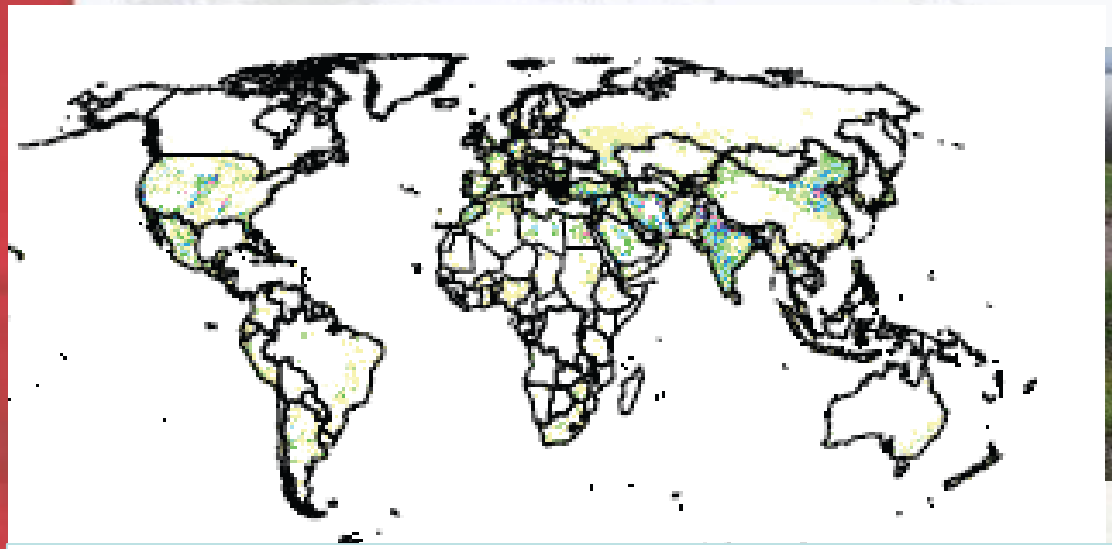
Spate irrigation and groundwater recharge in arid and semi-arid areas (case of Balochistan)



GLOBAL IMPORTANCE OF GROUNDWATER

43% of irrigation in the world from groundwater
36% of potable water
24% of direct industrial water supply

The trend is that this will increase:
-Breakthroughs in pumping technology (solar pumping for instance)
-Supermarket revolution – demands uniform produce produced with groundwater
-Climate change – more reliance on the groundwater buffer

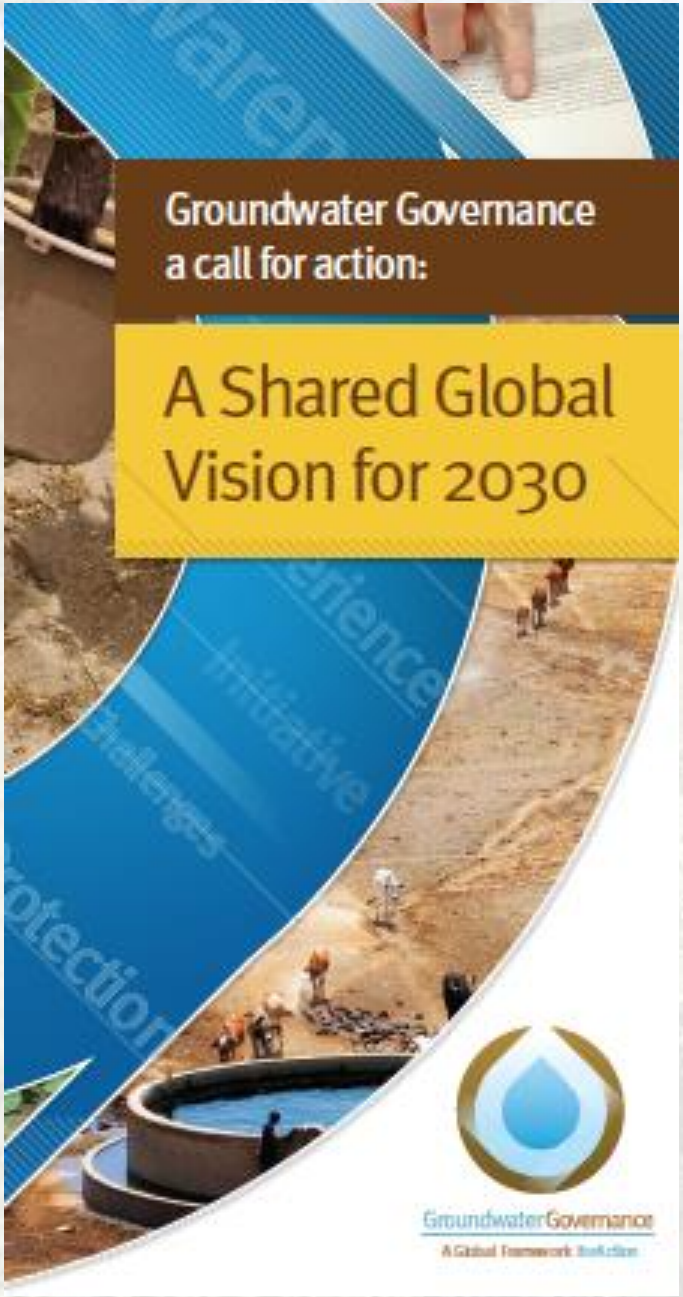
Yet the groundwater miracle is reaching its limits

