



United Nations
Educational, Scientific and
Cultural Organization



International
Hydrological
Programme



5th World Water Forum, Istanbul Groundwater Side Event, 21st March 2009

Transboundary Aquifers & Global Changes

Shammy Puri

Secretary General of the International Association of Hydrogeologists

Istanbul March 2009

Global perspectives; Aquifers, ecosystems & sustainability



Istanbul March 2009

What it's about

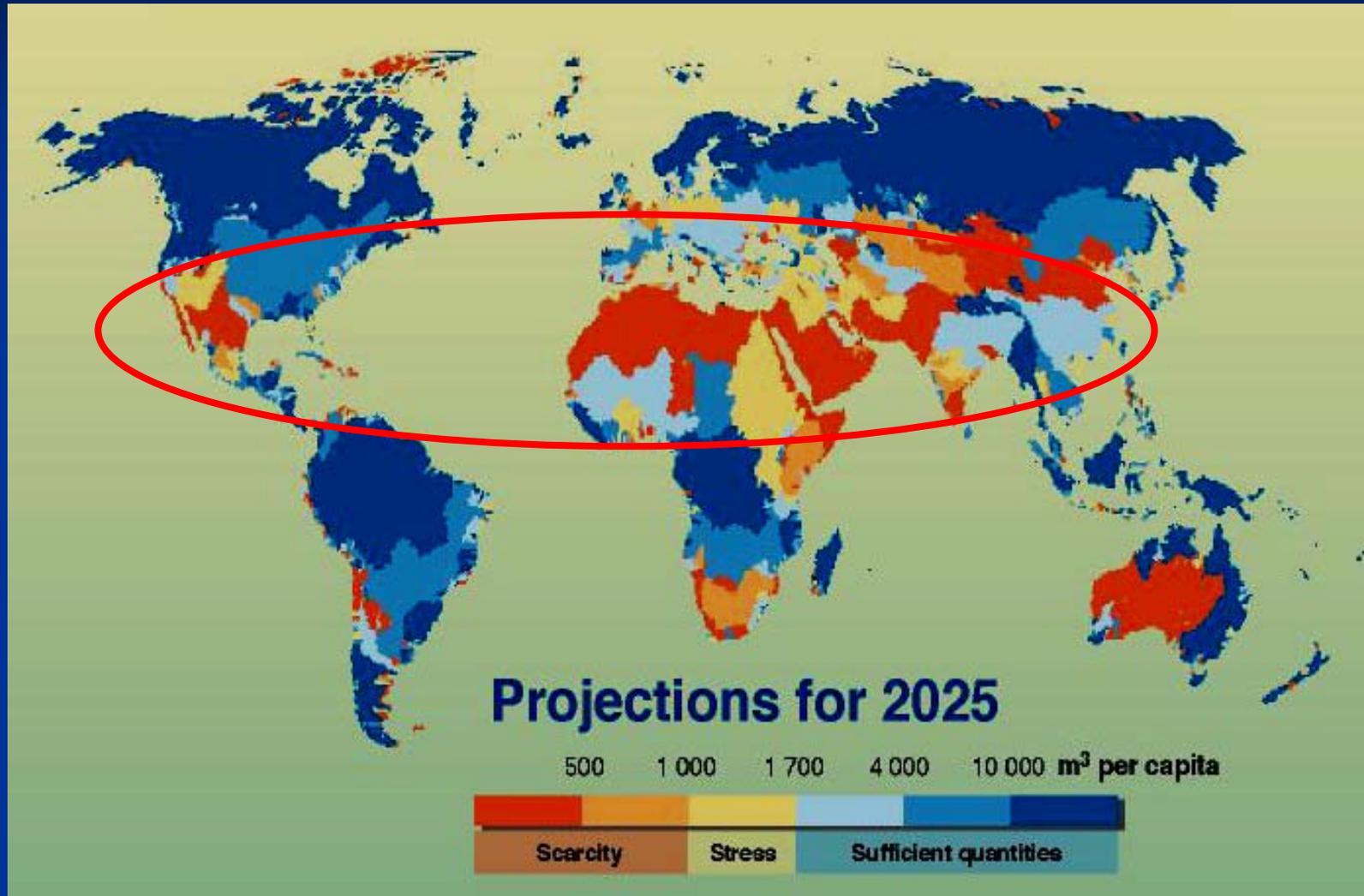
- Apart from climate change, watershed's (aquifers) are being subjected to *"change"*
- This change is *global* and it is proceeding at an unprecedented pace, & in geographic scope affecting river basins & aquifers
- EcoSystem degradation involving loss of ecological capital is intense
- The global 'loss of aquifer storage' combined with the risks to *aquifer functions* & to ecosystems dependent on them..... needs urgent quantification
- Why? Because economic losses, translated through environmental and livelihood losses, will be difficult to reverse (= *decline in resilience of ecosystems*)
- **But**, we are lacking sound methodologies for taking this from science to policy, and so far the IWRM paradigm may have failed to address this, *specifically for aquifers & their dependent ecosystems*
- ...and so an *"EcoSystem services"* approach may be more effective

