Update on GCI II Project

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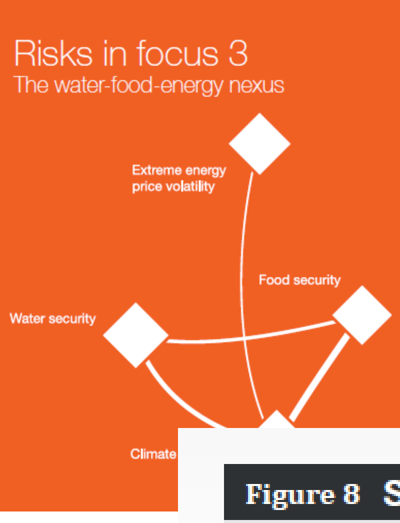
Marx and Janos Bogardi)
GWSP SC Meeting
October 1, 2012

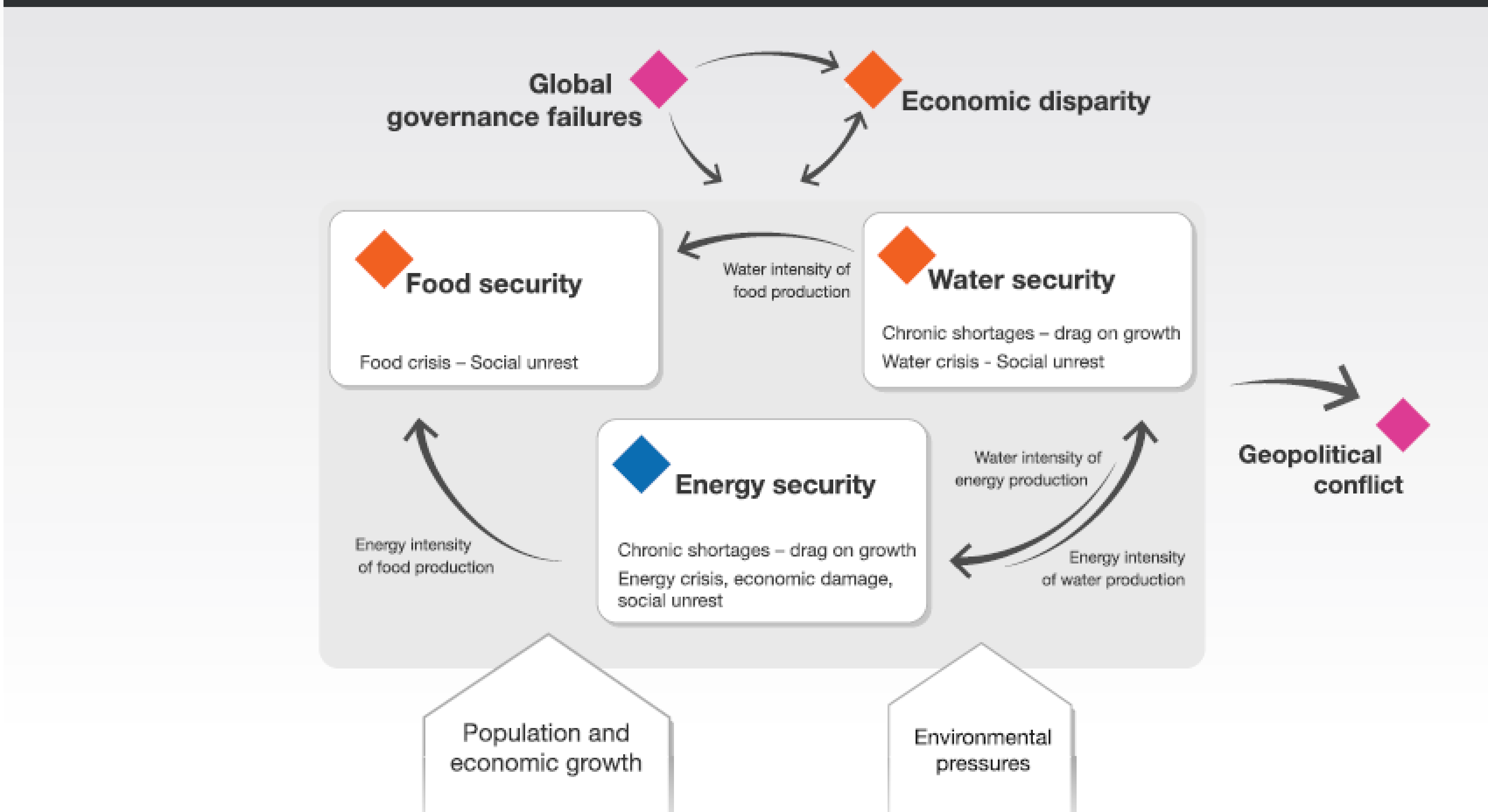


Three major risks for the global economy:

1. The macroeconomic balances nexus
2. The illegal economy nexus
3. **The water-food-energy nexus**

(2011 World Economic Forum)

