Water Security – What lies in a Word?

The North-South Dimensions of Water Security
North-West University
14 May 2015

Carin Bosman

What is "Water Security"?

- Soldiers protecting dams?

…if only it was that "uncomplicated"...!

"Water Security" defined (UN-Water, 2013)

- *"the capacity of a population to safeguard sustainable access to adequate quantities of acceptable quality water*
  - *for sustaining livelihoods, human well-being, and socio-economic development,*
  - *for ensuring protection against water-borne pollution and water-related disasters, and*
  - *for preserving ecosystems,*
- *in a climate of peace and political stability"*

…but what does it MEAN??

Gideon Johannes Lambertus Bosman
13 November 1906 – 5 September 1971

Christina Glaudina Bosman (born du Toit)
31 January 1917 – 5 April 1985

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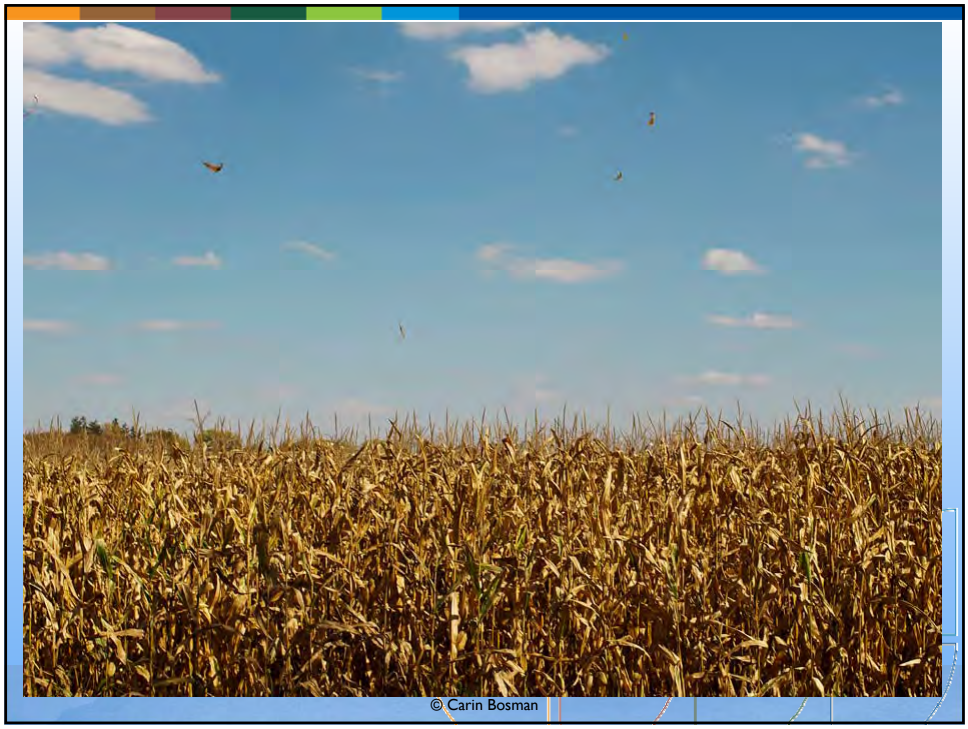
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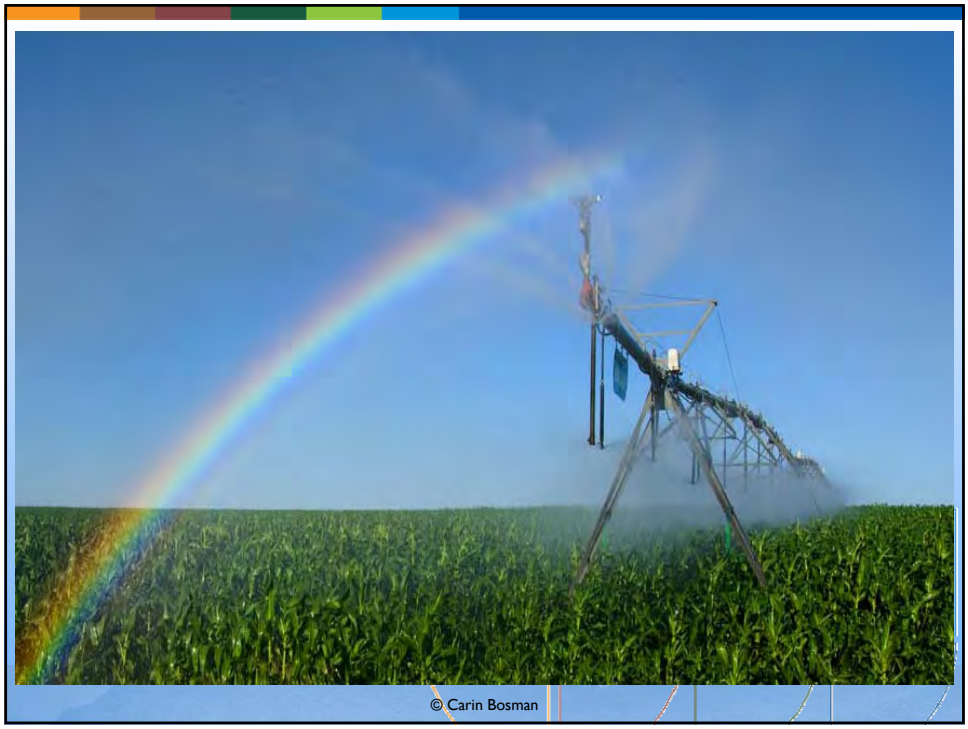

Water Security – our biggest challenge for the 21st century…

- Water, food, and energy are interrelated and interdependent:
  - It takes energy and water to produce food;
  - It takes water (and food!) to produce energy;
  - The production of energy (and food) contaminates water; and
  - It takes energy to extract, purify and distribute water, and to purify contaminated water.
- The water-food-energy nexus…

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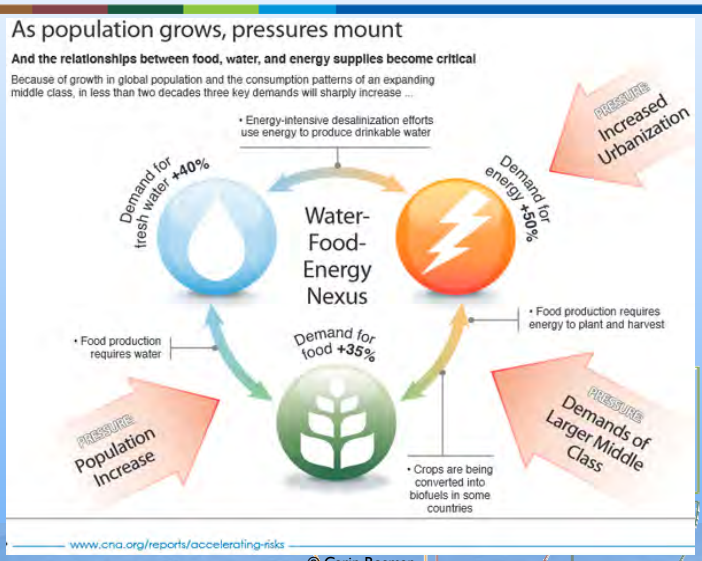
Water-Food-Energy Nexus

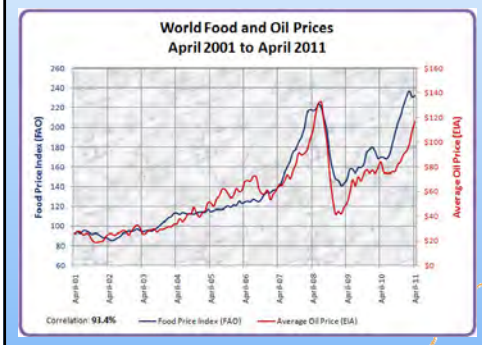


"a Growing Middle Class"

- Current world population at around 7 billion
- 2 billion people currently regarded as middle class
- By 2030, 3 billion more middle class consumers
  - More people with higher quality of life
  - Higher pressure on especially food and water resources
  - Increase pressures on energy resources
  - Which in turn increase pressure on water resources

Food and Fuel…

- Food prices are highly sensitive to the cost of energy inputs through fertilizers, irrigation, transport and processing.



In 2010, South Africa became, for the first time in history, a net importer of food…

Water for food or for fuel...?

