

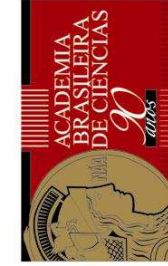
Science for Water Security and

International Cooperation

Prof. ^o José Galizia Tundisi

World Science Forum

tundisi@iie.com.br



November, 26th, 2013

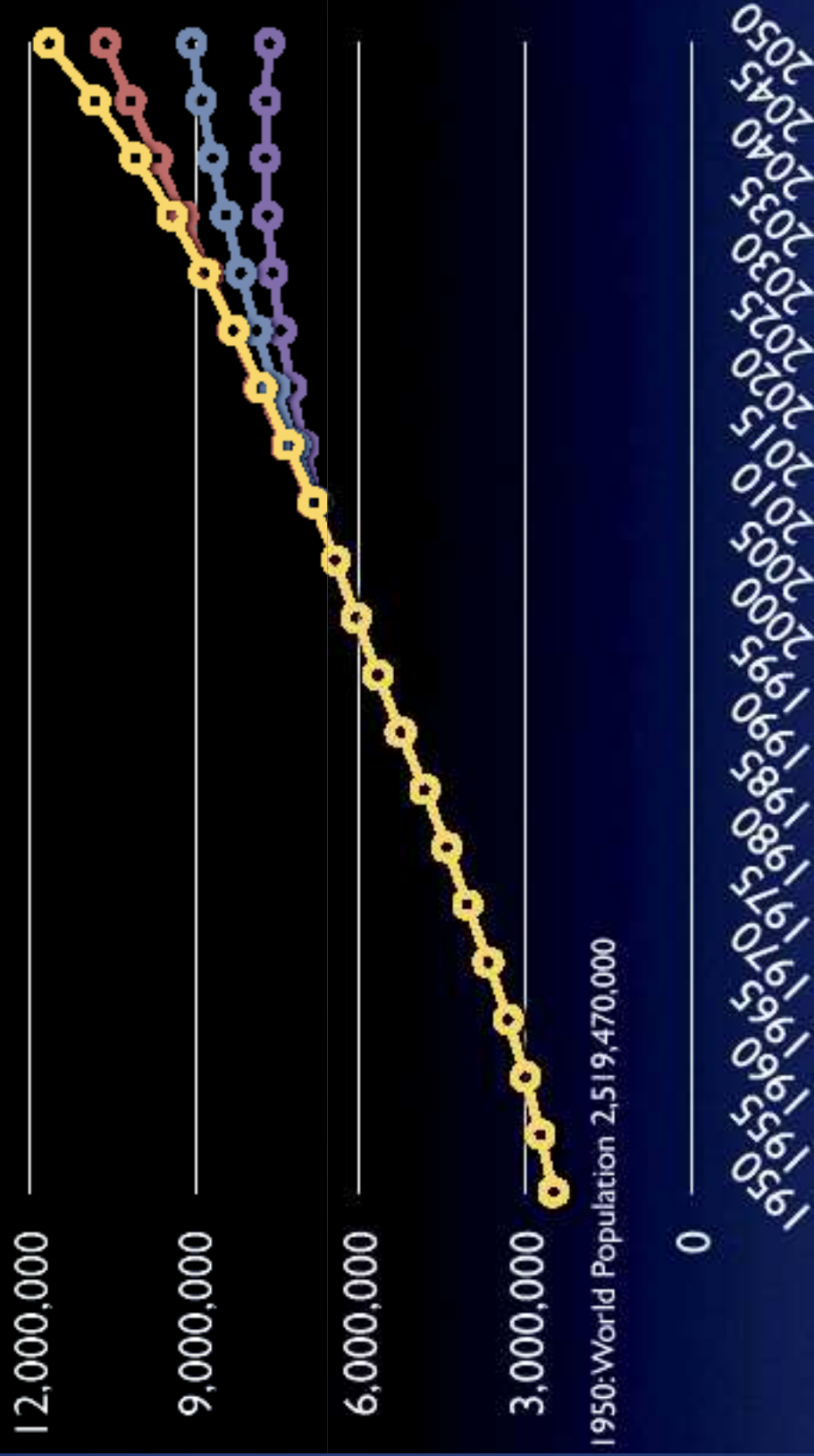


Foto 4 - Irrigação por pivô central (Capítulo 9, página 311).

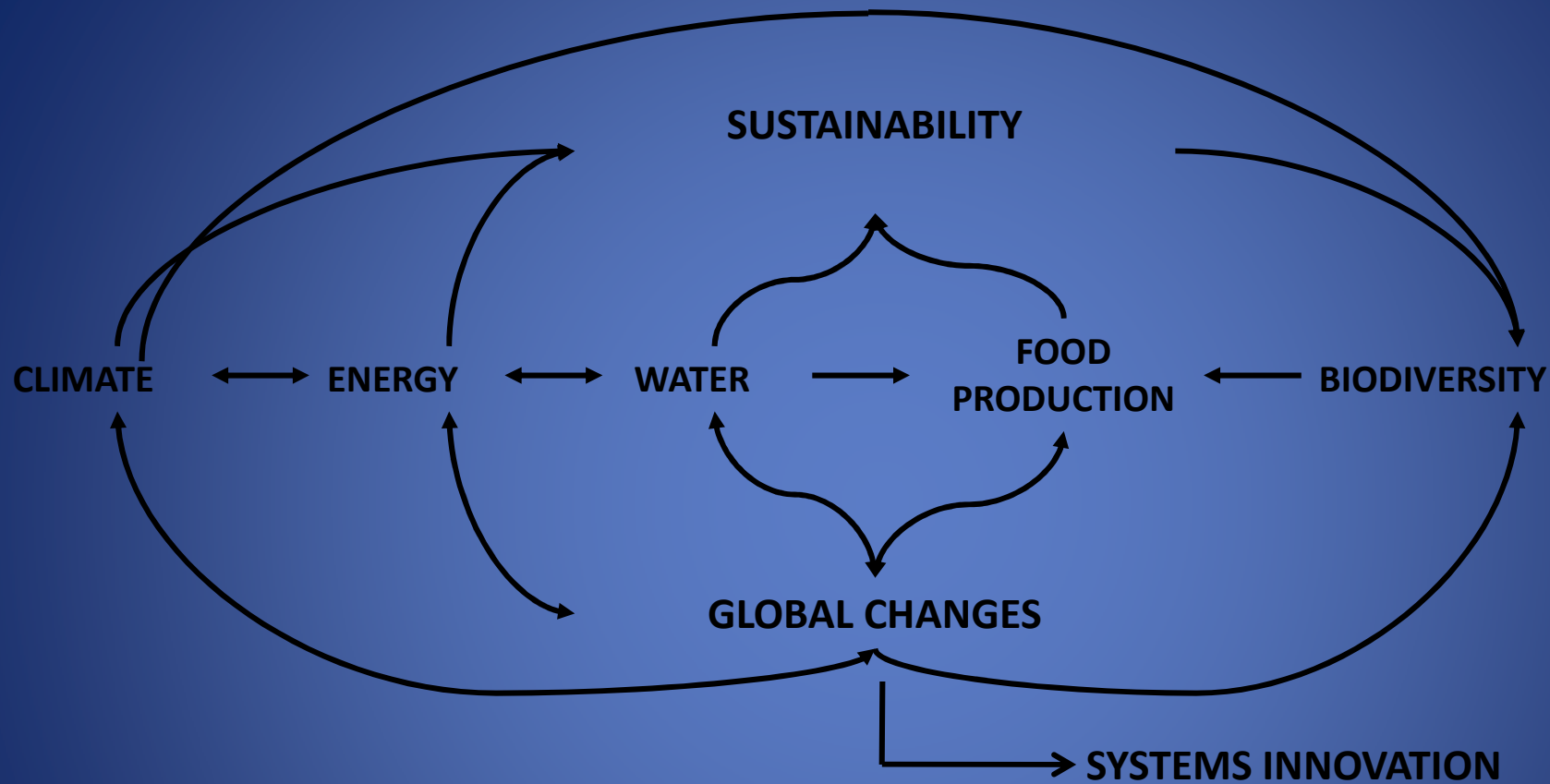
World Population Prospects (in Thousands)

Source: Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat, *World Population Prospects: The 2004 Revision and World Urbanization Prospects: The 2003 Revision*, <http://esa.un.org/unpp>, 23 April 2006, 8:57:09 PM

- Constant-Fertility Variant
- High Variant
- Medium Variant
- Low Variant



- Increasing population and urbanization with pressure on water resources.
- Increasing water scarcity in certain regions, decreasing water quality and increasing pollution, eutrophication and contamination.
- Incomplete or poor infrastructure producing loss of treated water, inefficient water distribution, increasing costs of treatment.
- Almost 2 billion people still lack basic facilities of water supply and sanitation.
- Threats (water scarcity, water stress) due to global changes.
- Improve public participation, education and water governance.



