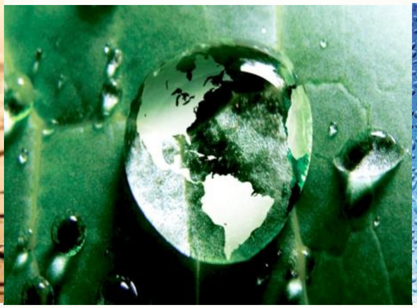
The Global Water Scenario: Human & Socio-Economic Impacts & Solutions

The Future of Science
10th World Conference - 'The Eradication of Hunger'
18-20 September 2014
Venice, Italy



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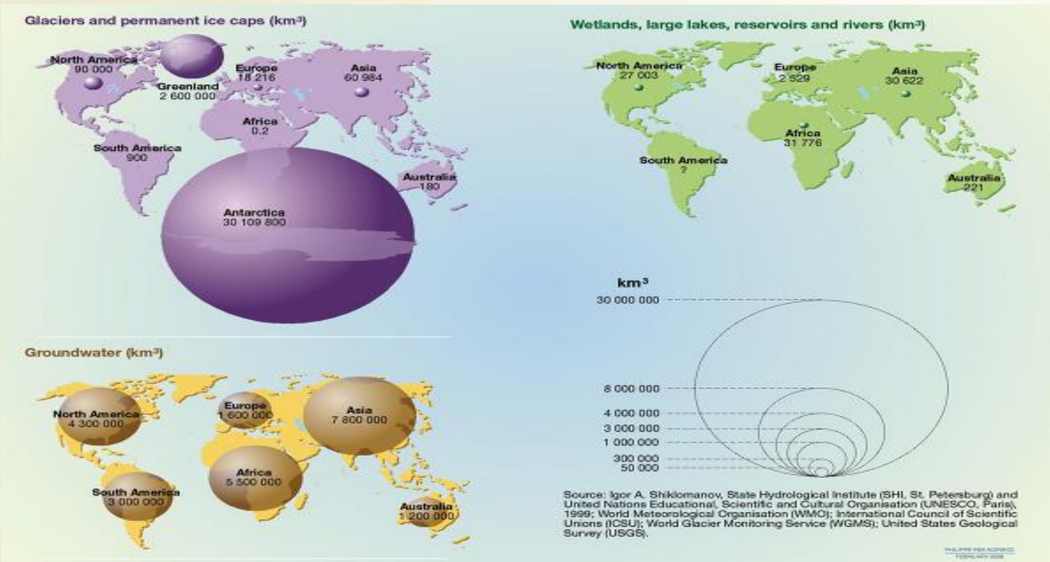
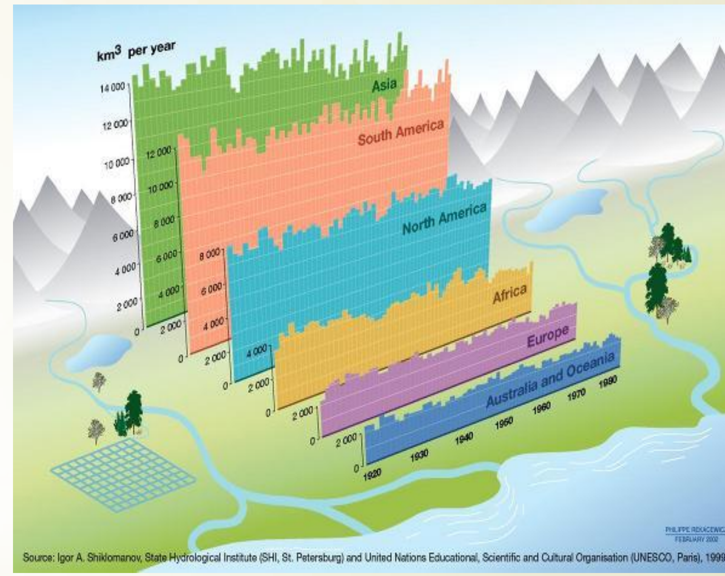
Global Water Crisis

Volume of Water



Runoff Volumes



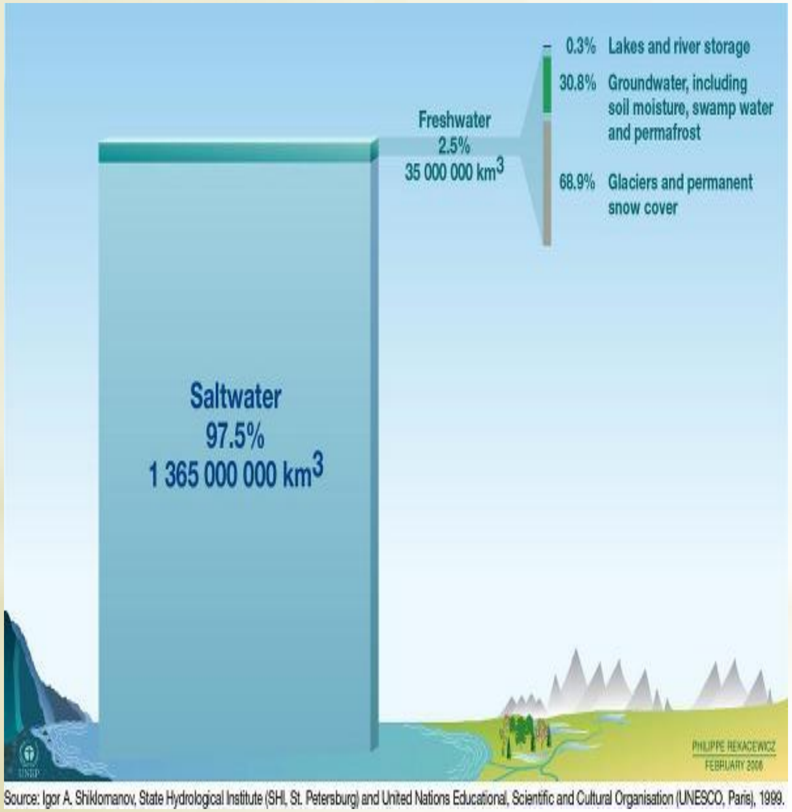
Six countries have half of the world's total **renewable** freshwater resources:
Brazil, Canada, China, Columbia, Indonesia, and Russia;

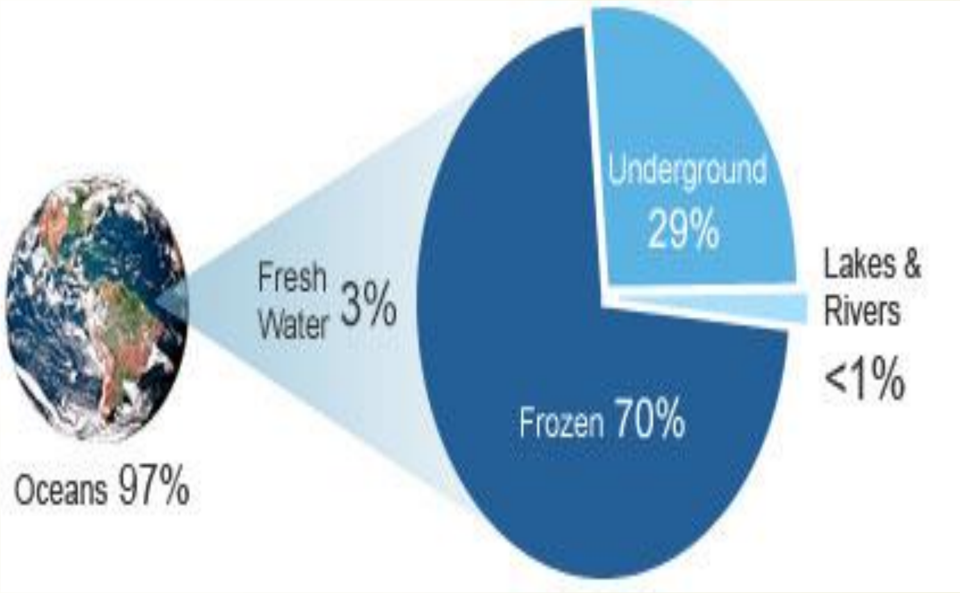
Water **within** countries is not evenly distributed;

Timing is an important factor in water access.