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Humans and the Environment

- Because of
  - Increased Population Growth (Social Causes)
  - Process of Industrialisation (Economical Causes)
- There has been
  - Increased Generation of Waste (Socio-economic causes) and
  - Increased Pressure on Resources – especially WATER RESOURCES (Environmental Causes)
- Which effectively result in
  - Environmental Degradation and Pollution on Global, Regional and Local Scales and (Environmental Effects)
  - Social and Economical problems (Socio-Economic effects)

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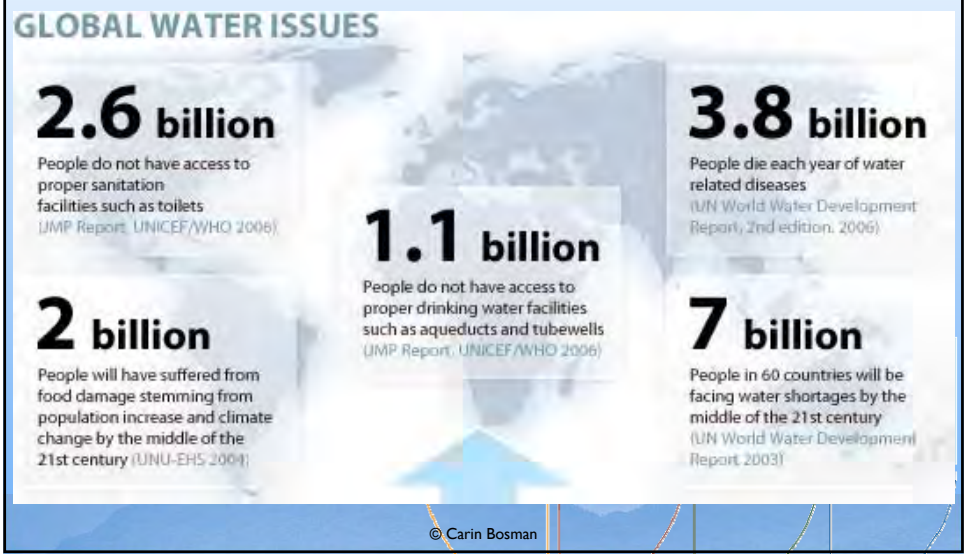
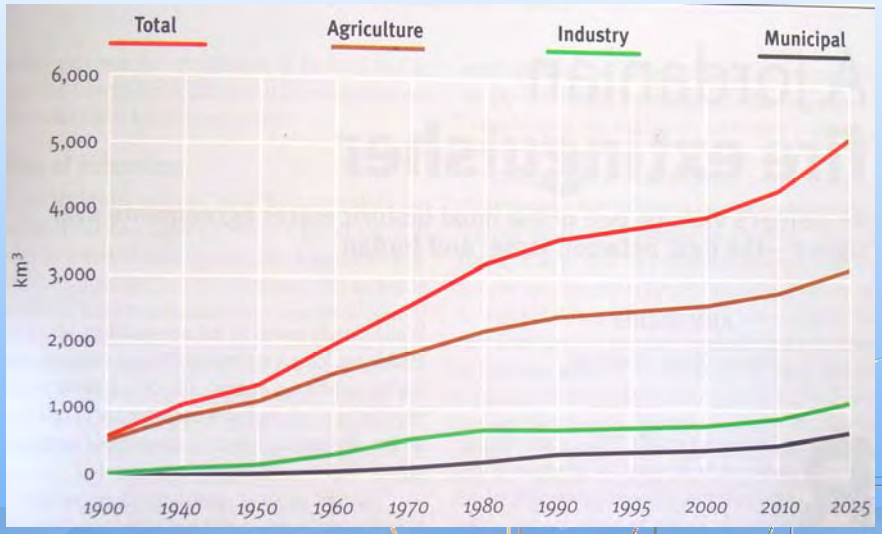
Water Security?

- Different from "food security" and "energy security"
  - Reliable access to sufficient supplies
- Water security also considers the destructive aspects relating to water
  - Floods and droughts

Global Water Issues



Global Water Consumption



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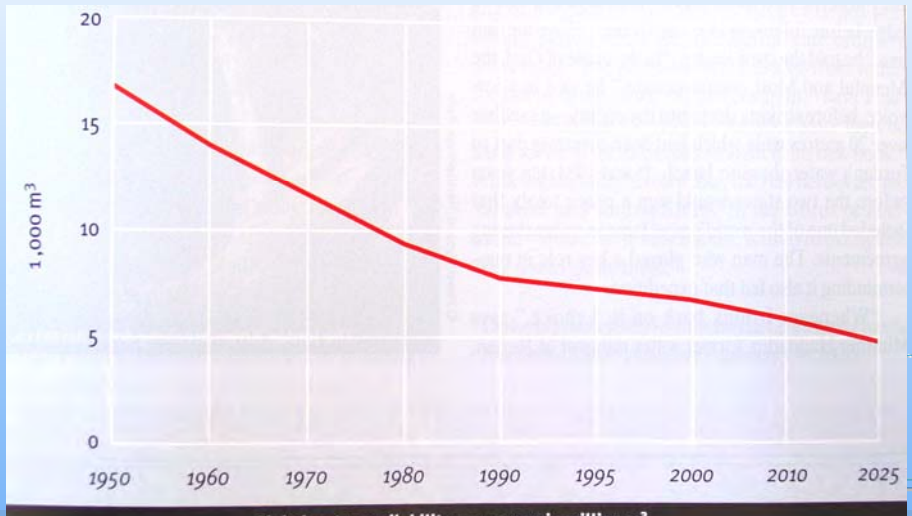
Water Available



Global water availability per person in million m³.

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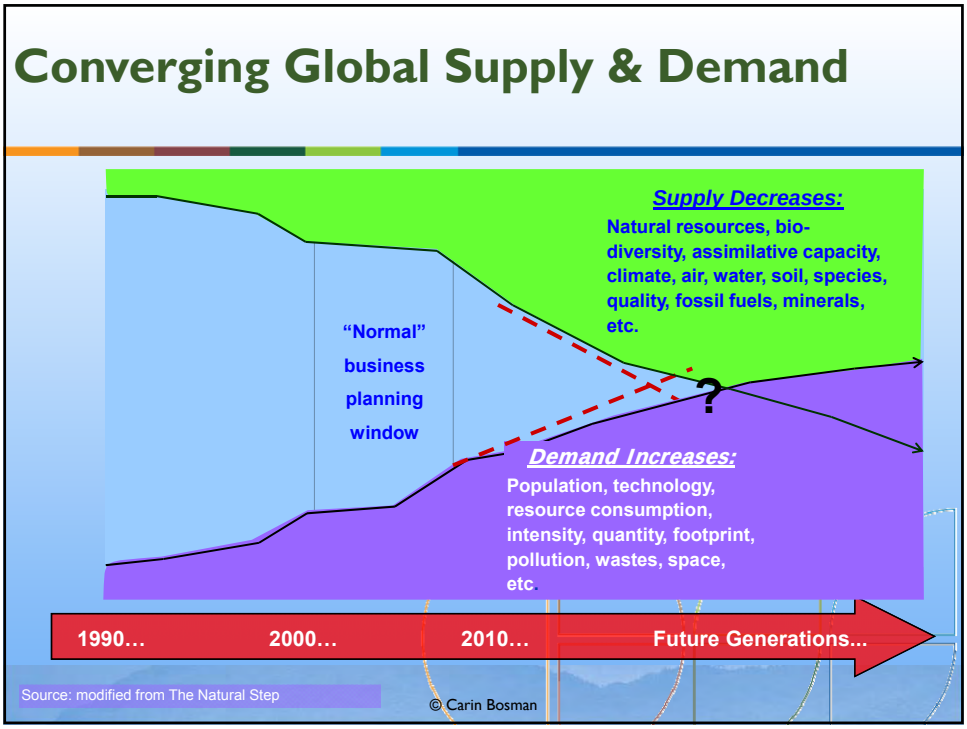
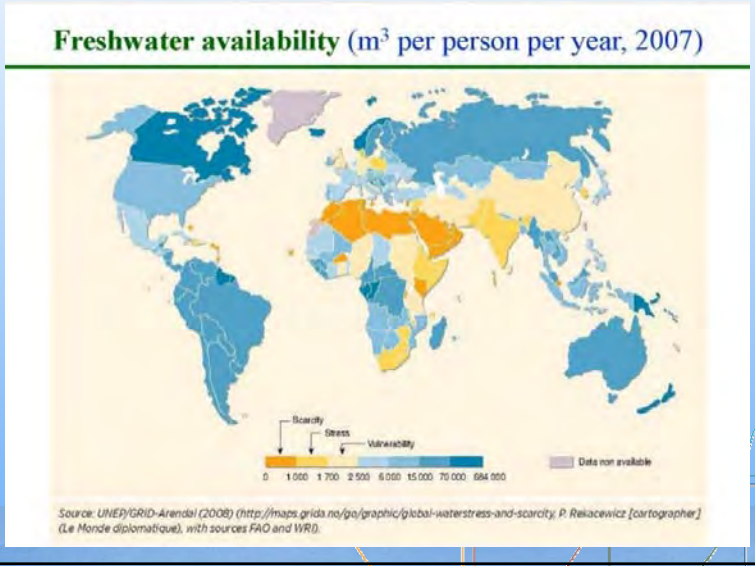
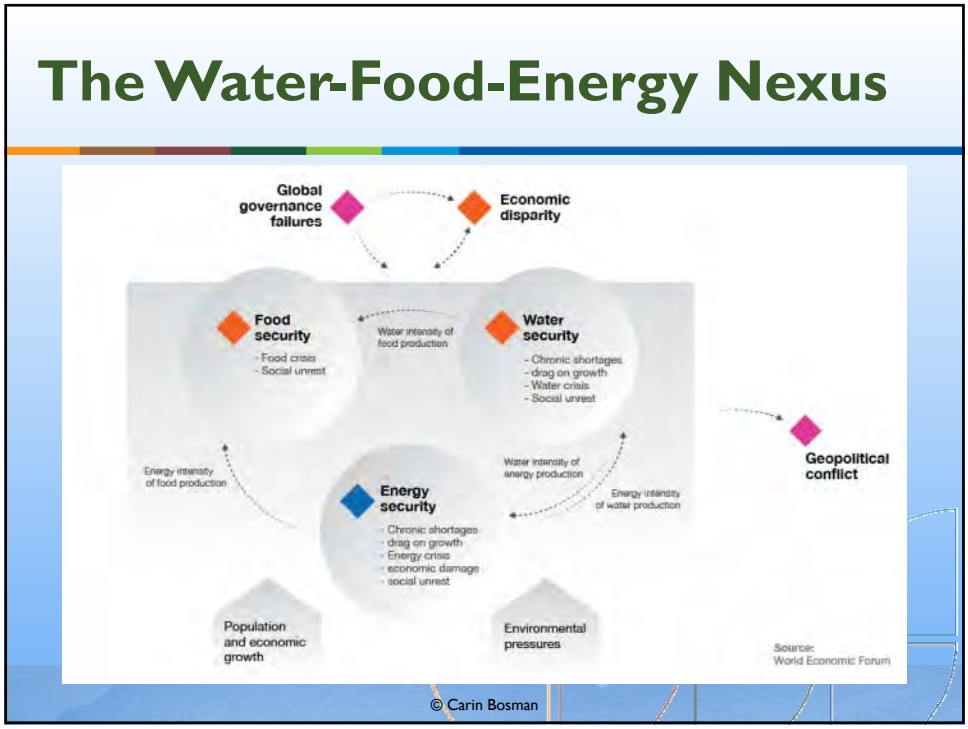
Converging Global Supply & Demand



