Reallocating water away from irrigated agriculture: challenges and implications for policy

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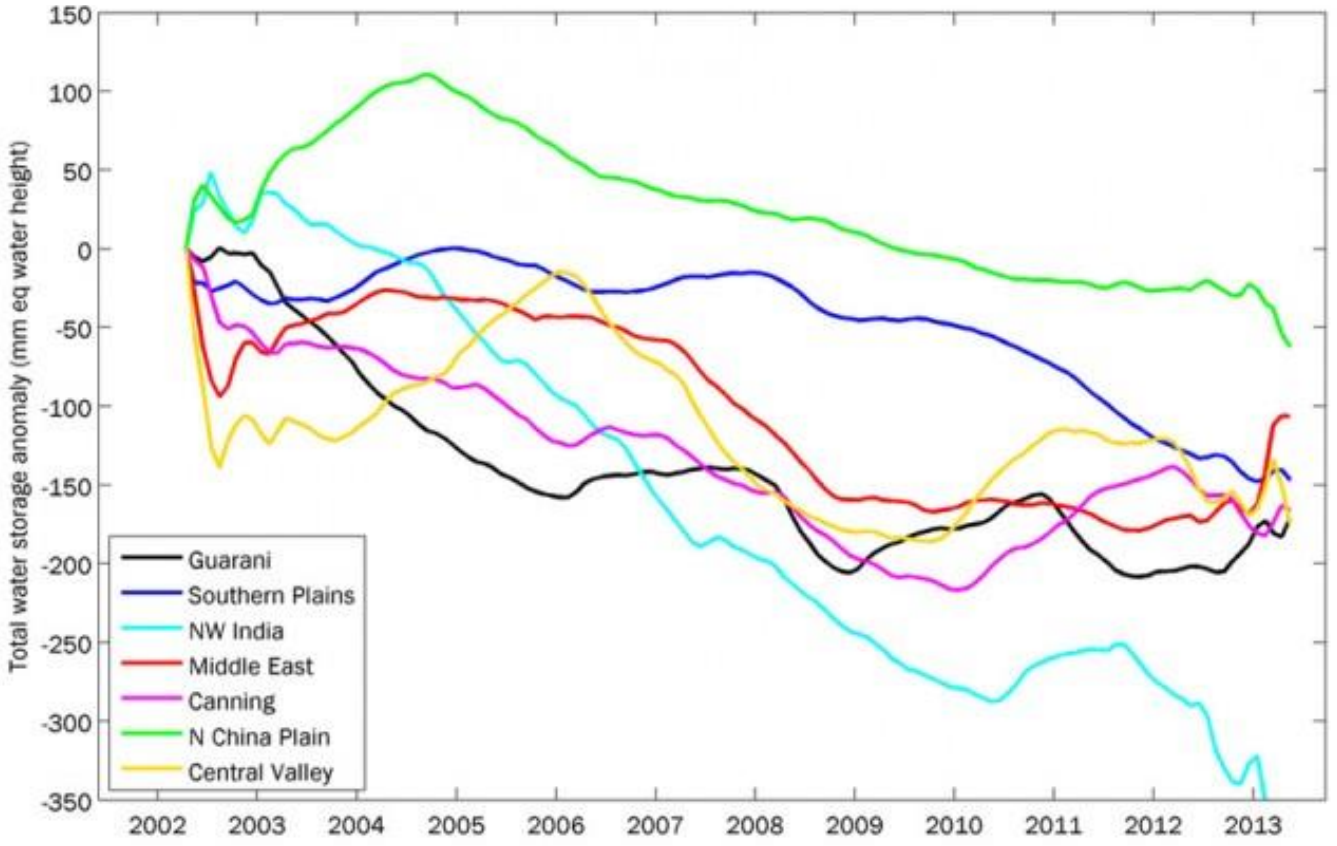
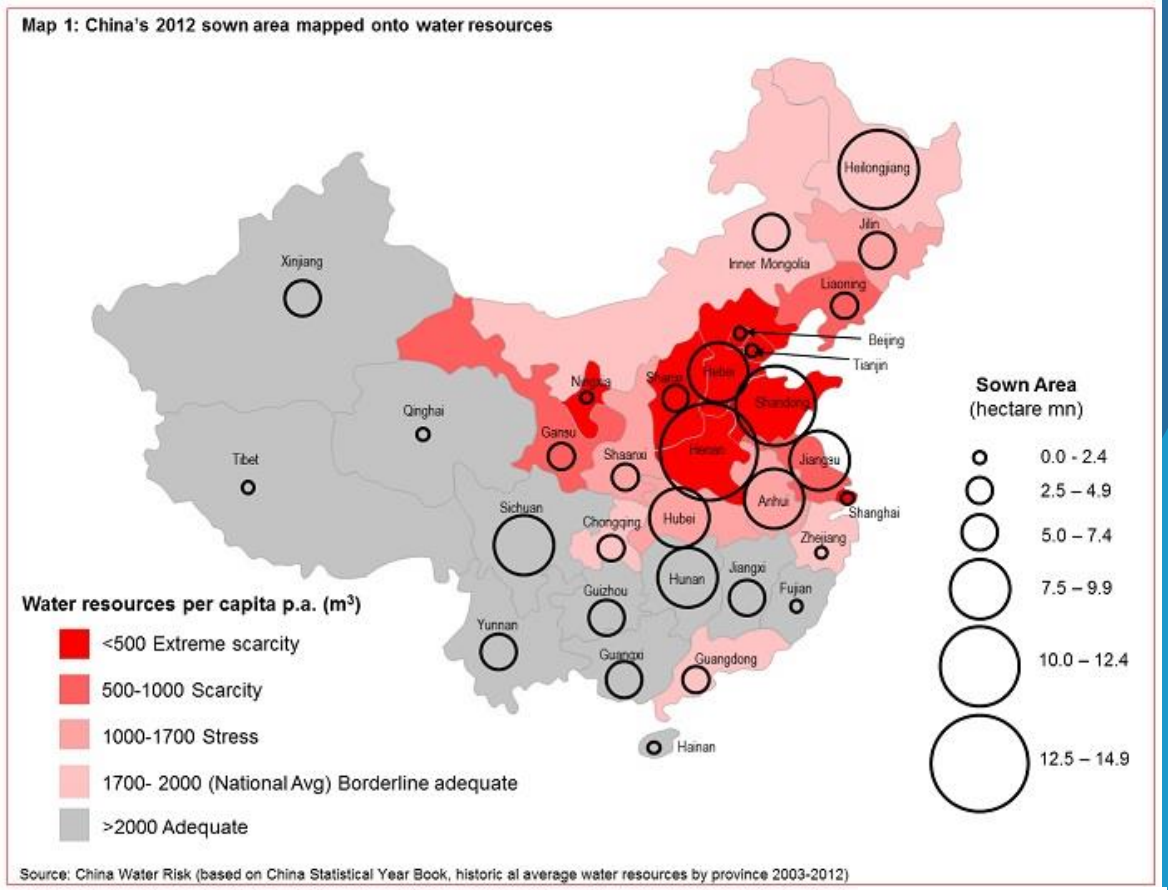
Reallocation and reducing consumption needed

