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Institute for Integrated Management
of Material Fluxes and of Resources

Water Resources Management from a Nexus perspective

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Photo: MHE



International Conference
Sustainability in the Water-Energy-Food Nexus
19-20 May 2014 in Bonn, Germany



Photo: Jungmann



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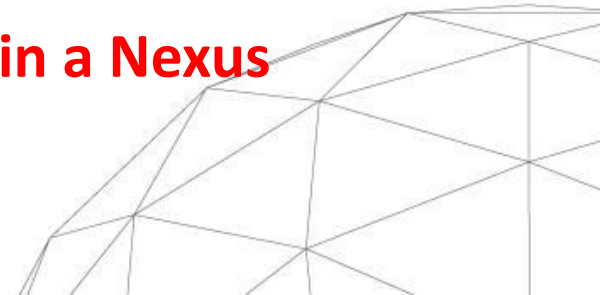
Water Resources Management from a Nexus perspective

- This presentation -

- Water resources in a Nexus – in general

Water Resources in Africa – as examples

- Freshwater needs & climate in Africa – in general
- **Water Resources** are **found in a Nexus**
a case study
- **For the future: Water Resources** are **put in a Nexus**
a proposed project





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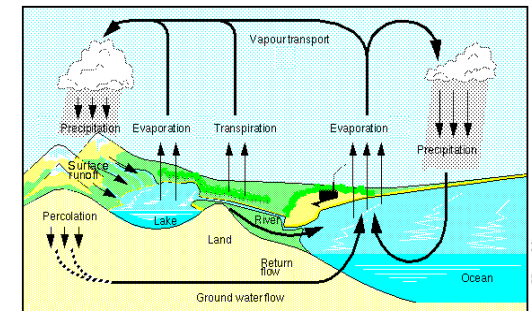
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Water Resources Management from a Nexus perspective

Water Resources in a Nexus

Especially **Inter-connectivity & inter-dependency**

- **Water cycles:**
Precipitation - surface water - soil water – groundwater – water in man-made systems, etc.
- **Chemical cycles (e.g., C, N, P, metals, particles, etc.):**
Atmospheric/gaseous -**water** – soil – geology – living organisms and non-living matters, etc.
- **Material cycles (e.g., life cycle):**
Gaseous-**water**/liquid-solid, etc.
- **Socio-economic factors**
- **Management**
- **Capacity-development (institutional, individual)**



Source: E. Röckner, Max Planck
Institute of Technology



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Water Resources in Africa

Competing Needs for Freshwater

- Drinking water
- **High and increasing demands** for agriculture – food production
- Increasing demands for fisheries – food production
- Domestic use
- Industrial use
- Environment and ecosystems – animals and plants



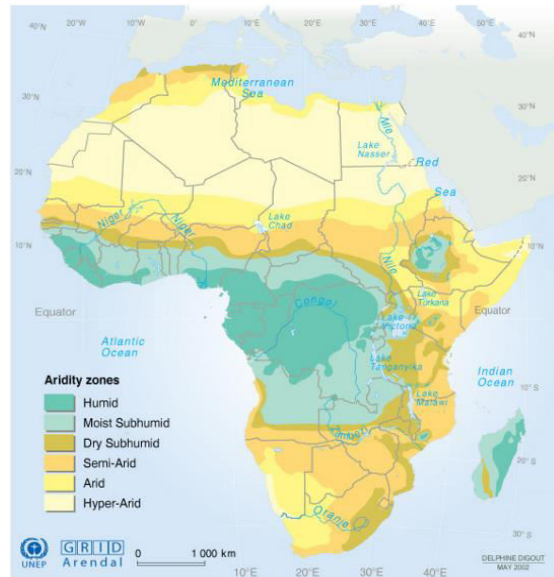


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Water Resources in Africa

Aridity Zones



Source: World Meteorological Organization (WMO), United Nations Environment Programme (UNEP), *Climate Change 2001: Impacts, Adaptation, and Vulnerability*, Contribution of Working Group II to the Third Assessment Report of the Intergovernmental Panel on Climate Change (IPCC).