Water scarcity




Water Security Risk Index 2010
maplecroft
Extreme risk
High risk
Medium risk
Low risk
No Data
Uzbekistan
Turkmenistan
Syria
Egypt
Mauritania
Niger
Sudan
Pakistan
Somalia
Rank Country Category
1 Somalia extreme
2 Mauritania extreme
3 Sudan extreme
4 Niger extreme
5 Iraq extreme
6 Uzbekistan extreme
7 Pakistan extreme
8 Egypt extreme
9 Turkmenistan extreme
10 Syria extreme


The Water-Food-Energy Nexus
Global governance failures
Economic disparity
Food security
- Food crisis
- Social unrest
Water intensity of food production
Water security
- Chronic shortages
- drag on growth
- Water crisis
- Social unrest
Energy intensity of food production
Water intensity of energy production
Energy intensity of water production
Geopolitical conflict
Energy security
- Chronic shortages
- drag on growth
- Energy crisis
- economic damage
- social unrest
Population and economic growth
Environmental pressures
Source: World Economic Forum
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Why is it called a "Nexus"?

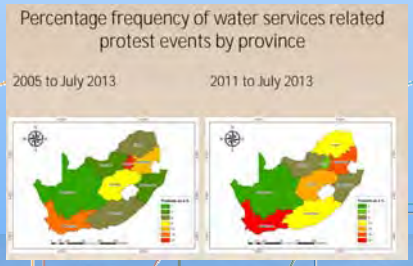
- Because actions related to one system can impact one or both of the other systems, it is necessary to follow a NEXUS APPROACH
- At the heart of the NEXUS APPROACH is a strong understanding of the interdependencies among these three systems and how to ensure food, water and energy security for an ever-growing population
- In a nexus approach, conventional policy- and decision-making in "silos" would give way to an approach that reduces trade-offs and builds synergies across sectors.
- a nexus approach integrates management and governance across sectors and scales
- If we cannot address this properly, conflicts will arise, leading to unrest and war…

Water Conflicts and Wars…

- International:
  - Syria – unrest started in 2011 as a result of a prolonged drought
  - ISIS – focus and attacks on Haditha Dam, Nuaimiyah Dam, and Mosul Dam, 2014/2015
  - South Africa – invasion of Lesotho to secure agreements on Katse Dam in 1999

Water Conflicts and Wars…

- South Africa - service delivery protests over water supply and sanitation issues:
  - 2014 & 2015: Madibeng (Brits, Northwest Province)
  - 2015: Malamulele, Mankweng, Thoka, Maake (Limpopo Province)



How to eat the elephant?

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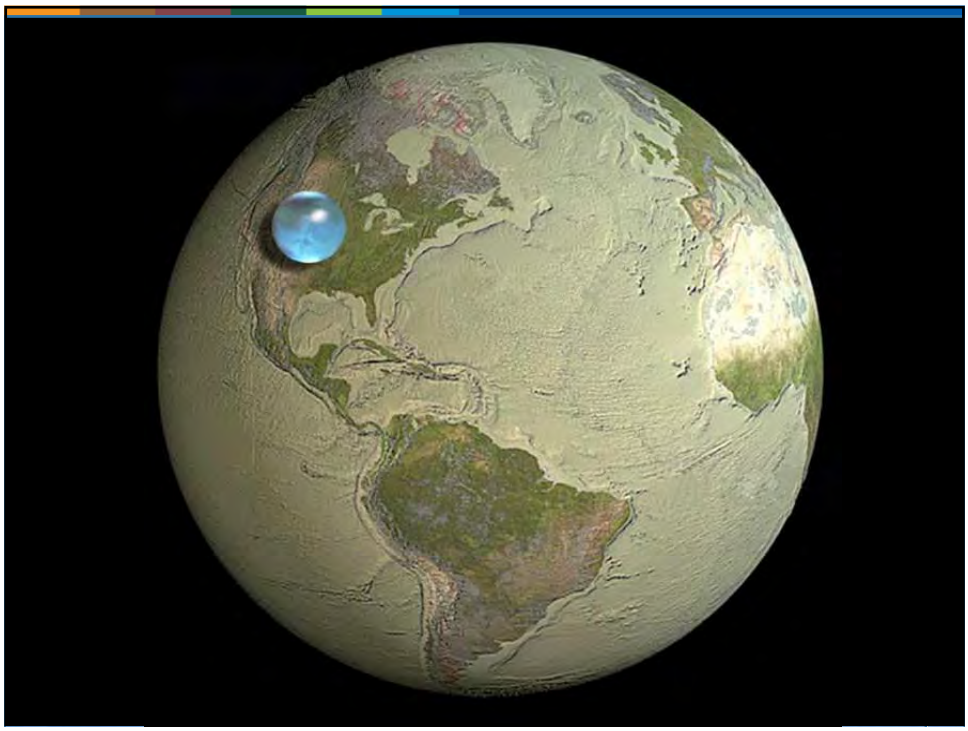
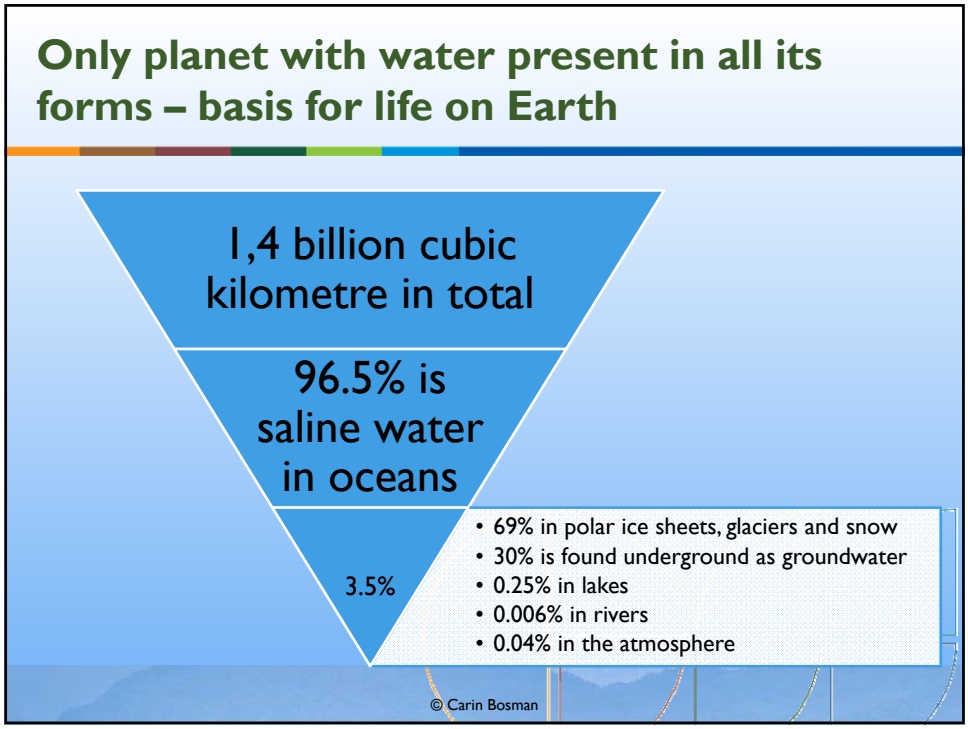
Understanding and Addressing "Water Security"