MATRIX OF COMPONENTS AND INTERACTION

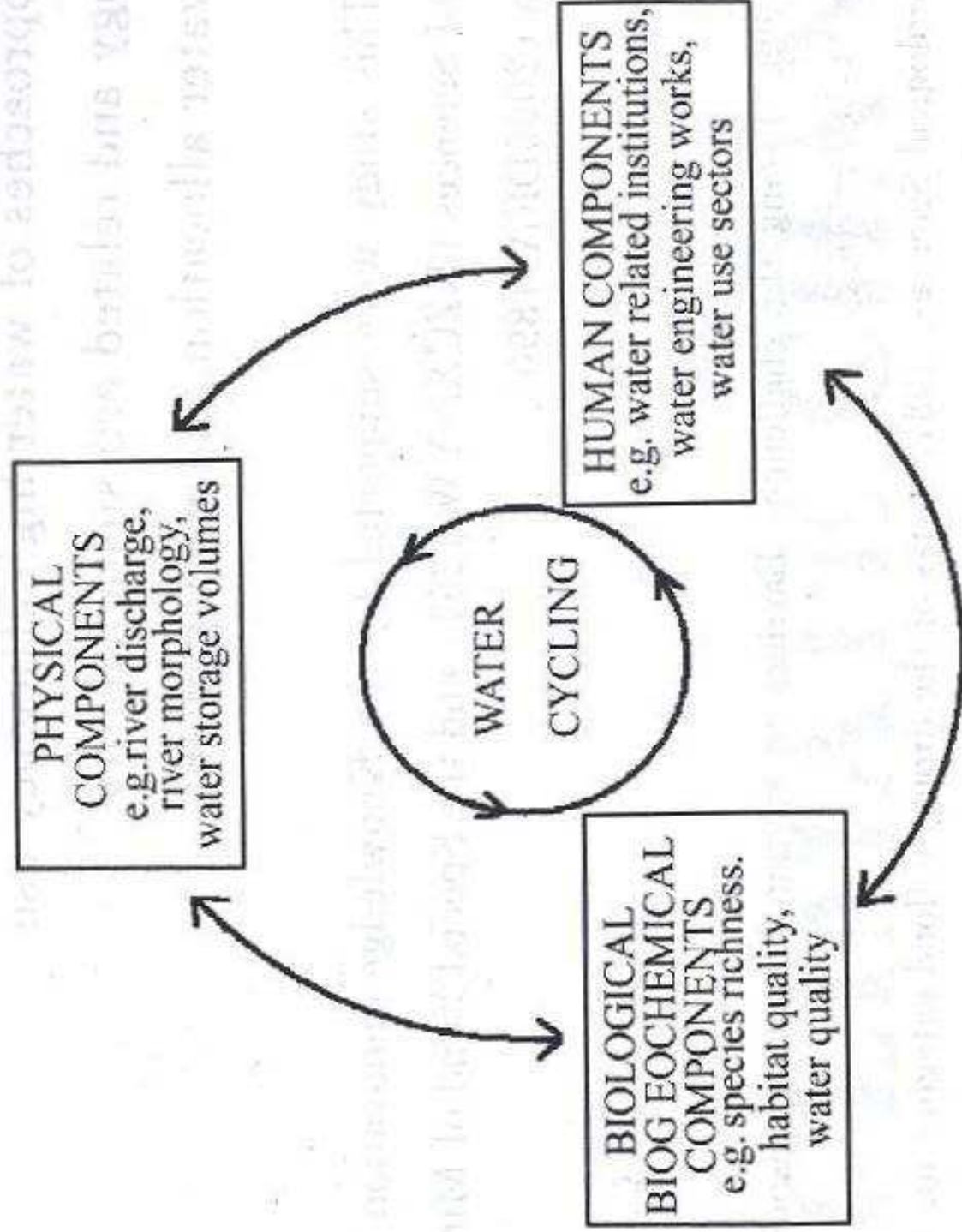
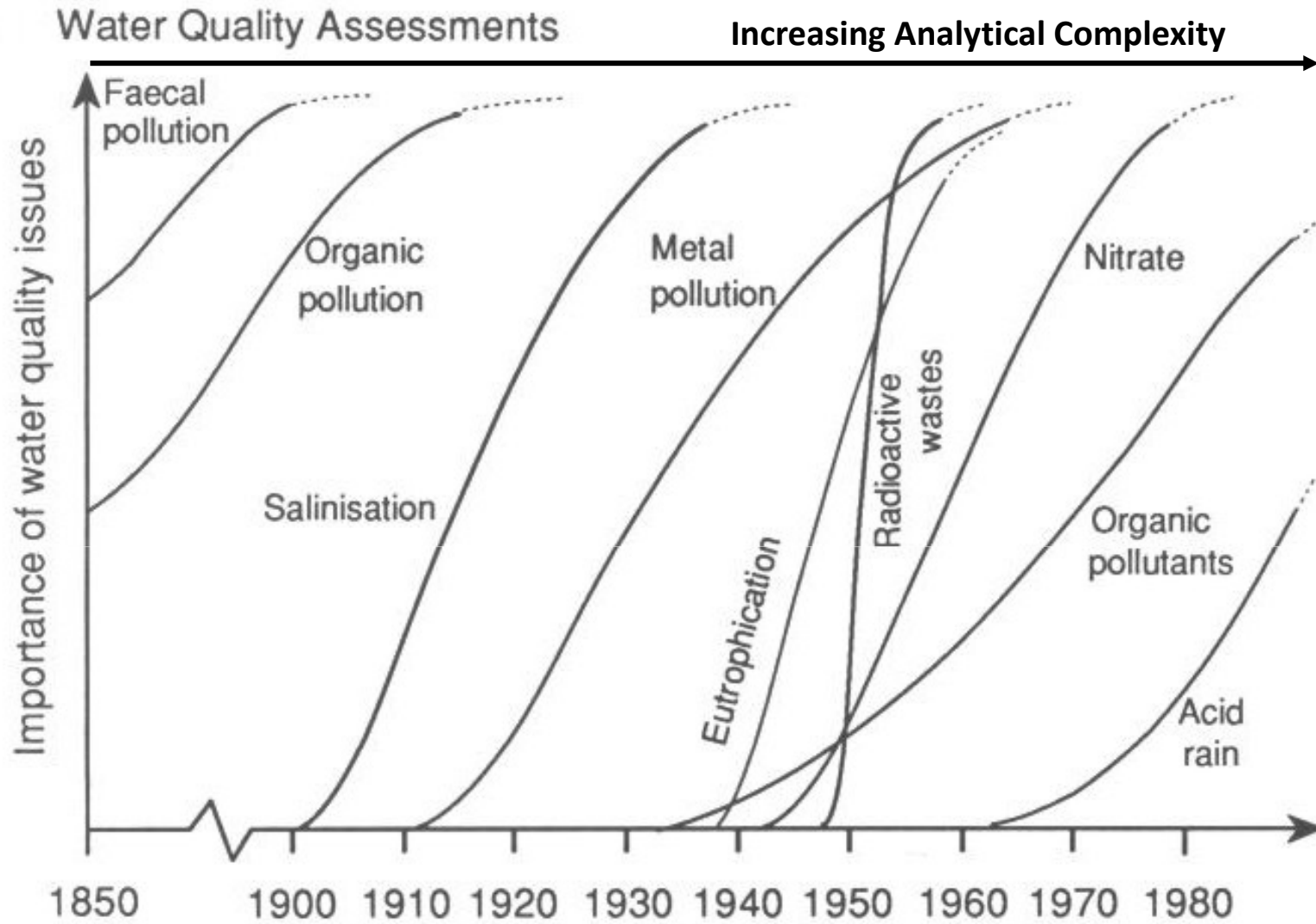


Fig. 1 Water system related to water cycle and major three components



The sequence of water quality issues arising in industrialised countries
 (After Meybeck and Helmer, 1989)

Figure 1 is a simplified illustration of a broad range of water quality problems.

