WATER RESOURCES COMMISSION

Water Safety, Climate Change and Integrated Water Resources Management

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Water Resources Commission

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Theme: The Global Climate Change: A Challenge for the WASH Sector in Ghana

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Introduction

- There is evidence that the climate of the world is changing.
- Worldwide temperatures have risen by 0.6 degrees Celsius in the last 130 years.
- This will lead to impacts on a wide range of climate related factors.
- **Human activities and some natural causes seem to be responsible for the** changing climate.
- The impact will affect **‘water safety’** and will have implications for water management.
- Of great importance is the potential change in water supply that may occur in parallel with increased demand for water as population increases.

Ice and fire

Key changes to the hydrological cycle

- Changes in the seasonal distribution and amount of precipitation.
- An increase in precipitation intensity under most situations.
- Changes in the balance between snow and rain.
- Increased evapotranspiration and a reduction in soil moisture.
- Changes in vegetation cover resulting from changes in temperature and precipitation.
- Accelerated melting glacial ice.
- Increases in fire risk in many areas.
- Increased coastal inundation and wetland loss from sea level rise.
- Effects of CO2 on plant physiology, leading to reduced transpiration and increased water use efficiency.

Freshwater resources

- Freshwater resources are highly sensitive to variations in weather and climate.
- The changes in global climate that are occurring as a result of the accumulation of greenhouse gases in the atmosphere will affect patterns of **freshwater availability** and will alter the **frequencies of floods and droughts.**
- Climate model simulations and other analyses suggest that total flows, probabilities of extreme high or low flow conditions, seasonal runoff regimes, groundwater-surface water interactions and water quality characteristics could all be significantly affected by climate change over the course of the coming decades.

Surface water

- Rivers are very important to Earth because they are major forces that shape the landscape provide transportation and water for drinking, washing and farming etc.
- Rivers can flow on land or underground in deserts and seas.
- A river's contribution to the water cycle is that it collects water from the ground and returns it to the ocean.
- Rivers may come from mountain springs, melting glaciers or lakes.
- A special environment is created when the fresh water from the river mixes with the salty ocean water.
- This is environment is called estuary.

Groundwater

- We don’t often see is the water that soaks into the ground is called groundwater.
- If you traveled underground you would eventually get deep enough to find that all the rock around you is soaked with water.
- You’d have entered the saturated zone!
- The water in the saturated zone is called an aquifer.
- Most rural communities get the water they use in their house from wells that tap aquifers like a straws.
- Groundwater can become contaminated by human activity. Contaminated water has chemicals, such as pesticides or fertilizers, mixed in with the water.

Implications for water quality

- Freshwater bodies have a limited capacity to process the pollution stemming from expanding urban, industrial and agricultural uses.
- Water quality degradation can be a major source of water scarcity.
- A decline in water quality can result from the increase in runoff and precipitation- more nutrients, pathogens and pollutants.
- When drought conditions persist and groundwater reserves are depleted, the residual water that remains is often of inferior quality.
- This is a result of the leakage of saline or contaminated water from the land surface, the confining layers, or the adjacent water bodies that have highly concentrated quantities of contaminants.
- This occurs because decreased precipitation and runoff results in a concentration of pollution in the water, which leads to an increased load of microbes in waterways and drinking-water reservoirs.

Implications for water quality cont'd

- The increase in water temperatures can lead to a bloom in microbial populations, which can have a negative impact on human health.
- Additionally, the rise in water temperature can adversely affect different inhabitants of the ecosystem due to a species' sensitivity to temperature.
- The health of a body of water, such as a river, is dependent upon its ability to effectively self-purify through biodegradation, which is hindered when there is a reduced amount of dissolved oxygen.
- This occurs when water warms and its ability to hold oxygen decreases.
- Consequently, when it rains, the contaminants are flushed into waterways and drinking reservoirs, leading to significant health implications.
- There is a likelihood of saltwater intrusion near coastal regions as sea water levels rise.