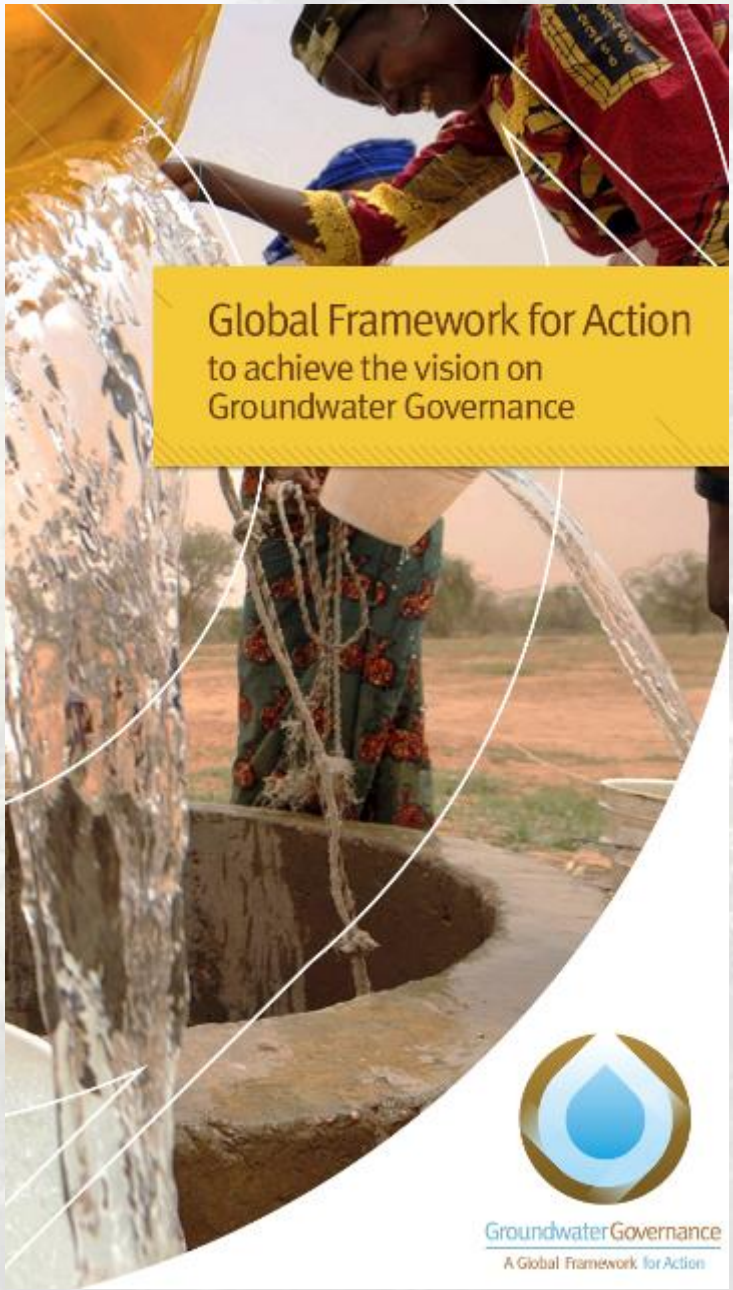
The global recharge-discharge deficit is estimated at 20%

- Falling groundwater tables
- Groundwater pollution
- Salinization
- Compaction of aquifers and land subsidence
- Distorted ecosystems/ microclimate
- Subsurface space mismangement
- Conflicts and areas being abandoned

Balochistan no exception – in fact one of the ‘worst cases’

- Concerns since 1980’s
- Growing population, growing agriculture, growing cities
- Groundwater collapses after periods of droughts
- In spite of studies and debates never systematic effective action
- Groundwater overuse is Balochistan single worst enemy


Groundwater Governance
a call for action:
A Shared Global
Vision for 2030
GroundwaterGovernance


Global Framework for Action
to achieve the vision on
Groundwater Governance
GroundwaterGovernance
A Global Framework for Action