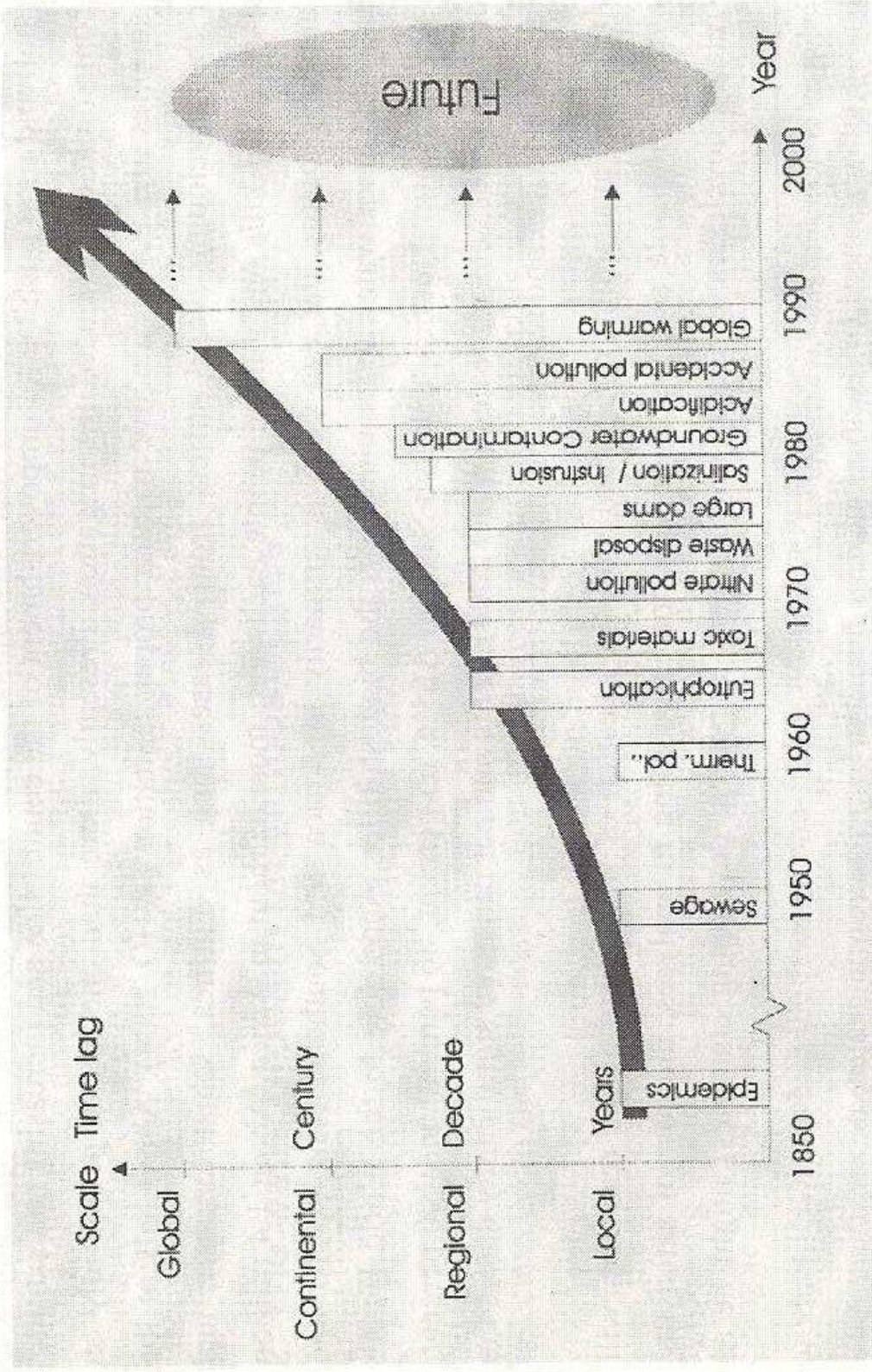


Figure 1. Trends in water quality issues

Source: Somlyódy 1995 and Somlyódy et al. 2001.

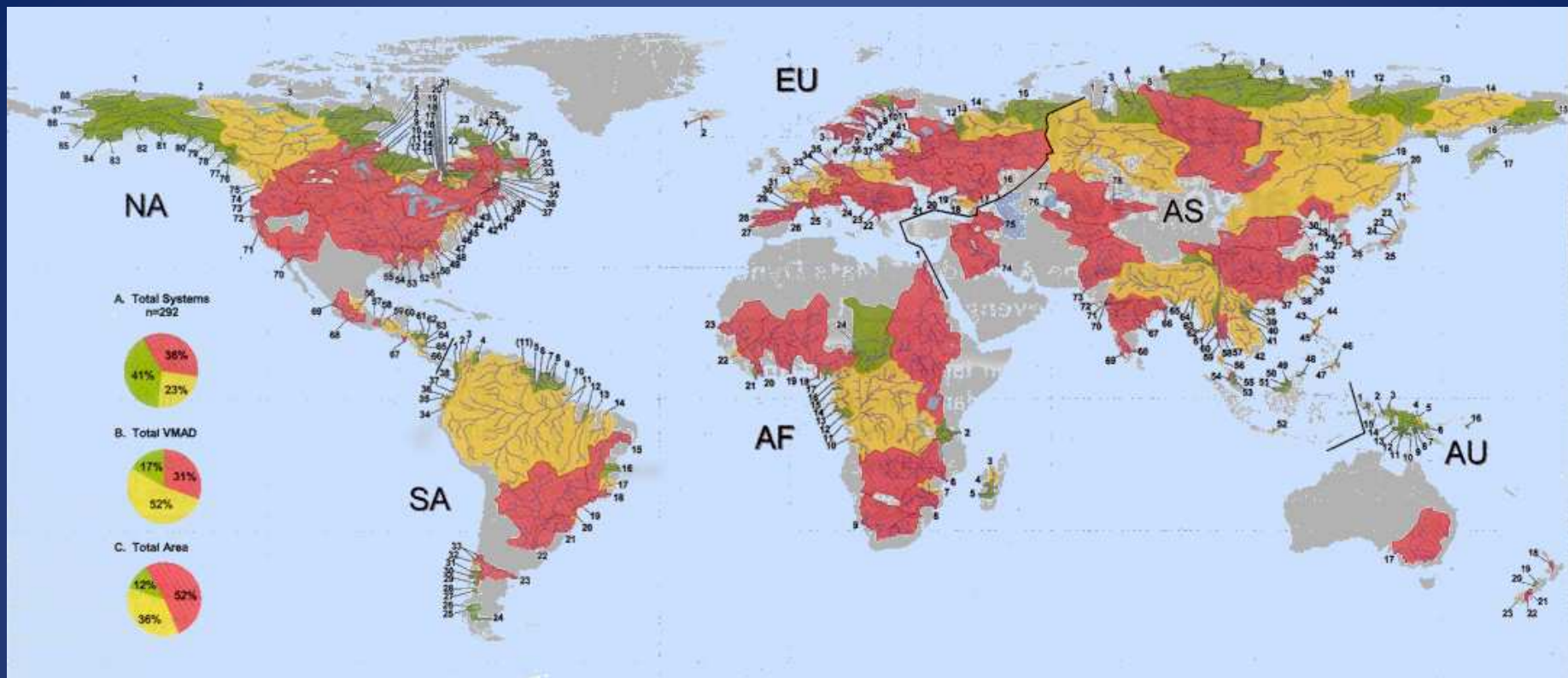
Note: Ther. pol. = thermal pollution.

Table 1. Water use and national income.

	GDP per capita, US\$ (1990)	Annual water withdrawals per capita, m ³ (1970–1987)		
		Domestic	Industrial and agricultural	Total
Tanzania	110	8	28	36
Sri Lanka	470	10	493	503
South Africa	2530	65	339	404
United Kingdom	16,100	101	406	507
Sweden	23,660	172	307	479
United States	21,790	259	1903	2162

Source: World Bank (1992: *Development and the Environment*, Tables 1, 33).

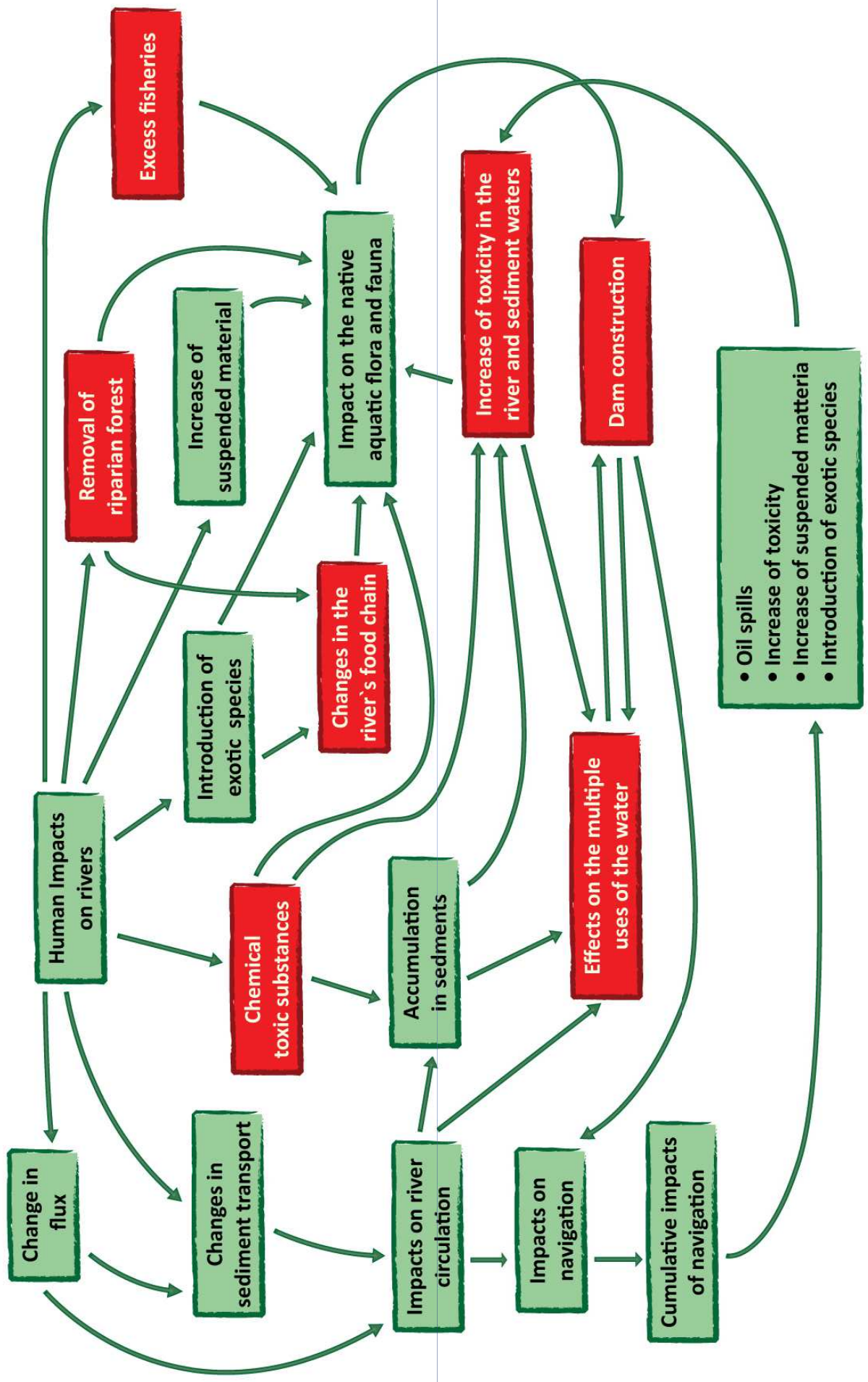
IMPACTS AND ENVIRONMENTAL THREATS



	North & Central America (n=88)	Asia (n=78)	Europe (n=41)	South America (n=38)	Africa (n=24)	Australasia (n=23)
Number of Systems (count)	31 Not affected, 40 Moderately affected, 17 Strongly affected	29 Not affected, 29 Moderately affected, 20 Strongly affected	5 Not affected, 10 Moderately affected, 26 Strongly affected	6 Not affected, 12 Moderately affected, 20 Strongly affected	8 Not affected, 9 Moderately affected, 7 Strongly affected	4 Not affected, 2 Moderately affected, 17 Strongly affected
Total VMAD (%)	51 Not affected, 29 Moderately affected, 21 Strongly affected	38 Not affected, 16 Moderately affected, 46 Strongly affected	12 Not affected, 21 Moderately affected, 67 Strongly affected	11 Not affected, 7 Moderately affected, 82 Strongly affected	29 Not affected, 8 Moderately affected, 63 Strongly affected	6 Not affected, 7 Moderately affected, 87 Strongly affected
Total Area (%)	61 Not affected, 20 Moderately affected, 19 Strongly affected	45 Not affected, 10 Moderately affected, 45 Strongly affected	8 Not affected, 18 Moderately affected, 74 Strongly affected	30 Not affected, 6 Moderately affected, 64 Strongly affected	12 Not affected, 26 Moderately affected, 62 Strongly affected	28 Not affected, 2 Moderately affected, 70 Strongly affected

