Bridging science & policy in water management

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Water sustains life

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- Human rights to water vs. water rights. (article 25 UN declaration of human rights)
- Water as commodity threatens the poor
- Privatization policy on developed and developing: Neoliberalism.
- Soaring water prices: basic right to basic need.

Water sustains life

- Economic globalization is to blame for water crisis.
- Water regimes based on watershed management and conservation.
- Global water crises in quantity and quality is man-made disaster.
- Environmental imbalance and degradation of life –support ecosystem.

Crisis of water management

Crisis of water management

- Inadequate sustainable policies.
- Fragmented institutions
- Absence of legal system.
- Absence of political will.
- Gap between science & policy.

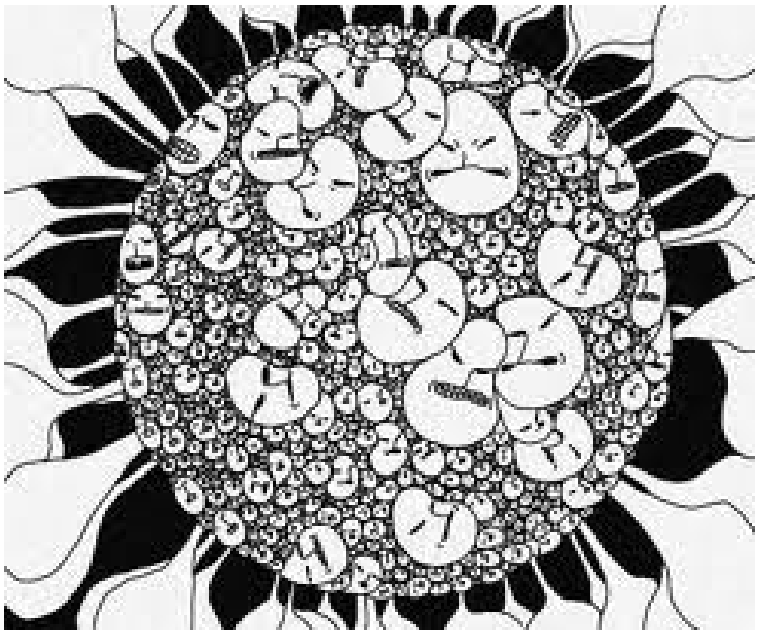
Crisis of water management

- Public water budget is constrained.
- Water investment is poorly targeted.
- Funding for pollution regulation is insufficient.
- Control over aquifer use is lacking
- Rain-shed harvest is neglected.

