"The role of irrigation techniques for adaptation and sustainable improvement of agro- and farm forestry"

A Question of Balances

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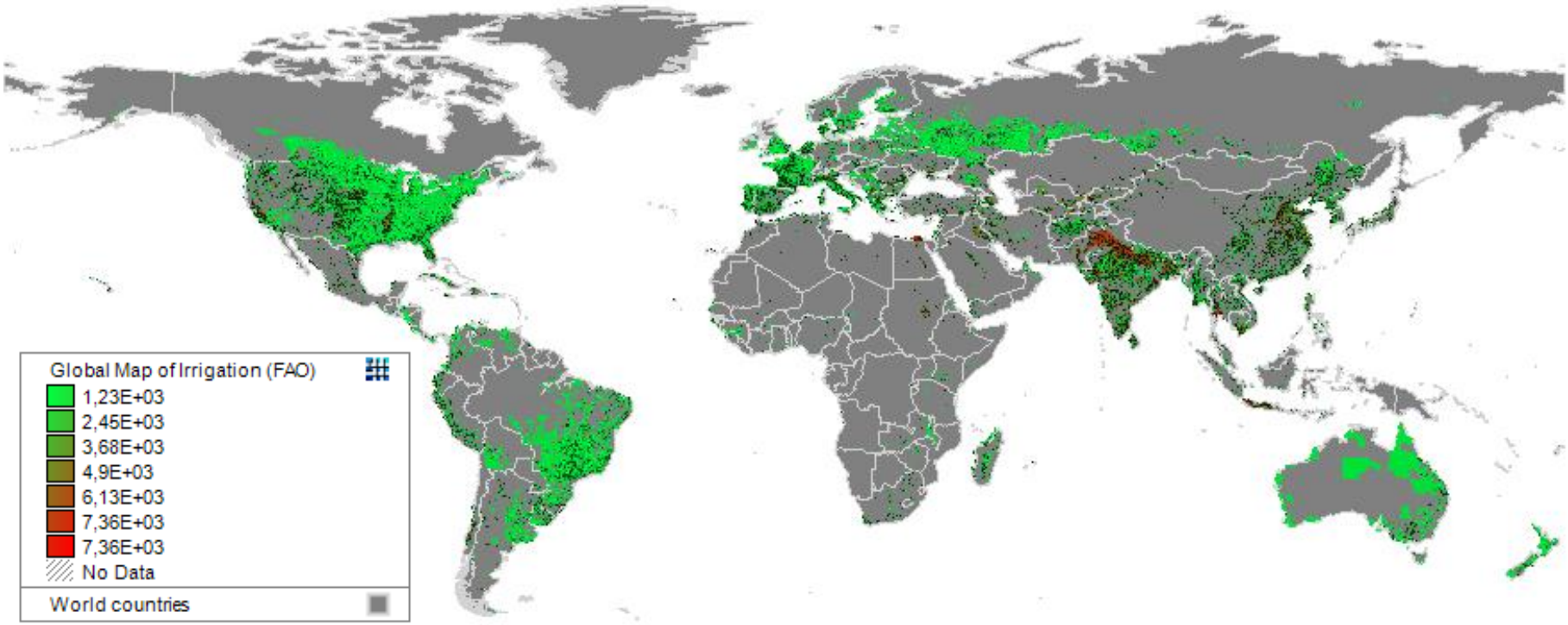
Line of Thought

1. Motivation
   - Potential Benefits and Perils of Irrigation
   - Irrigation plays a key role for key problems
2. State of the art and research need
   - Research need
3. Some Basics
   - Irrigation Techniques
   - Water balances and salinity
4. Towards adaptation and sustainable improvement
   - Indicators for Hydrological Efficiency and Health
   - An integrated approach

Line of thought

The global distribution of irrigation



Some notes on the distribution

- $\uparrow$ United States, Brazil, India and Europe (France, Spain, Italy, Greece, Cyprus)
- $\downarrow$ Afrika with the exception of Egypt, Lybia.
- $\rightarrow$ Diversions in Russia, Salinization problems in Australia.

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Irrigation in the last 50 years has rarely been sustainable.