(source: UNDP/GRID-Arendal, 2005)

Climate & arid zones

- 40 % of Africa's population lives in arid, semi-arid, and dry subhumid areas
- Climate change → **an increase in arid zones**

Climate & coastal zones

- **Coastal issues** → **erosion, pollution, saltwater intrusion, subsidence, unplanned urbanization**
- **Climate change (sea level rise, flooding, cyclones, ...)**
→ Intensification of coastal problems



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Water Resources in Africa

Water Resources [projects] are found in a Nexus

A Case Study

A previous project:

**Characterizing the Manga aquifer to ensure
safe drinking water in south-east Niger**

Implementing agencies and collaborators

- le Ministère de L'Hydraulique et de l'Environnement, Direction des Ressources en Eau, Niamey, Niger (R.Sanoussi and others)
- IAEA (M.Ito and others)
- K. Zouari, R. Trabelsi, E. Gibert-Brunet
- Others



Project: Characterizing the Manga Aquifer to ensure safe drinking water in south-east Niger

Background:

Low precipitation & recurring drought → water is scarce

Irrigation development → more water is needed

Objective:

Sustainable groundwater resource use and management,
for potable water supply in South-east Niger

Specific, immediate objectives:

To examine

- **recharge and flow processes** and
 - **mineralization mechanism**
- in the Manga aquifer



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Project: Characterizing the Manga Aquifer to ensure Safe Drinking Water in South-east Niger

Study site: South-east Niger adjacent to Lake Chad



(bluelivingideas.com, 2010)



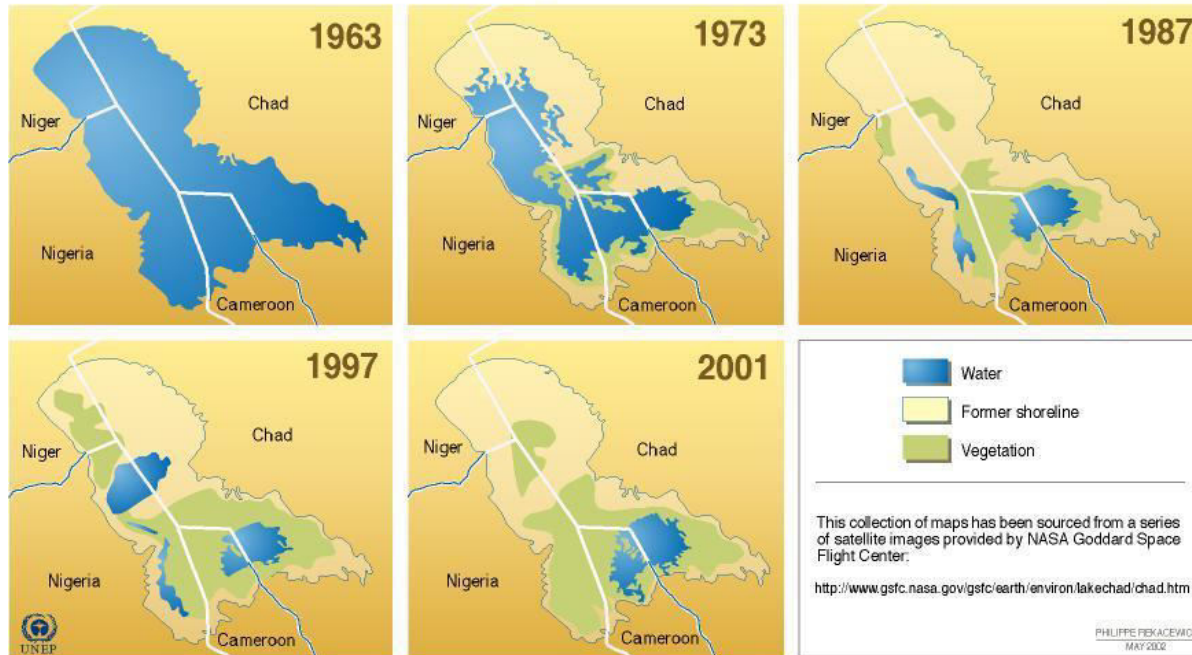
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Lake Chad – Shrinking Lake

A Chronology of Change

Natural and Anthropogenic Factors Affecting Lake Chad



(Source: UNEP 2002, GSFC 2001)