Figure 8 System diagram for risks associated with the water-food-energy nexus



Surveys were used to gather information to characterize the following relationships and to address the questions/ hypotheses that formed the bases for GCI !!. The four core science questions or hypothesis that were considered for study included:

How are issues related to the **integrated water-energy-food (W-E-F) security issues** affecting major river basins? **(How important is the issue?)**

How are **major river basins being managed** in order to address **the emerging challenges** arising from water-energy –food security issues and the effects of changes in the climate, demographics and economies of the world? **(How are basins being managed to increase W-E-F tradeoffs?)**

How do **water-energy-food security strategies/mechanisms link separate and remote river basins** and affect their physical, socio-economic, ecological and governance status? **(How far-reaching are effects in one basin?)**

How well are **current approaches to governance and management addressing the W-E-F issues** and does a basis exist for recommending changes for the future? **(Do we need to change approaches to water management?)**

Survey questions were related to the following topics:

1. Background: Information to be obtained from background research on the Basin.
2. Land use
3. Global Change (including climate change, land use change, river channel modifications, etc)
4. Water Quantity (Supply and demand) (includes water management)
5. Water Quality impacts
6. Agricultural Drivers
7. Energy Drivers
8. Food versus Energy Tradeoffs (Biofuels)
9. Maintenance of Diversity
10. Extremes and risk management
11. Legal frameworks and ownership
12. Environmental Services
13. Conflict and conflict resolution
14. Government intervention (subsidies, regulations..)
15. Soft Solutions/Data Access/ Knowledge Sharing
16. Governance Questions:

Procedure:

Two types of questionnaires were developed – a long one for experts and a shorter more general one for practitioners.

Information thought to be readily available on the web was not requested in the questionnaires. GWSP IPO staff (mainly Sina Marx) helped to acquire these data.

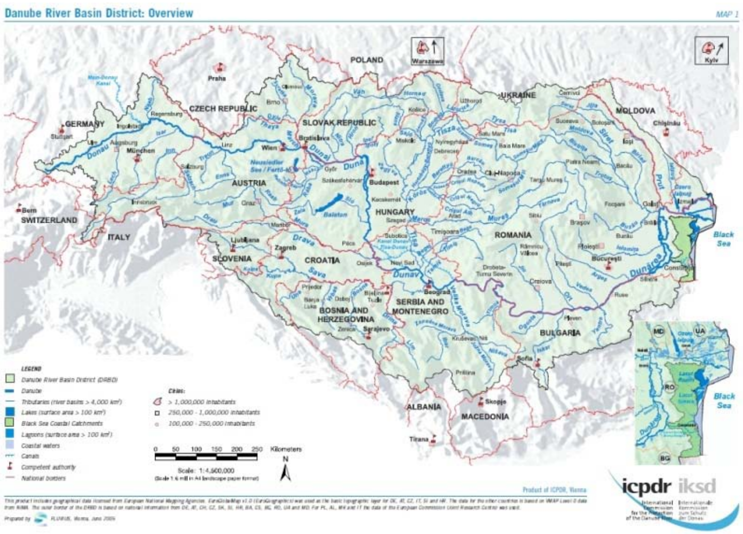
Identifying people with the right expertise was difficult in some basins where we had few contacts. In a few cases the responses were not fully helpful. In other cases the promises of completed survey forms has not materialized.

The Basins to be surveyed have been chosen from the GCI and the Twin-to-Go basins. Approximately 80 questionnaires were sent to experts and practitioners in the following basins:

Response Received:
Amudarya River Basin
Danube River Basin
Elbe River Basin
Hexi Corridor Inland Basins (China)
Huai River Basin
Incomati Basin
Jordan River Basin
Lake Winnipeg Basin
Mekong River Basin
Murray Darling Basin
Orange River Basin
Volta River Basin
Yellow River Basin.

No Response received:
Brahmaputra River Basin
Euphrates River Basin
La Plata River Basin
Mississippi River Basin
Nile River Basin
Okavango River basin
Tigris River Basin

River Basin: Danube



Countries: 19

Development Level: Higher GDP for downstream Countries.

Characteristics:
Length: 2857 km
Area: 817.000 km^2
Population: 84-86 Mill.