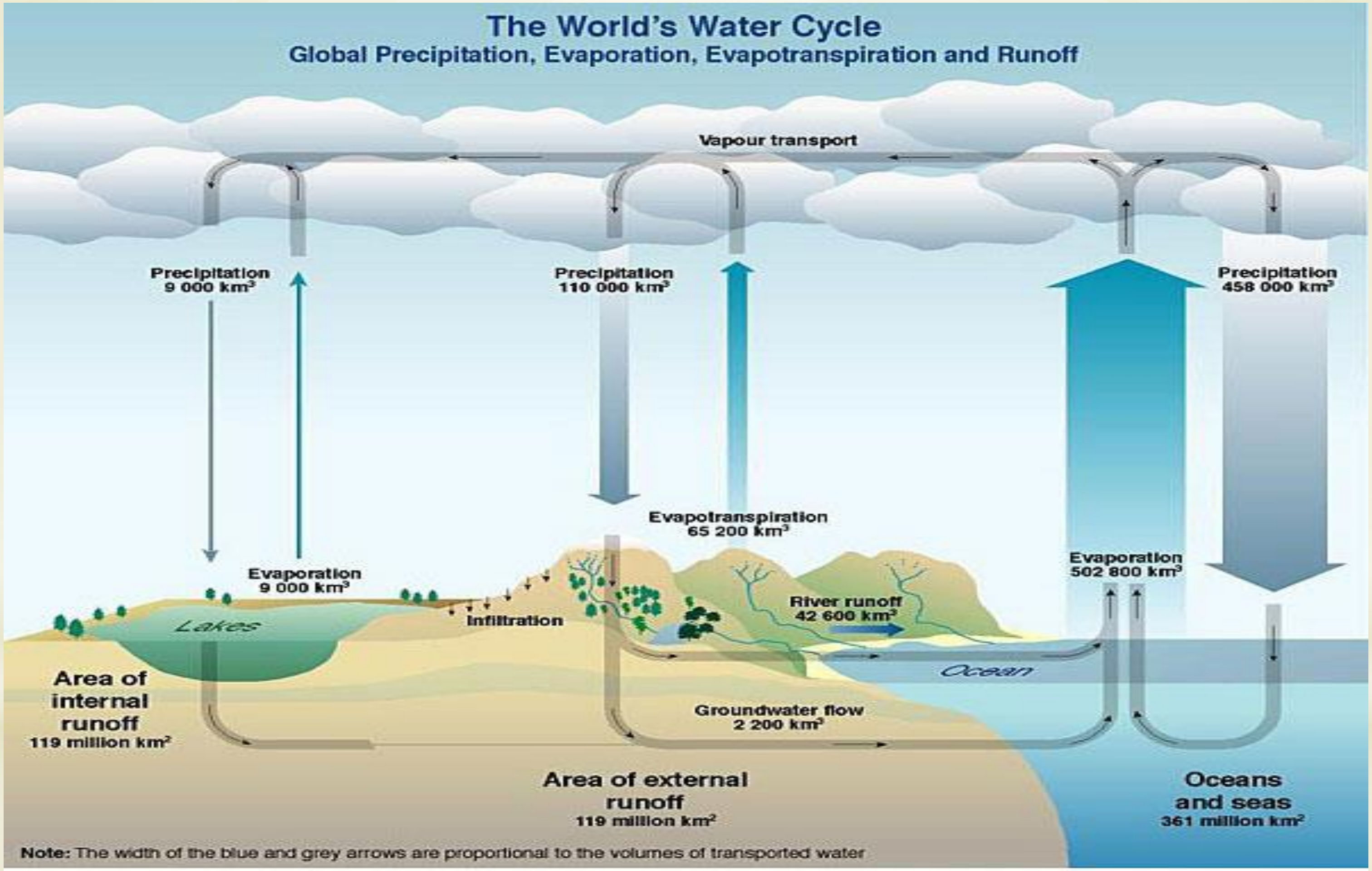
Available Water

<1% of Earth's total water available for human consumption
97.5% Saline, 70% glaciers, 29% aquifers





Hydrological Cycle



Source: Igor A. Shiklomanov, State Hydrological Institute (SHI, St. Petersburg) and United Nations Educational, Scientific and Cultural Organisation (UNESCO, Paris), 1999; Max Planck, Institute for Meteorology, Hamburg, 1994; Freeze, Allen, John, Cherry, *Groundwater*, Prentice-Hall: Engle wood Cliffs NJ, 1979.

Groundwater Abstraction As A Percentage of Mean Recharge

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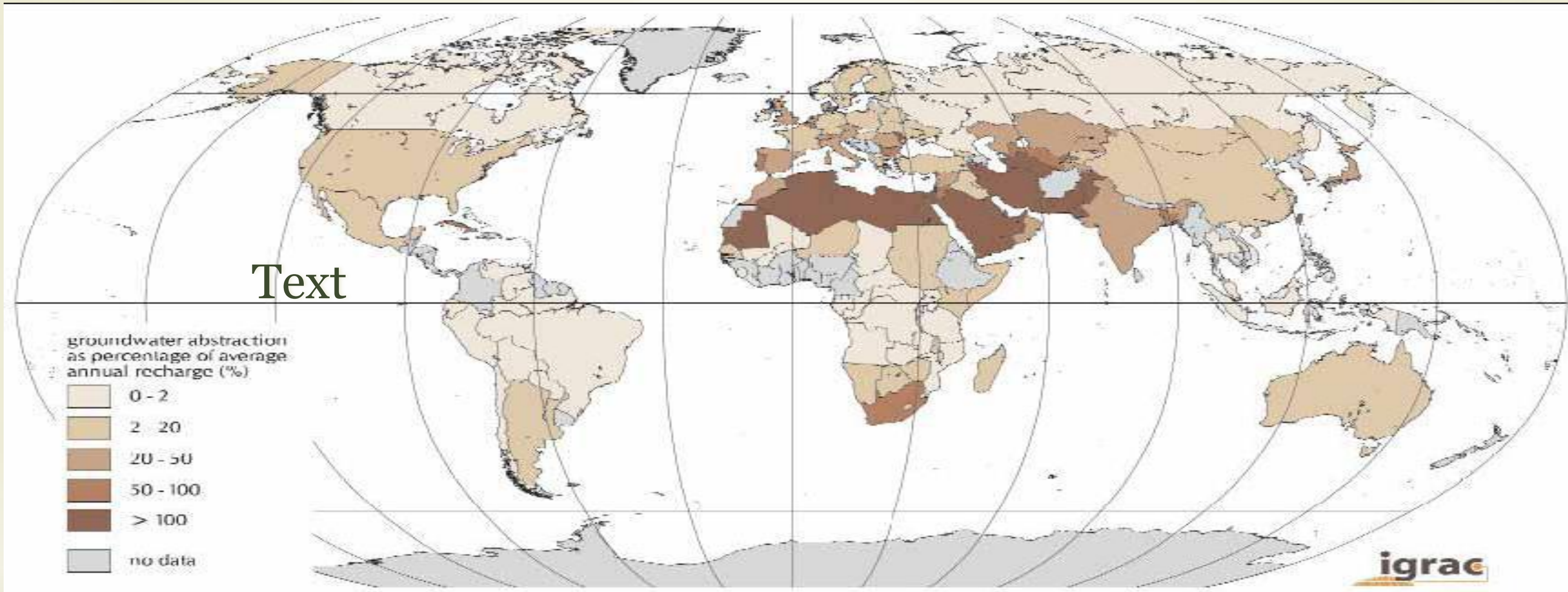
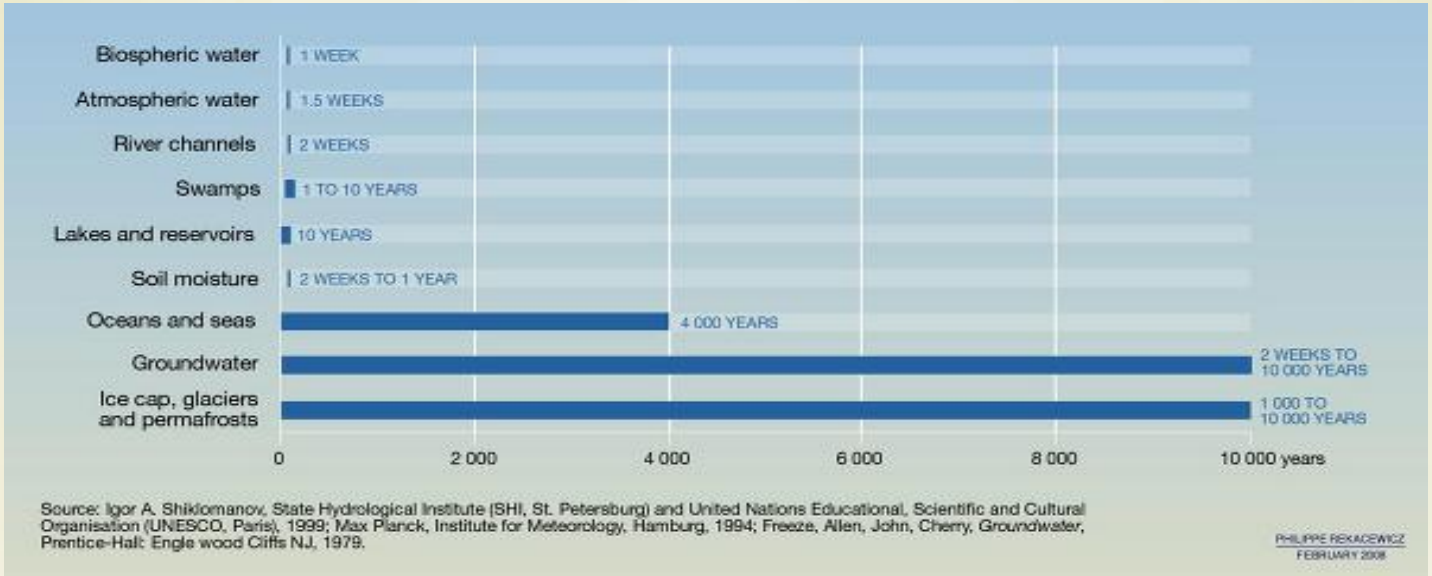


GEOGRAPHIC BREAKDOWN OF WATER ABSTRACTION:

ASIA	55%
NORTH AMERICA	19%
EUROPE	9.2%
AFRICA	4.7%
SOUTH AMERICA	3.3%
REST OF THE WORLD	8.8%

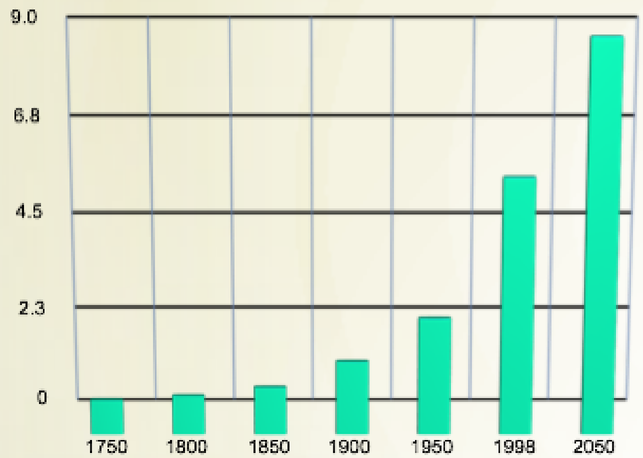
Groundwater Residence Time



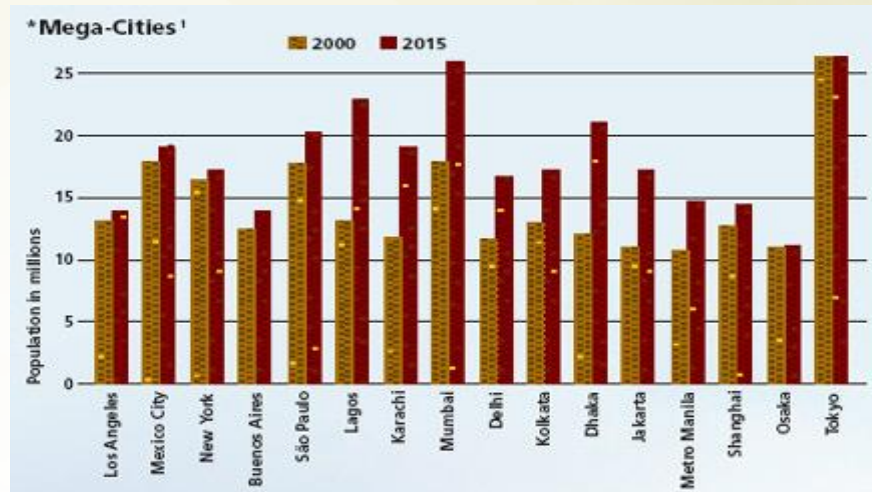
Component	Mean Residence Time
Permafrost zone & Ground Ice	10,000 years
Polar Ice	9,700 years
Oceans	2,500 years
Mountain Glaciers	1,600 years
Groundwater (excluding Antarctica)	1,400 years
Lakes	17 years
Swamps	5 years
Soil Moisture	1 year
Atmosphere	8 days
Biosphere	Several hours