Legend: ■ Not affected ■ Moderately affected ■ Strongly affected

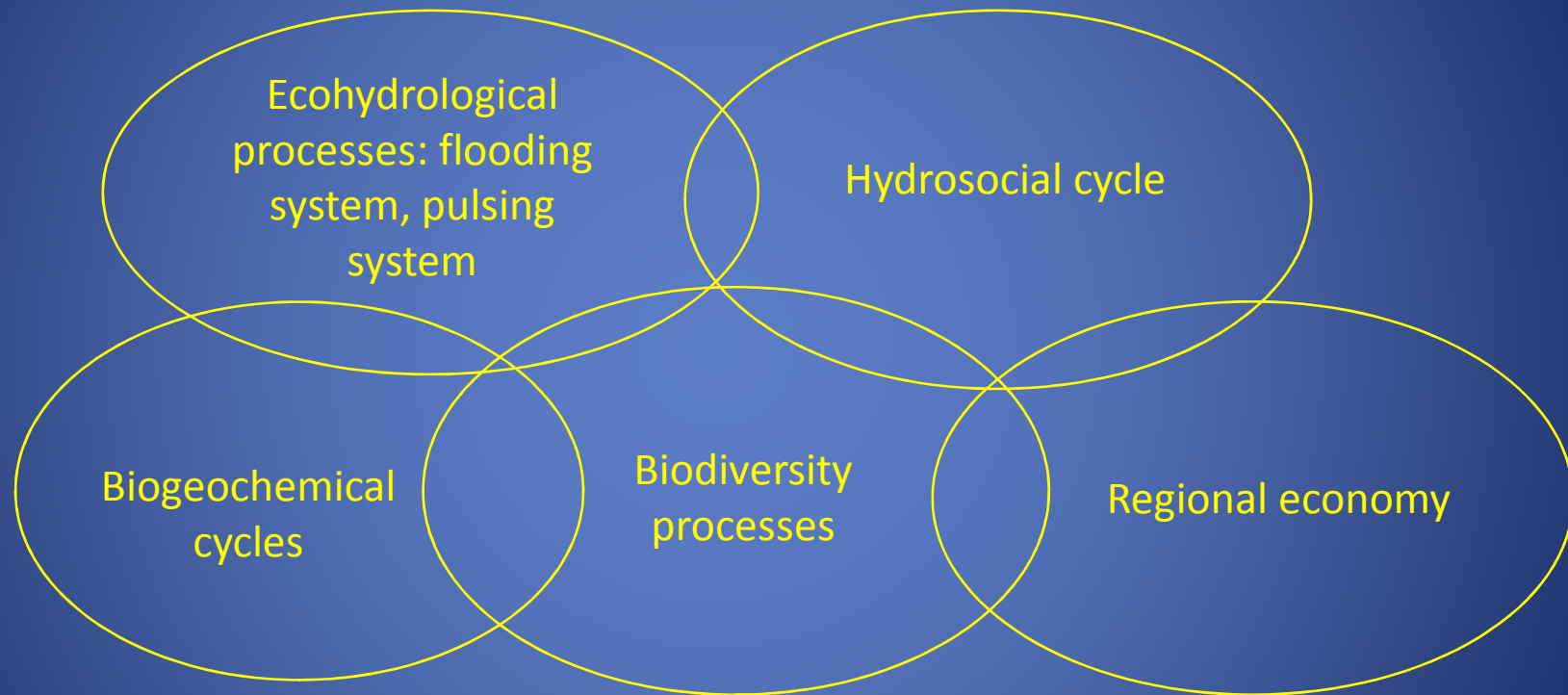
Science, 2005





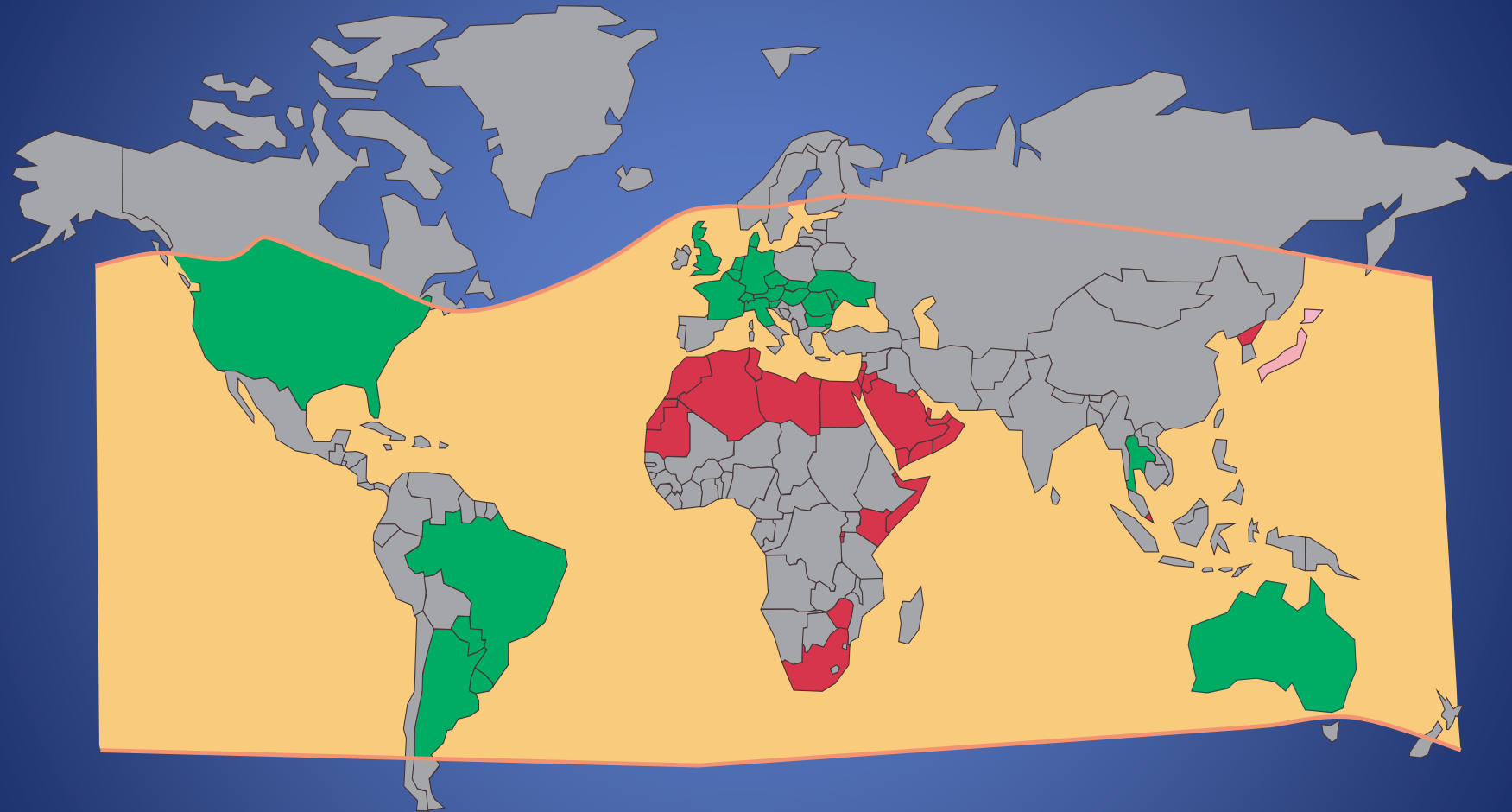


THE NATURAL SYSTEMS OF AMAZON AND THE INTEGRATION OF COMPONENTS



Situation 2000

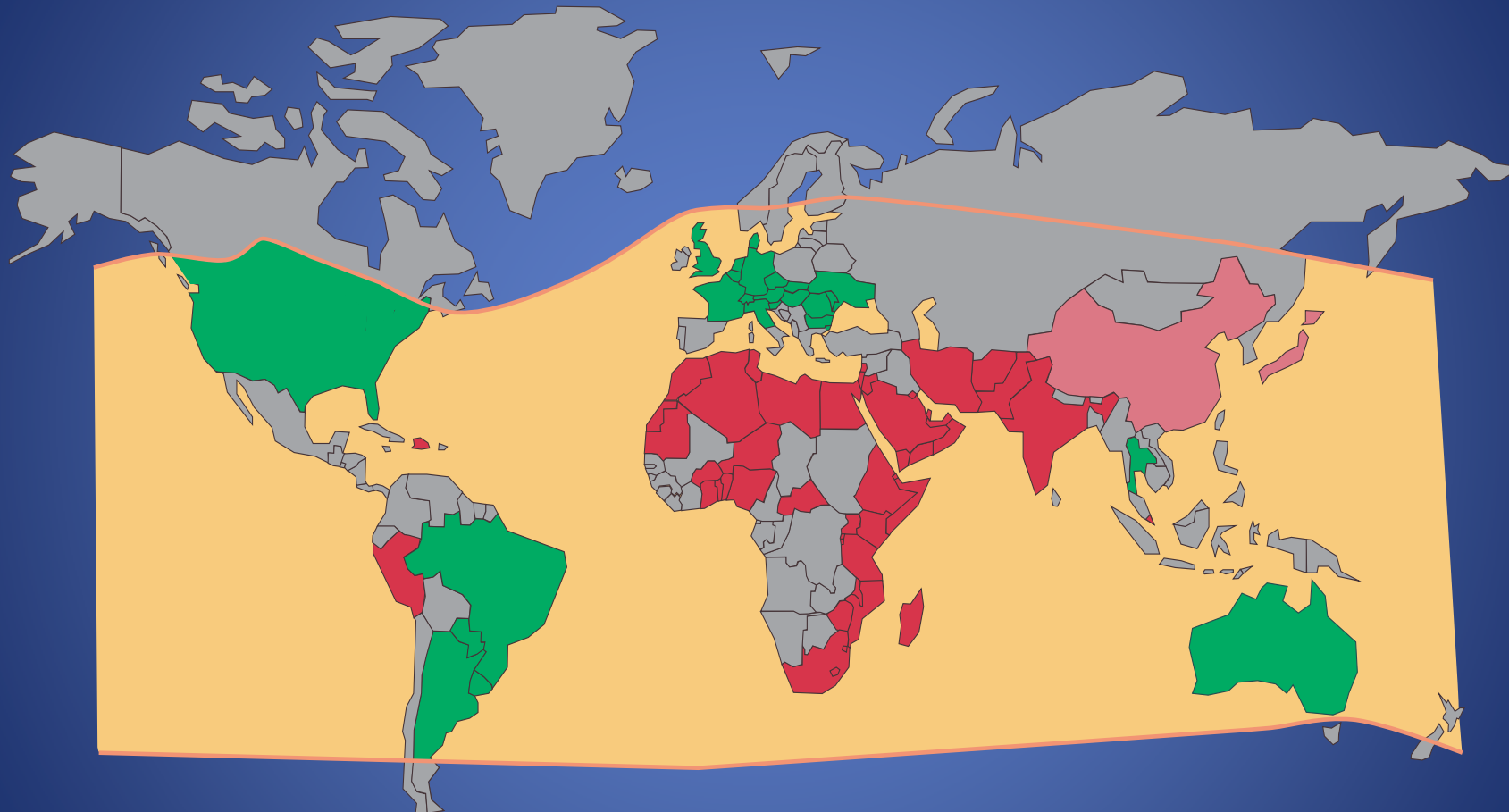
Situation 2000



- Limits for food production
- Lack of water for sufficient food production
- Water, soil and climatic conditions allow substantial food production for export

Situation 2025

Situation 2025



- Limits for food production
- Lack of water for sufficient food production
- Water, soil and climatic conditions allow substantial food production for export

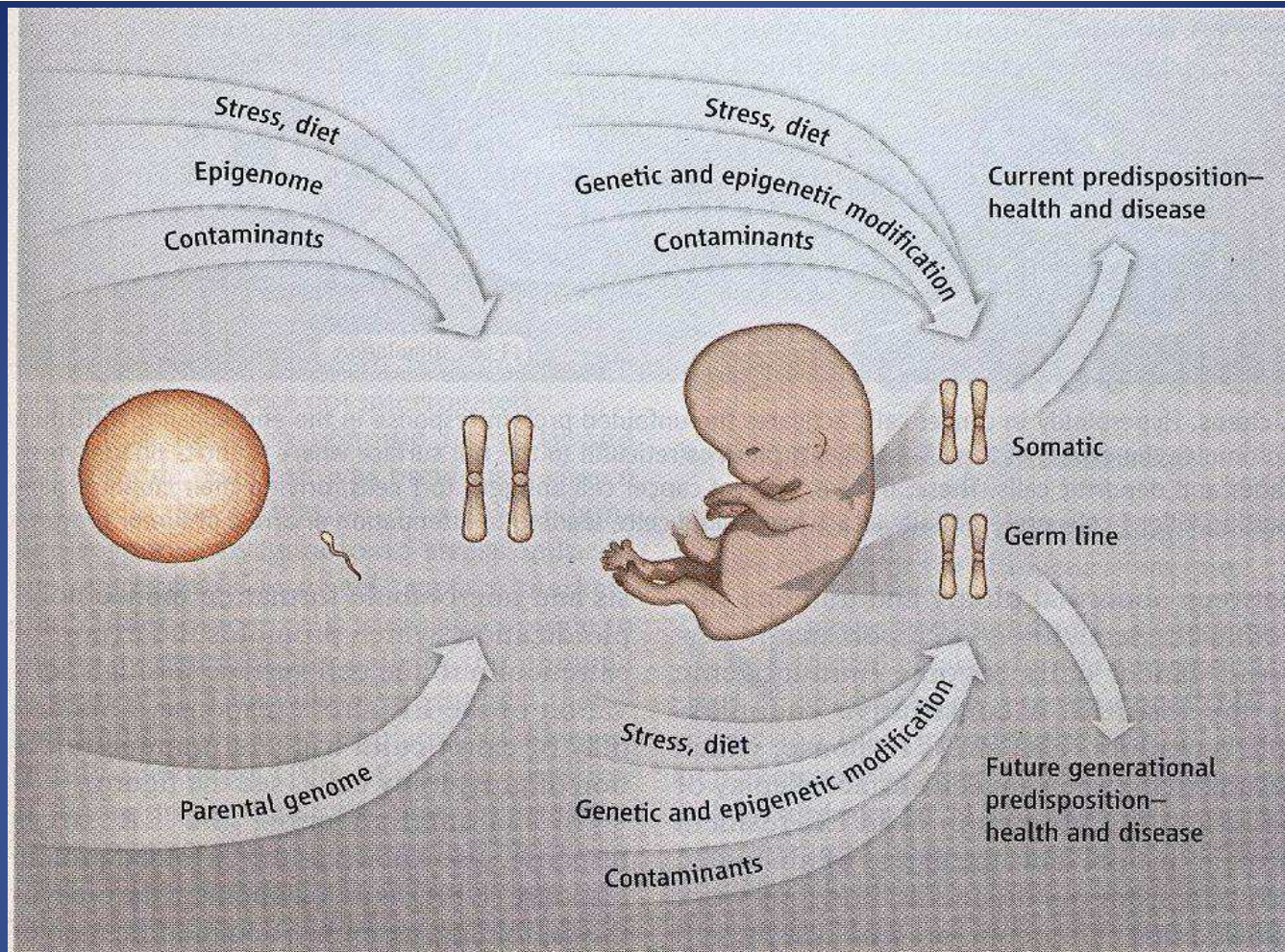
EMERGING THREATS TO WATER QUALITY

EMERGING THREATS TO WATER QUALITY

- Climate Change and Variability;
- Dam Removal;
- Waterborne and Water-Related Pathogens;

EMERGING THREATS TO WATER QUALITY

- Chemical Contaminants;
- Endocrine Disruptors;
- Pharmaceuticals and Personal Care Products;
- Invasive Species;



The role of the environment. Environmental factors, including numerous contaminants, have been shown to modify the parental genome, so that the genetic makeup of any offspring is a combination of a parental inherited genome (itself likely influenced by epigenetic mechanisms of the germ line) and environmental influences on that germ line during maturation. Environmental factors such as diet, stress, and contaminants can also modify the genome of the developing embryo by classic selection and mutation or by epigenetic mechanisms at both the somatic and germline levels. These modifications can produce predispositions for health and disease in the current lifetime of the individual. Future transgenerational effects could also be established through modifications in the germline genome or epigenome after exposures during the lifetime of that individual.