Pressures for change:
-Economic pressures are severe; Political pressure; Climate change (temperature has impact, rainfall is uncertain)

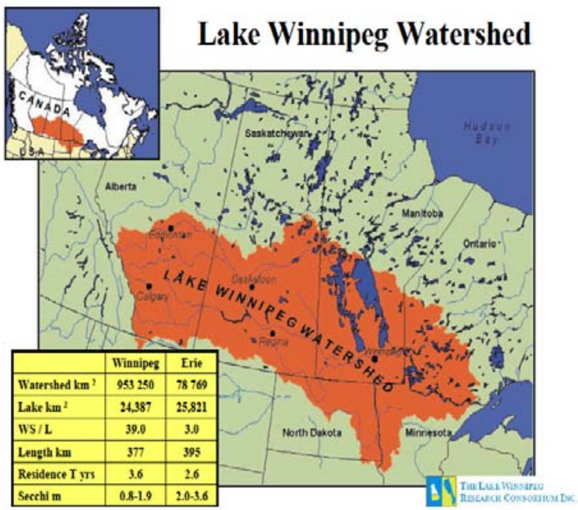
Human interventions: reservoirs for irrigation, water abstraction, channelisation of rivers, environmental degradation

Challenges: Euthrophication, Some major pollution sources, Impacts on the Delta and Black Sea, The Gabcikovo hydropower case, Black Sea endangered, Sensitive ecological areas endangered. Morphological changes in river

Governance Approaches: Moved from bilateral agreements to basin wide agreements; establishment of ICPDR; from a single objective approach to an integrated approach

Lessons: Human impacts on the basin are much larger than climate change

River Basin: Lake Winnipeg



	Winnipeg	Erie
Watershed km^2	953 250	78 769
Lake km^2	24,387	25,821
WS / L	39.0	3.0
Length km	377	395
Residence T yrs	3.6	2.6
Secchi m	0.8-1.9	2.0-3.6

Countries: 2

Development Level: Large exports from agricultural activities

Characteristics:

Length: 1939 km (Saskatchewan)

Area: 953,250 km^2

Population: 6.6 Mill.

Pressures for change:

-Agriculture demands versus flood control; energy processing effects on water quality; climate change effects on floods/droughts;

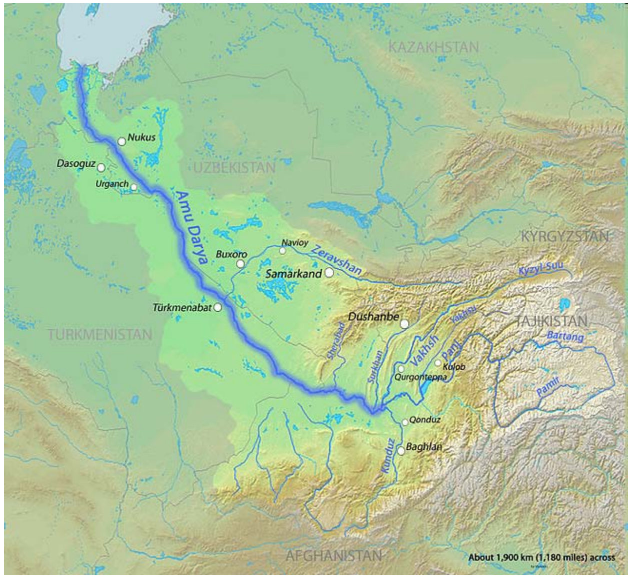
Human interventions: reservoirs for irrigation, hydro, and flood control, water abstraction, transport by rivers of excessive chemical fertilizers

Challenges: Water use for irrigation (Alberta), mining, hydropower production, flood protection; disagreements over water use; and flood control versus water needed; nutrient transport and eutrophication, interbasin transfers

Governance Approaches: Many agreements and cooperative mechanisms (e.g. IJC, RRBC) at the federal and provincial/state level; appropriation agreements.

Lessons: Food demands around the world lead to intensive agriculture and the production of pollution and the export of virtual water.

River Basin: Amudarya River

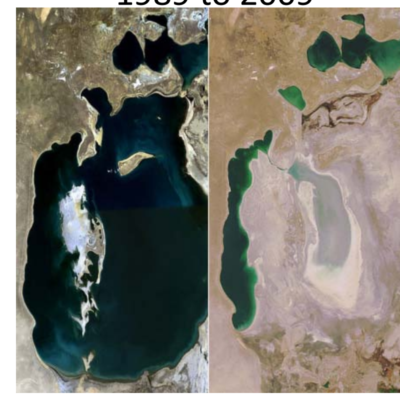


Countries: 5

Development Level: TBD

Characteristics:
Length: 2540 km
Area: 309,000 km^2
Population: 50 Mill.

1989 to 2009



Pressures for change:
-Agriculture demands versus flood control; energy processing effects on water quality;
Human interventions: pre – 1990 centrally planned - water use conflicts with availability; Post -1990: countries compete with few effective coordination mechanisms

Challenges: Outdated inefficient irrigation infrastructure; lack of water treatment; shift in crop types (cotton to wheat); upstream (energy)/downstream (agriculture) conflict; finances to develop hydropower; resistance to change.

Governance Approaches: Coordination mechanisms needed; Interstate Council for the Aral Sea and Interstate Commission for Water Coordination (ICWC) created.

Lessons: Rapid degradation of water available and ecosystems can accompany change born In conflict if regional and national coordination mechanisms become non functional.

River Basin: Jordan River

Countries: 5

Development Level: TBD

Characteristics:

Length: 330 km

Area: 18,500 km^2

Population: TBD Mill.