- Cases where irrigation systems collapsed (or will collapse): Hula, Mesopotamia, Mesaoria, Dizi.
- Cases where irrigation was developped and then abandonned: Israel.
- Space for innovation and intelligent design: Challenge Africa.

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Irrigation water demand is challenged by other uses.

- Irrigation accounts for 50-85 % of water consumption in regions of water scarcity.
- Irrigation, crop yield per m^3 water used are key factors for sufficient food production.
- Productivity per m^3 is low in terms of economic yield.
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- To learn from the problems of the past.
- Improvement and sustainability.
- A simple, adaptive, system-oriented approach.

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How does irrigation work?

Flood irrigation

- The oldest and still most common technique.
- Several types: flood, surge, furrow.
- Labor intensive, no external material, $>$ 50 % lost

Spray irrigation

- Sprinkler, no ponding.
- Losses to the atmosphere (drift, evaporation)
- Improved systems (pending pipes), material-intensive.

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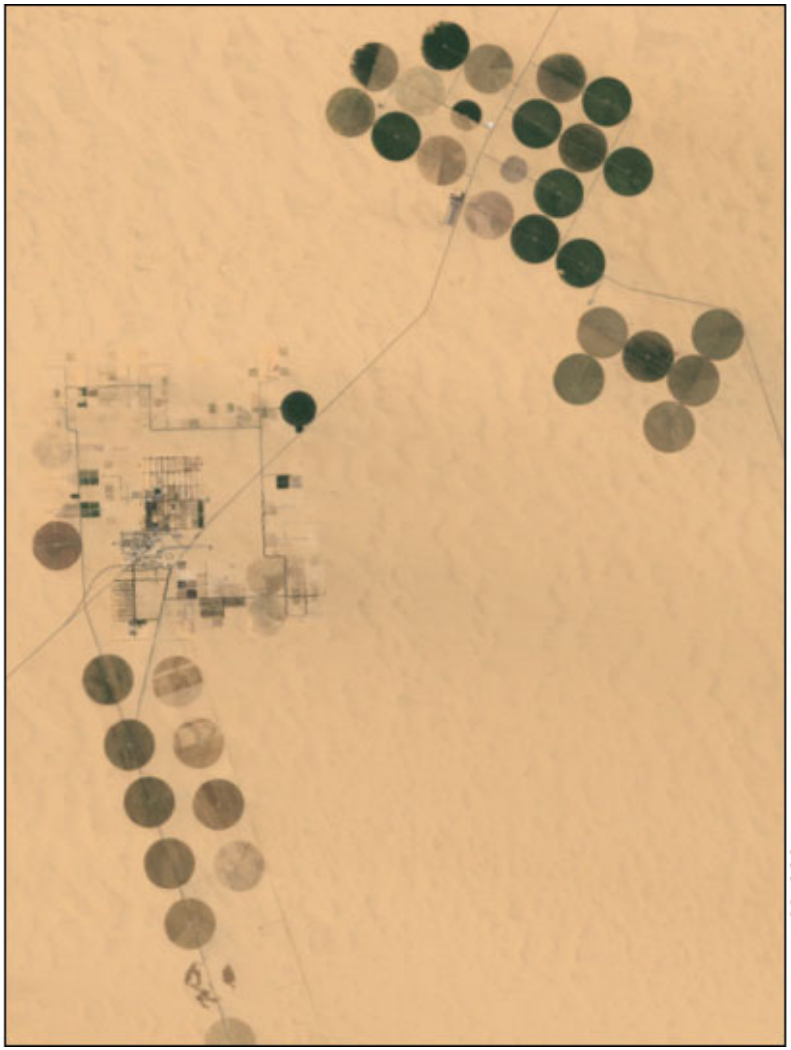
Example of flood irrigation