Population Growth & Demographics

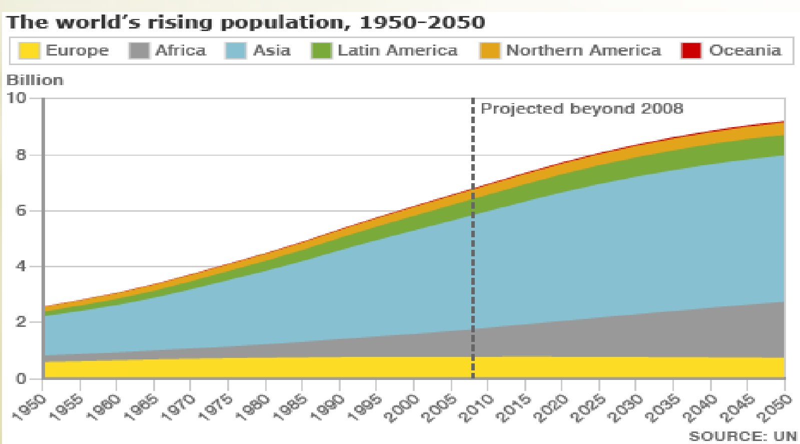
Population Growth

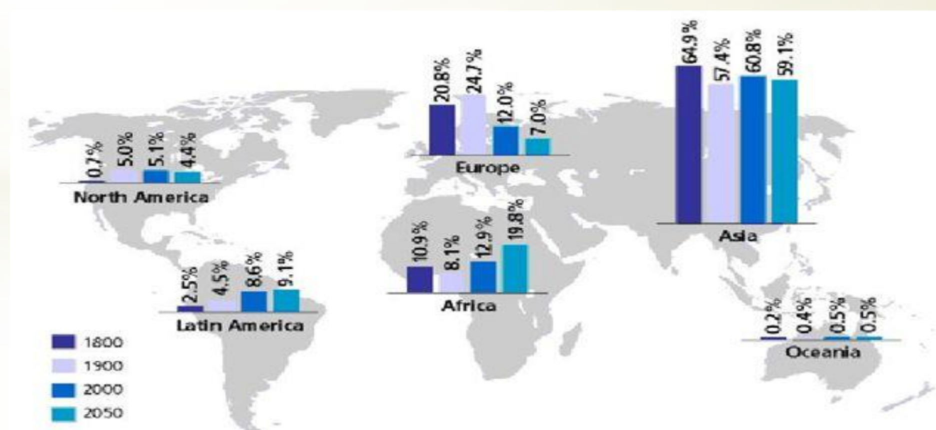


Urban Growth



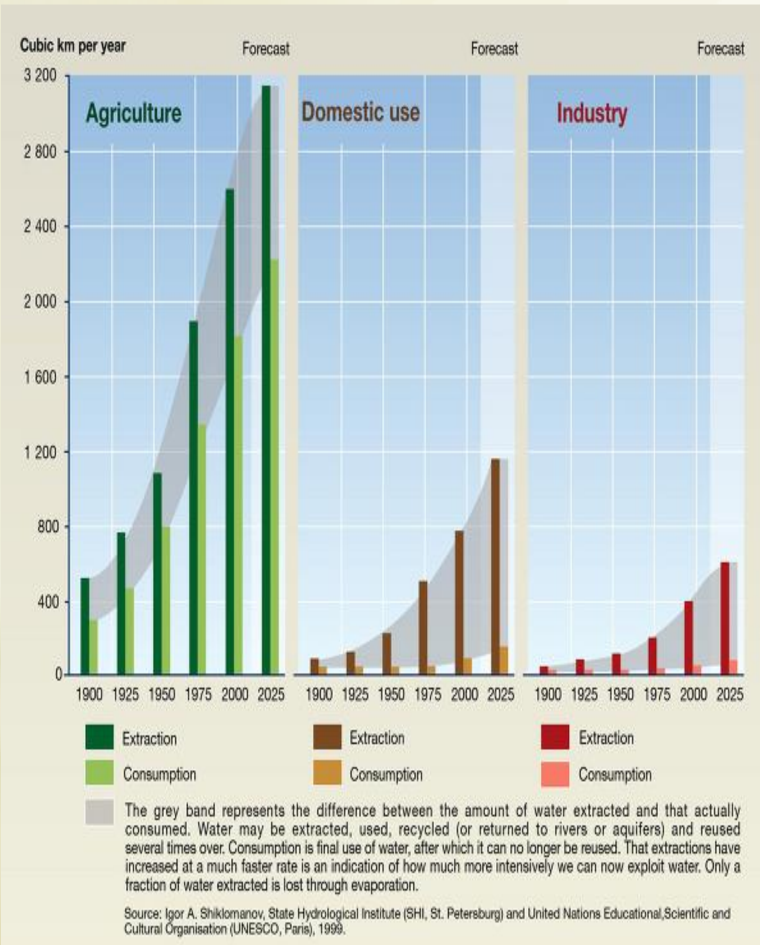
Global Population Shift

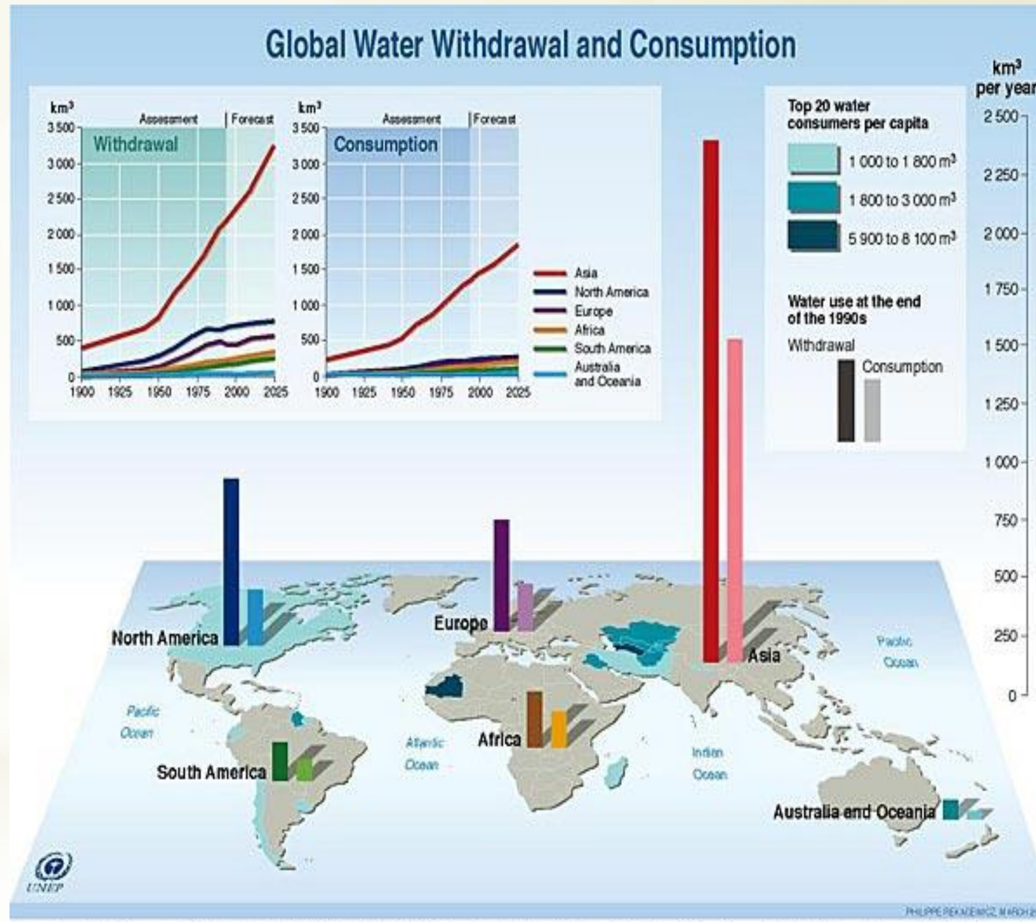




Patterns of Consumption

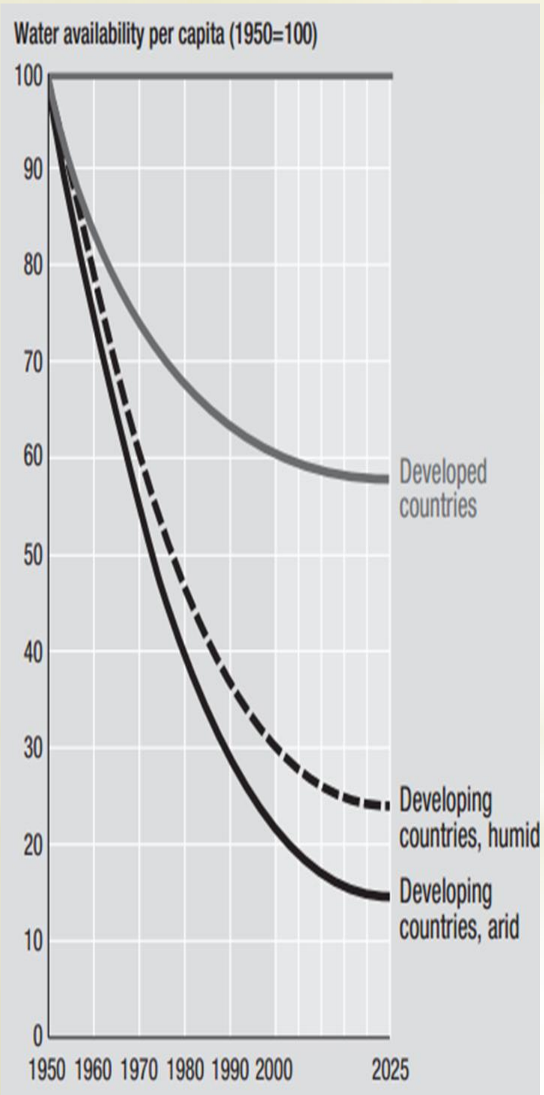
Water Withdrawals per Sector (Cubic Kilometers per Year)

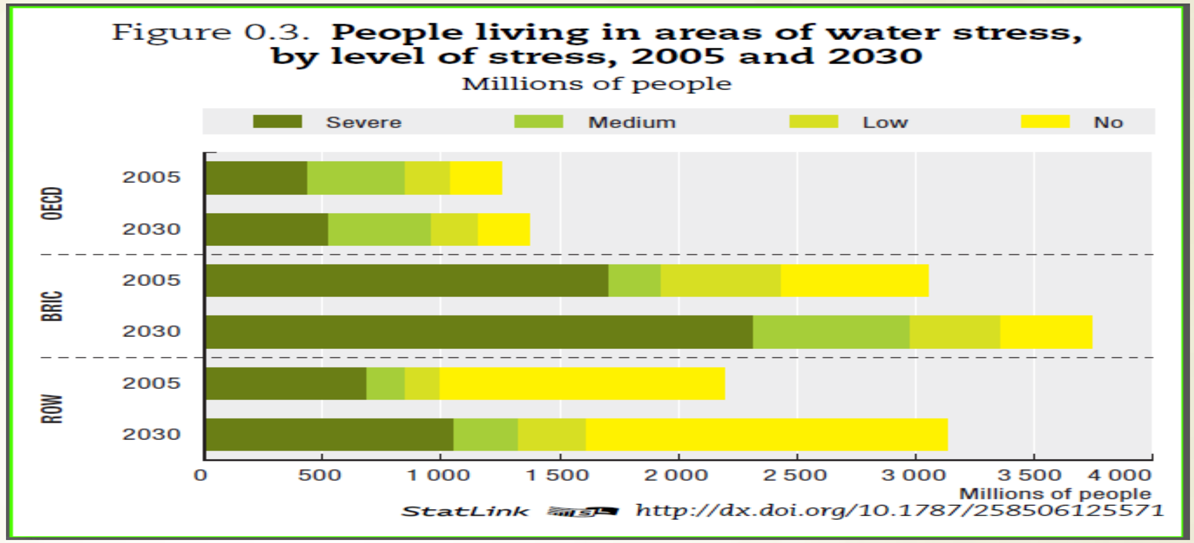


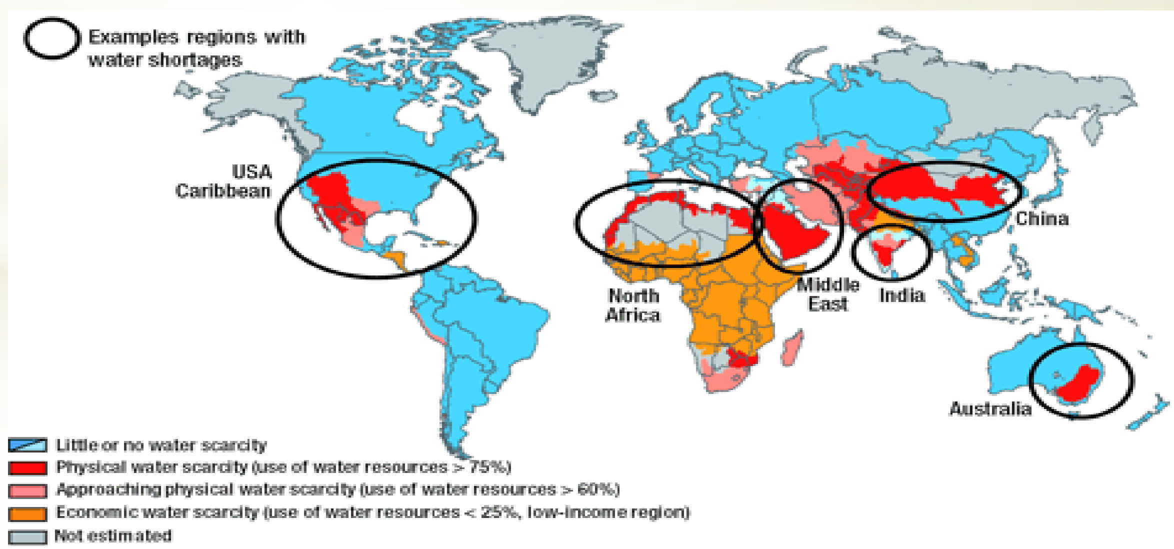


Source: Igor A. Shiklomanov, State Hydrological Institute (SHI, St. Petersburg) and United Nations Educational, Scientific and Cultural Organisation (UNESCO, Paris), 1999; *World Resources 2000-2001, People and Ecosystems: The Fraying Web of Life*, World Resources Institute (WRI), Washington DC, 2000; Paul Harrison and Fred Pearce, *AAAS Atlas of Population 2001*, American Association for the Advancement of Science, University of California Press, Berkeley.