World population stress

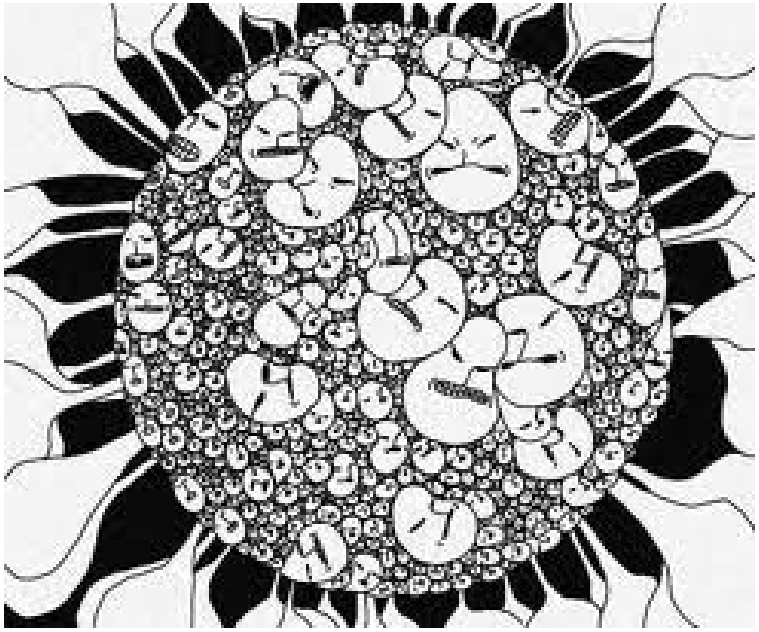
World population stress →

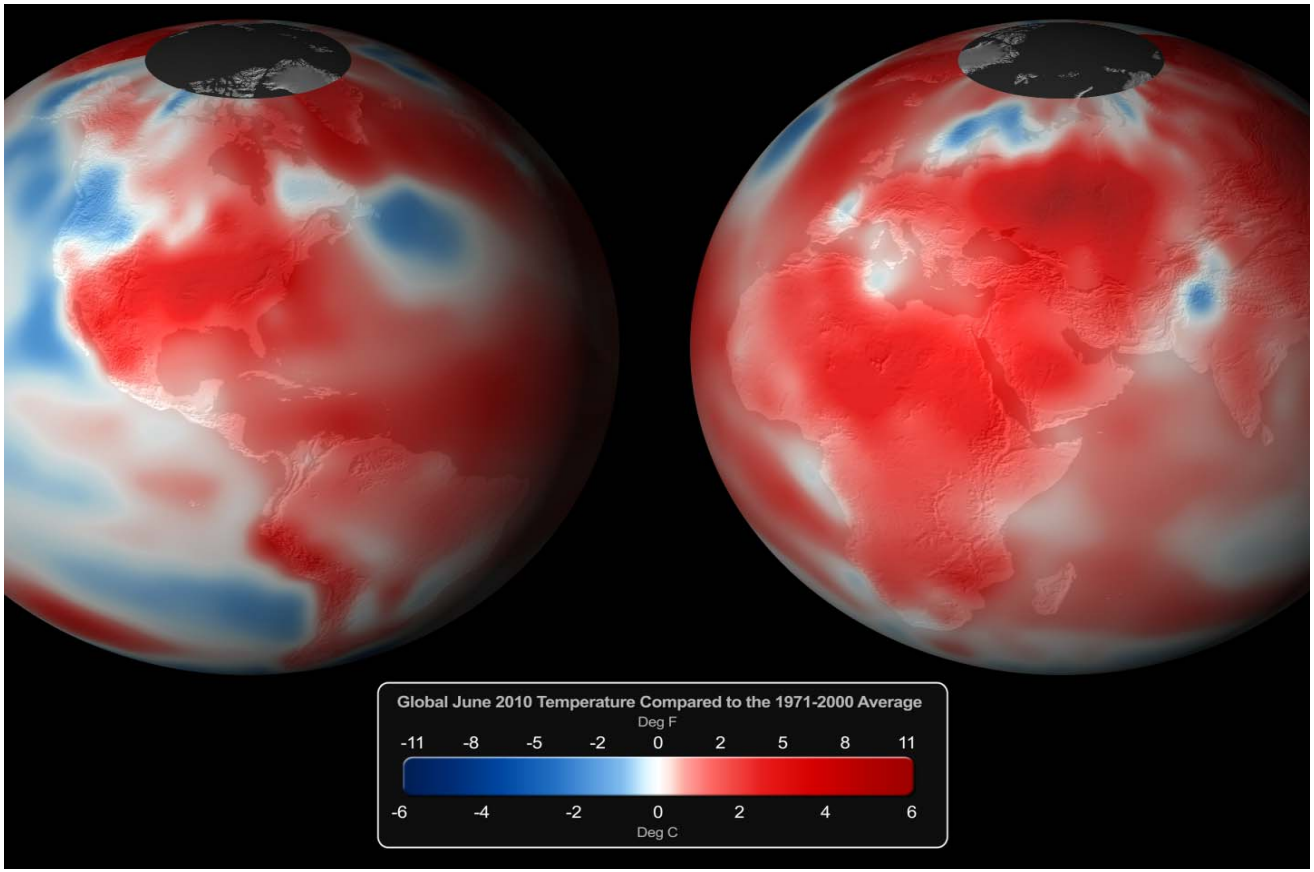
- Already one third is living in water-scarce areas.
- Rapid population growth lead to environmental degradation and inadequate water supply and sanitation service being overloaded.
- Water supply sources stretched to its limits.
- Surface and ground water pollution is increasing
- In 20th century world population tripled (7 billion) use of water grew six fold.