‘Our safety our water’

- The quality of water defines its uses. Water can be available limited in its use.
- The challenge associated with water quality problems in rural communities is the prevalence of water-borne diseases
- These diseases are caused by either human induced pollution or pollution as a result of natural occurrence related to geology and others
- Human induced pollution may result in introduction of pathogens, as well as some chemical substances such as nitrates, sulphate, sodium, ammonia, etc.

Water diseases

There are several ways in which water is involved in transmission of disease:

- *Water-borne diseases result from the contamination of water by human or animal* faeces, or by urine infected by pathogenic viruses or bacteria, in which case the disease is transmitted directly when the water is drunk or used in the preparation of food.
- *Water-washed diseases are those resulting from inadequate personal hygiene* because of scarcity or inaccessibility of water.
- *Water-based diseases are those arising from parasites that use an intermediate* host that lives in or near water (e.g. guinea worm).

Diseases cont'd

- *Water-related diseases are diseases borne by insect vectors which have habitats* in or near water (e.g. malaria).
- *Water-dispersed diseases are infections whose agents proliferate in fresh water* and enter the human body through the respiratory tract (e.g. Legionella).
- High concentrations of nitrate, sulphate, ammonia and sodium in water may cause oxygen deficiency in blood system, acute diarrhoea, and may also lead to exacerbation of illnesses such as hypertension, cardiovascular or renal diseases.

Groundwater pollution

- Groundwater is generally safe for drinking in its raw state.
- Interaction between water and rock forming minerals during groundwater movement gives the groundwater its essential mineral character while it may also lead to release of harmful elements/substances into the water e.g. arsenic, fluoride, uranium, mercury, etc.
- groundwater supply sources are often not monitored, because after the first water quality analysis it is assumed that the quality will remain the same for the rest of its existence, and this poses a great danger for rural communities.

Pollution during floods

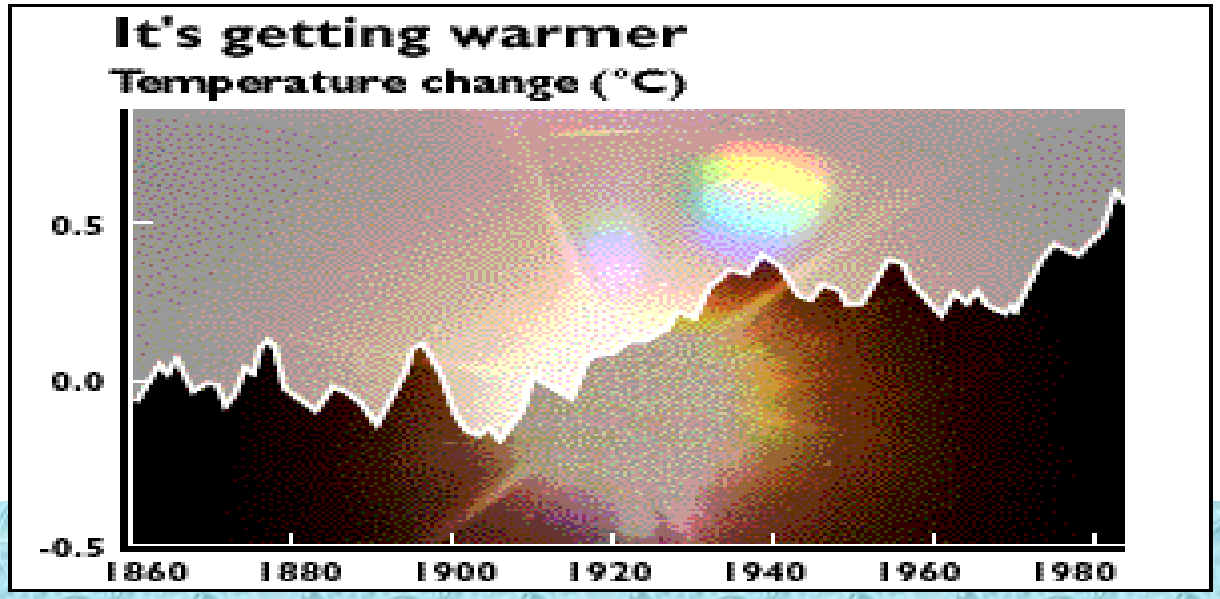
- Where streamflow and lake levels fall, there will be less dilution of pollutants; however, increased frequency and intensity of rainfall will produce more pollution and sedimentation due to runoff
- Flooding can affect water quality, as large volumes of water can transport contaminants into water bodies and also overload storm and wastewater systems.
- Sea level rise may also affect freshwater quality by increasing the salinity of coastal rivers and bays and causing saltwater intrusion, movement of saline water into fresh ground water resources in coastal regions.