Decline in storage in major global aquifers



Shah, 2011

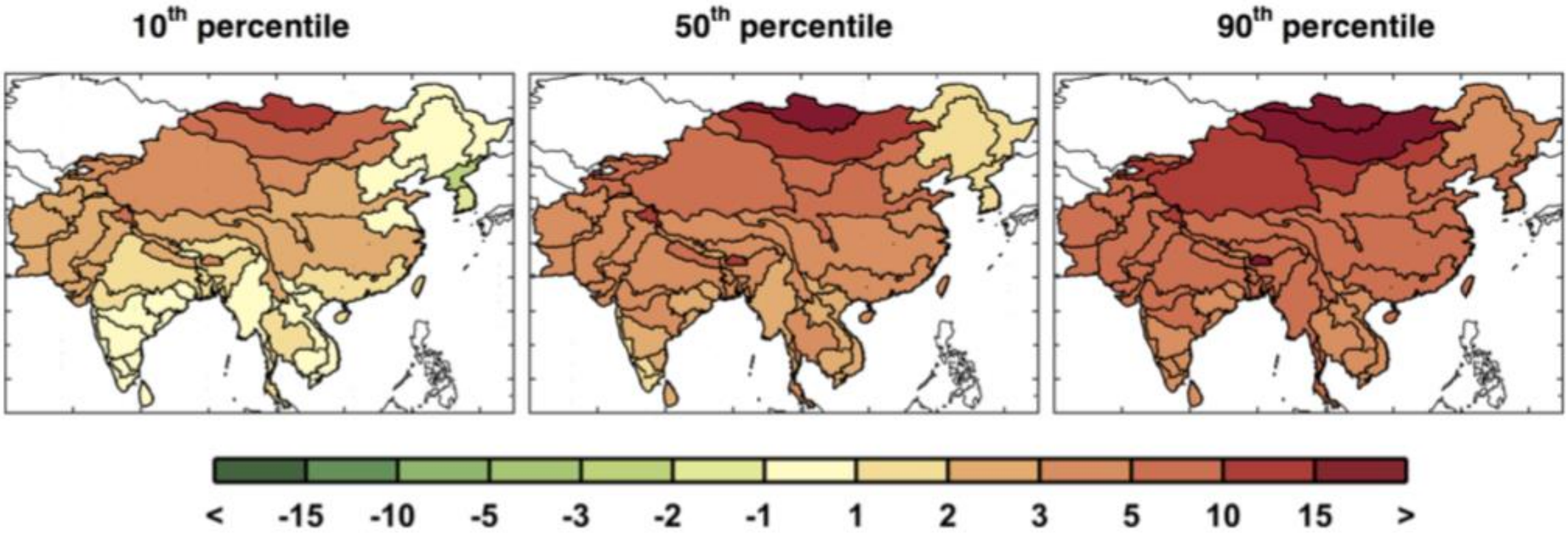
Water scarcity on the North China Plain



Sun et al, 2014

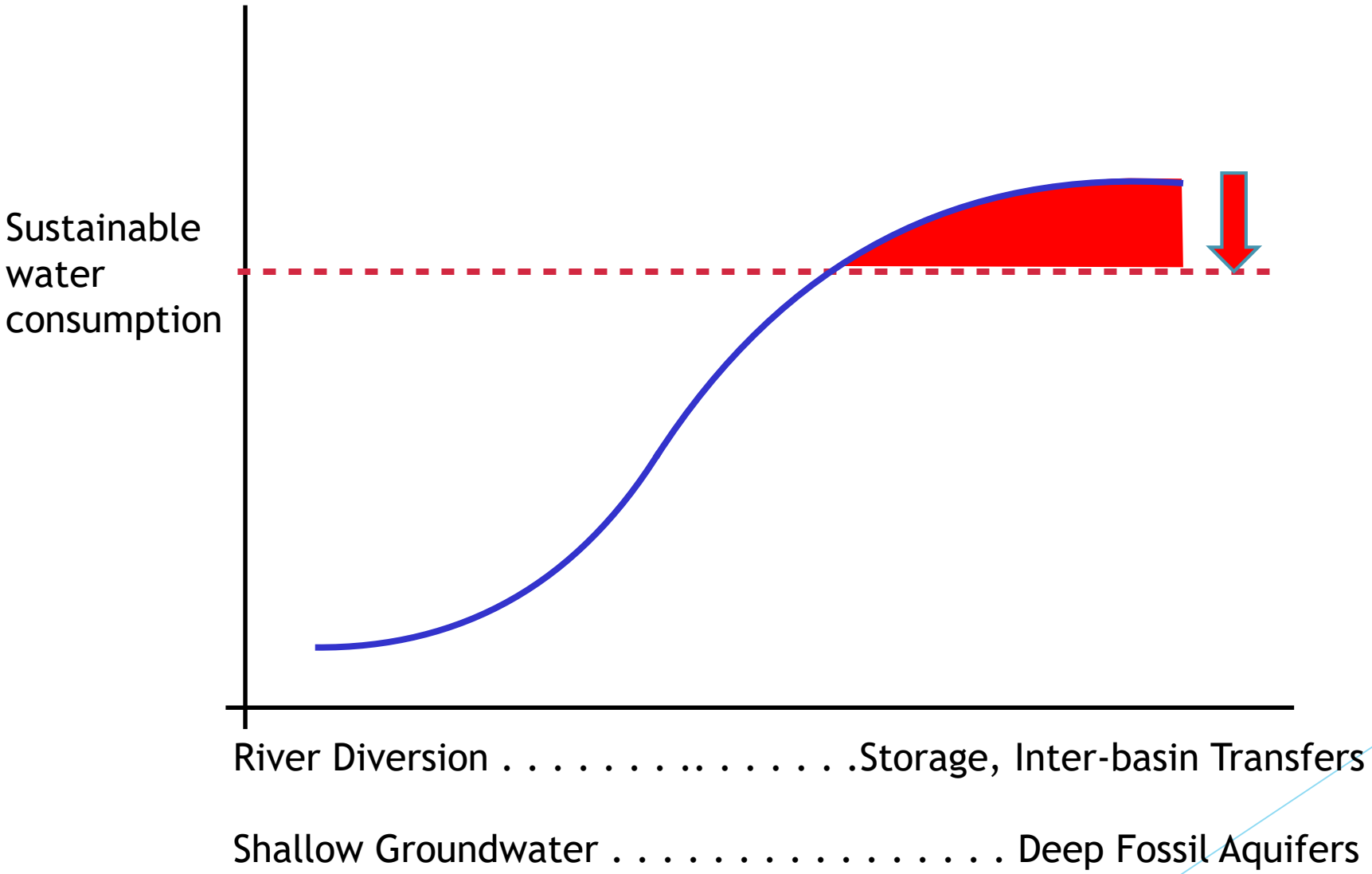
….in parallel with increasing demand

Irrigation requirement (%) showing changes in decadal average from the baseline to the future scenarios averaged over 2041–2050