World population stress

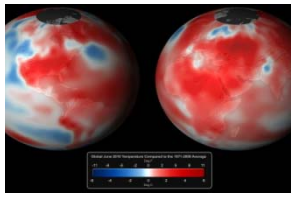
- By 2050, additional 3 billions will be born mostly in water scarce countries.
- It is the poor, who suffer the most. 1.2 billion without access to safe water, 2.6 billion without basic sanitation.
- Annual people dying 1.8 billion of unsafe water.
- Hunger and malnutrition 1 billion.





Climate Change Stress

Climate change stress



- By 2050, half people on our planet will be living in water scarcity.
- IPCC notes that climate change, water availability may decrease by 25% in arid region, which is already water-stressed.
- Water glaciers to decline where one-sixth of world population resides.
- In Asia, crop yields to decline by 2.5-10% by 2020 and 132 million could be at risk of extreme hunger by 2050.
- Arab countries may suffer 25% decrease in precipitation and 25% increase in evaporation as a result of 3°c rise in temperature.

Water policy: pricing and subsidies

- Free water is wasted water.
- Pricing for domestic, industrial, agricultural may lead to efficiency, and resource conservation.
- Investment demand by In't bodies and private sector.
- Governments resist pricing and out-subsidies.
- Ascend pricing from poor to middle class to the wealthy.
- The poor pay higher prices for poorer quality water from street vendors.

Water policy: science & legal framework

- Technological and engineering solutions not effective without water policy, institutional and legal frame work.
- Land and pricing reforms, transparent water rights, economic incentives, regulatory framework, basin management authority, public participation.
- Empowering women and community-based group in the decision-making process.
- Unique water management scheme: efficiency, cutting losses, protecting water from overuse and pollution.
- Integrated approach: **water, land, and people** for a sound ecosystem, and sustainable management.

Water policy: management of trans-boundary & shared river basins (rights to water)

- 34% of world's population lives in In't river basins covering half the planet land surface and contains 80% of fresh water river flow.
- There are 260 shared river basins, in addition to 270 shared underground aquifers shared among 145 countries.
- 2\3 of renewable water resources in Arab countries originate from sources outside the region. Shared management of downstream with upstream countries is imperative.

Water policy: management of trans-boundary & shared river basins (rights to water)

- Management of shared aquifers or water shed areas or water basins among countries of shared basins.
- Drawing on UN convention of the **"law of non-navigational uses of international water"**. Water scarcity will increase tension among countries of shared basins. Therefore, establishing database for managing shared water resources and build science policy for economic development and cooperation is a must among countries of shared basins.
- Shift future conflict toward **"share and care"** in building **"peace for development"**.

Water policy: water~loss

- Water leakage and water theft of the network distribution of water estimated at:
  - 13% in Europe.
  - 15% in USA.
  - 25% in Turkey.
  - 35% in Arab region.
- Computerized **"smart distribution network"** to wipe out loss is priority.

Water capacity among nations: UN classification

- **Rich water** countries who secure 8000 m^3 \capita\year.
- **World average** is 6000 m^3\capita\year.
- **Severe water scarcity** is below 500 m^3\capita\year.
- 13 Arab countries among world's most water scarce nations.
- In 8 Arab countries water availability is less than 200 m^3\capita\year, less than half UN-designated water-severe country.
- 45 million in Arab countries lack access to clean safe water.