Lake Chad

- Shared by **Niger, Nigeria, Chad and Cameroon** in West Africa
- **Climatic changes** and **high demands for agricultural water** are responsible for the lake's shrinkage

A number of projects for the assessment and improved management:

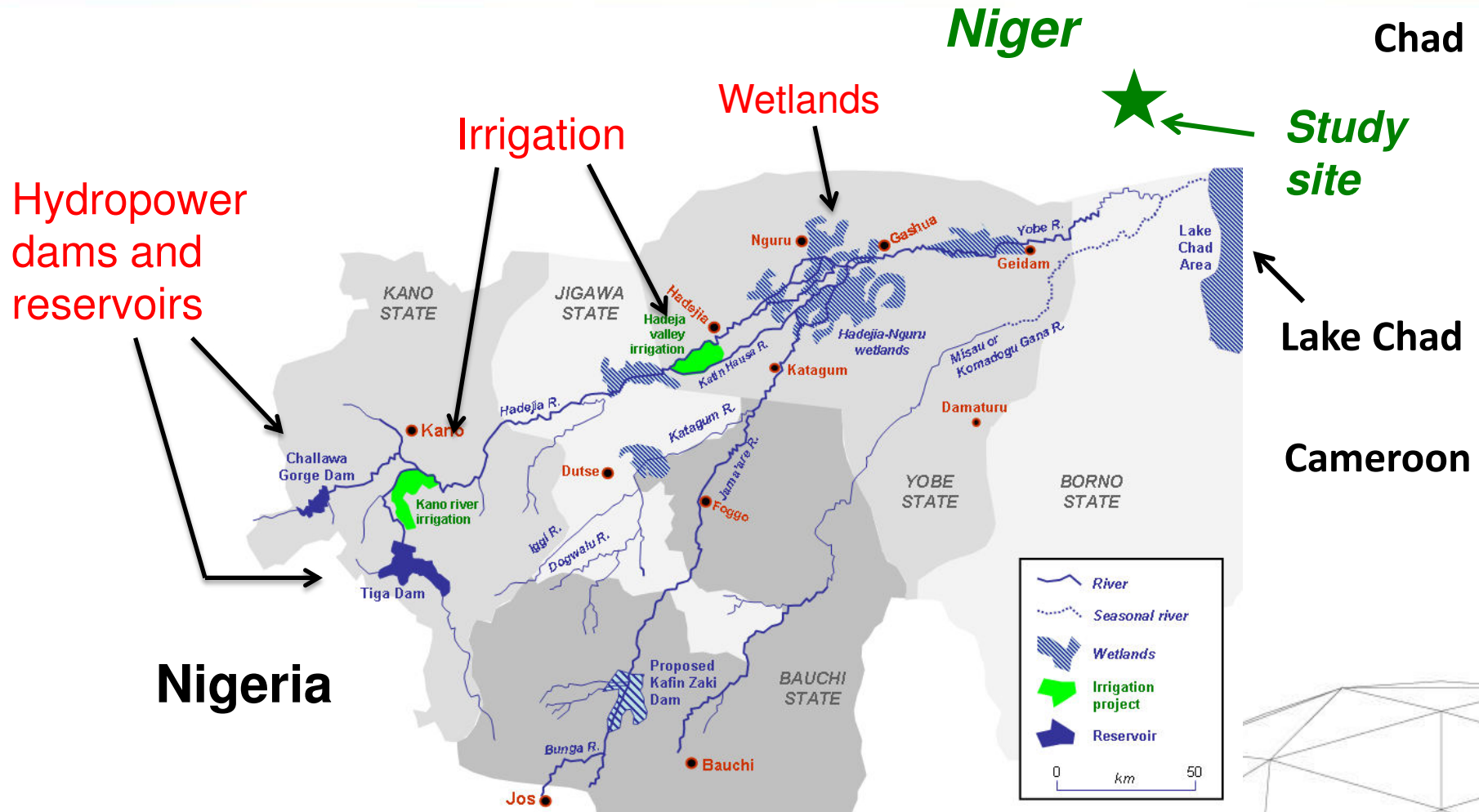
e.g., the Lake Chad Basin Commission, UNEP, GEF, GIZ, BGR, IUCN, WWF, universities, and others.