Pressures for change:

- Population growth and urbanization, decreasing groundwater levels; no biofuels or hydropower production, NGOs seeking more water for the environment.

Human interventions: 1964 Israel implemented national water carrier (construction started in 1953; 1967: War led to destruction of Syrian diversion project

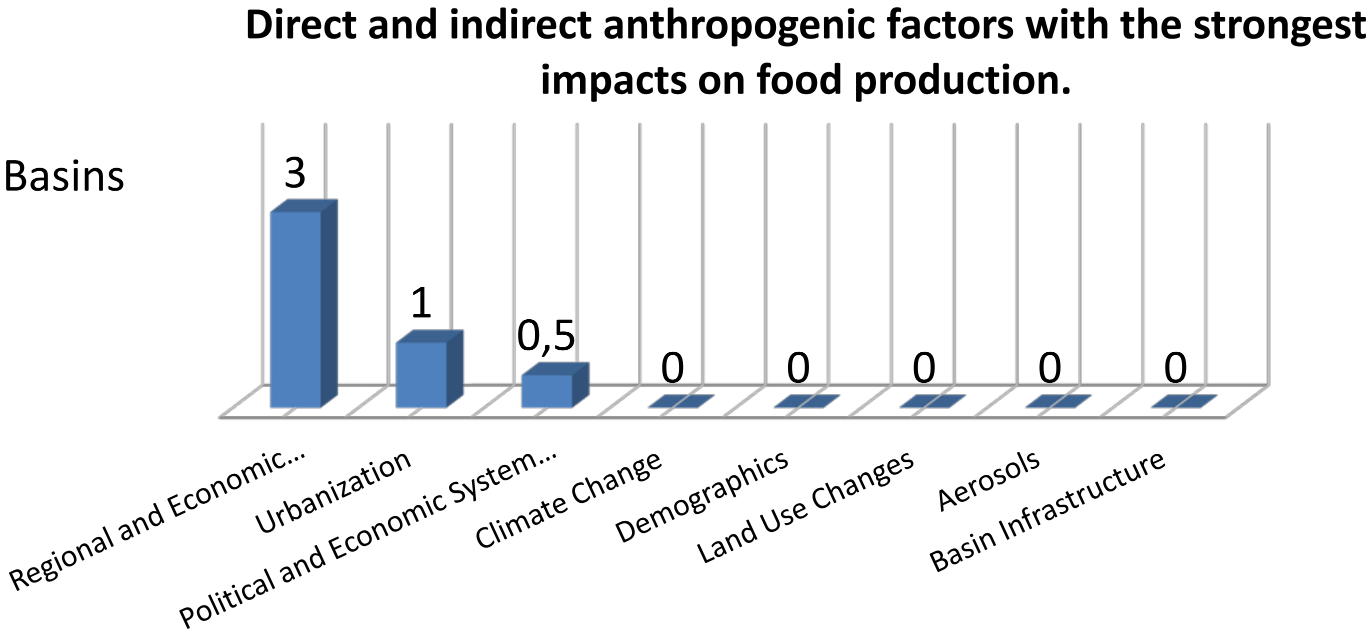
Challenges: Extreme variability and wide range of climates over a very short distances, frequent political conflicts over water and other issues, lack of equitable access, increased water demand due to population growth, downstream salinization.

Governance Approaches: Enforce use restrictions, increase water prices, encourage technologies (recycling water)

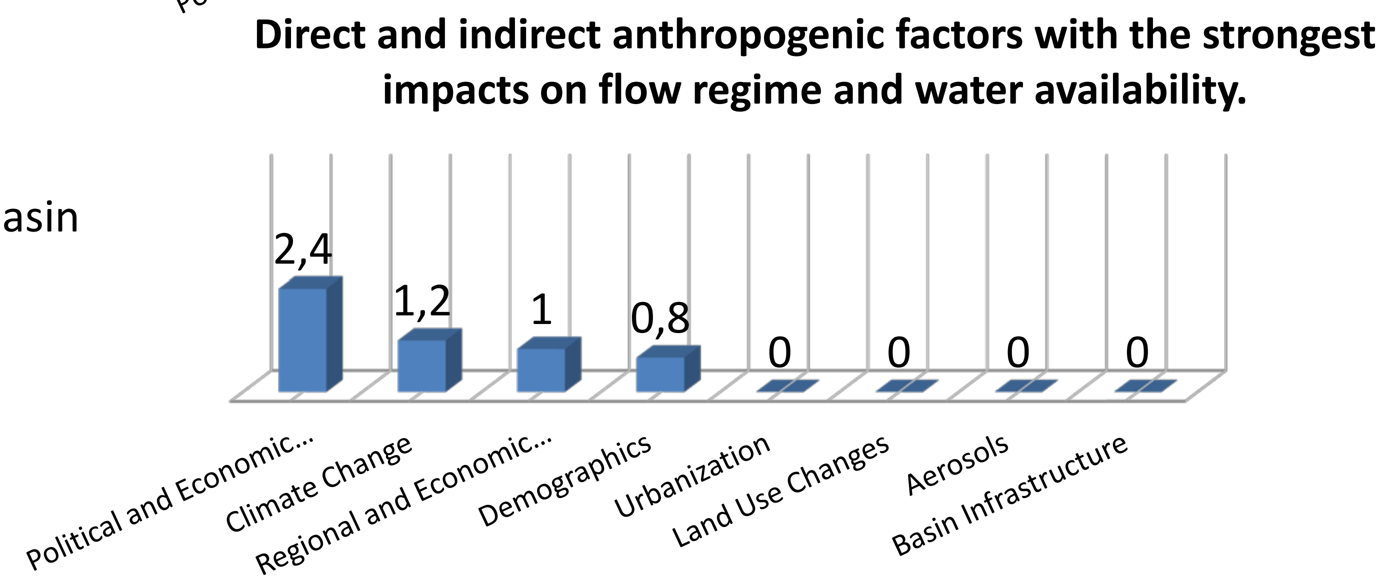
Lessons: Technical collaboration plays a role in ensuring dialogue between the ripirian nations