Groundwater Governance Vision - Principles

① Public guardianship and collective responsibility

② Effective management and stakeholder engagement at local level

③ Adequate and shared knowledge

④ Manage the linkages with land management and pricing

> Several successful examples of local management

Joint mapping and farmer water schools in AP, India:

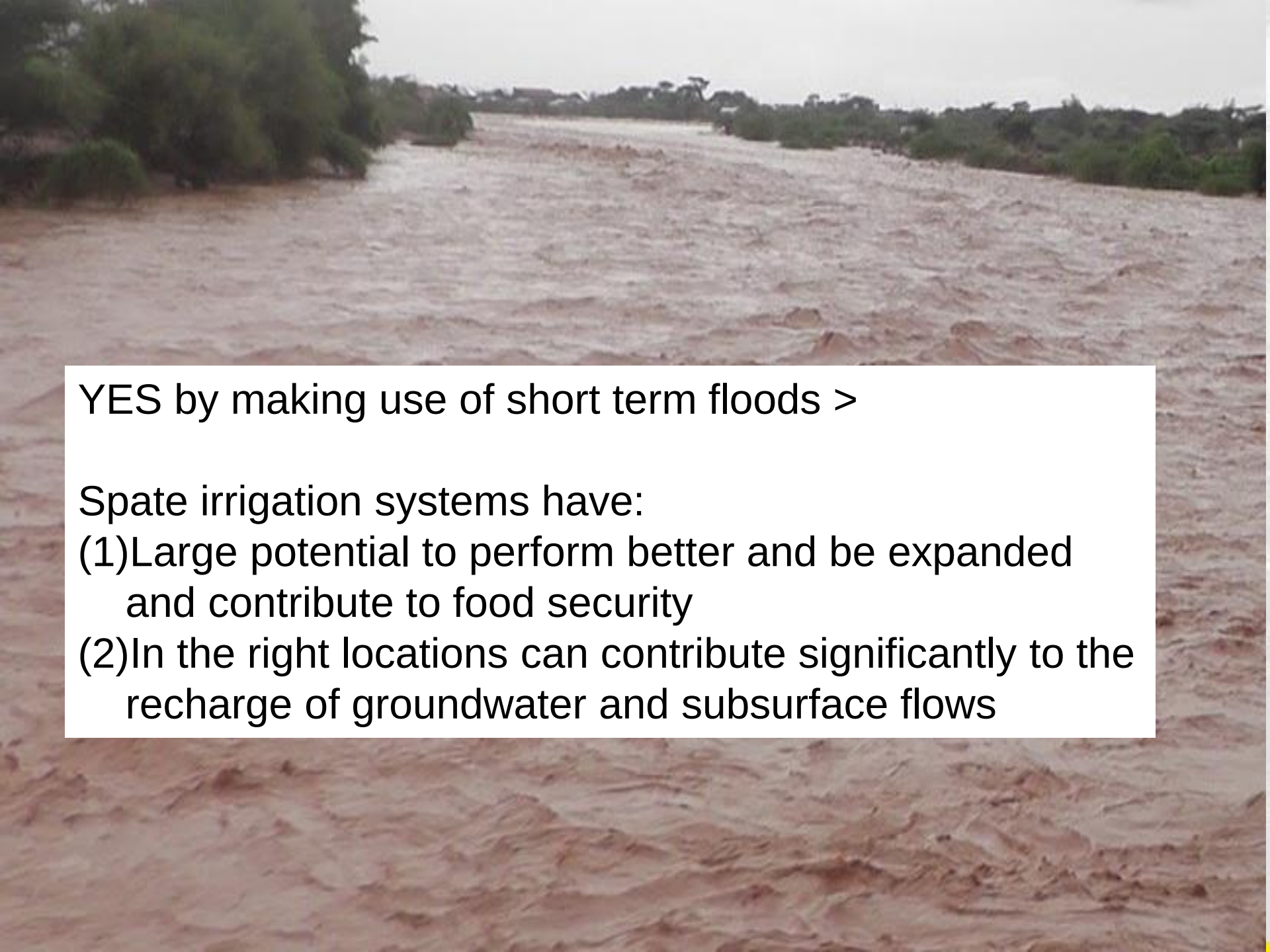
Reduced overuse in all critical areas

Intense landscape treatment, Tigray - Ethiopia

Using a range of techniques, applied in a short time frame (5 years):
changed the micro-climate, controlled erosion and gullying
and helped increase shallow groundwater levels

Be clever: systematically using roads for groundwater recharge

Can spate irrigation contribute to groundwater management in Balochistan



YES by making use of short term floods >

Spate irrigation systems have:

(1)Large potential to perform better and be expanded and contribute to food security