Effects on Coastal Populations

- For coastal populations, water quality is likely to be affected by salinization, or increased quantities of salt in water supplies.
- This will result from a rise in sea levels, which will increase salt concentrations in groundwater and estuaries.
- Sea-level rise will not only extend areas of salinity, but will also decrease freshwater availability in coastal areas.
- Saline intrusion is also a result of increased demand due in part to growing coastal populations that leave groundwater reserves increasingly vulnerable to contamination and diminishing water reserves

Ecological changes

- Changes in water quality could have implications for all types of uses. For example, higher temperatures and changes in water supply and quality could affect recreational use of lakes and rivers or productivity of freshwater fisheries. Certain species of fish could find temperatures too warm and migrate to more northern or higher altitude locations where water is cooler.



challenges

- The poor of the world are generally the most vulnerable to the impacts of climate variability and change on water, but they often have a low capacity to cope with such impacts.
- Even without climate change, most developing countries are confronted with serious water problems.
- For water managers in developing countries, the impacts of changes in climate often appear minor when compared to some of the problems they are facing already.

The role of the private sector / NGOs

- Private sectors that traditionally have not concerned themselves specifically with water resources and its management should be made aware of the effects of climate change within the broader water-related sphere in the near future.
- The effects will not always be negative. New business opportunities are likely to emerge.
- Opportunities exist for innovative approaches to financing the required coupling of investments in water infrastructure and environmental protection.

Politics and Institutions

- The political and institutional dimension is a most critical element in coping with climate variability and climate change from a water resources management perspective.
- The world's political leadership, with the support of international financing agencies, should invest in capacity building in the South to help them enhance

Strategies

- Adaptation of strategies to cope better with the potential impacts of enhanced climate variability and change.
- A number of institutional and organizational issues have been
- Planning for the future require financial and must take into account:
- infrastructure, economic and human capacity, socio-political systems and environmental awareness. between developed and
- Integrated Water Resources Management (IWRM)

prepare for the future

- Flood protection measures can be structural or non-structural. Structural measures include:
- dams
- flood control reservoirs, i.e. constructing reservoirs where the excess flood waters
- can be stored, and then released as a controlled flow to help alleviate the flood problem by attenuating flood peaks, and dikes.

Planning with the unpredictable

- It is prudent to begin planning for changes that can be foreseen and to build resilience to deal effectively with the increased uncertainty arising from the potential, but as yet unpredictable impacts of climate change.
- Nevertheless, some types of changes can be foreseen with relatively high confidence.

The river and the land and Integrated Water Resources Management (IWRM)

Any river is really the summation of the whole valley. To think of it as nothing but water is to ignore the greater part.

Major challenges for water managers

- Securing water for people
- Securing water for food production
- Developing other job creating activities
- Protecting vital ecosystems
- Dealing with variability of water in time and space
- Managing risks
- Creating popular awareness and understanding
- Forging political will / traditional authority to act
- Ensuring collaboration across sectors and boundaries

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The end

Thank you for your attention