Changes... what are they?

Some examples related to 'globalisation'...

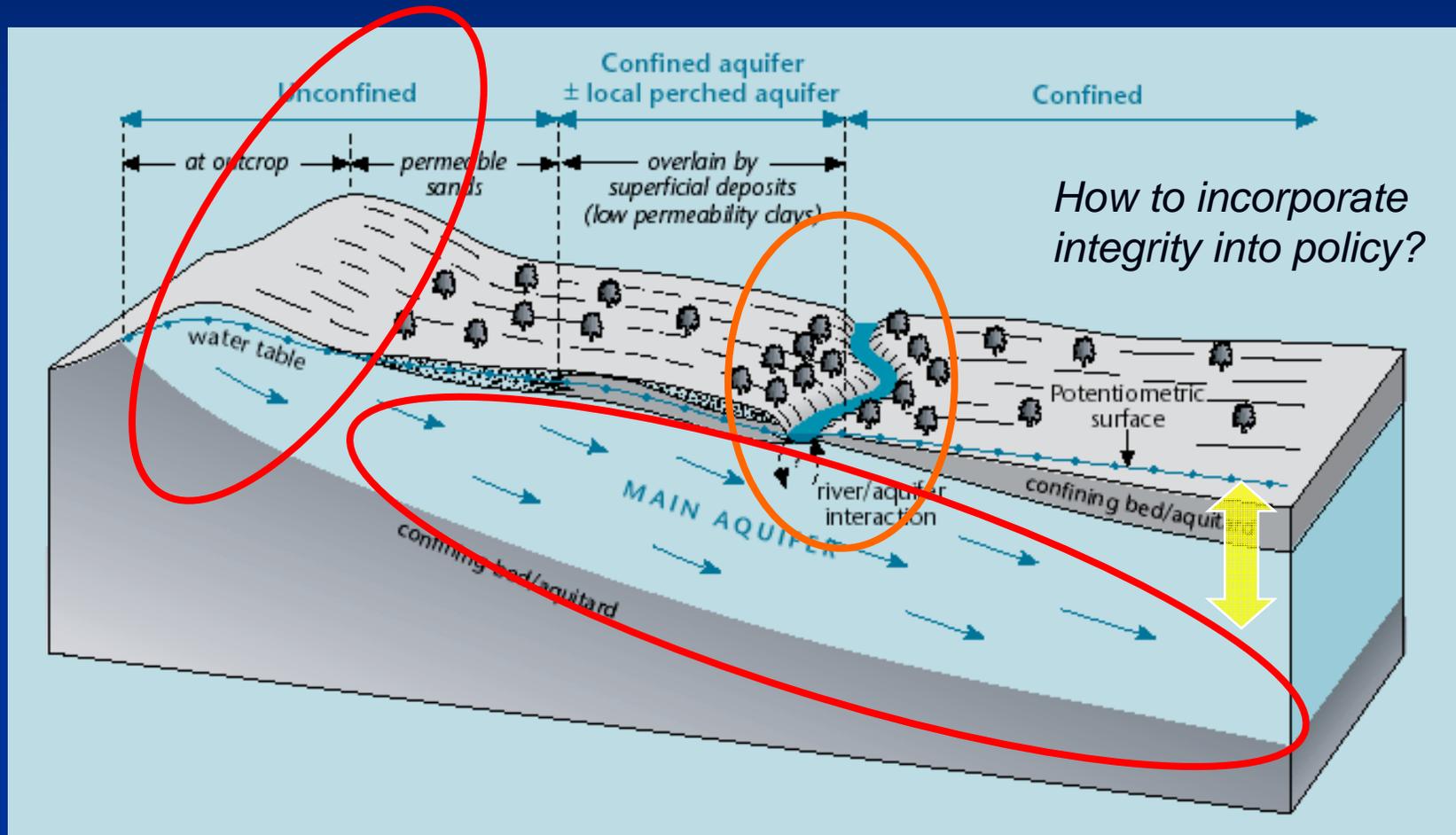
- More land was converted to cropland since 1945 than in the 18th and 19th centuries combined
- 25% of the world's coral reefs were badly degraded or destroyed in the last several decades
- 35% of mangrove area has been lost in this time
- Amount of water in reservoirs quadrupled since 1960
- Withdrawals from rivers and lakes doubled since 1960 & from aquifers considerably more...
- More people have moved from rural areas to cities in the last 20 years than in the last century...
- So, what is the prognosis??