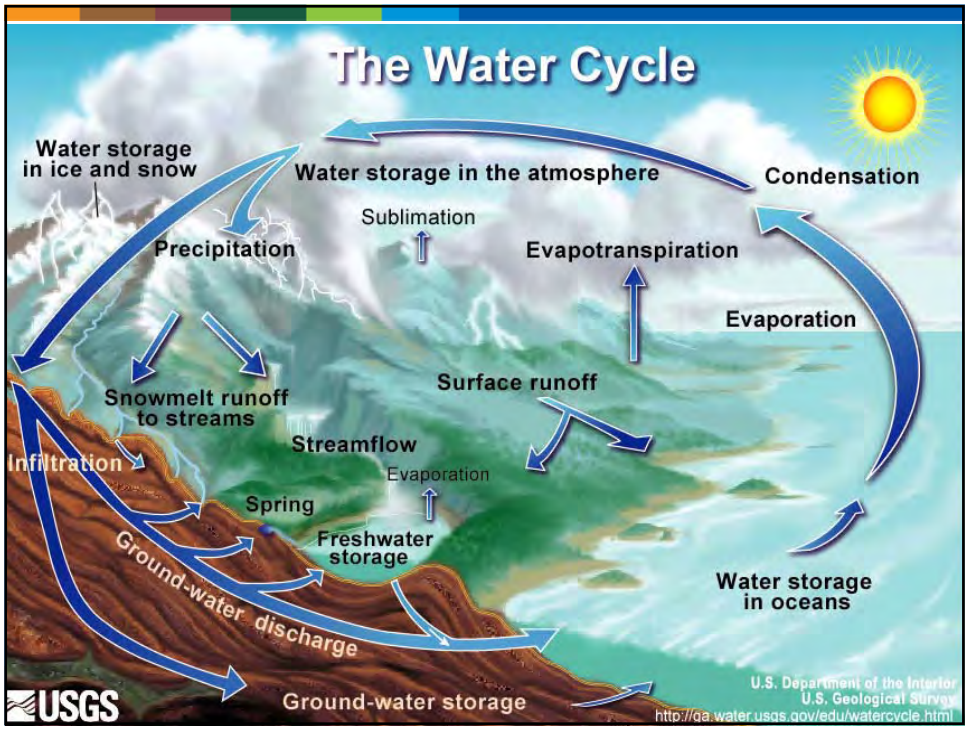
A. Understand the nature and limitations of the water resource
B. Understand the issues: access, availability, impacts, quality, conflicting needs, and governance constrains
C. Develop and Implement Solutions to ensure Global Water Security

A) Understanding the nature and limitations of our water resources



Only planet with water present in all its forms – basis for life on Earth





Fresh water of the hydrosphere

TABLE 17.1 Fresh Water of the Hydrosphere

Parts of the Hydrosphere	Volume of Fresh Water (km^3)	Share of Total Volume of Fresh Water (percent)	Rate of Water Exchange
Ice sheets and glaciers	24,000,000	84.945	8000 years
Groundwater	4,000,000	14.158	280 years
Lakes and reservoirs	155,000	0.549	7 years
Soil moisture	83,000	0.294	1 year
Water vapor in the atmosphere	14,000	0.049	9.9 days
River water	1,200	0.004	11.3 days
Total	28,253,200	100.000	

Source: U.S. Geological Survey Water Supply Paper 2220, 1987

Water characteristics

- Naturally Nutrient poor
- Scarcity of macro-nutrients (N&P) crucial to the health of the species and the ecosystems of the aquatic environment
- Essential for maintenance of biodiversity and provision of services to humans

Land/Soil characteristics

- Naturally Nutrient-rich
- Nutrient cycle:
  - Soil-bacteria-plants-animals-soil
- Nutrients required to maintain valuable soil integrity and plant diversity

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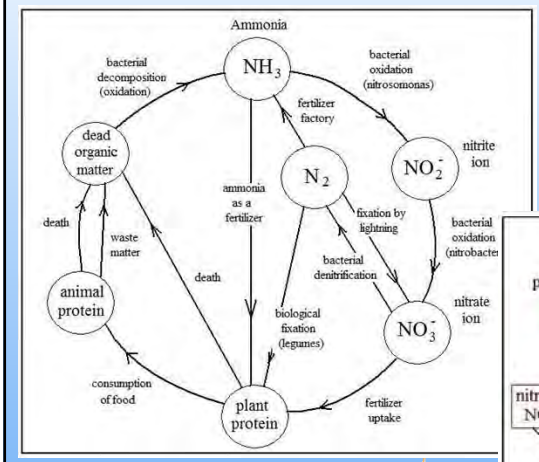
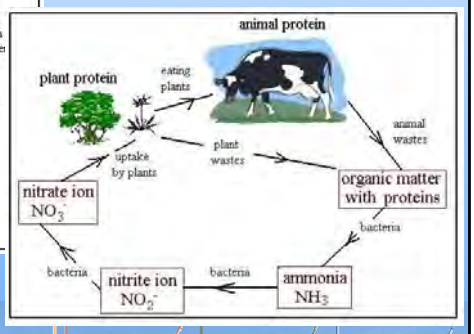
Nitrogen Cycle





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B) Understanding the Issues

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Understanding the Issues

1. Access and Availability
2. Impacts and Effects on Water Quality
3. Conflicting needs and governance constrains

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Understanding the Issues: I) Access & Availability