Preliminary Basin Intercomparisons

Yellow and Huai Basins



Jordan River Basin



Challenges in the analysis to date:

Not all of the basins have provided responses.

Some of the surveys were of less value than others.

In order to fill the gaps interviews will be held to try to obtain confirmation or expansion of answers to the questions.

Potential Contributions of the Winnipeg workshop to GCI II:

The GCI II workshop held in Winnipeg was intended to review the inputs received to date and to use these basins as a basis for discussions that will lead to the identification of some principles that underlie the Water-Energy-Food nexus in developed and undeveloped basins.

Observations from the GWSP Global Catchment Initiative Phase II
(Based on Survey responses from 11 basins):

- The Challenge of Integration
- The Political and Policy Interfaces
- The Changing Role of Rivers
- Monitoring Change in the Basins
- Implications of Energy and Food Production and Consumption
- Data Issues and Integrated data systems
- Advancing IWM and Political Cooperation through Technical Cooperation
- The influence of scale on implementing IWRM
- Water management for the Bioeconomy

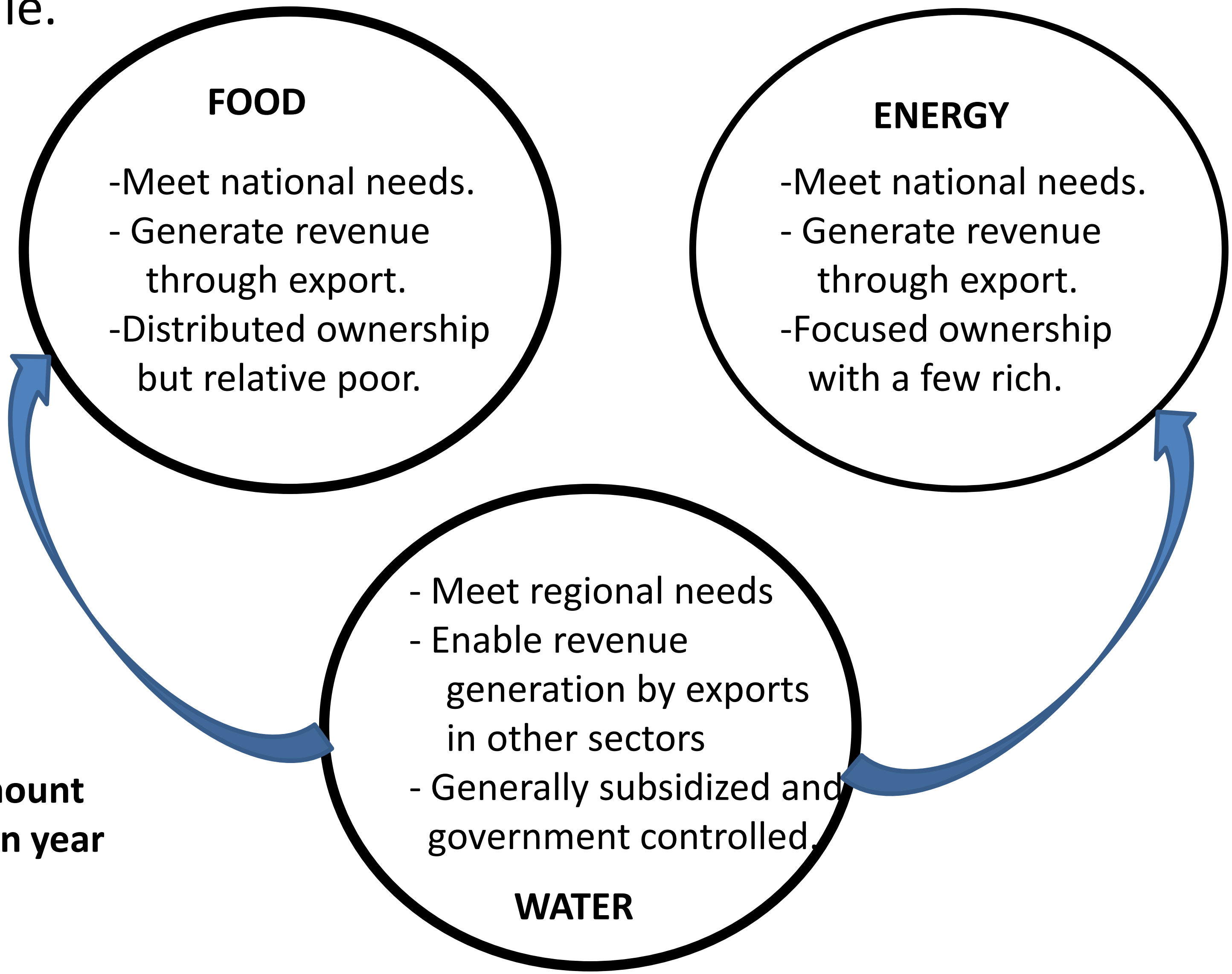
Needed: New approaches to governance:

Governance: the systems and stakeholder roles for decision making and for the allocation of responsibility and accountability.

Governance structures should:

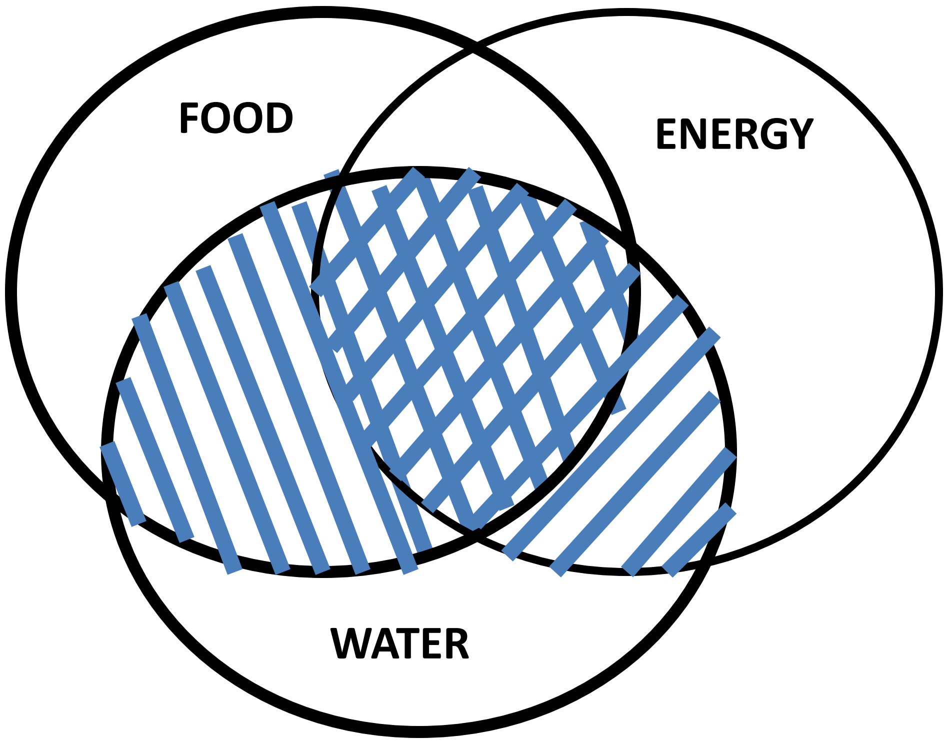
- enable issues related to water, energy, food and environment to be considered within a single forum,
- involve experts from different levels of government to interact with stakeholders and the public in consultative and when appropriate in decision making processes,
- seek fora where state or national leads can provide feedback which would be helpful for developing basin-wide management plans.
- maximize the use of Earth Observations and scenarios to make the decision process as transparent as possible.

Energy and food are generally managed separately each with the goal of maximizing the profit from production for a sector at the national scale.



Water allocations determine the amount available in a given year to each sector

Significant areas of overlap exist between the management needs of water, energy and food.