Water capacity: wastewater treatment & reuse

- In Arab countries 10 km^3\year of which 5.7 km^3 undergoes treatment and 1\3 is only reused.
- 43% of annually generated wastewater is discharged untreated.
- Untapped wastewater treatment and reuse require appropriate policy intervention, national strategy, economic analysis and **scientific knowledge** to develop best practices in lost recovery, professional training and public awareness.
- In semi-arid water scarce zone, all wastewater should be treated and reused.

Water capacity: desalination

- Arab countries with 5% world population, have 50% share of world desalination capacity.
- By 2016, desalination capacity will be doubled.
- Annual investment by next decade, will reach from $15-$20 billion in Arab region.
- Currently, 25% of Saudi oil and gas used to generate electricity and water. By 2030, will rise to 50%, if current subsidies continue.
- Tariffs' covers 10% of cost.
- Gov't policy should shift to regulatory function and let desalination industry encompassing design, manufacture, operation & R&D to the competitive private sector.

Sustainable management of a scarce resource: science & water management

- Science is crucial for sound management and governance in enlightened water policy.
- R&D in water science has great potential in finding solutions for a limited source.
- In scarce countries, culture of wise use of water should be brought with **education** from childhood to become a **culture** of efficiency, cutting losses, protecting from pollution and overuse, recycle.
- Healthy use of residential rain-shed reservoir.

Sustainable management of a scarce resource

Sustainable management of a scarce resource: R&D policy

- The economic summit in Kuwait 2009, by heads of states, has placed three top priorities for R&D in the Arab countries as security:
  - Energy
  - Water
  - Food security
- Not seriously incorporated in Arab national policies with well-defined strategy and plan of action.

Sustainable management of a scarce resource: science potential in water policy

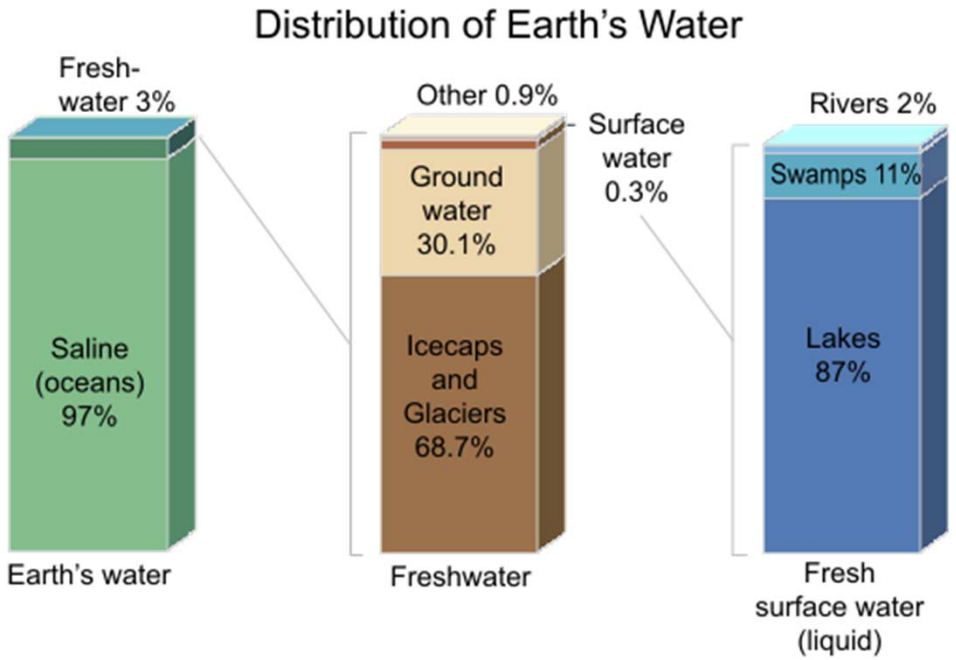
- Steer financial allocations whether governmental funding of international cooperation, university & graduate research, R&D on energy-water-food nexus **triangle**.
- Establish long term strategy across changing governments and parliaments **on science and policy in water management and steer funding** on R&D of the **triangle,** incubate delivery of R&D, transfer through technopark.
- Start up companies around, the **triangle** in technoparks. Seek venture-capital and joint-venture regionally & internationally.