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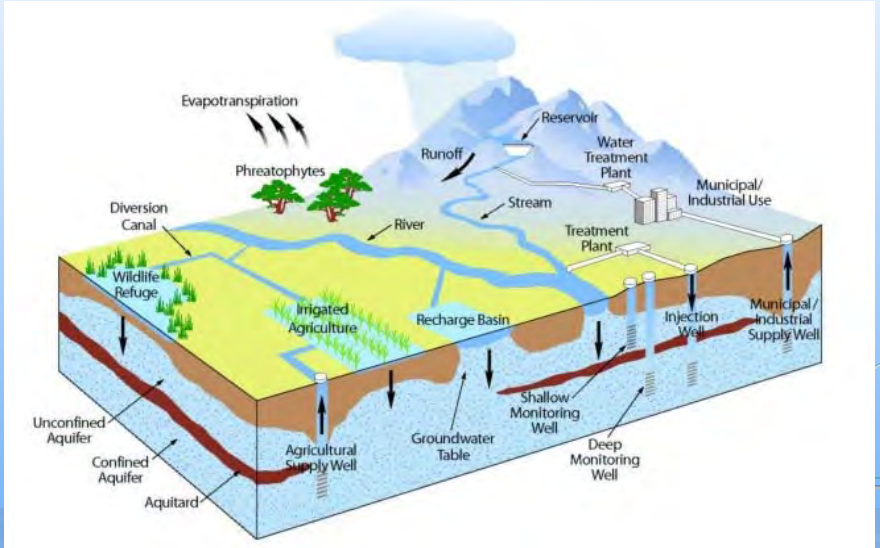
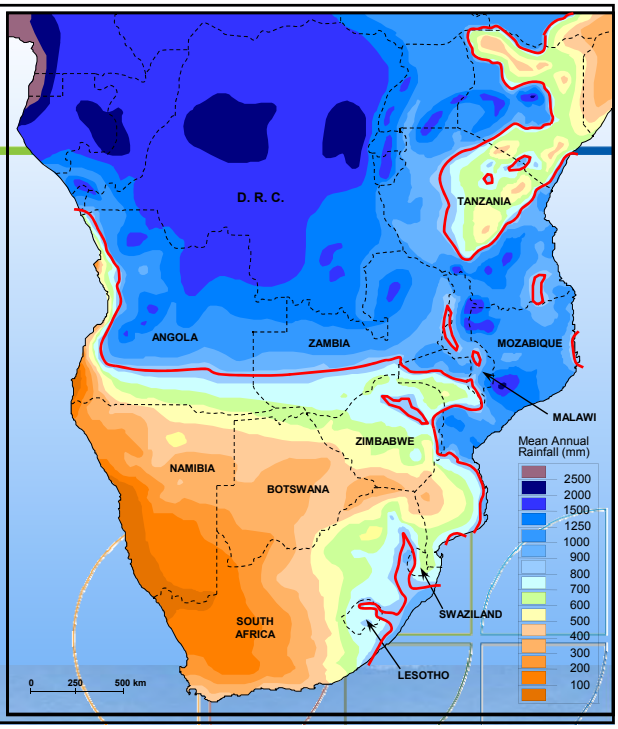
The hydrological cycle of the Anthropocene



South Africa

- semi-arid climate
  - water supply from surface water sources alone not adequate to address current and future demand
- Integrated nature of the hydrological cycle:
  - interrelationships between surface water, ground water and atmospheric water

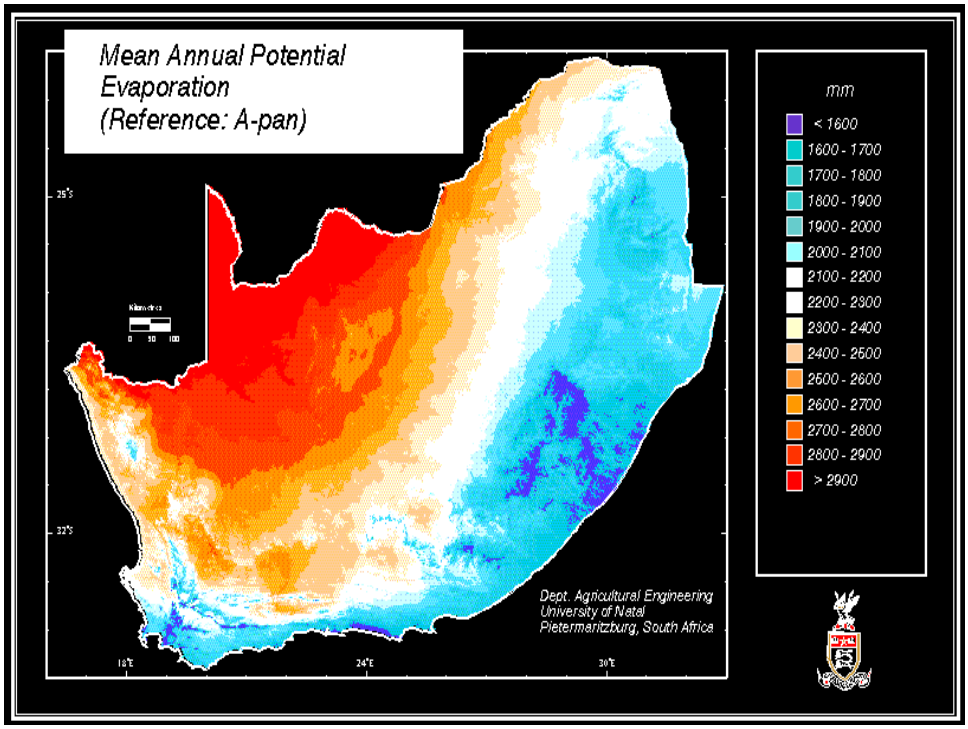
MEAN ANNUAL RAINFALL



= 860 mm isohyet

= World average rainfall

SADC Average Annual Rainfall = 948 mm



Climate Change

- The most direct effect of global climate change is on water resources:
  - Uneven distribution of water resources
  - Extreme climate events, specifically floods and droughts
- Mitigating climate change implies changing our sources of energy, but adapting to climate change means changing the way in which we use and manage water
- Drought results in shallow boreholes running dry, magnifies nitrate run-off, and dry land causes shifting pipes and settlement of soils – increased contamination and infrastructure maintenance costs
- Harsher winters challenges pipes, and increase energy requirements

Understanding the Issues 2) Impacts and Effects on Water Quantity and Quality

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Abstraction Impacts

Exeter Sink, Barry County, March 3, 2005, Jim Vandike

Abstraction Impacts

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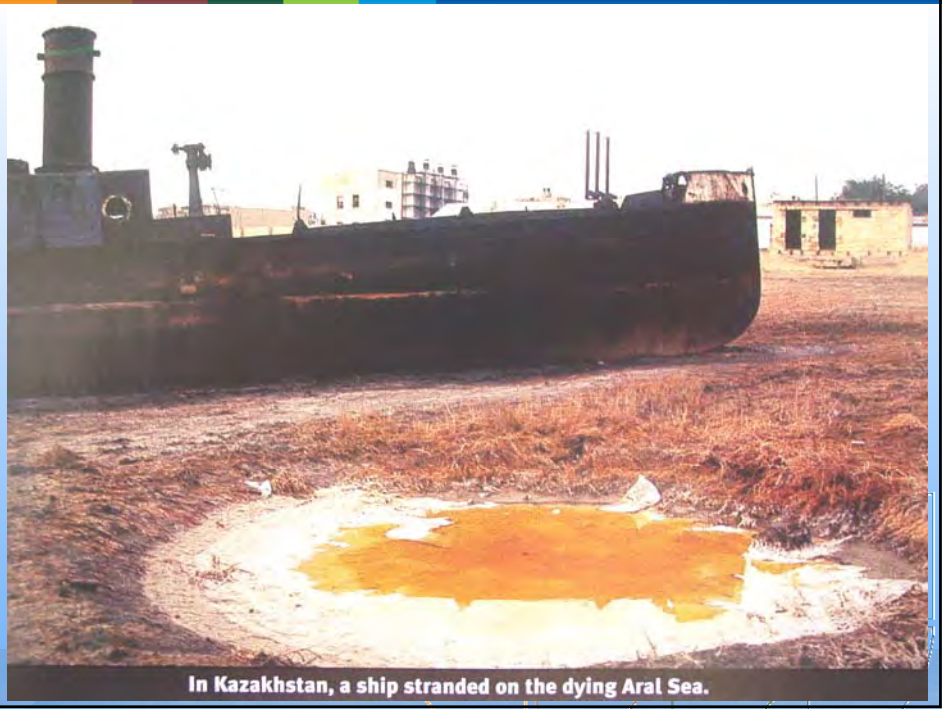
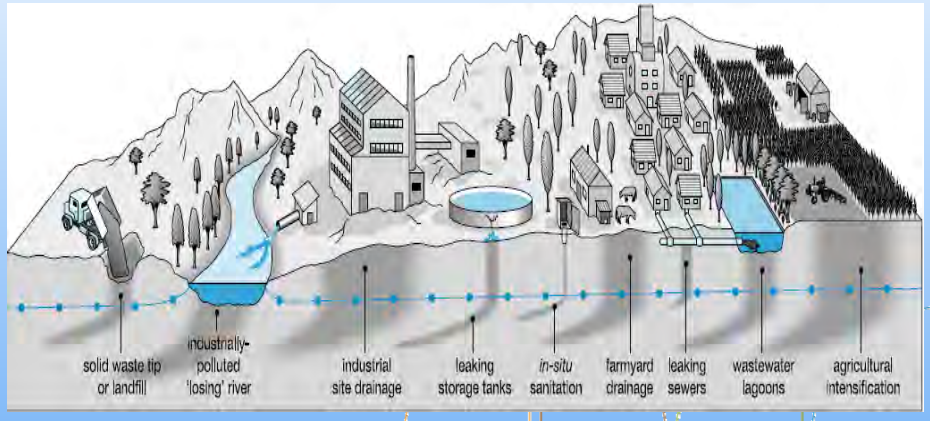

In Kazakhstan, a ship stranded on the dying Aral Sea.