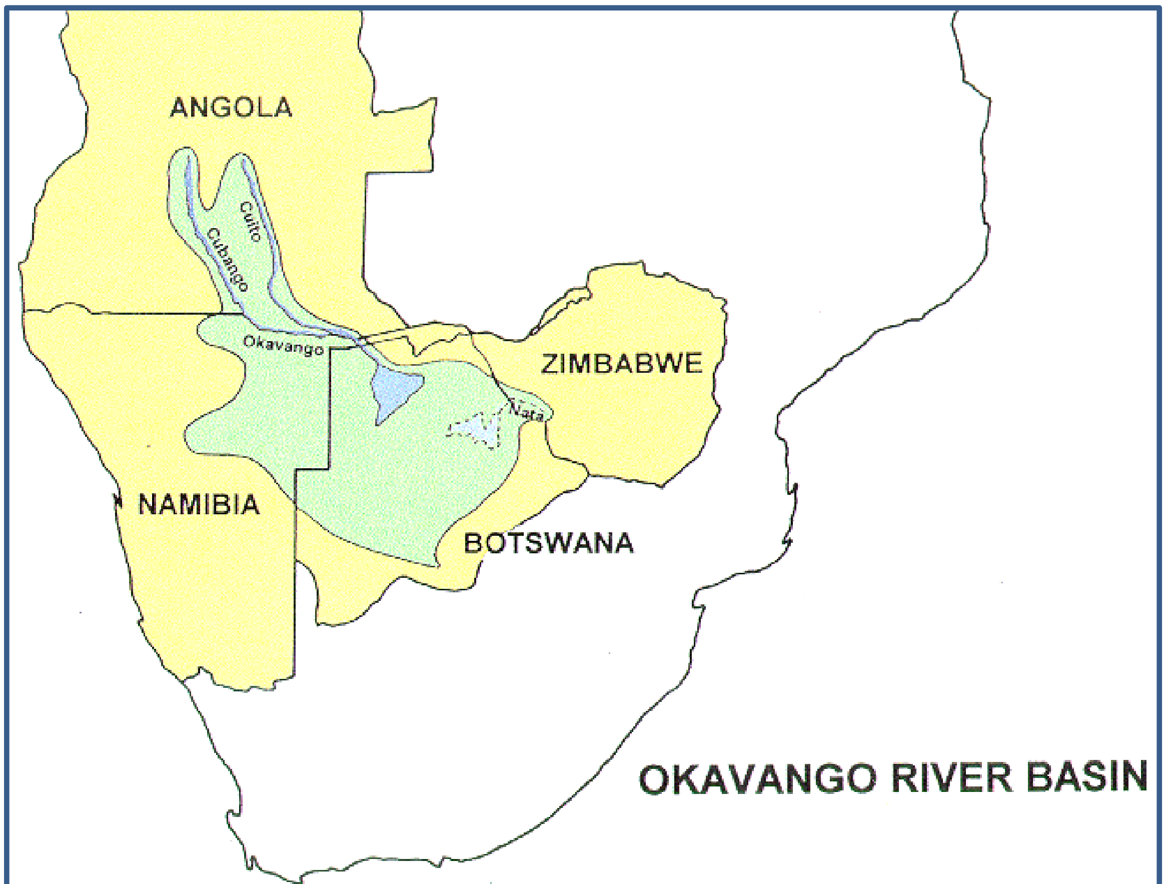


Some areas where joint risk should be addressed:

- **Climate change (trends, shifts and extremes)**
- **Economics/ investments**
- **Links to environmental services**
- **Pressures from increasing consumption due to demographics.**

Unfortunately, the needs of the environment are not well articulated in most national policies.

For transboundary basins: Managing these basins with only national perspectives limits the sharing of the benefits of water for food and energy production and environmental sustainability   To support more integrated water resources management, data bases are needed that enable accurate monitoring of these basins.



Water in the context of Earth Observations:

Water is the entry point for Sustainable Development (SD) and the Green Economy. Without water security it will not be possible to realize these SD Goals and to cope with the wide range of economic and social risks that will arise from climate change, disasters and manipulation by humans of the Earth’s surface.

Water security requires the ability to:

- Map the availability and quality of surface and sub-surface waters,
- Measure and understand how the water cycle varies and changes,
- Predict how the availability and quality of water resources will change on a range of time and space scales,
- Support the integrated planning and management of water resources both nationally, internationally, and globally,
- Implement new technologies for water discovery and supply.

This can only be achieved with timely, coordinated observations!

Results have been presented at:

1) ICSU Forum on Science, Technology and Innovation for Sustainable Development held in conjunction with Rio + 20. (Rick Lawford)
2) University of Rio de Janerio (Rick Lawford)
3) World Water Week in Stockholm (Janos Bogardi)

Next Steps:

1) Clear hypotheses need to be defined and tested using this data base of surveys (Your ideas are invited).
2) A second effort to obtain inputs from missing or undersampled basins.
3) Completion of a more comprehensive analysis of the surveys.
4) Review UN Water Survey to see what lessons can be learned.
5) Organization of one or two sessions at the Water in the Anthropocene conference.
6) Documentation of the results in a book (?) and one or more journal articles.

The RIO Experience:

The high level discussions:
These were relatively opaque unless one had a good connection to someone who was a member of the negotiation team. Diversions included: the Brazilian pitch to take over the statement, the concerns by special interest groups that their concerns were being included, etc.