Per capita renewable supplies



Istanbul March 2009

Aquifer functions that need urgent consideration



Integrity of the aquifer system

The 'integrity' of the aquifer system refers to

- the aquifer rock matrix, the hydrostatic conditions of the water within the matrix, the hydrochemistry of the water;

The integrity of the system is at *risk* when any of the following have been over stressed:

- the recharge process that ensures adequate replenishment,
- the discharge process that ensures baseflow to streams and coastal areas (including mangroves, lagoons),
- the hydrostatic relationship throughout the rock matrix that determines flow and the hydrochemical process that determines water quality.

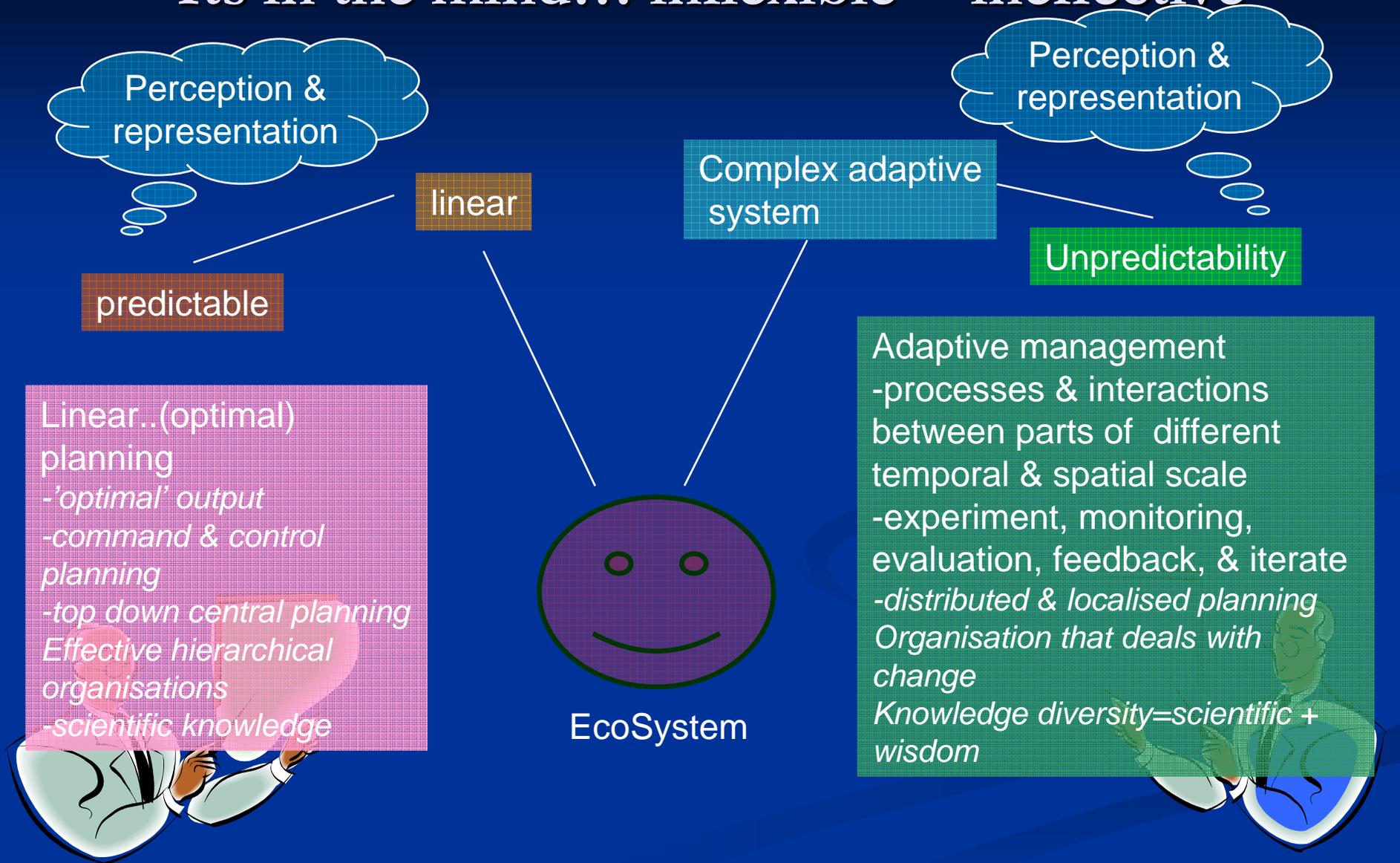
The integrity of an aquifer can be *destroyed*, if for example saline intrusion (resulting from significantly disturbed hydrostatics) invades to such an extent, that the aquifer system stops functioning and cannot effectively be rejuvenated.

We need to increasingly consider resilience of aquifers & ecosystems..

Resilience, what is it?

- Going from *Conventional* to *Adaptive* freshwater management for Human and EcoSystem compatibility
- Ecosystem resilience is
 - capacity of an ecosystem to cope with change and perturbation, such as storms, drought and pollution.
 - loss of resilience leads to more vulnerable systems, and
 - to possible ecosystem shifts to undesired states that provide fewer ecosystem goods (like fish and crops) and services (like food control and water purification).
- Such loss of resilience can be caused by, for example,