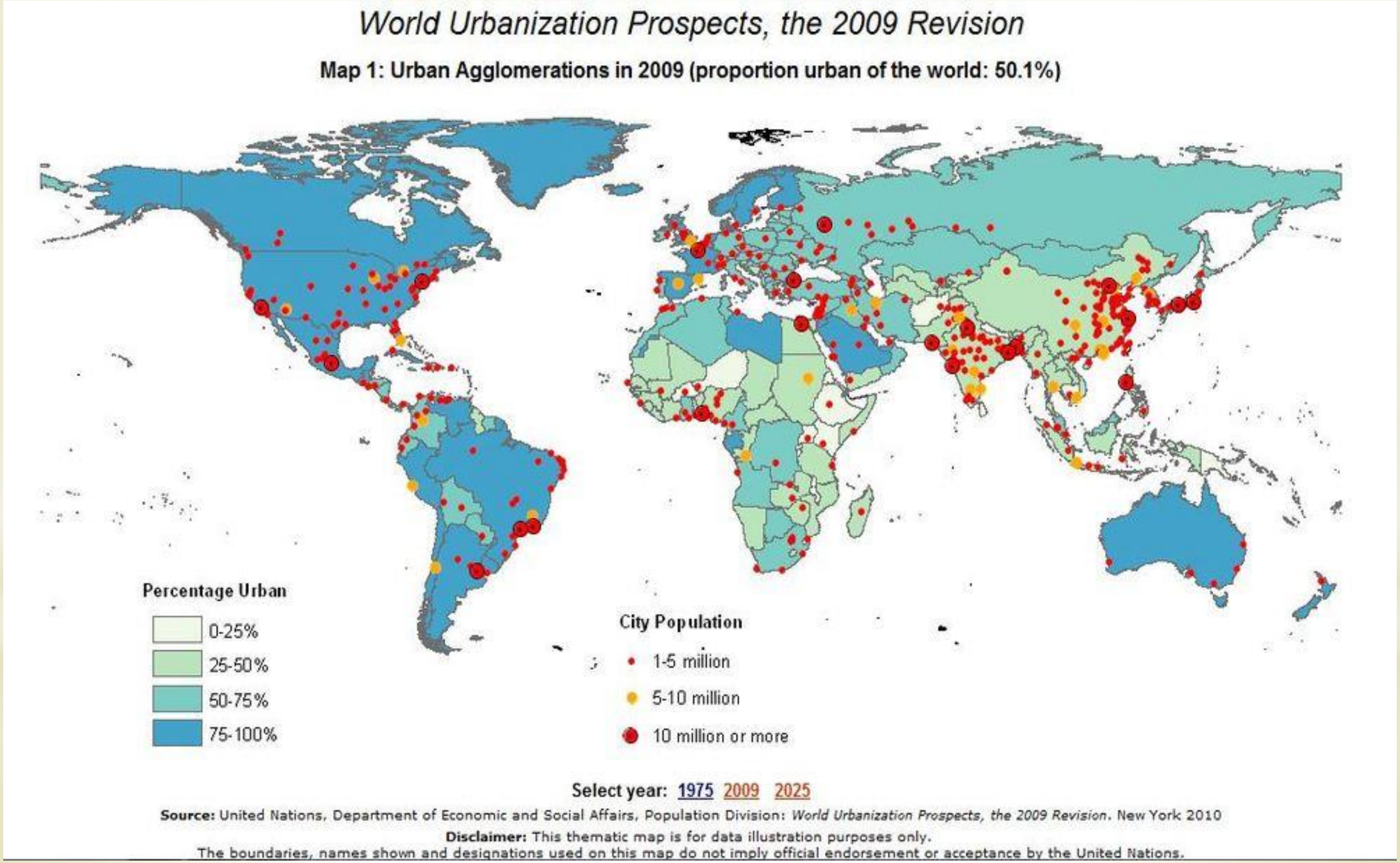
Water Availability Per Capita & Region



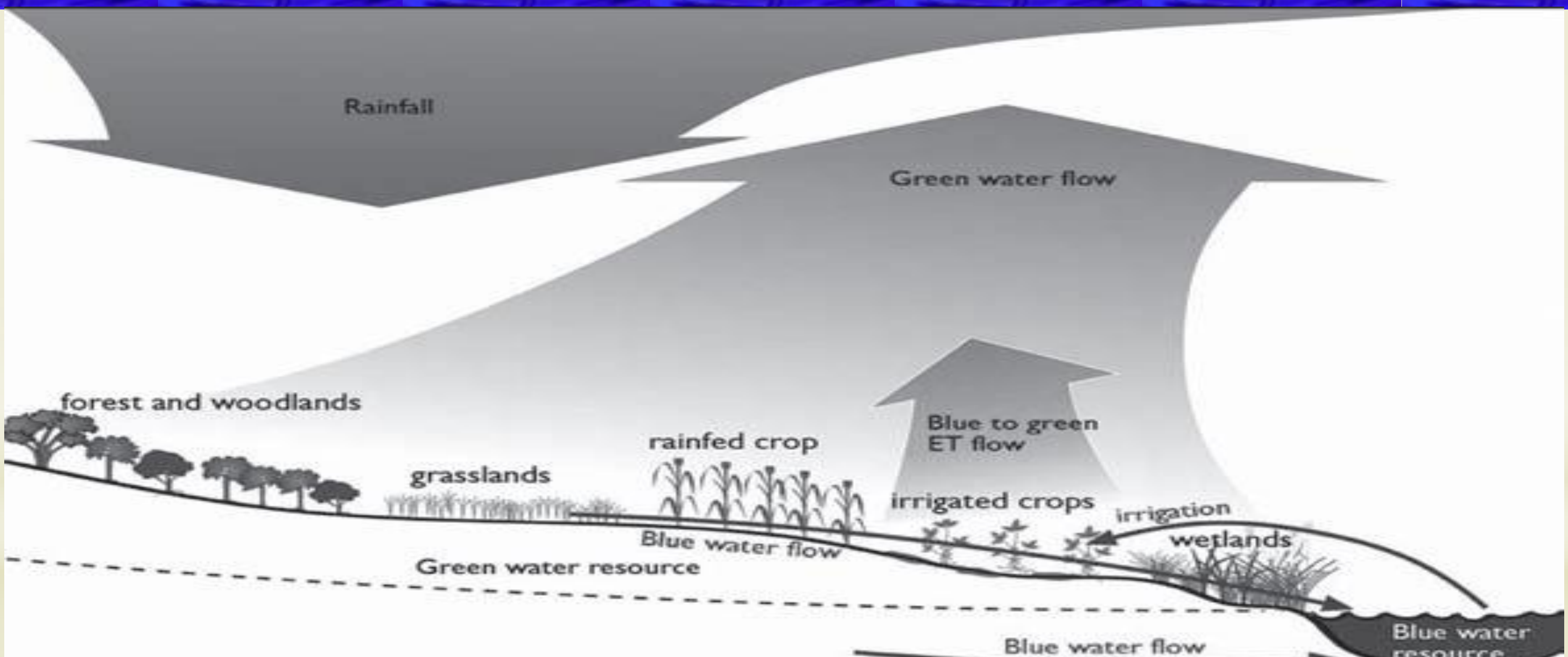




Urbanization vs Agriculture



Blue versus Green Agriculture



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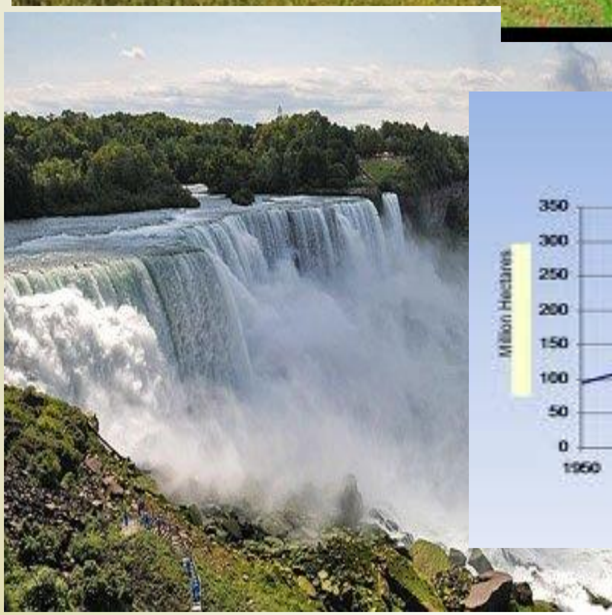
World Irrigated Land