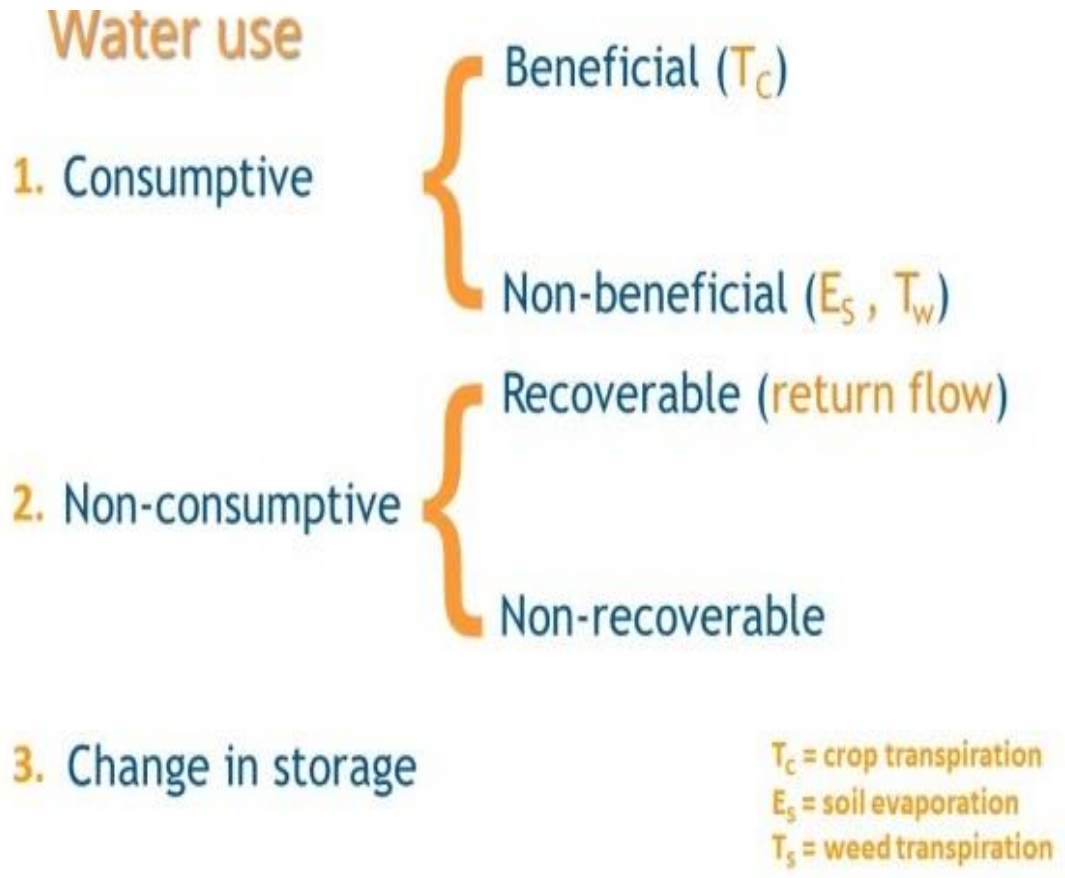


Fant et al, 2016

Water resource development pathways



Hydrological fundamentals



Consumptive use

(i) beneficial transpiration by farm crops, support to the environment;
(ii) non-beneficial transpiration by weeds and non-beneficial evaporation from foliage, soil, storages, and canals.