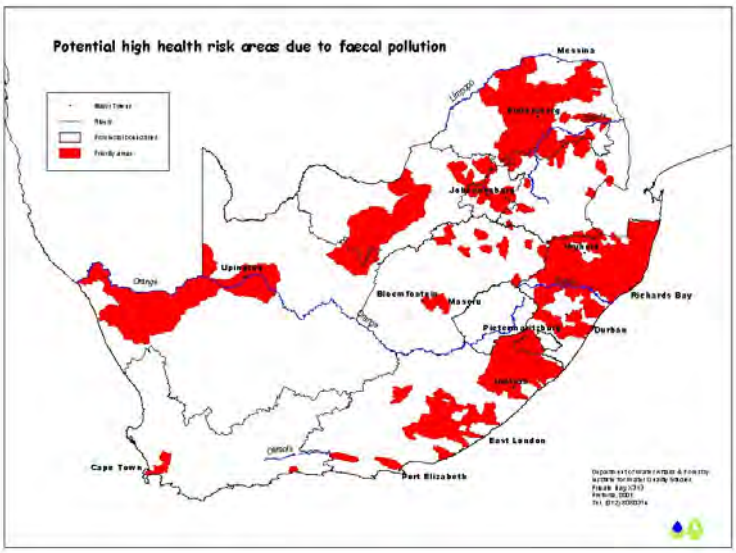
Land-use activities commonly responsible for groundwater pollution in Urban areas.



Pollutants from Human Activity and their effects on Water Quality

Human Activity	Main pollutants	Effects of pollution
Urbanisation: Domestic waste disposal Concentrated habitation & untreated sewage disposal inadequate sanitation	Nitrates Phosphates Pathogens	Pathogens cause typhoid, cholera, gastro-enteritis, nutrients cause eutrofication
Industrial waste water discharge and waste disposal, including Fossil fuel burning for power, heating and transport	Heavy metals Organics Carcinogens	Human & Aquatic organisms disease / death = remove assimilative capacity
Mining waste water discharge	Large scale land use Salts and acid mine dranage Heavy metals, incl radio-active	Erosion Salination Cumulative effects
Farming – organised and mechanised agriculture	Nutrients Pesticides Fertilisers Silt and salt	Eutrification, Erosion , sedimentation and loss of storage volume in dams Salination

Groundwater quality – Faecal pollution



Leachate and seepage

Mining waste….

© Carin Bosman

Acid Mine Drainage

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"It isn't pollution that's harming the environment. It's the impurities in our air and water that are doing it."

--George Bush, former US President

Global Water Security Report:

- One of the greatest challenges regarding water security is the lack of knowledge regarding its social, political, economic and environmental components, but most importantly, regarding the basic sciences determining its availability and quality
- Ignorance of the basics results in incorrect identification of root causes of problems, and the implementation of ineffective or counterproductive "interventions"
  - In the Ganges Basin, due to a lack of understanding of the basic hydrological function of the system, decision-makers believed that the solution was to dam water in Nepal, where, in fact, the solution revolves around managing groundwater abstraction and recharge in the Ganges floodplain.

Understanding the Issues
3) Conflicting Needs and Poor Governance

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Poor Water Governance…

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Key challenges

- Water-related problems, when combined with poverty, social tensions, environmental degradation, ineffectual leadership, and weak political institutions, will result in social disruptions that can result in state failure.
- Transboundary water (both surface and groundwater resources) management intersect several issues, including water availability for agriculture, hydropower, treatment of wastewater, mining, etc.
- Policy coherence and integration across political borders is critical, but often lacking

Interconnected Risks

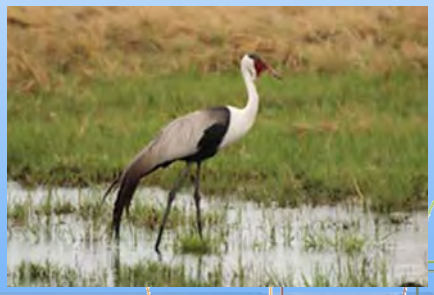
Silo-ism in governance and conflicting needs

- DWS: "No further irrigation from the Vaal River catchment"
- DLA: "Establishment of irrigation schemes is critical for the upliftment of historically disadvantaged and resource-poor farmers and will enhance food security"
- DME: "Addressing our energy needs will partly be met by the establishment of irrigation projects for the production of crops for bio-fuels"

Napoleon's Lesson in Africa

- Under a good government, the Nile gains on the desert
- Under a bad government, the desert gains on the Nile

C) Develop and Implement Solutions to ensure Global Water Security



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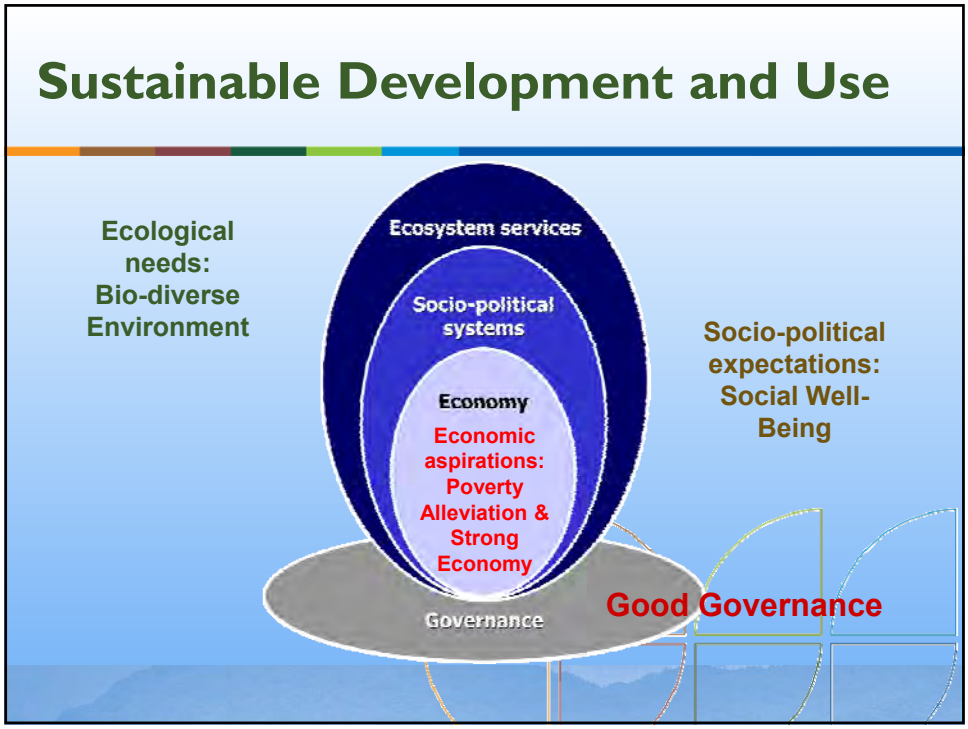
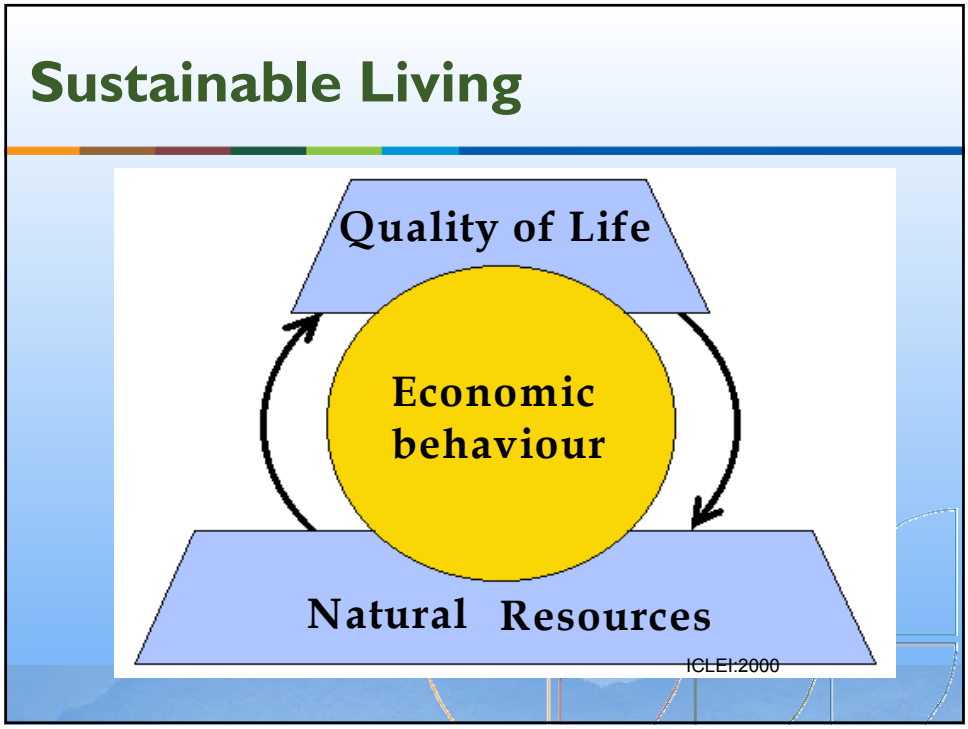
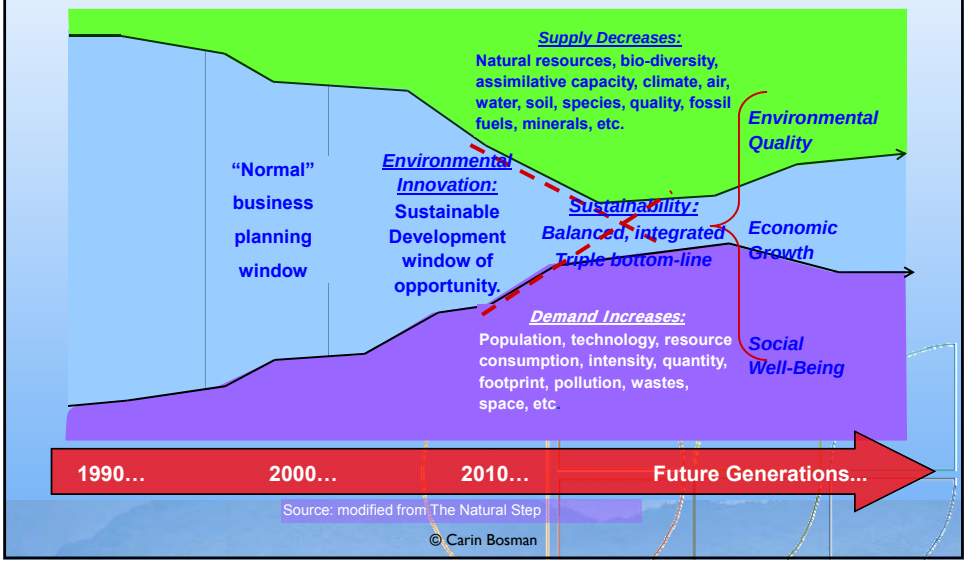
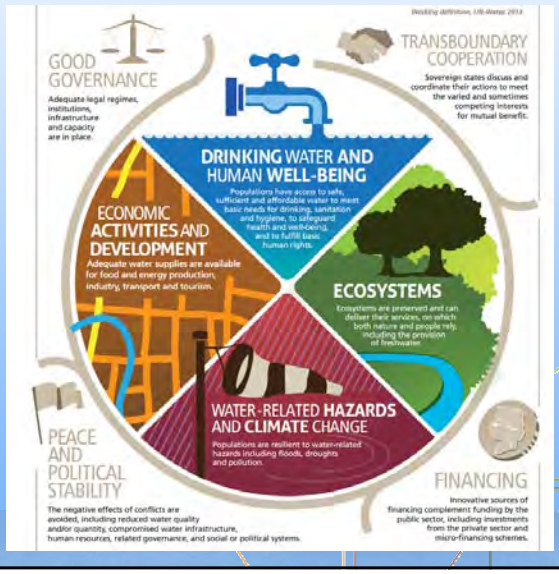

