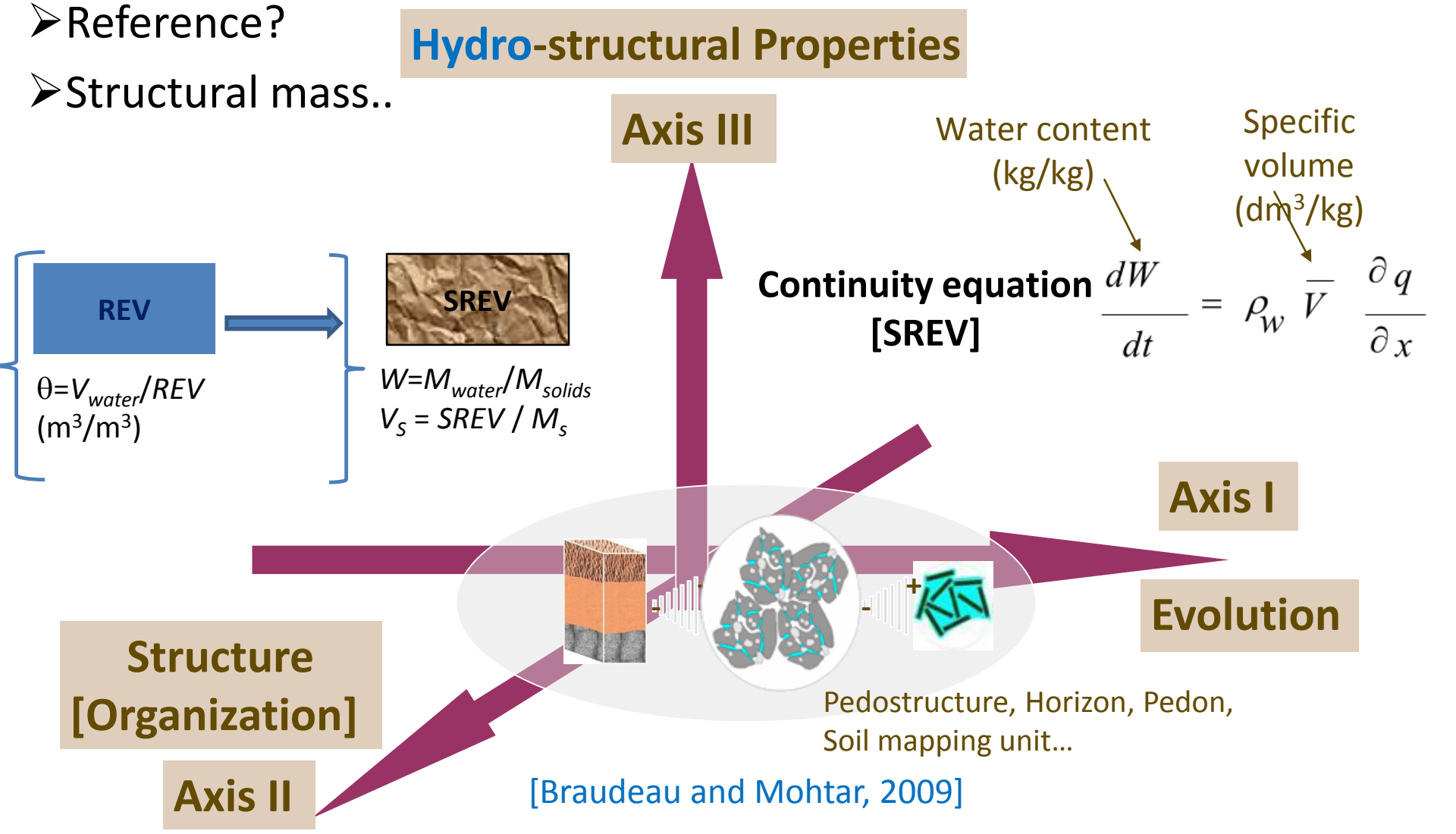
The Consequences for Soil Water Modeling

- Soil **Parameters** of the hydrologic system are mostly **empirical** and ignores the soil-water and soil-structure interactions.
- Hydrologic models simulate **rigid medium** and do not reflect the dynamic of the soil medium as it swells and shrinks.
- Linkage between micro and macro scales is not explicit/dynamic.
- **Accordingly, models do not allow for scaling of processes and transferability of information across scales.**