SUSTAINABLE USE OF WATER RESOURCE

MANAGEMENT

20th Century

- Local
- Sectoral
- Response

21st Century

- Watershed (Ecosystem)
- Integrated
- Predictive

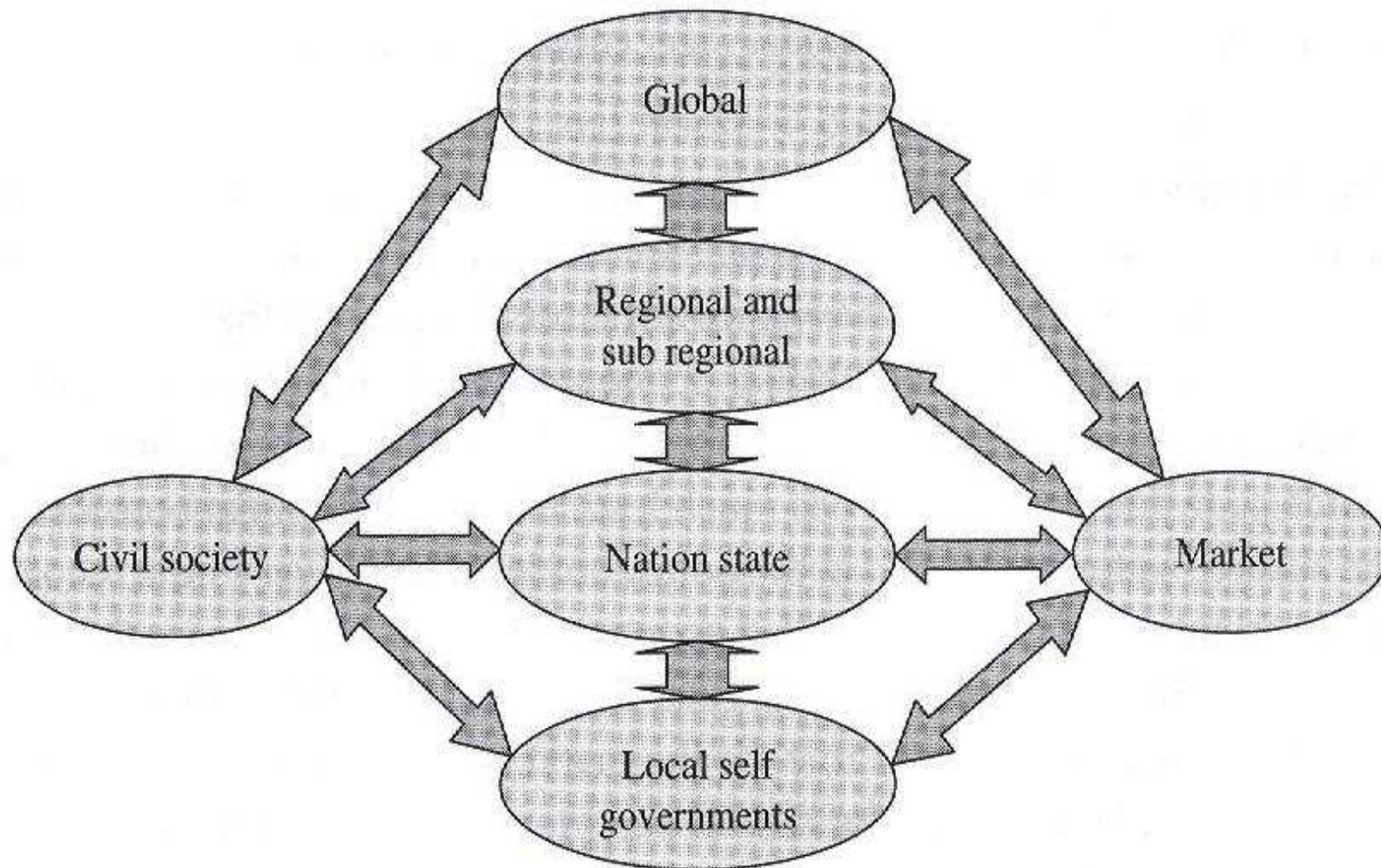


Figure 8. The new and idealized concept of governance.

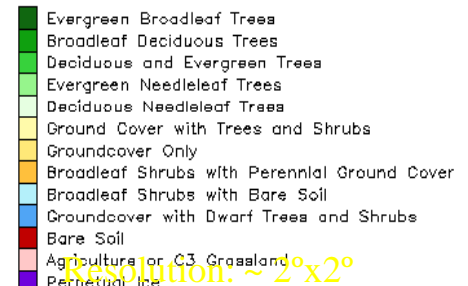
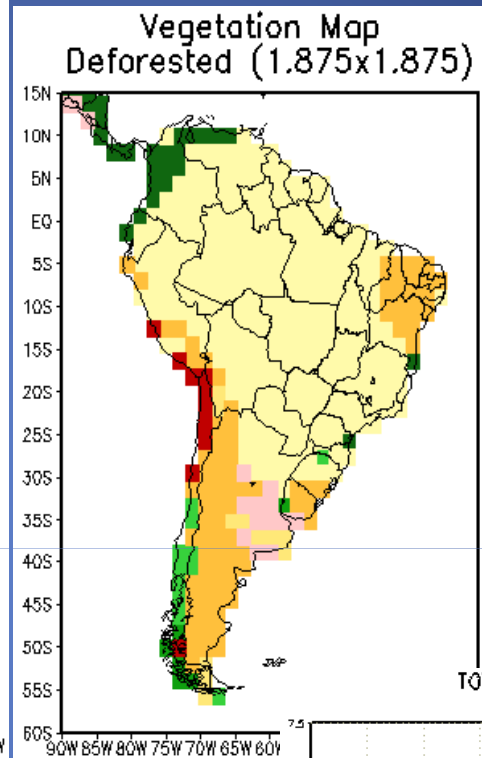
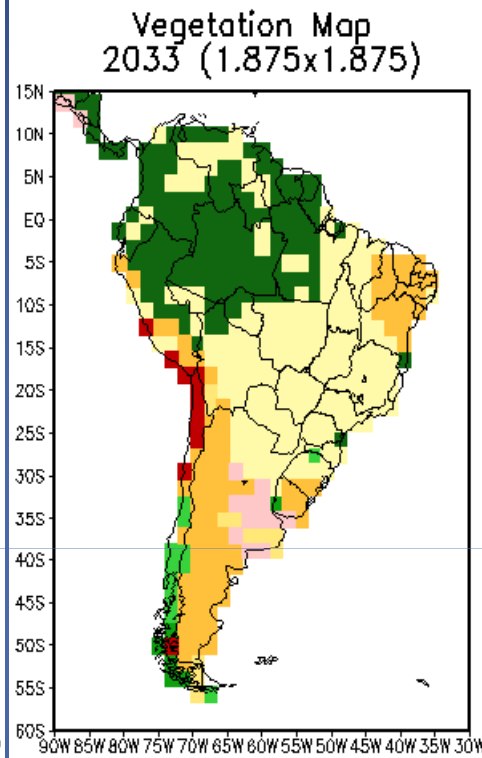
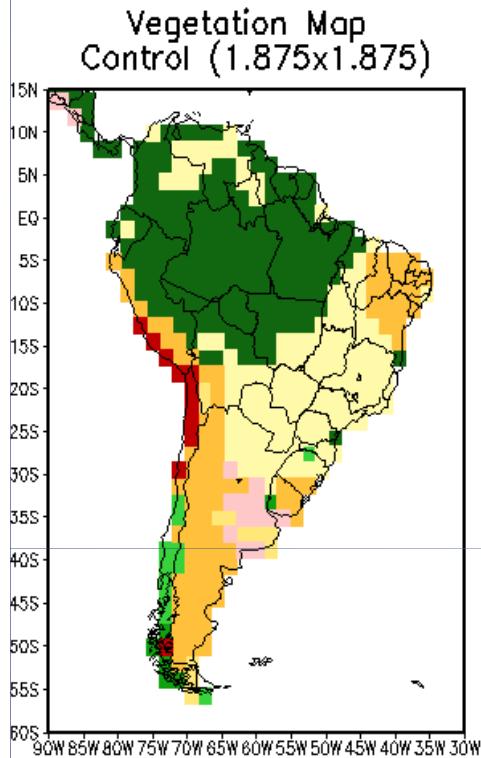
CLIMATE CHANGE