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The Komadugu-Yobe River

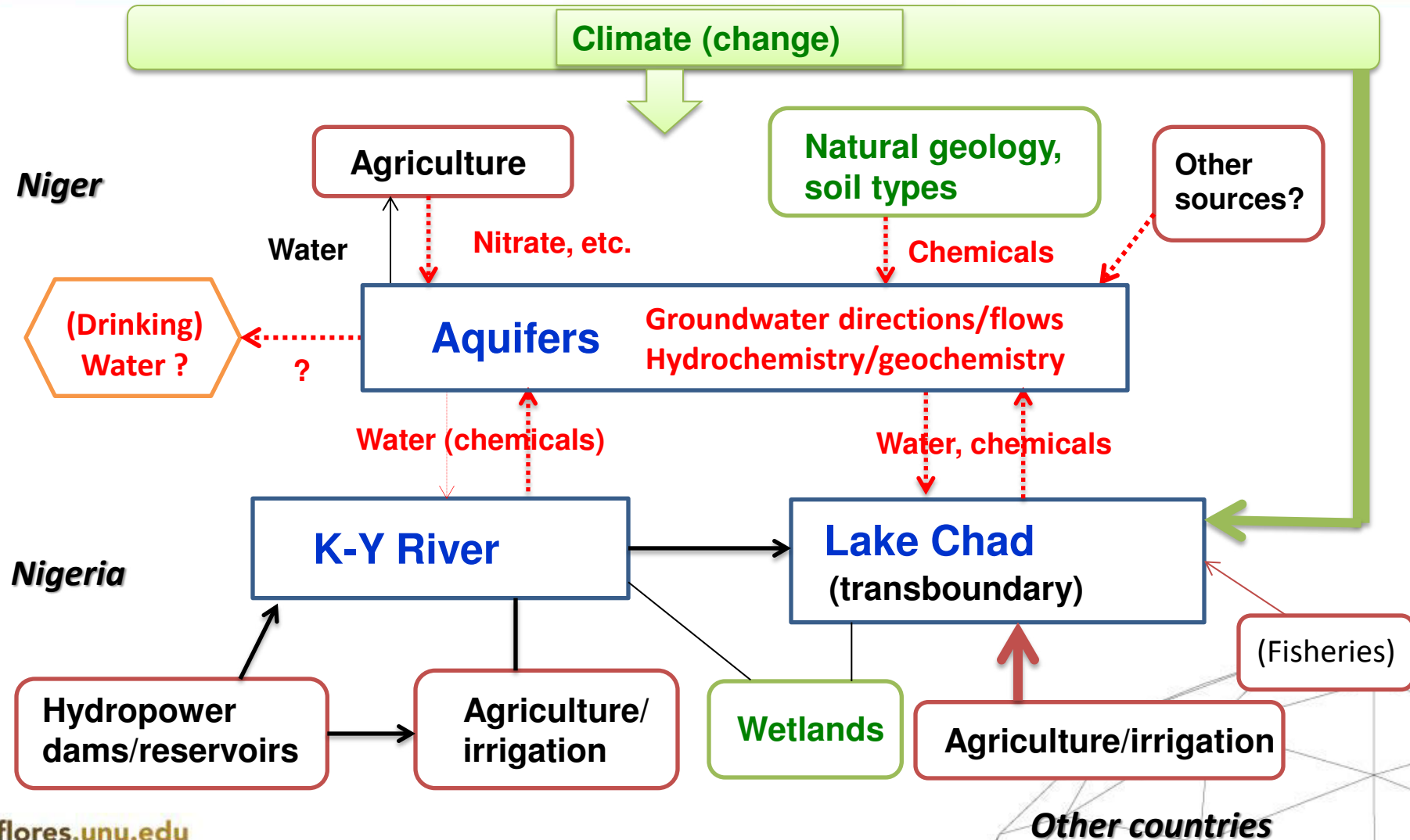




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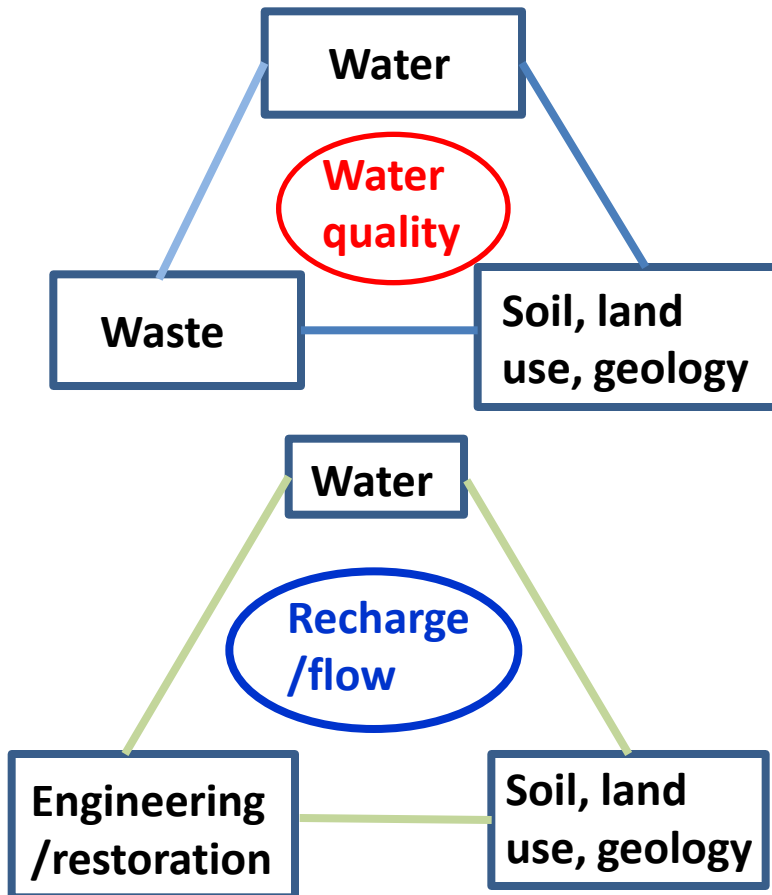
Water resources system related to south-east Niger – simplified





Reflections – from a nexus perspective

Examples



- Project partners knew **inter-connectivity and inter-dependency** (a nexus)
- **Boundaries (and scales):** project boundary, geographic boundaries, national boundaries, sectorial boundaries, social boundaries, etc.
- **The importance of inter-dependency** should be presented to **all levels**
- **Think a Nexus**
- **Act sometimes locally**
- **Act sometimes step-by-step**





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Water Resources in Africa

For the future

Water Resources [projects] are **put in a Nexus**

A proposed project:

**Effects of climate, land use and urbanization on
water resources in the city of Beira, Mozambique**

Project partners

- UNU-FLORES
- Universidade Católica de Moçambique (UCM) -CIG
- Universidade Eduardo Mondlane (UEM)
- Ministry of Science and Technology (MCT)-Water Research Institute
- Possibly others





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Environmental and social conditions related to water resources in the coastal city