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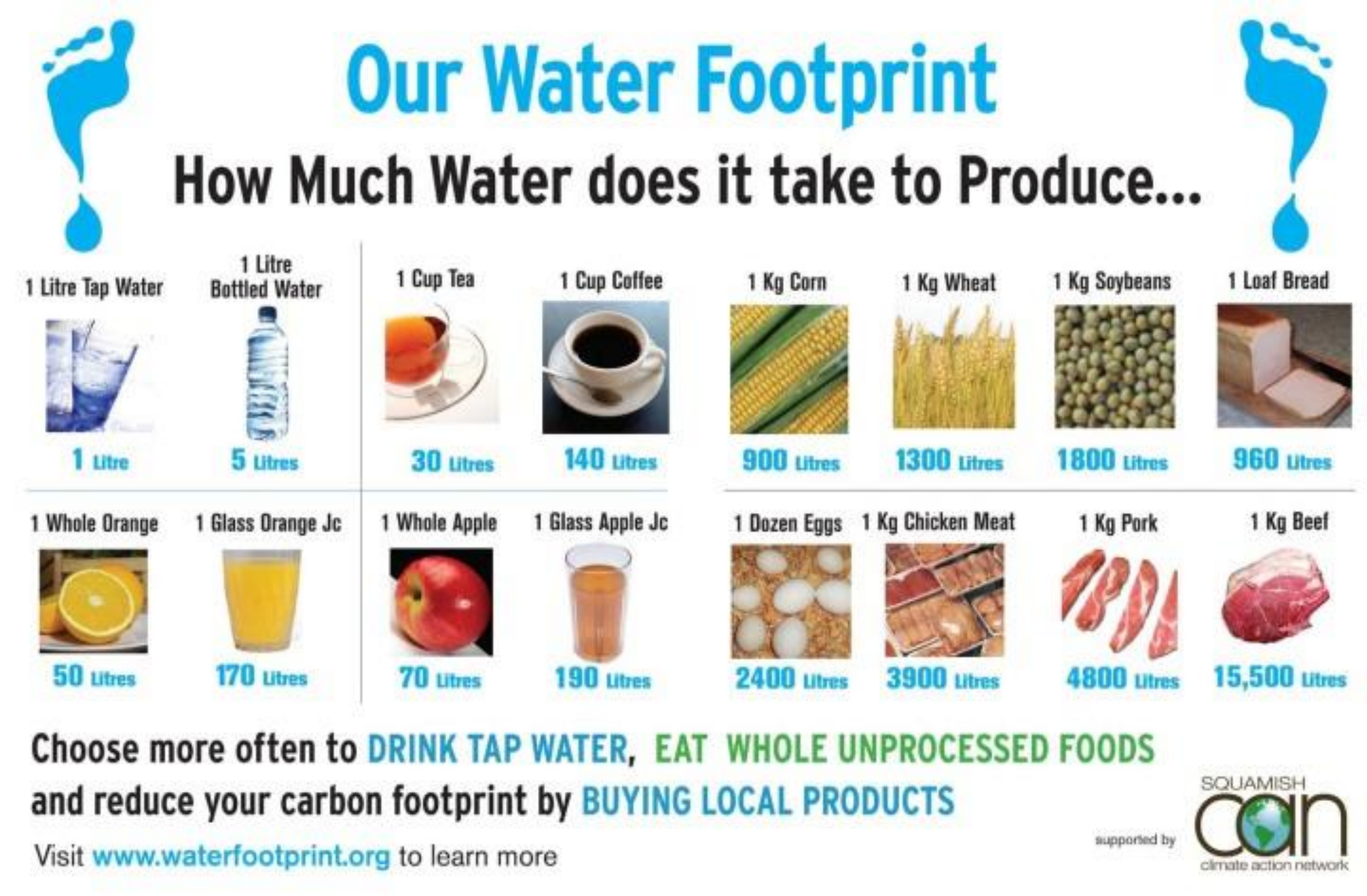
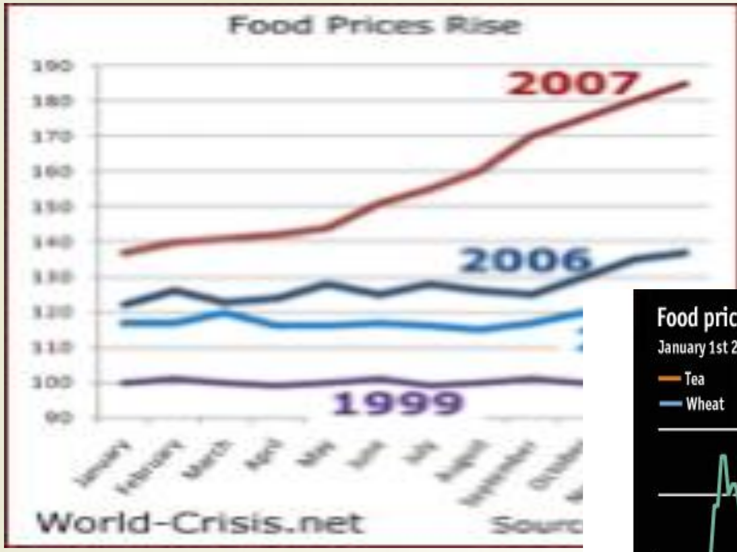
Estimates of Water Embedded in Different Products

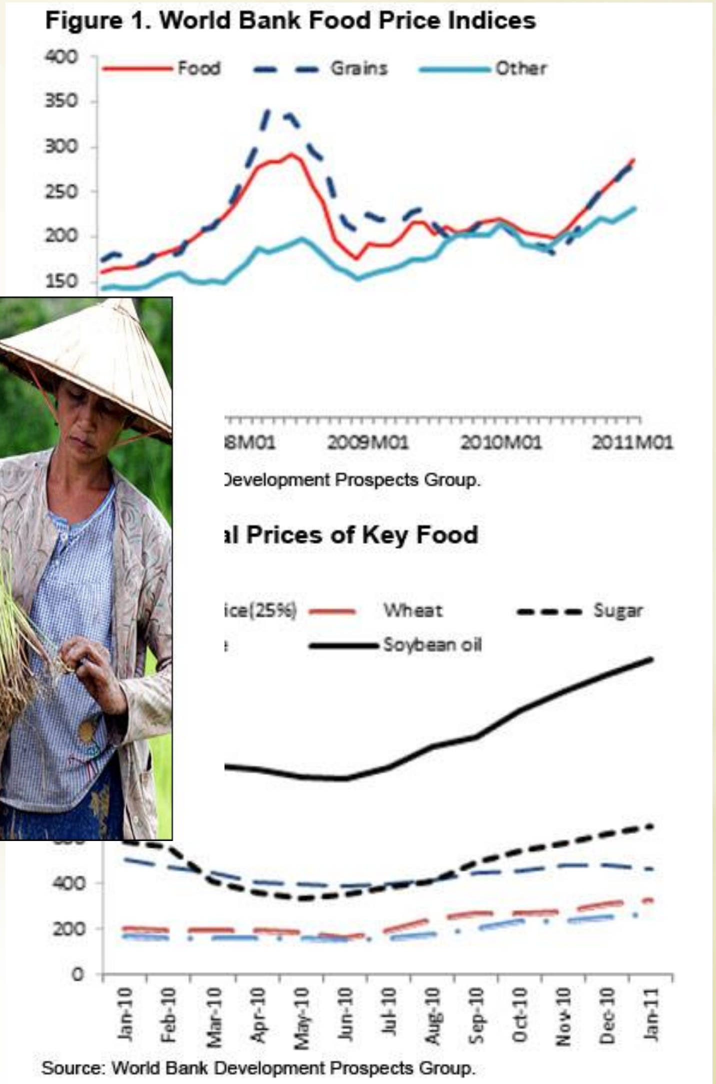
Portion	Litres	Portion	Litres	Portion	Litres
Pint of beer, 568ml	170	Cup of coffee, 125ml	140	Glass of orange juice, 200ml	170
Sheet of A4, 80 g/m²	10	Cotton tee-shirt, medium 500g	4100	Microchip, 2g	32
Cup of tea, 250ml	35	Glass of wine, 125ml	120	Orange, 100g	50
Slice of bread, 30g	135	Bread with cheese, 30g + 10g	90	Bag of potato crisps, 200g	185
Egg, 40g	135	Tomato, 70g	13	Hamburger, 150g	2400
Potato, 100g	25	Apple, 100g	70	Bovine leather shoes	8000