Sensitivity Analysis to 'Savannization' of Amazonia

Control

2033

All Savanna

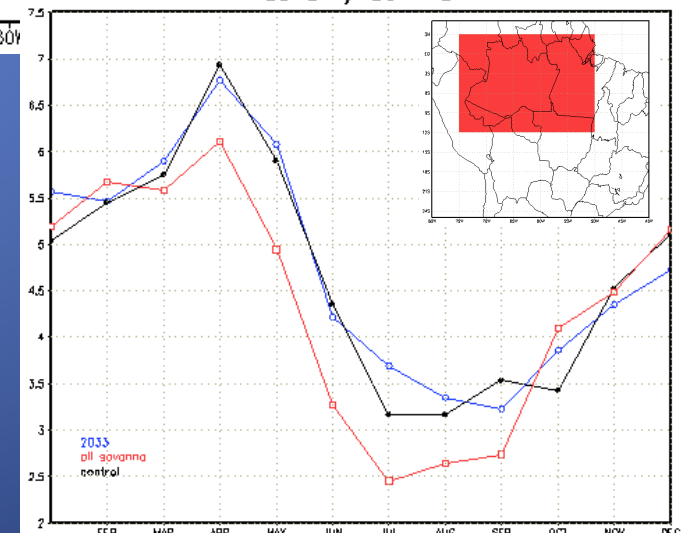


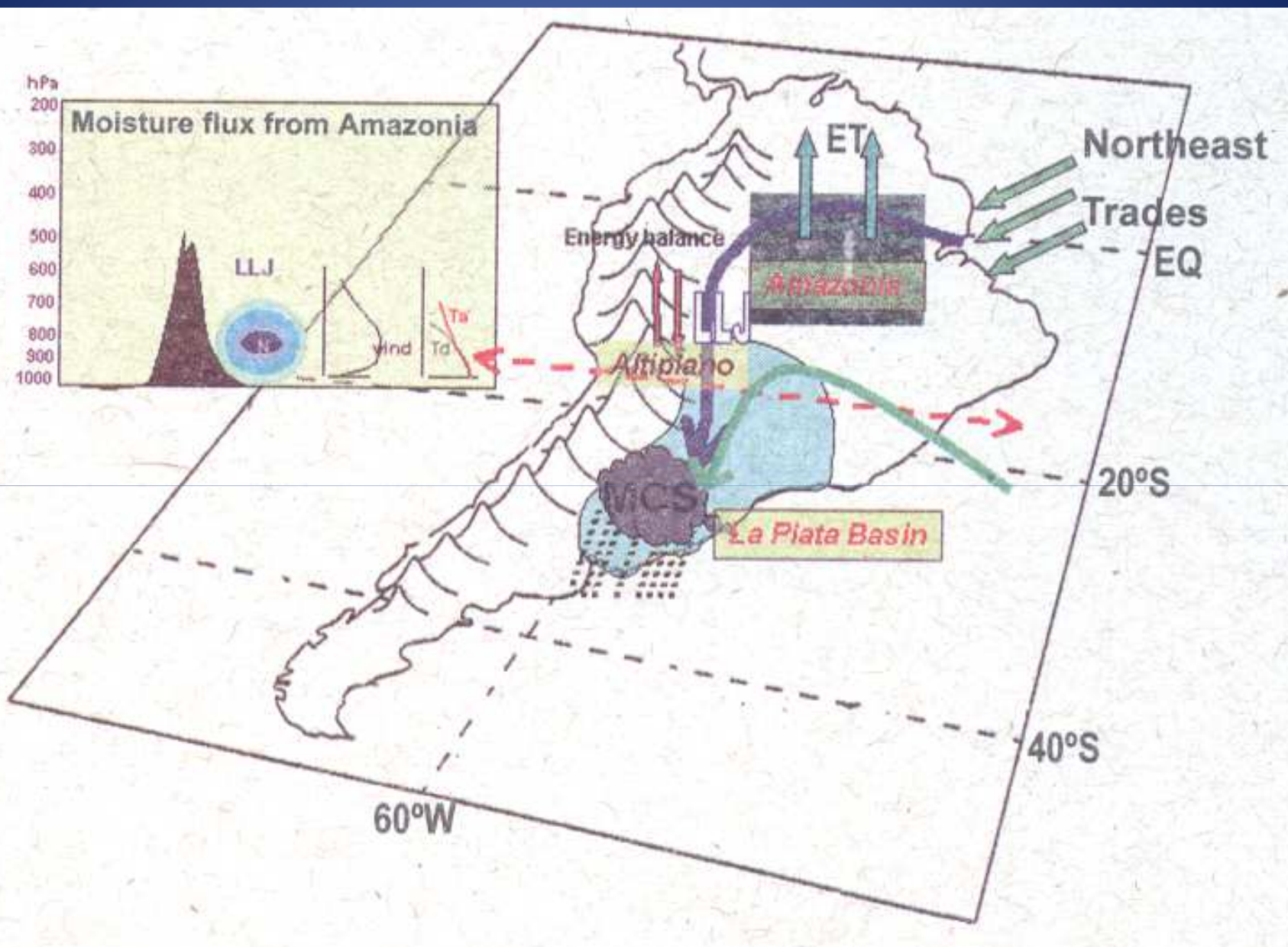
Dry Season Precipitation*

	2033	All Savanna
JJA	5,4%	-21,7%
JJAS	1,9%	-21,9%

* 12°S-3°N / 50°W-75°W

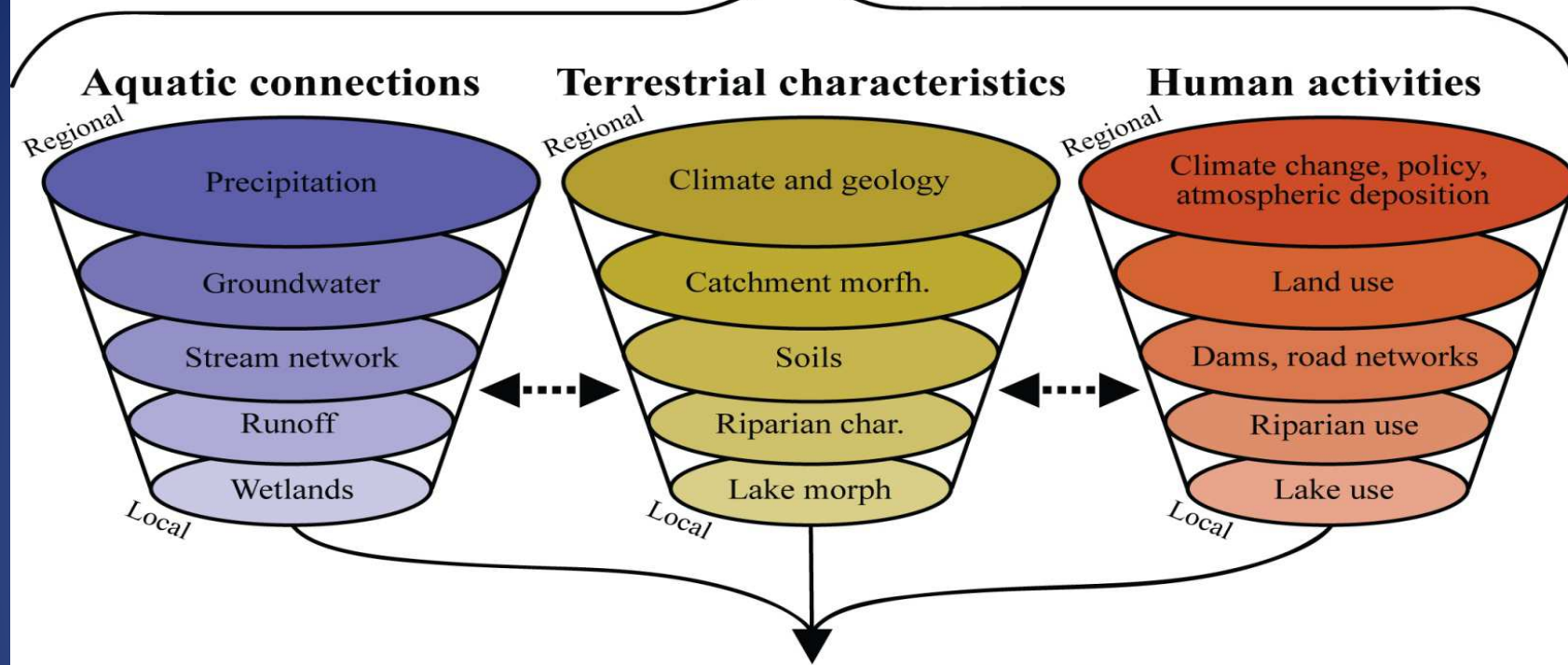
TOTAL PRECIPITATION (mm/day)
12S-3N / 50W-75W





Fonte: Marengo, 2008

Landscape features



Foz do Areia reservoir
(Water chemistry, physics & biology) *Verh. Internat. Verein. Limnol., Vol 30*

Provisioning Services

Products obtained from ecosystems

- Food
- Fresh water
- Fuel wood
- Fiber
- Biochemical's
- Genetic resources

Regulating Services

Benefits obtained from regulation of ecosystem processes

- Climate regulation
- Disease regulation
- Water regulation
- Water purification
- Pollination

Cultural Services

Nonmaterial benefits obtained from ecosystem

- Spiritual and religious
- recreation and ecotourism
- Aesthetic
- Inspirational
- Educational
- Sense of place
- Cultural heritage

Supporting Services

Services necessary for the production of all other ecosystem services

-Soil formation

-Nutrient cycling

-Primary production

INTERNATIONAL COOPERATION

THE INTER-AMERICAN NETWORK OF ACADEMIES OF SCIENCE

Accomplishments Report
September 2010-July 2013



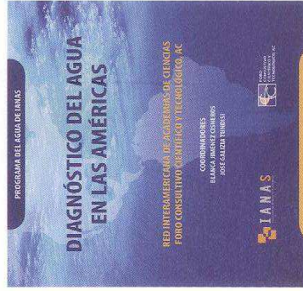
IANAS



Science Education focal points meeting, Mexico City, 2011



The IANAS Executive Committee 2010-2013, Venezuela 2012



"Water Diagnosis in the Americas" March, 2012



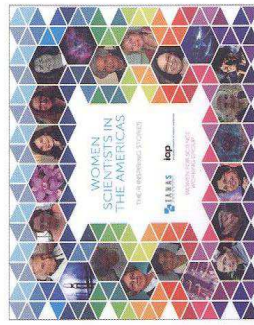
Co-Chairs Michael Clegg and Juan Pedro Lacleste working along with the IANAS Strategic Planning committee in Irvine CA, adjusting the strategic plan for the organization.