In the end these results (amongst many other) topics recognized:
- The important role of Future Earth,
- the need to strengthen the role of the UN (and UNEP) in implementing Sustainable Development,
- the water-food-land nexus,
- the valuation of environmental services and the use of these numbers in new economic indicators,
- the contributions of changes in consumer patterns to achieve the green economy,
- the enhancement of the production and use of green technologies,
- the potential role of Earth Observations in monitoring the implementation of SD.

The general discussions (side events):
Some of the discussions were stimulating, some were led by people who were misinformed, many did not allow for much feedback. To get visibility it was important to be leading a session or to have something to announce.

The Exhibitions:
Some countries (especially Brazil and several Asian countries) went to a lot of effort to have good exhibits and lots of information to distribute about their contributions to the Green economy.

Other Slides

Some Risks in Food Security (with implications for water):

-the growing demand for food (arising from growing populations and dietary expectations)

(2000: Average: 2,700 Kcal/day with GDP/cap of $5,000
2050: Projected Average: 3,300 Kcal/day with GDP/cap of $12,500)

- the global economy,
- competition with other sectors (e.g., biofuels) for certain food types,
- insufficient water to irrigate in some areas,
- no further arable land for development,
- soil degradation and water pollution due to agricultural runoff,
- the impacts of drainage systems, and changes to flood regimes and the global water systems.

Some Risks in Energy Security (with implications for water and the environment):

- the growing demand for energy
- the global economy,
- volatility in fossil fuel prices,
- excessive use of polluting energy processing techniques (e.g., fracking for natural gas),
- competition for biofuel feedstocks with agriculture,
- limits to basic supply of traditional resources,
- rejection of nuclear energy,
- limited investments to develop infrastructure to use low-head hydro in meeting energy demands,

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Risks to the Environment (with implications for water):

- a base flow is required at all times to maintain in-stream fish and fish habitats.
-streams and rivers need to provide alternative routes for fish where there are obstructions to the flow,
-river temperatures rising above critical thresholds for fish and other aquatic species,
- when not drained or modified wetlands provide valuable environmental services (e.g., they clean the water),
- prescription drugs dumped in water can affect biota,
- phytoplankton blooms in lakes affect fish and their food chains.

Path 1: Increase the contributions of science by linking the science and observational systems to policy objectives through targets and sustainable monitoring.

Water is under stress from a wide range of stressors. Given the success of the Millennium Development Goals (MDG) in achieving improved access to drinking water(UN report), it is recommended that a similar process of **setting targets and monitoring progress** towards those targets be established **for other critical water indicators**, such as water supply, water quality and water use in a balanced way. They should be developed in collaboration with an **effective and well-funded observation and monitoring plan** that would follow international observational standards, adopt uniform monitoring procedures and implement interoperable analysis platforms to ensure that governments receive systematic advice in a sustainable way.

Path 2: Broaden the ownership of the sustainable development by creating a more open governance process that includes citizens, private sector and all levels of government.

New partnerships are essential to enable the implementation of the goals identified for the water-energy-food nexus. The benefits of partnerships between the water and agricultural sectors have long been recognized because agriculture is the largest user of water. Partnerships need to be expanded to other sectors. Just as water management problems are multiscale the solutions are also multiscale which means that partnerships are needed among the public and private sectors and between national and municipal governments. **Multiscale polycentric governance is needed** to address water security issues.

Path 3: Develop water management plans within an Integrated Water Resource Management framework to implement regional bioeconomies that will combine water and land management to maximize contributions to Sustainable Development.

Path 4: Analyze the interactions between land ownership/ management and water impacts to determine where adjustments can be made to improve water availability and quality.

The management of water alone cannot resolve the questions of waste management, runoff, etc because of natural (weather factors) and the industrial processes that take place on the land. Water is the means of transmitting problems from one area to another and for amplifying those problems. However, the ability to **manage the water and landscape jointly** must be supported by an assessment capabilities to determine the points where land management can resolve water problems.

Path 5: Develop a strategy for encouraging investments in water infrastructure that advances the sustainable development of water for food, energy and environmental security.

Investment needs to be directed to supporting needed science, observational and monitoring infrastructure, development of strategic partnerships and on the implementation of prototype water based bioeconomies. Thought should be given to options and implications for **bringing water more directly into a market economy without compromising the rights of all people and ecosystems to have full access** to quality water. Innovations such as domestic and industrial systems that **match water source and use** based on quality and **developing a wastewater treatment and reuse industry**.

Some activities that are/could support the implementation of these water pathways

1. Recently improved focus within the UN on water issues through the strengthening of UN-Water
2. Global Water System Project (GWSP) Global Catchment Initiative (W-E-F focus) Phase II study
3. GEOSS Water Cycle Integrator to support Capacity Development
4. GEOSS Water Strategy Report
5. Contributions of the Global Energy and Water Cycle Experiment (GEWEX) to Future Earth
6. Development of experimental regional bioeconomies based on new water-land management paradigms.