Non-consumptive use

(i) Recoverable return flows to aquifers and surface water systems via drains and streams;
(ii) Non-recoverable return flows to sinks & non-accessible aquifers.

Water saving:

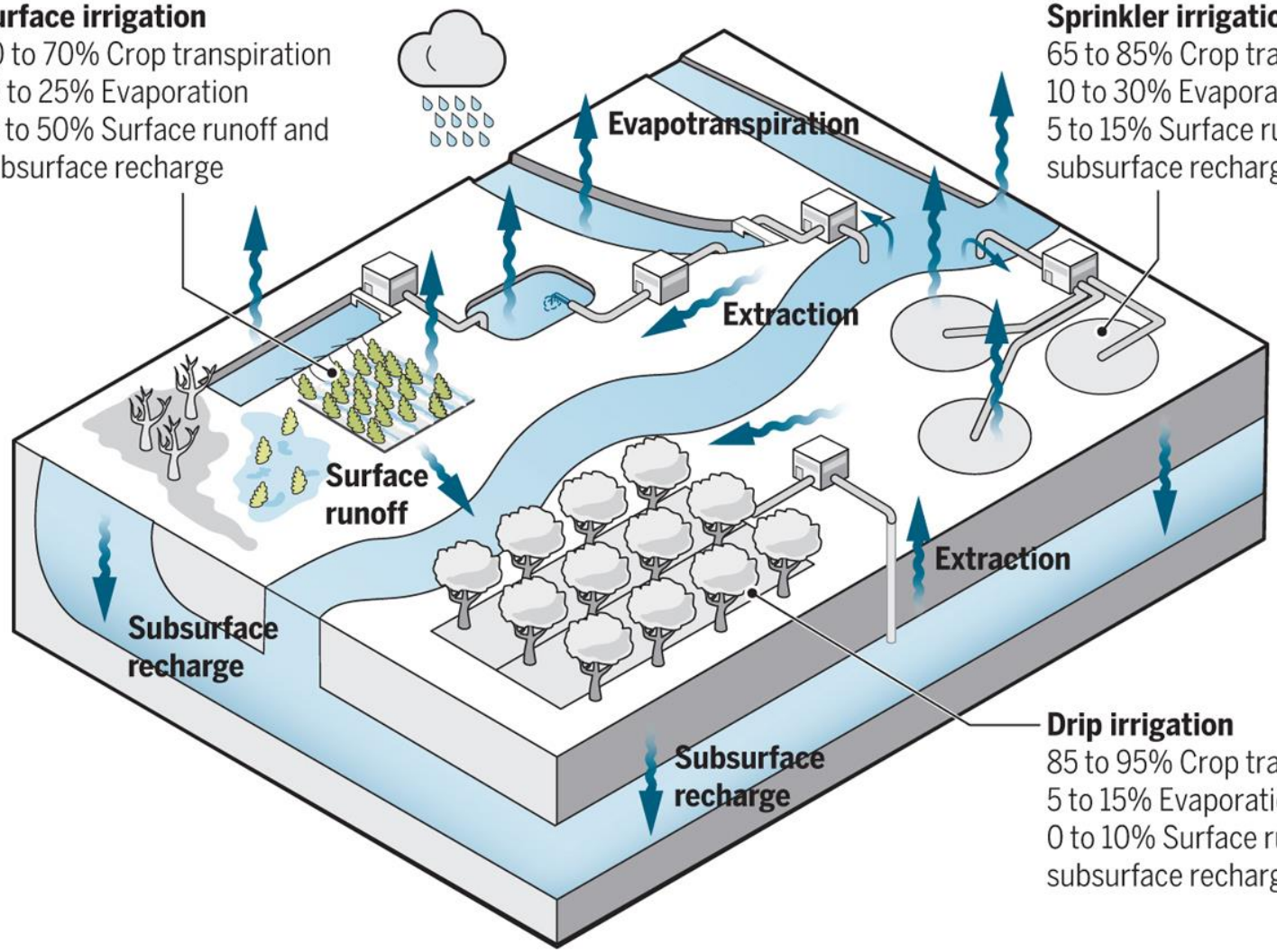
water that would otherwise be no longer available for use in the river basin