Example of furrow irrigation

Example of Centre-pivot (Spray) irrigation

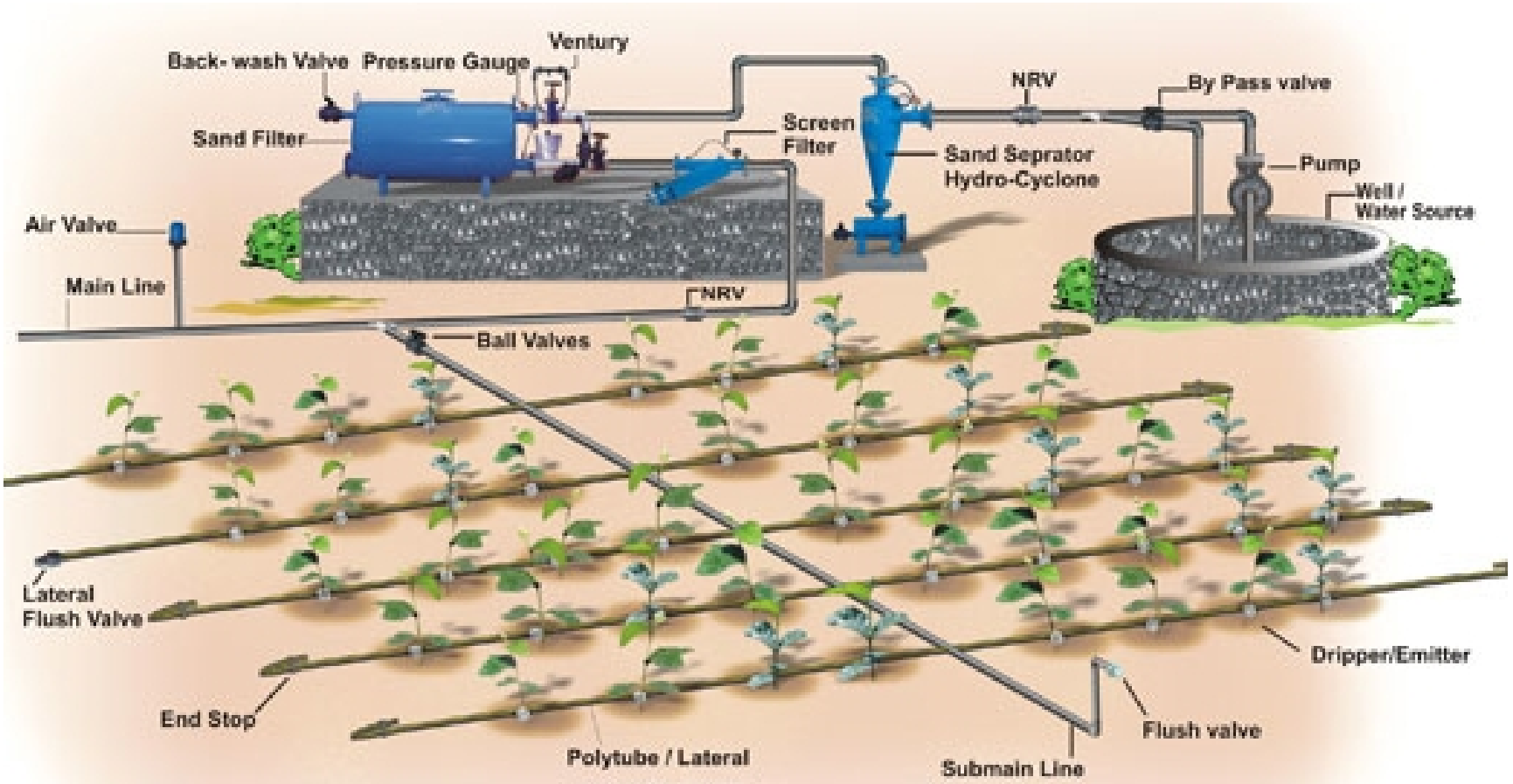


Improving irrigation technically.