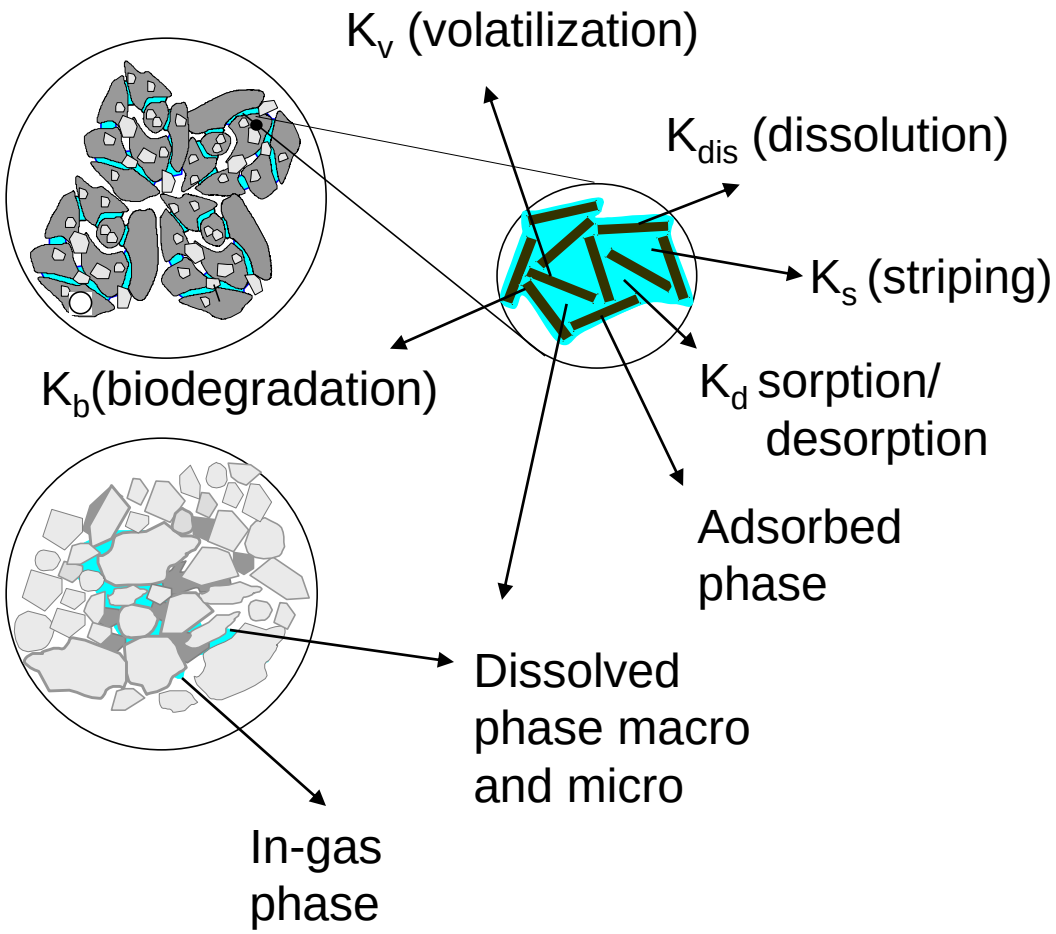
Structural Representative Elementary Volume [SREV] in Hydrostructural Pedology -

- Reference?
- Structural mass..



Implications of the Pedostructure Multi-Scale Hydrologic Modeling

- Linking properties to behavior
- Consistent accounting for Green Water resources
- Coupling biological & geochemical processes.
- Integrating results from the local scale of processes.
- Consistent soil mapping and typology based on thermodynamic and natural organization of soil



Nexus Team

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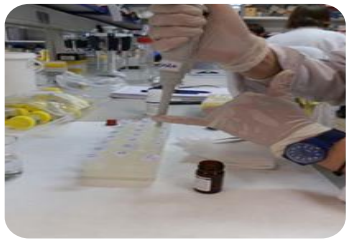

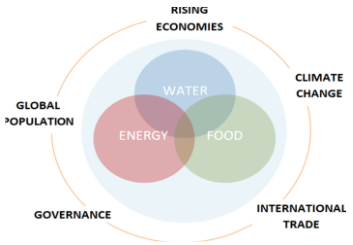

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Thank You