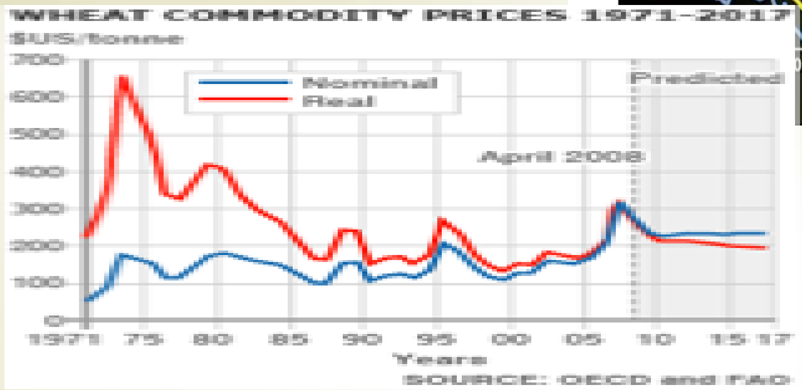
Our Water Footprint



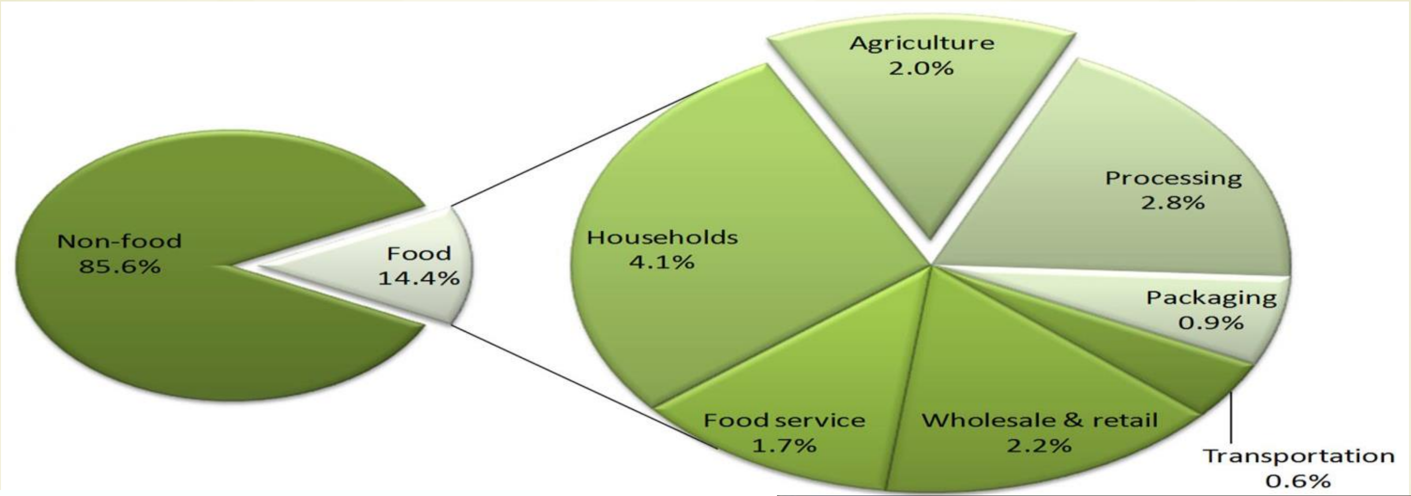
Food Price Rises

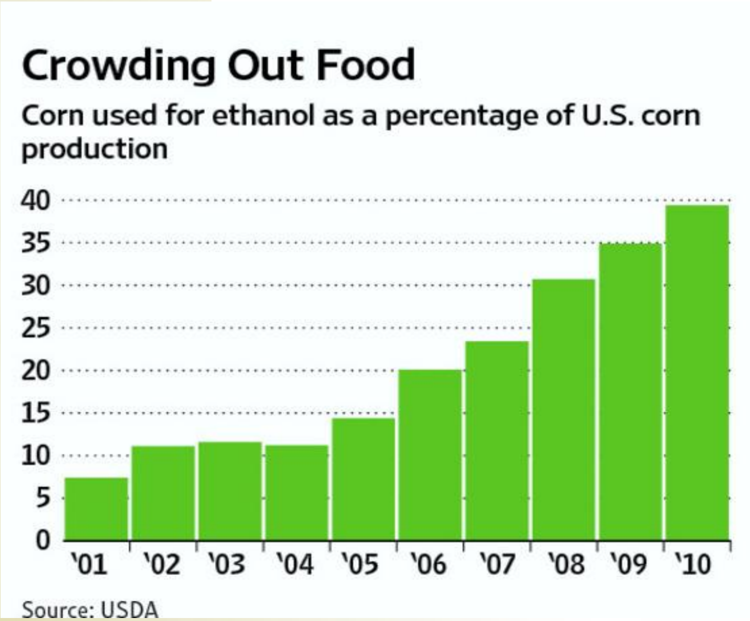


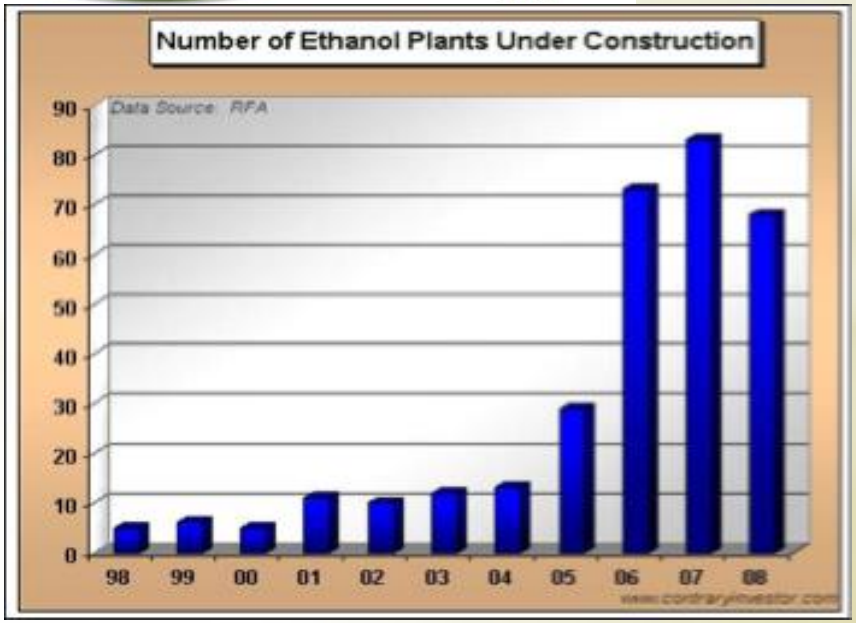




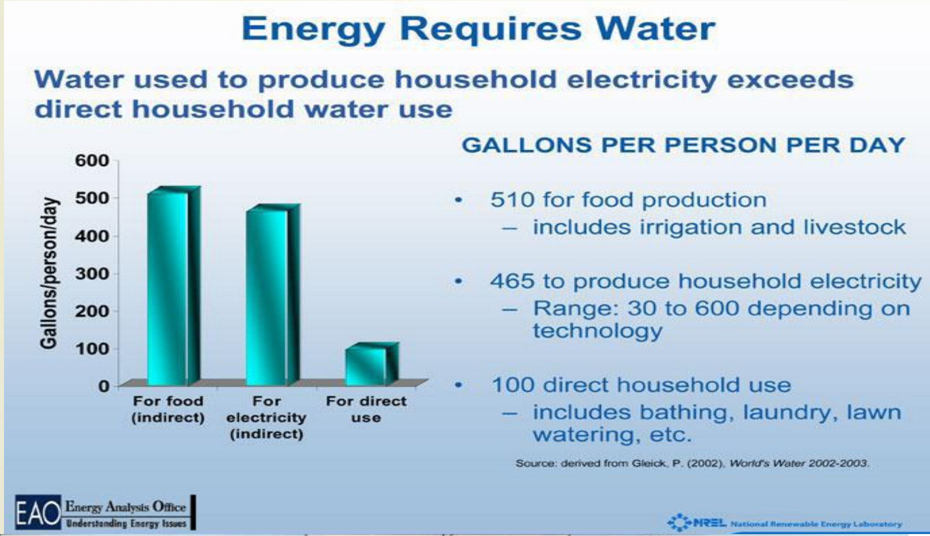
Food for Energy

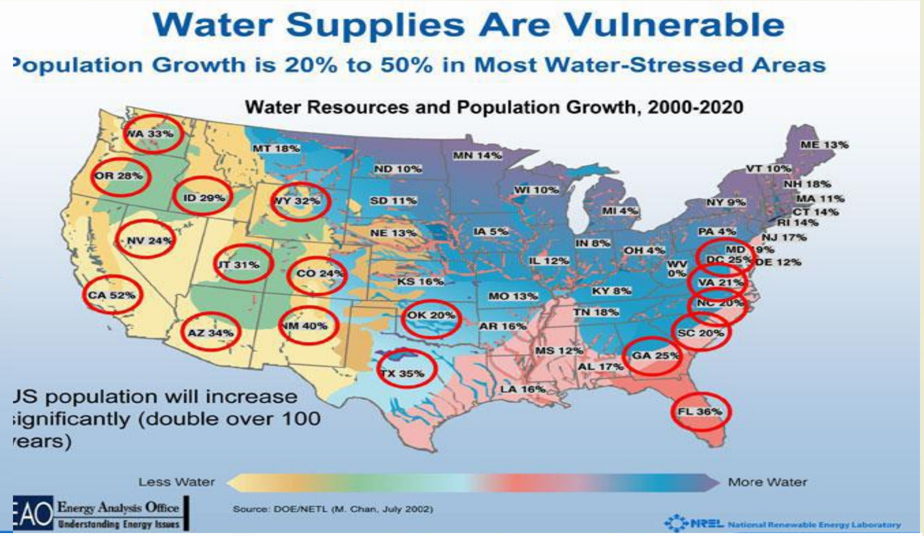


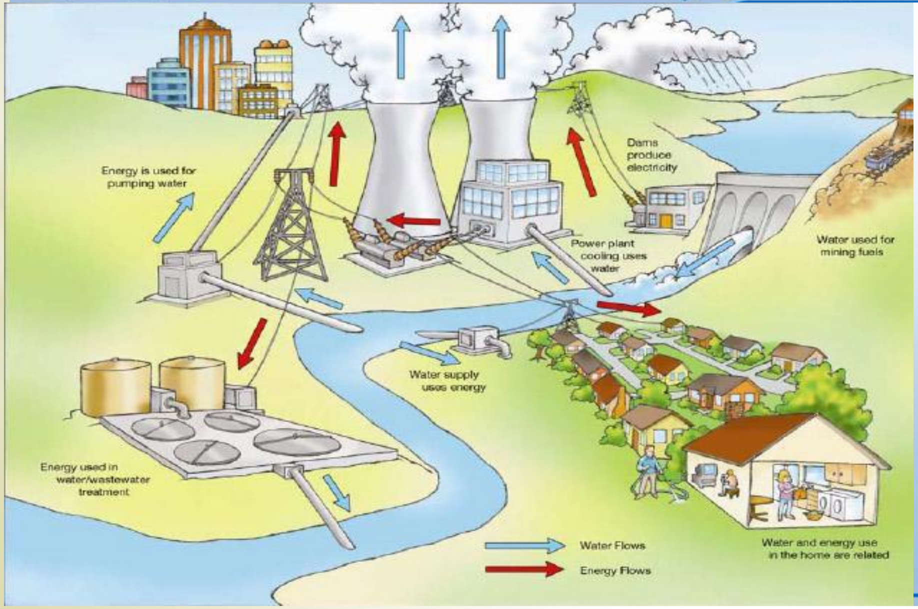


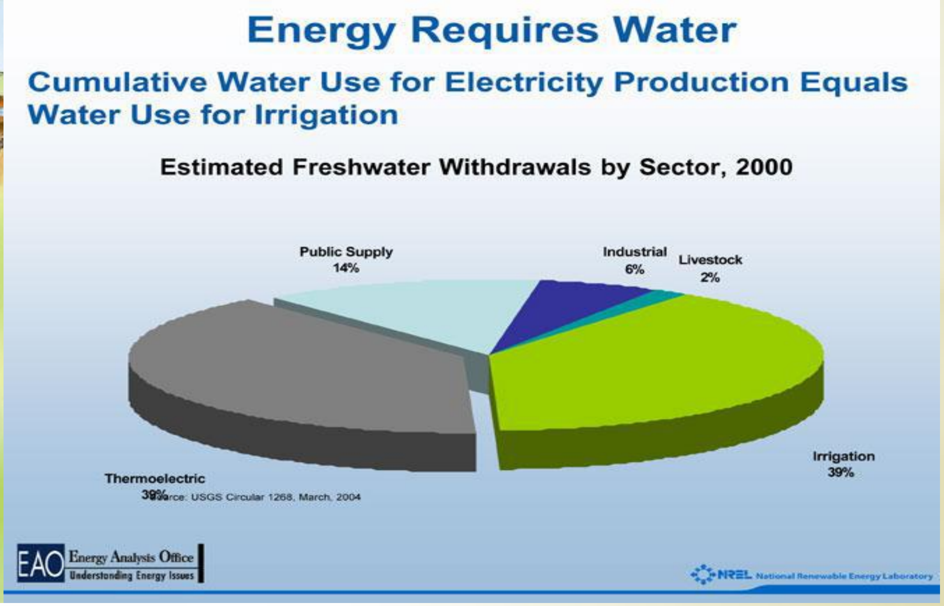


Water for Energy

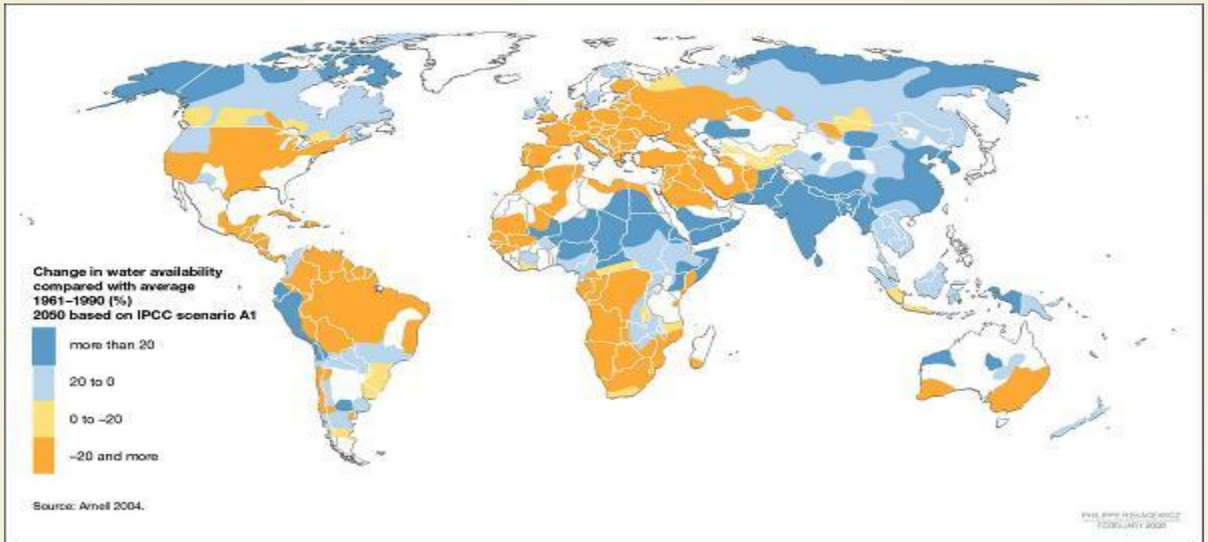


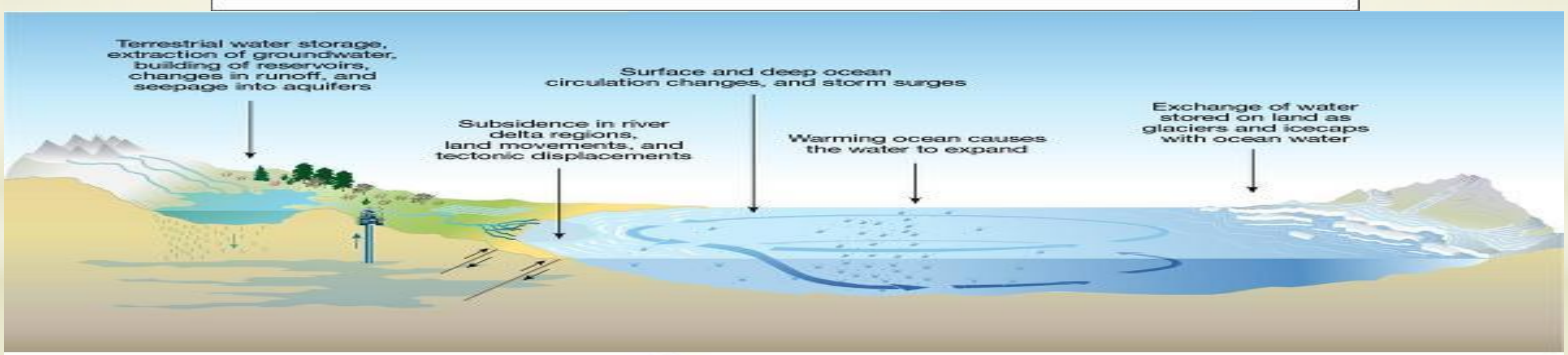


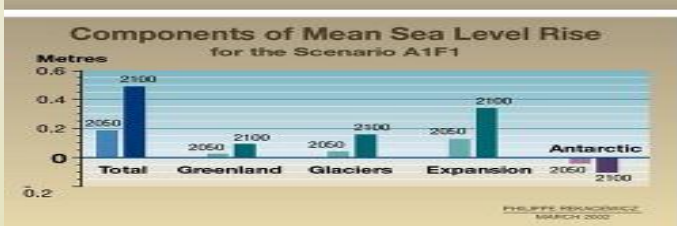




The Contribution of Climate Change to Declining Water Availability







The A1 scenario family describes a future of rapid economic growth, a global population that peaks in the middle of the 21st century and then declines, and the rapid introduction of new and more efficient technologies. The major underlying themes are convergence among regions, capacity-building, and increased cultural and social interaction, with a substantial reduction in regional differences in per capita