Sustainable Development and Use
Ecological needs: Bio-diverse Environment
Ecosystem services
Socio-political systems
Economy
Economic aspirations: Poverty Alleviation & Strong Economy
Governance
Socio-political expectations: Social Well-Being
Good Governance


Sustainable Living
Quality of Life
Economic behaviour
Natural Resources
ICLEI:2000

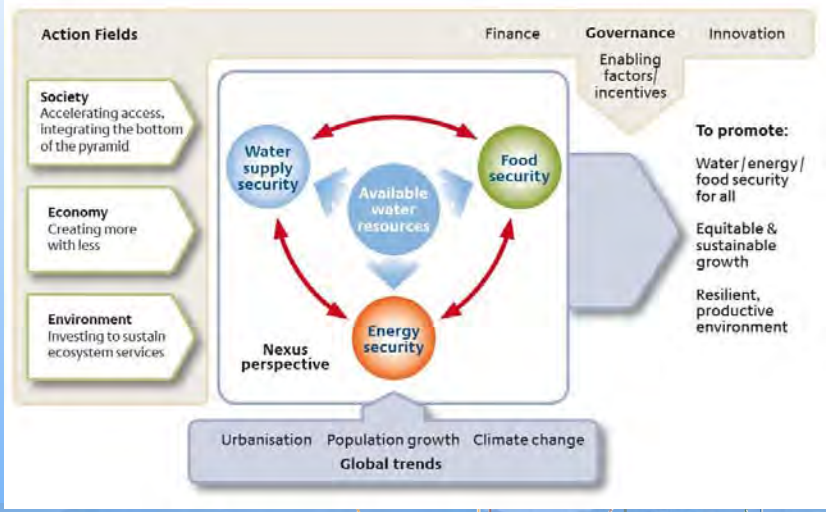
Addressing Global Supply & Demand



Ensuring a Water Secure Future



Take action now to ensure a sustainable tomorrow…



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Strategic Focus Areas

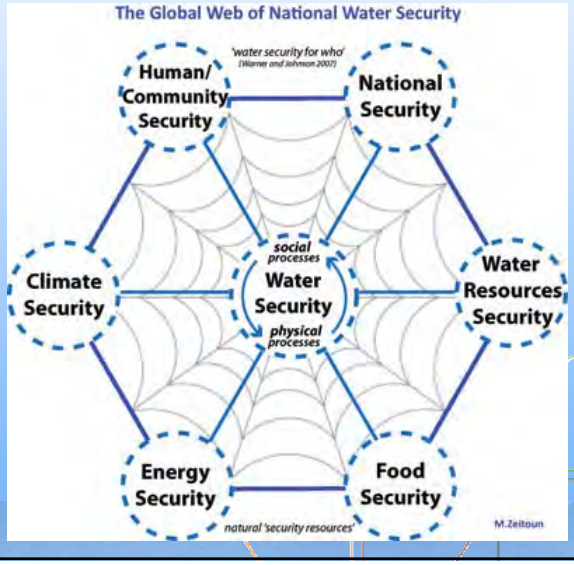
1) Building partnerships:
   - Inter-and intra-governmental cooperation
   - NGOs and Industry
2) Strengthen and improve water governance
3) Fully implement integrated water resources management
4) Building capacity and share knowledge
5) Investments in Infrastructure Innovation

1) Building partnerships

- Water security encapsulates complex and interconnected challenges and highlights water's centrality for achieving a larger sense of security, sustainability, development and human well-being.
- Many factors contribute to water security, ranging from biophysical to infrastructural, institutional, political, social and financial – many of which lie outside the water realm.
- Water security is at the centre of many security concerns, each of which is intricately linked to water.
- Addressing this goal therefore requires interdisciplinary collaboration across sectors, communities and political borders, so that the competition or potential conflicts can be resolved.

UN Water, 2013

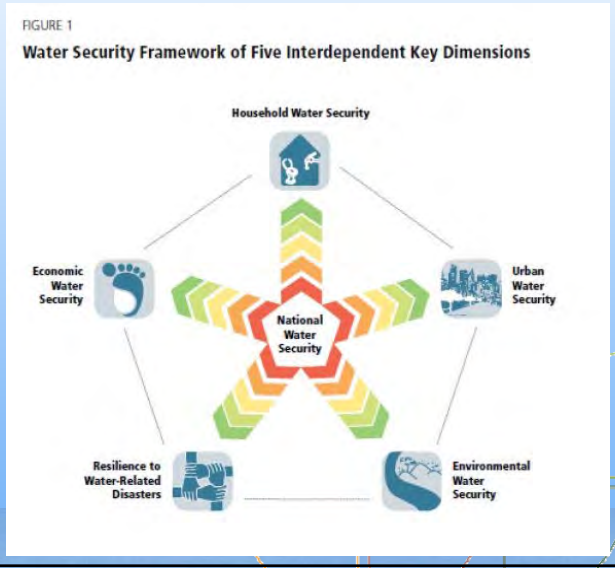
Inter-relationships between Global sectors