Accounting for water

The paradox of irrigation efficiency (surface, sprinkler, and drip) and the water inflows and outflows can be seen in a watershed example. Ranges of crop transpiration, evaporation, runoff, and recharge are authors' judgment of possible values. These values depend on crop and soil types, weather, and other factors.

Surface irrigation
40 to 70% Crop transpiration
10 to 25% Evaporation
15 to 50% Surface runoff and subsurface recharge

Sprinkler irrigation
65 to 85% Crop transpiration
10 to 30% Evaporation
5 to 15% Surface runoff and subsurface recharge



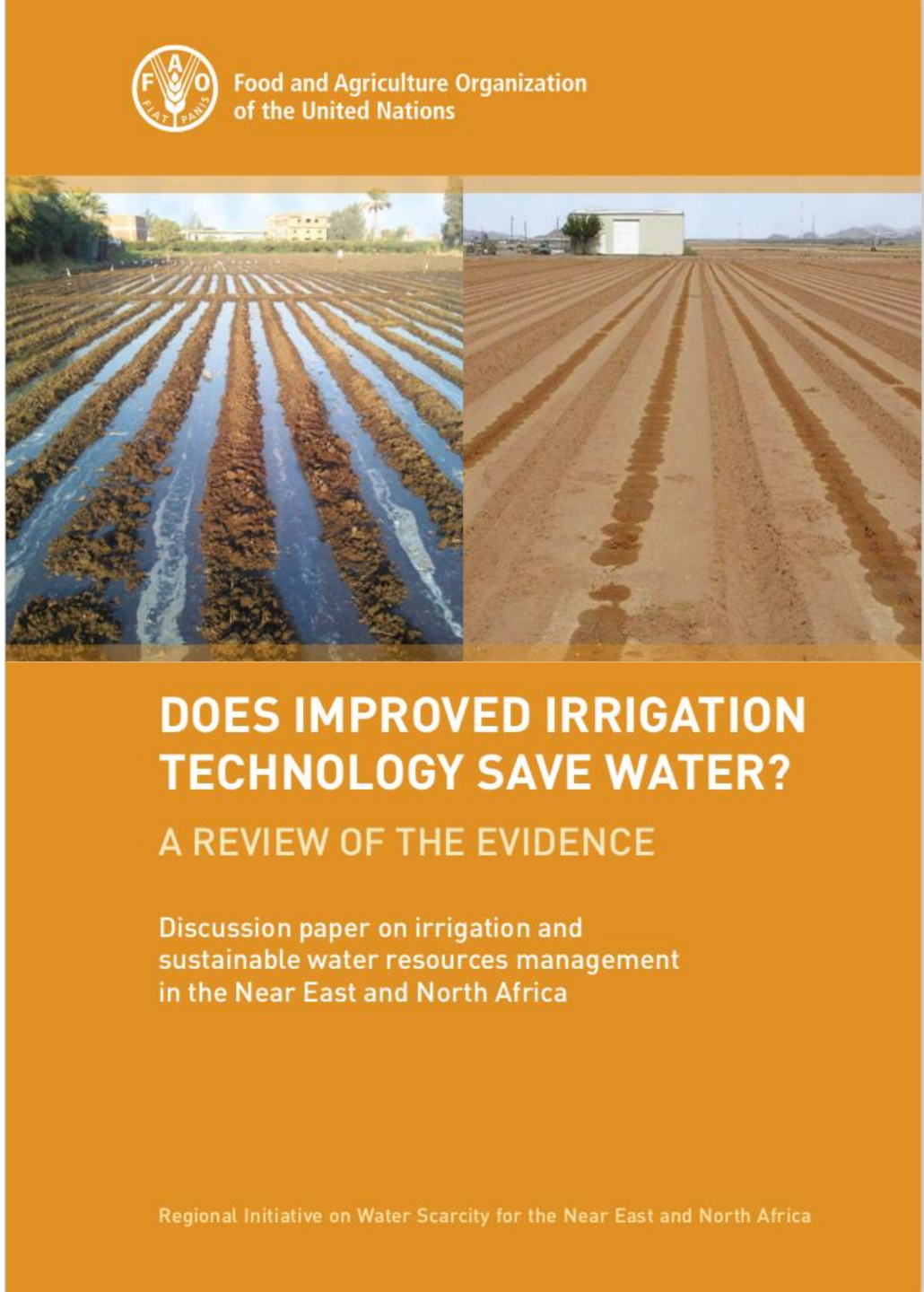
Drip irrigation
85 to 95% Crop transpiration
5 to 15% Evaporation
0 to 10% Surface runoff and subsurface recharge

