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Climate change and the water resources sector:
Is Integrated Water Resource Management the answer?
(Summary by Karin Berkhoff)

Integrated Water Resource Management (IRWM) is characterized by the following attributes: it is multi-functional, has a human dimension (decision-making in water usage, waste, pollution). There are conflicting issues, for example concerning upstream/downstream users or upslope/down slope ones.
IWRM requires the harmonisation of issues of numerous agencies and departments responsible for one or more aspects of water and related natural resources management. It can be seen as a philosophy or management strategy. It aims at the achievement of a sustainable water use by all stakeholders while maintaining the characteristics and integrity of water resources at the catchment scale within agreed upon limits.
IWRM combines six strategies and goals:

- systems approach
- integrated approach
- management approach
- stakeholder approach (participatory decisions)
- partnership approach (common objectives, collective rules/ responsibilities/ accountability)
- sustainable approach (equitable access, protection of resource integrity).

There is both vertical and horizontal integration in IWRM:
Vertical integration (considering different scales) ranges from the lowest level of the single user to the top policymakers in a ministry and all levels of government. Spatial scales that can be important for IWRM range from global, national, catchment and community down to the household level. In the southern hemisphere the household scale is most important for implementing IWRM (thinking from small to huge) whereas in the northern hemisphere IWRM goes down from international to regional scale.
Horizontal integration (considering interdisciplinarity) implies co-ordination and collaboration among all the institutions responsible for resources management at a catchment scale.
The question comes up: What do we have to consider in the water resources sector in regard to Climate Change (CC)?
a) scenarios, appropriately downscaled to our catchment
The challenge is to establish regional climate models with daily resolution instead of using global climate models. Given that, models are needed on catchment scale where the manager has to operate. Usually, hydrological models are used for that purpose.
b) consider the appropriate hydrological model
Model requirements for dealing with CC are:

- a landscape component (key CC issues: land use, moisture budget, runoff generation, water quality)
- hydrological processes
  (Channel component. Supply: surface water, groundwater, dams, return flows. Demand: Human, ecological, urban/industrial, irrigation, power)

In South Africa the model ACRU is used. It possesses daily resolution, stormflows are considered as well. The following processes have to be modelled:

- Hill slope and riparian zone processes
- Wetlands
- Irrigation (62% of all water stored in Africa is used for irrigation!)

c) meaningful water management issues
Details “explode” from annual to monthly to daily values: the mean is meaningless concerning temperature and rainfall! A regional climate model can be calibrated against observations. Only if one looks at the whole picture one is able to recognize trends.

Regional water mangers are for example interested in the following model results:

- losses of ETP from dams (up to 2000 mm/year, 3000 mm/year in the desert)

- number of days/year with topsoil at permanent wilting point
- number of storm flow events/year (storm flows fill the dam)
- lowest annual base flow in 10 years
- median annual base flow in 10 years
- highest annual base flow in 10 years
- number of groundwater recharge events/year (they will increase in the future which is a positive effect of CC)
- period of highest stream flows derived from baseline climate data
- shifts in period of highest stream flows
- mean annual net irrigation requirements
- lowest annual sediment yields (because of storms)
- median annual sediment yield

Definition:
blue water = surface and groundwater (goes down the stream)
green water = goes through plants
white water: interception from leaves and also from soil. White water never gets into touch with the plants!

Hydrological baselines will shift with CC. The impacts of CC may be felt sooner than we wish.

Climate, water and ecosystems
Freshwater is an essential driver of terrestrial/aquatic ecosystems. The environment is a legitimate water user – it is not competing with human water use!

Water & health
Variability of water availability is often a major trigger in disease.

The adaption process consists of 3 steps:
1. awareness of threat
2. intention to adapt
3. active adaption

Definition:
Risk management = risk assessment (hazard determination, …) + risk mitigation and control.

There is a decision framework in climate variability and CC with the following types of decisions
- strategic (long-term, 10-50 years)
- tactical (6-9 months)
- week-wise

Long-term decisions:
  - legal & policy
  - institutional and management
  - monitoring research & information

Limits to adaption: financial, physical, feasibility, capacity

In the future we need to place more emphasis on secondary hydrological effects => go beyond just water!

Discussion

Change the politicians to get aware of CC? Problem: corrupt government.

More investments needed for irrigations? No, but: education, empowering females.

Development aid is needed but has to be spent reasonably.

Is there enough water in South Africa for all people? Yes, but not managed well.
Dream of the government is to be able to provide 25 litres/day per person (the average family consists of eight people).

Dilemma: highly developed farmer is subsidised ⇔ subsistence farmer is poor.

If we had one minute to talk to Kofi Annan, what would be the conclusion? CC is reality, it affects many sectors. Pay more attention to CC! Water is more sensitive than other sectors.

Golf course development in South Africa mostly along the coast (like other developments also).

Ownership of agricultural area: Commercial farmers are local farmers, pay no taxes.