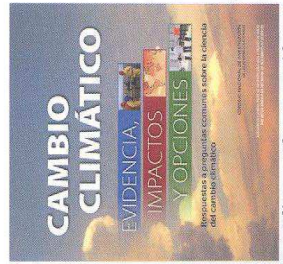
Women for Sciences Focal Points meeting, Mexico 2011



Bridging the Gap between Scientists and Journalists was one of the sessions for the meeting Challenges and Opportunities in Communicating Science to Public, Buenos Aires, 2011



Book "Women Scientists in the Americas. Their Inspiring Stories" March, 2013

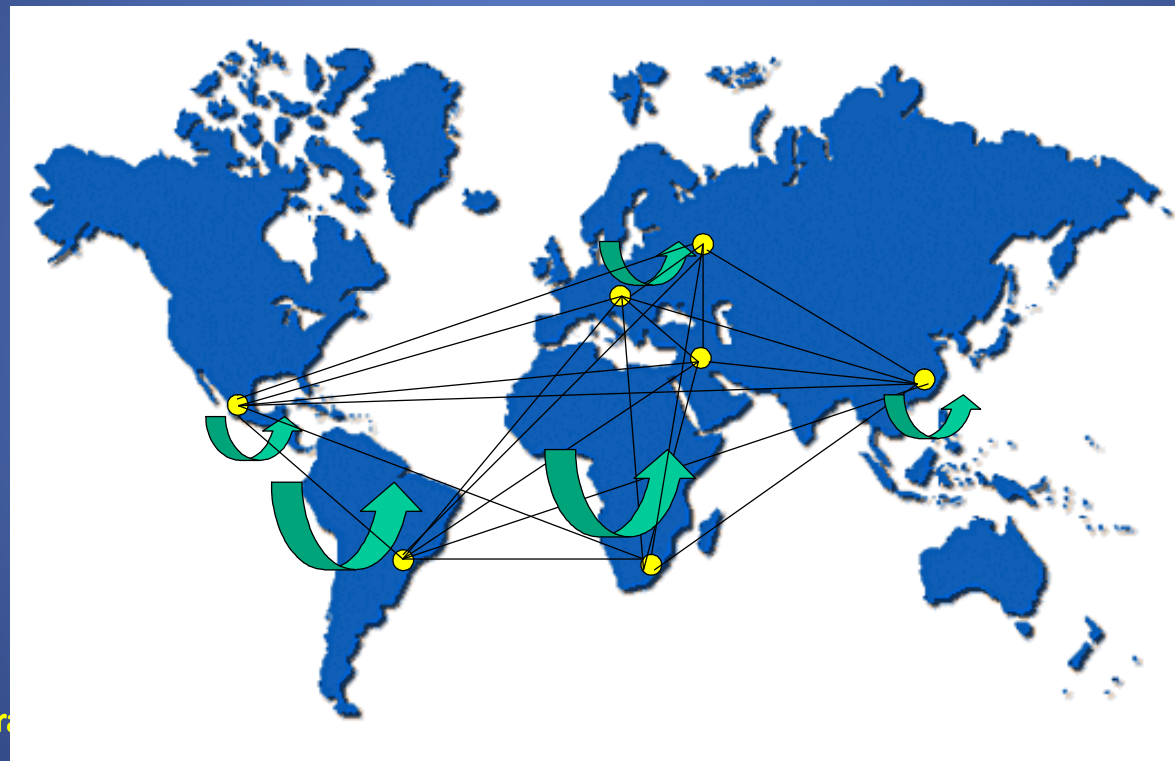


Climate Change, Evidence, Impacts, and Choices, 2013



Energy meeting in Bogota, Colombia 2011

International Centers for Innovation, Research & Capacity Building Cultural diversity and water management



- Institute of Geographical Sciences and Earth Information (China)

- International Institute of Biodiversity and Water Resources (Brazil)

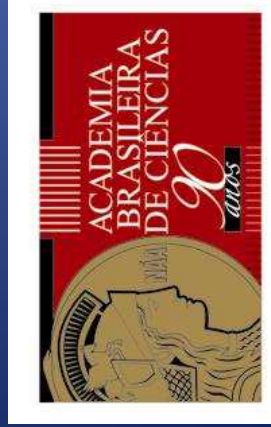
- Water Research Commission (South Africa)

Ecology

The Academies' Meeting Paris, March 24-25, 2011

Alphabetical order of the countries represented in Paris:

Brazil, Canada, France, Germany, India, Italy, Japan, Mexico, Russia,
Senegal, South Africa, United Kingdom and United States of America



RECOMMENDATIONS

**The Academies of the G8+ countries
strongly recommend the following
action plan to their Governments**

RECOMMENDATIONS

- Develop basic infrastructure for sanitation and maintenance, to achieve acceptable quality water as key priorities and reduce rural/urban disparities. Sanitary facilities in schools are a priority, adapted to local, environmental, technological and cultural constraints;
- Promote education including training of professionals and technicians; help to improve management of water quality, in order to change the behaviour of populations regarding water supply.

RECOMMENDATIONS

- Establish networks of competence at national, regional and global levels to improve the efficiency of water use in domestic context, as well as in agriculture and industry, through research and innovative practices that are ecologically oriented.

RECOMMENDATIONS

- Fund research and development for the identification of pathogens of animal origin and the development of simple, low-cost and efficient markers. Further epidemiological studies are needed to develop vaccines against water-borne pathogens.
- Promote capacity-building to improve water management and hygiene standards; support watershed level community-based actions favouring the key role of women both in rural and peri-urban areas (“unheard voices
f
”)

CONCLUDING REMARKS

- WATER – The poorer the nation is, the more important water tends to be economically.
- ENVIRONMENTAL THREATS – Floods, Droughts, Diseases, Pollution.
- TRADITIONAL SOCIETIES AND THE TRADITIONAL SECTOR – Hydrosocial cycle.
- INFORMAL SECTOR – Water availability in periurban regions.

CONCLUDING REMARKS

- **AGRICULTURE** – 70% water used in food production. Increasing use of ground water.
- **INDUSTRY** – Large amount of water needed. Strong connections with pollution.
- **ENERGY** – Hydroelectricity predominates in many countries need integrated management.
- **SERVICES** – Tourist services need large volumes of water good quality.
- **ECONOMIC GROWTH** – Necessary to include water distribution and good quality to all sectors of society.

CONCLUSIONS

WATER FOR SUSTAINABILITY AND SECURITY

- The water crisis is above all a crisis of management. There is a water management crisis. (Rogers 2006).
- Water uses for sustainability include: hunger alleviation goal; sanitation goal;
- Integrated management initiative will have to consider the watershed as an adequate management unit (biogeophysical, social economic). Ground water management is a essential component of the integrated management of water resources. (IWRM).

Conclusions

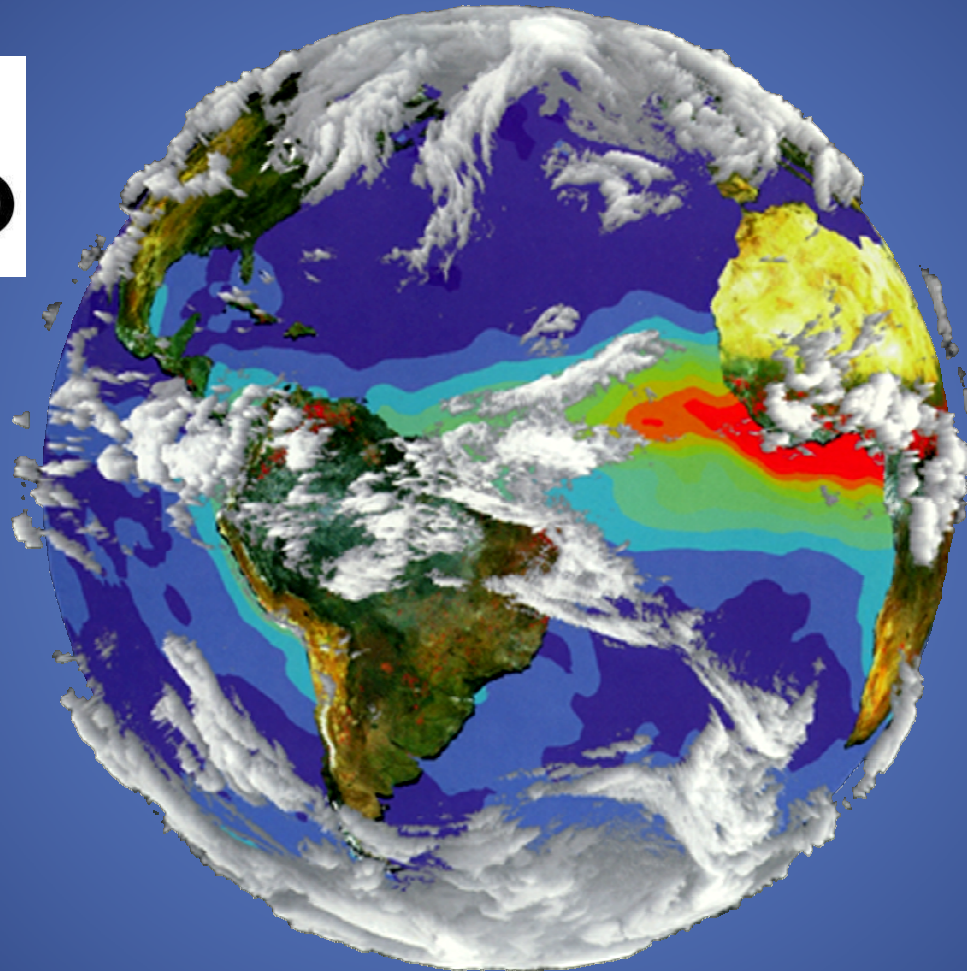
- Linkages between water quality and water quantity are important new developments in research and management of water resources and all the problems involved.
- Water scarcity by pollution of surface and ground water is a fundamental process affecting continents, regions, towns, urban and rural areas.
- Costs of water treatment are increasing worldwide, due to the degradation of water supply, surface and ground sources.

Conclusions

- To improve water management for sustainability it is necessary:
 - An integrated approach (multiple uses, water cycle).
 - A predictive approach.
 - A strong research basis on water resources problems, Hydrology, Hydrogeology, Limnology. Linkages between Climatology/Hydrology /Hydrogeology/Limnology, Eutrophication/Pollution. Long term research on related topics is fundamental to support management programs and capacity building at watershed level.
 - A capacity building programme with emphasis on water quality/quantity and case studies as a basis for training is essential as a new step forward.

THANK YOU!

the
INTERACADEMY PANEL
on international issues
iap



José Galizia Tundisi
tundisi@iie.com.br
www.iie.com.br
Rua Bento Carlos, 750
Centro – São Carlos – SP.