- **Local climate [change]**

heavy rainfall events & cyclones

Sea level rise

→ **Flooding**

- **High and low tides – up to 7m**

The wet and dry seasons

- **Rapid population growth → unplanned urbanization**

- New and informal settlements

- Increased demand for water supply and sanitation

- **Illegal / artisanal mining upstream → actual and possible pollution**



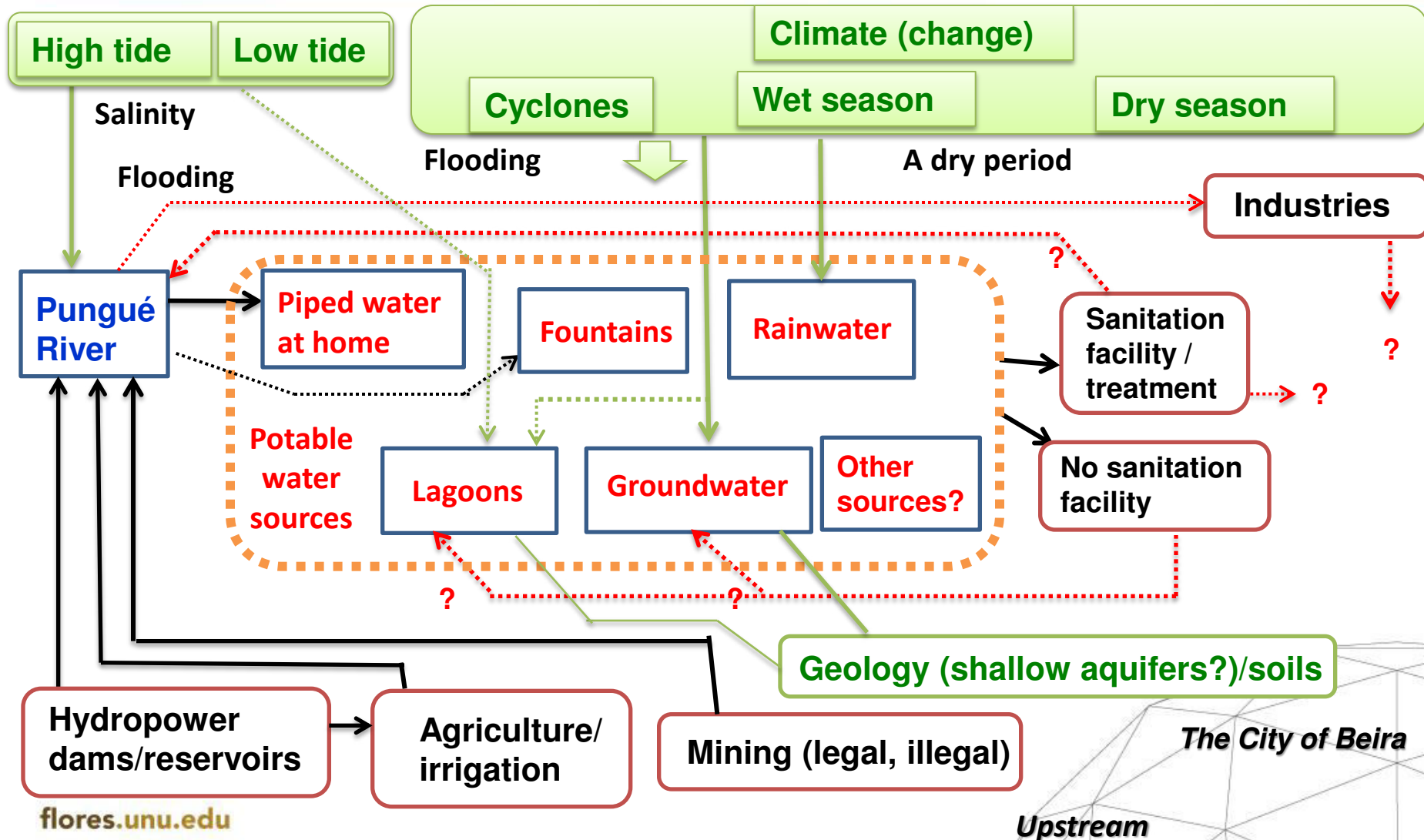
Source: www.cdc.gov



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Water resources system related to the coastal city in Mozambique – work in progress





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More info:
<http://flores.unu.edu>

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International Conference

Sustainability in the Water-Energy-Food Nexus

19-20 May 2014 in Bonn, Germany

SPECIAL SESSION ORGANIZED BY UNU-FLORES

SUSTAINABILITY IN THE WATER-ENERGY-FOOD NEXUS: AN ENVIRONMENTAL RESOURCES PERSPECTIVE

20 MAY 2014 11:00 – 12:30

PARALLEL SESSIONS | BLOCK D

FIRST FLOOR | ROOM SALON ARNDT



SESSION MODERATOR

Reza Ardakanian

- 1 Stephan Hülsmann (*UNU FLORES, Dresden, Germany*)
Nexus in practice – a systems analysis approach
- 2 Mari Ito (*UNU FLORES, Dresden, Germany*)
Water resources management from a Nexus perspective, a case study in Africa
- 3 Kai Schwaerzel (*UNU FLORES, Dresden, Germany*)
Neglecting the Soil-Water Nexus hampers the sustainable regional development in NW China
- 4 Hiroshan Hettiarachchi (*UNU FLORES, Dresden, Germany*)
Open Dumps to Nexus approach: Historical evolution of waste management
- 5 Mathew Kurian (*UNU FLORES, Dresden, Germany*)
Institutional Arrangements: Co-Provision as a Nexus Concept



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