Dimensions of Water Security

- Different scales:
  - Geopolitical, regional, national, catchments, provincial, cities, rural, peri-urban, households
- Different aspects:
  - Integrated water resource management
  - Redirection of investment and financing
  - Mitigation of risks
  - Sharing knowledge and benefits, including transboundary

Key Dimensions of Water Security



Asian Water Development Outlook ("AWDO")

- 5 key Dimensions:
  - Satisfy household water and sanitation needs in all communities
  - Develop vibrant, liveable cities and towns
  - Support productive economies in agriculture and industry
  - Restore healthy rivers and ecosystems
  - Build informed and resilient communities that can adapt to change
- Quantifiable, and being measured

Key Dimensions of Water Security

- Household
  - Reliable water supply and sanitation services
  - Health
- Community
  - Resilience to disaster
  - Affordable
- Economy
- National
  - Survival and security of the state
- Environmental
  - Ecological survival, both local and global

2) Strengthen and Improve Water Governance

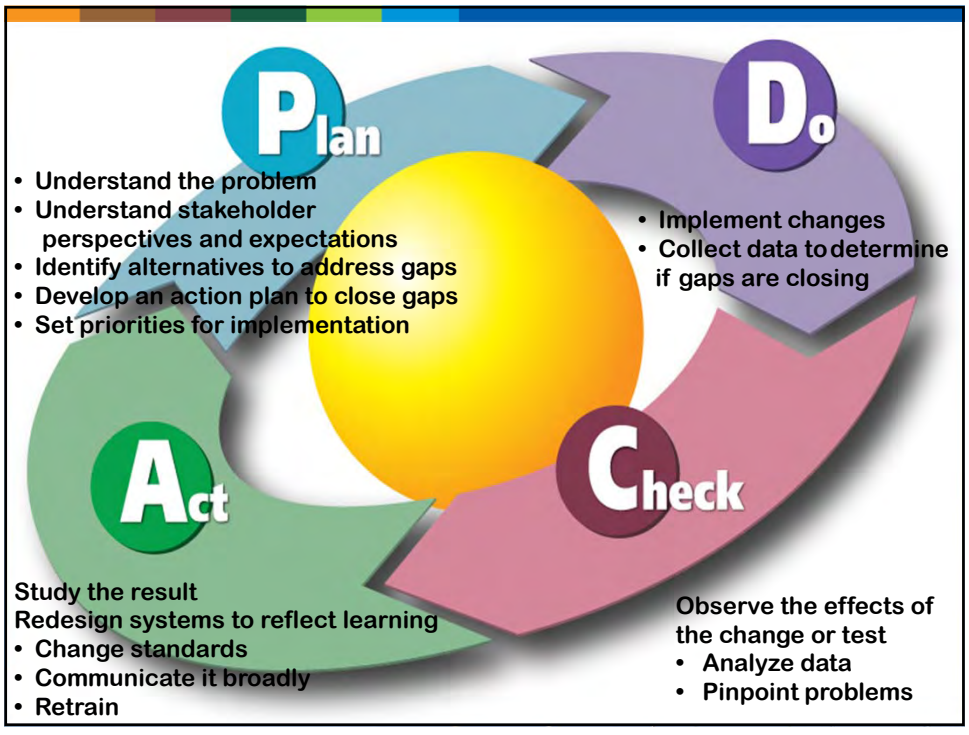
- Government – national, provincial, local
- Corporate governance – implementation of King III
- Ensure the incorporation of sustainability principles into practical policy, regulation, procedure and guidelines
- Change funding mechanisms
- Facilitate a culture of change
- Ensure improved service delivery at local level
- Ethics of systems and processes
- Develop mechanisms and tools to facilitate implementation of BPEO

2) Strengthen and Improve Water Governance

- Optimise water resource allocation and regulation
  - Development of streamlined authorisation procedures
- Understand the differentiated concept of "pollution" and implement mechanisms to prevent pollution of surface and groundwater resources
  - Science-based and reasonable thresholds and targets for disposal, discharge and emissions
- Increase mechanisms to ensure water conservation and create a water-saving society
- Assistance with practical interpretation and application of legislation

3) Implement integrated water resources management

- IWRM provides the adaptive process necessary to ensure increased water security:
  - It focusses on stakeholders needs and expectations
  - It facilitates planned governance
  - It facilitates the implementation of the BPEO
  - Water security should always be listed as a primary objective



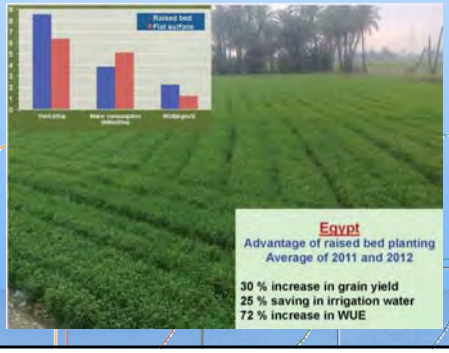
4) Building capacity and share knowledge

- Capacity Building
  - Awareness raising among officials, planners, administrators, economic sectors, local authorities, civil society, etc essential
  - Adequate financial and human resources
  - Capacity Building in sustainability principles and how to use these principles in practice
- Knowledge: Research ensures a good scientific information basis for effective management:
  - ecosystems, hydrological and ecological processes
  - Socio-economical analysis
  - Regularly updated with effectively structured and coordinated monitoring
- Share information and knowledge between water quality management, land use planning, urban development, water supply for irrigation, industrial and other use

5) Invest in Infrastructure and Innovation

- We HAVE the science!!
- Rethink, redesign and re-engineer infrastructure, systems and practices that are unsustainable, especially those inherited as a result of being colonised by water-rich countries:
  - Innovative approaches to agriculture
  - Water supply and distribution
  - Water-borne sanitation
  - Coal fire energy supply
  - Macro-scale services
  - Water-efficient technologies and systems

Irrigation systems

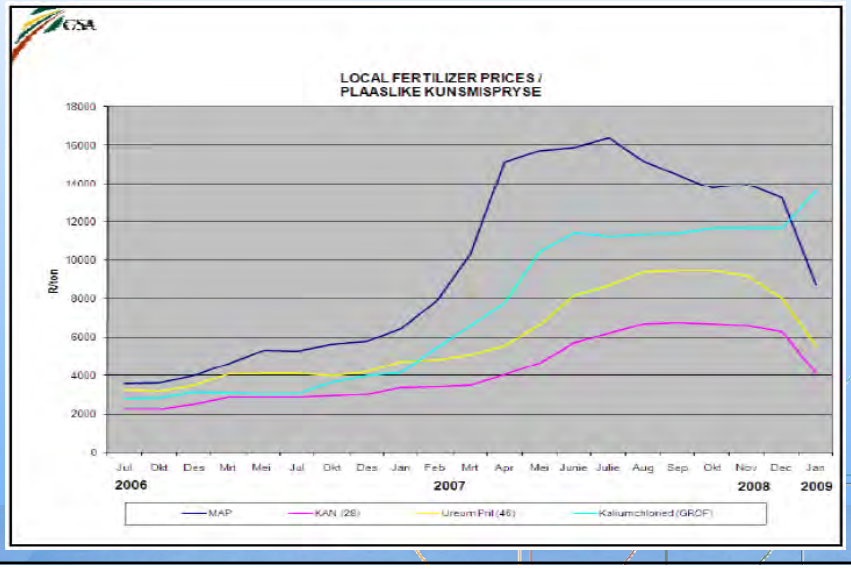


"Modern" Waste WATER treatment systems …

ageing infrastructure…

unsustainable in a water-stressed context

…there is money in muck…

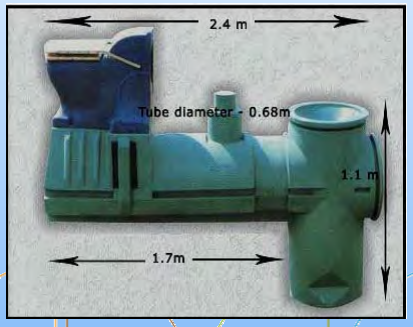


First Black water vacuum collection: Lierner System – Amsterdam, 1870

Separation at source: Collection systems

Urine diverting toilets

Waterless toilets



South African Invention!

Approach

- Use existing network in government, industry, professional organisations and NGO's
- Capacitate and facilitate common understanding
- Influence policy and decision-making
- Influence funding of developments
- Communicate, network, and cooperate
- Find better alternatives
- Above all, consider unintended consequences!

Questions?

"The wars of the next century will be about water, unless we change the way we manage water"
~Ismael Serageldin,
Founder of the World Water Council

Thank You!

"Quality and value today for a sustainable tomorrow"