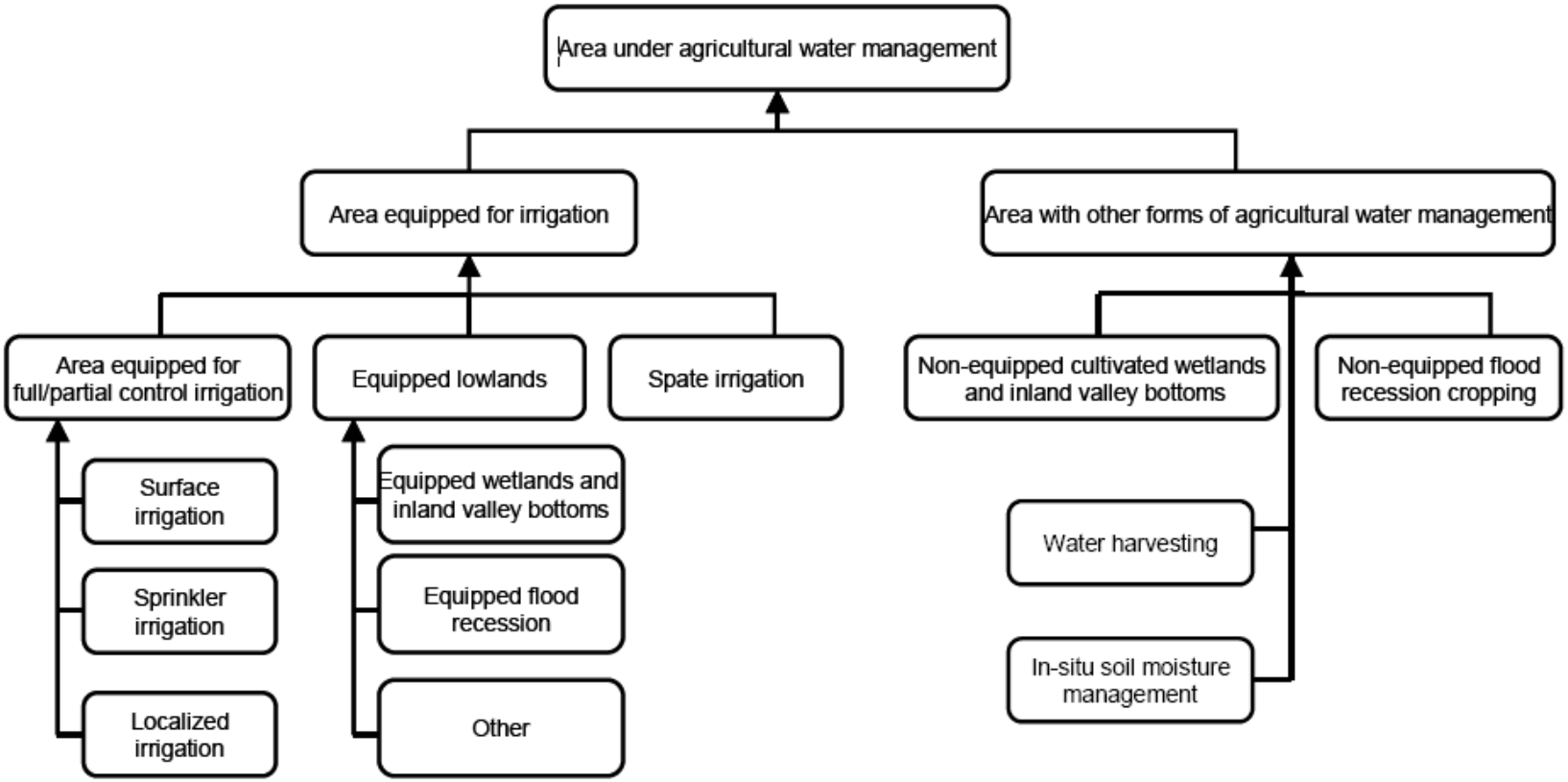
Drip irrigation

- Water is conveyed in pipes and drips.
- Losses are minimized.
- Requires technical skills and material & investments.

General Scheme of Drip Irrigation



A broader context of WM



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Internal and external sustainability criteria

Corollary

Irrigation needs to sustainable in terms of water supply, soil & plant health and socio-economic development.

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An irrigation scheme comprises the water source, the soil assembly, the productive ecosystem and the society.

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A proposed scientific framework

Baseline

- There are internal and external criteria for adapted and sustainable irrigation.
- External criteria concern the sustainability of water use.
- Internal criteria concern the viability and efficiency of irrigation.

- Outlook
  - Ecohydrological impact assessment.
  - Towards adaptation and self-regulation.

Some interesting articles I


Achtnich, R. (1980)
Bewässerungswirtschaft.
Verlag Eugen Ulmer.