R. Q. Grafton et al. Science 2018;361:748-750

Modernizing irrigation: impacts

- Can reduce labour costs, pumping costs and the need for chemical inputs.
- Can increase water productivity – especially where performance is low, however the scope is limited for field crops.
- **Demand for water will increase**. Water becomes more valuable to the farmer when local beneficial consumption is maximised.
- **Water consumption will increase** because farmers will (logically) expand irrigated area, increase cropping density and/or substitute for more valuable and water intensive crops.

Efforts to improve irrigation efficiency will increase local consumption to the detriment of return flows and downstream users.

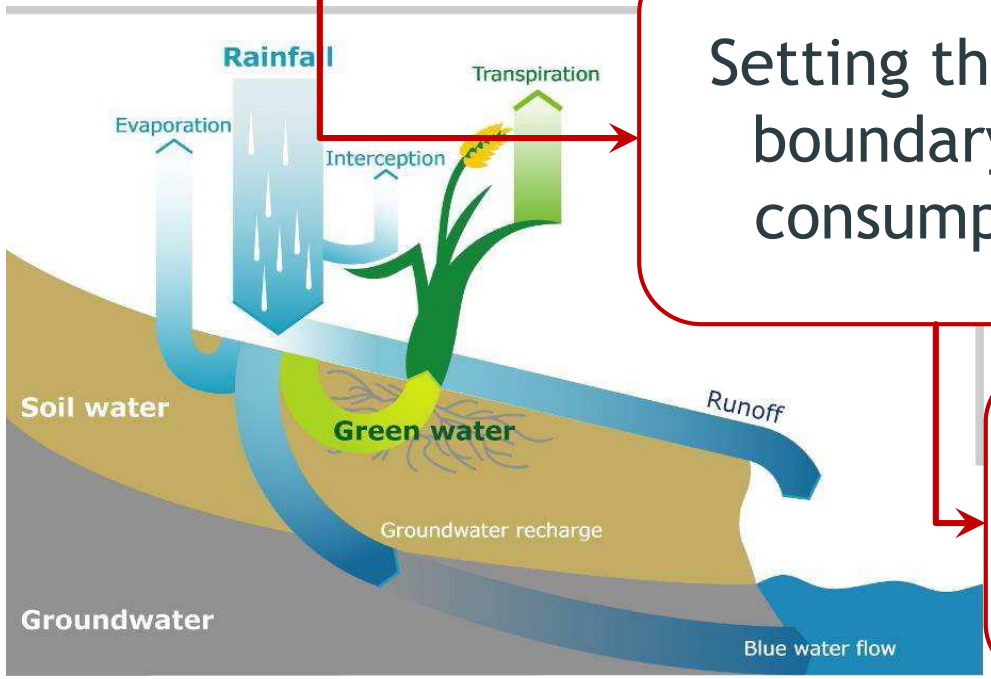


How do we ensure reallocation from agriculture is managed rather than chaotic?