(2)In the right locations can contribute significantly to the recharge of groundwater and subsurface flows

Extent and potential for spate irrigation

Table 1. Potential area of Spate irrigation in Pakistan

Province	Major Torrents or River Basins	Potential Area (mha)	Actual Spate Area Cultivated in 1999-00 (mha)
Federal	-	0.271	-
NWFP	25	0.862	0.109
Punjab	17	0.571	0.048
Sindh	-	0.551	0.011
Balochistan	17	4.680	0.185
Pakistan	-	6.935	0.343

Source: NESPAK 1998; Agriculture Census of Pakistan, Census Organization of Pakistan, 2000[3)]

This base year was a relatively dry year – the area under cultivation is normally higher

Improving spate irrigation: big opportunities – yields in Pakistan << 50% of elsewhere

- Rationalized water distribution
- Better moisture conservation
- Introduce best varieties
- Introduce agroforestry and better storage
- Special value chains
- Design for recharge!!

TWO STRATEGIES

1. OPTIMIZING RECHARGE FROM SPATE IRRIGATION
2. DEVELOPING GROUNDWATER RESOURCES IN DRY RIVER BEDS
   - SAND DAMS AND SUBSURFACE DAMS

How to optimize recharge from spate flows?

- Recharge mainly from main riverbed – far less from main wadi flood channels or fields
- Recharge most effective from gravelly sections of the river bed
- Recharge most effective, if spate flows slow
- Recharge from flat sections of the river bed
- Recharge from water ponded at bunds and weirs
- Recharge from (subsurface) base flow
- Spread spate over large area to optimize recharge

What to do to optimize recharge from spate flows?

- Keep ‘rough’ gravel bed intact with floods flow (more roughness bed)– be careful not to remove too much gravel
- Consider low weirs/ bed stabilizers to slow down the flow
- Avoid excessive siltation in main recharge section of the river bed
- Do not block the subsurface flow through cut-off weirs or bed stabilizers!!

Not a good idea:

Wadi Siham spate irrigation system Yemen completely blocked
subsurface flow and caused
a dramatic drop in water
levels in downstream wells

Good idea:

Farmers in this downstream area argued for a change in the traditional water distribution – with more chance of a flood going downstream

It was no so much the irrigation from the spate they were looking – instead they were interested in having their wells recharged

Good idea:

LOW RECHARGE WEIR
TO SLOW DOWN AND SPREAD FLOODS

Developing groundwater resources in dry river beds:

- Sand dams and subsurface dams

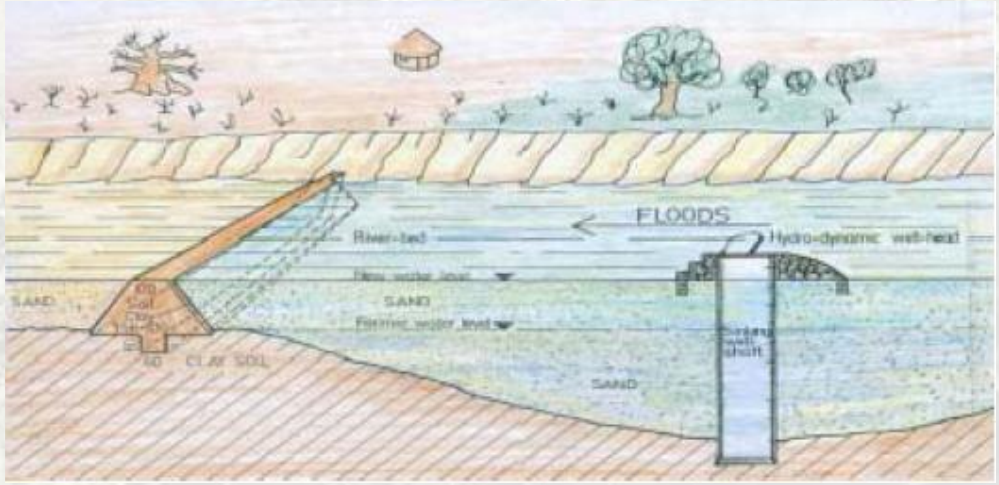
SAND DAMS – ACCUMULATE SAND BEHIND THE SMALL DAM BODIES – CREATING A STORAGE IN THE SAND LAYER – WITH LITTLE EVAPOTRANSPIRATION LOSS

(NON VENTED ROAD CROSSING DIONG

Subsurface dams: created underground barriers in dry river

A subsurface dam will:

- Block underground flow of water
- Raise water level in the sand and gravel to for instance 30 cm below surface of riverbed



Agenda for action

(1) Regulate groundwater use by activating community engagement in groundwater management

(2) Use all best techniques to systematically recharge (shallow) groundwater including systematic development of spate irrigation