 - pollution, climate variability, loss of biodiversity or altered freshwater flows.
- With decreased resilience, clear lakes can suddenly turn into murky, oxygen-depleted pools, grasslands into shrub-deserts, and coral reefs into algae-covered rubble.
- Resilience is the capacity of a system both to withstand pressures and to rebuild and renew itself if degraded.
- Where are we trying out these approaches.....

Its in the mind... inflexible = ineffective



What could be done..?

- Taking Science to Policy, advice in plain language...
- Institutions
 - **Increased transparency and accountability of government and private-sector performance**
- Economics
 - **Elimination of subsidies** that promote excessive use of ecosystem services (and, where possible, transfer these subsidies to payments for non-marketed ecosystem services)
 - **Greater use of economic instruments and market-based approaches** in the management of ecosystem services (where enabling conditions exist):
- But, more focussed research and analysis is needed
- ARTICLE 10 of the Law of Transboundary Aquifers encapsulates these principles.....

What research is needed & why

- What are the long term implications of loss of resilience of ecosystems, eg replenish aquifer storage?
- What order of costs need to be provisioned for, to replenish the storage to, say 50% of original capacity?
- How can this increase the resilience of ecosystems to impact of climate variability?
- How can this better reinforce grant financing from agencies such as the GEF, the FFEM and others?

Thank you for your attention !!

Questions..... ??