...at basin/national/local level

1. Water Accounting, Auditing & Monitoring

(Sources, users, consumption, re-use, ...)



2. Setting the safe boundary for consumption

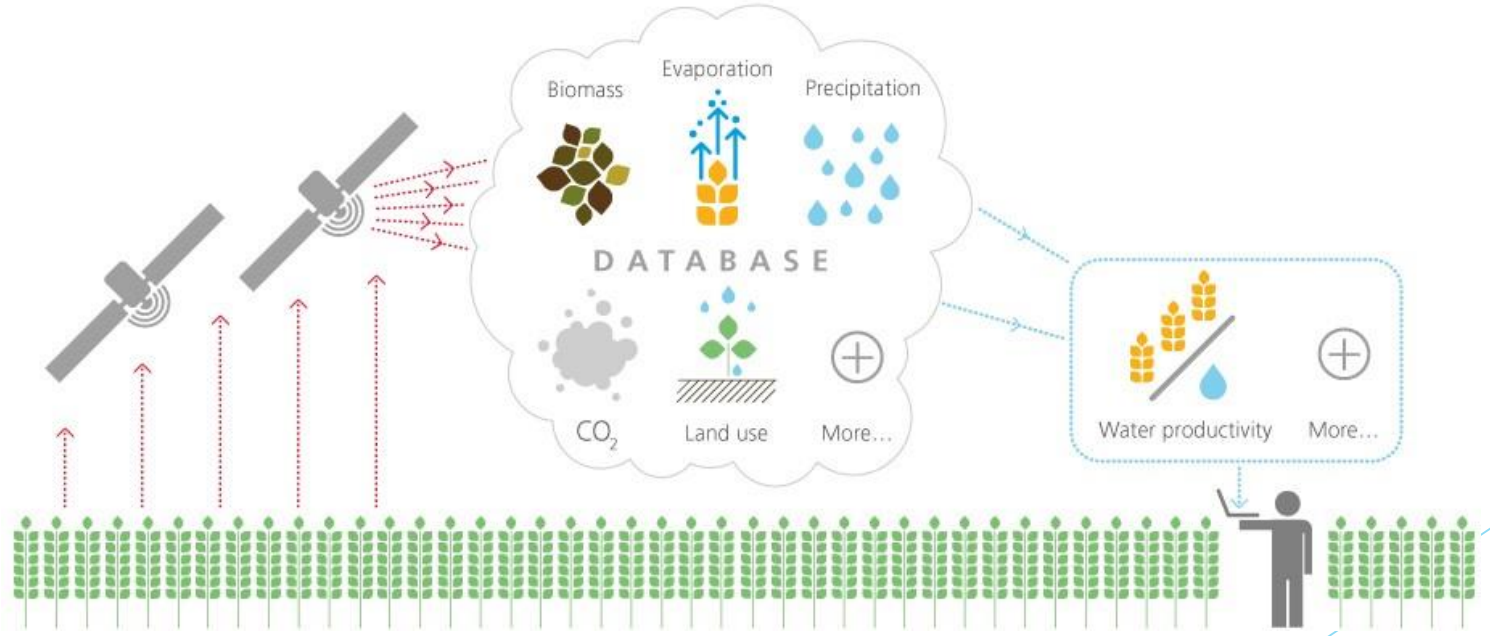
(Water allocation, political economy & strategic planning)

3. Adopt all measures to maximize the benefit of each drop of allocated water

(Modernization, crop shifts, new seeds, markets

Easier said than done….

1. Common myths are firmly entrenched (*but we know why*)
2. Water accounting is hard (*but getting easier*)
3. Water allocation and enforcing consumption limits is even harder (*but can be phased in*)



To conclude

1. **Water consumption is unsustainable** in many countries and reallocating as well as reducing consumption will be required.

2. Overcoming misunderstandings about the **paradox of modernizing irrigation** towards high efficiency is fundamental to the achievement of SDG 6.

3. Modernizing irrigation systems does have an important role in **increasing land and water productivity** (particularly in low performing systems).

4. Water accounting, water auditing and quotas on consumption are **prerequisites** for irrigation modernization to play a role in water saving.