Sustainable management of a scarce resource: science potential in water policy

- Develop a network on the **triangle** among research institutions and universities at the local, regional and global levels.
- Hold an annual science conference for updates on frontier areas of science related to the **triangle.**

Science potential for sustainable water policy

Unlimited potential what science can do on our planet, where salt water comprises 97.5% of planet waters, and fresh water of 2.5%: 70% tied in polar caps, and of what is left to humanity only 30% in rivers, lakes and ground water.



Science potential for sustainable water policy

- **At the global level (R&D)**
  - ❖ Nanoscience in seeds clouding
  - ❖ Monitoring climate change.
  - ❖ Nanomembrane in diffusion technology.
  - ❖ Sufficient RO's for harvesting fresh water from oceans & seas.
  - ❖ Nanosolar technology for renewables, for sustainable desalination (50% of world desalination in Arab region)

Science potential for sustainable water policy

- **At the regional level~ continue**
  - Remote sensing of water basins and aquifers.
  - Monitoring shifts of shared water of river basins and ground water.
  - Monitoring pollution by upstream countries.
  - Creating a network of science centers and universities of shared river and aquifer basins for sharing data and working together R&D on the triangle.

Science potential for sustainable water policy

- At the regional level-continue
  - ❖ Create stronger economic and political ties among countries of the shared water-basins leading to peace rather to conflicts.
  - ❖ 2\3 of water resources of Arab countries originate from sources outside the region.

Science potential for sustainable water policy

- At the national level
  - ❖ Water governance with stakeholders participation.
  - ❖ Expand public-private partnership (gov't-NGO's)
  - ❖ Remote-sensing to identify new water underground rivers and basins.
  - ❖ Share information between policy makers and authorities.

Science potential for sustainable water policy

- At the national level-continue

  - R&D for efficient agricultural and irrigation techniques, protected plasticulture etc…
  - R&D on genomic crops, utilizing less water, or new cultivars tolerant to aridity and salinity-stressed physiology.
  - Adopt science-based agricultural practices.
  - Acquiring water virtually through crops from rich-water countries, and concentrate on high value added crops that generate foreign exchange, through well-balanced trade policies . i.e:
    - **1 kg wheat needs 1000 liters of water.**
    - **1 kg rice needs 1400 liters of water.**
    - **1 kg red meat needs 13000 liters of water.**

  There is enough water resources of water in the world, but distribution, management and pollution make it unavailable to the masses.

Science potential for sustainable water policy

- **At the national level-continue**

  - Rich countries provide annually 8000 m^3 \capita, while scarce-water countries provide annually less than 1000 m^3 \capita. Distribution of water among sectors in Arab region:
    - 70% agricultural
    - 20% industrial
    - 10% domestic
  - Agriculture in **Jordan** consumes **80%** of water resources.
  - Agriculture in **Turkey** consumes **74%** of water resources.
  - Agriculture in **OECD** consumes **40%** of water resources.

Science potential for sustainable water policy

1. **Rainfall distribution of water in Jordan**

   - 8200 million m^3 annual rainfall, 80% loss to evaporation.

   - 1640 million m^3 annually left:
     - 510 million m^3 surface water.
     - 200 million m^3 ground water.
     - 860 million m^3 soil moisture.
     - 70 million m^3 reclaimed water.

2. **Jordan share from transboundary annually:**

   - 80 million m^3 Yarmouk transboundary basin (original 296 million m^3).
   - 60 million m^3 Tiberias.
   - 68 million m^3 Syrian-Jordan underground basins.
   - 100 million m^3 Saudi –Jordan basin underground (Disi).

   Total: 1948 million m^3 annually (314 m^3\capita\yr).

Source: M. Haddadin, Jordan research Journal No. 3, 2011

Thank you