incomes. The A1 scenario family develops into three groups with alternative directions of technological change according to their energy systems: fossil intensive (A1FI), non-fossil energy sources (A1T), or a balance of both (A1B).

Source: David Griggs, in Climate Change 2001, Synthesis report, Contribution of working groups I, II and III to the Third Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press , 2001.

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Pollution – Poor Water Quality



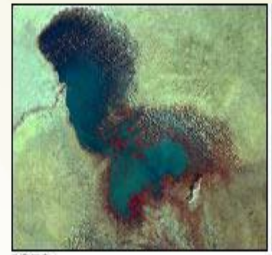




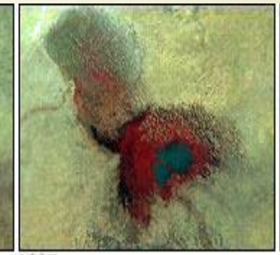

Mismanagement of Natural Resources
Lake Chad & Aral Sea

July - September, 1989

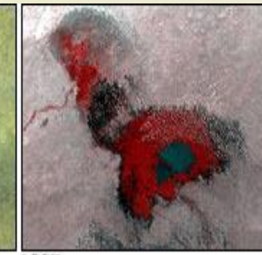
August 12, 2003



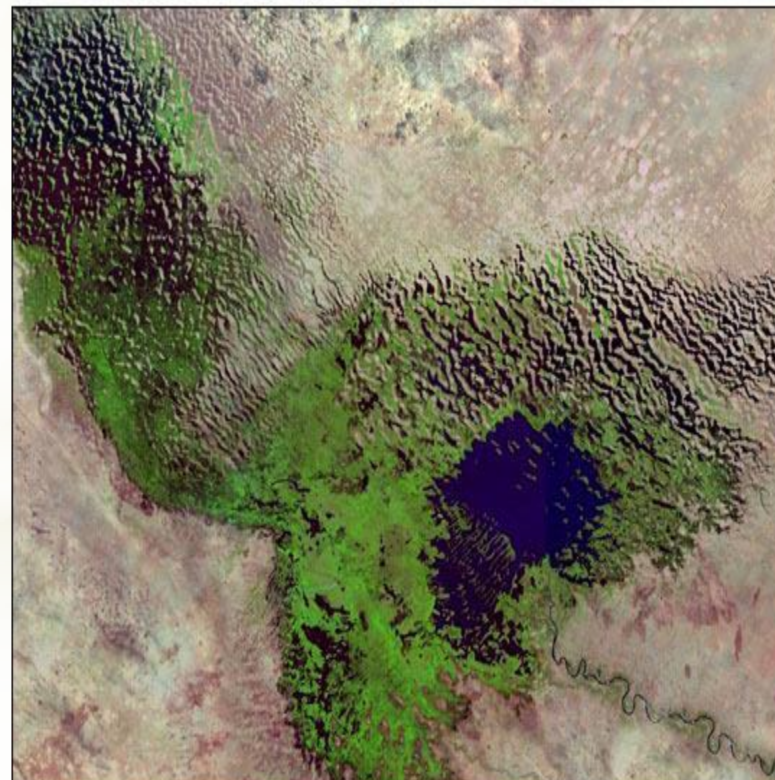
1973



1987



1997



2001

Valuing our Ecosystems

Forests account up to 15 per cent of the annual carbon emissions caused by human activity;

Only 1/5th of the planet is still covered in Forests. Forests have completely disappeared in 25 countries;

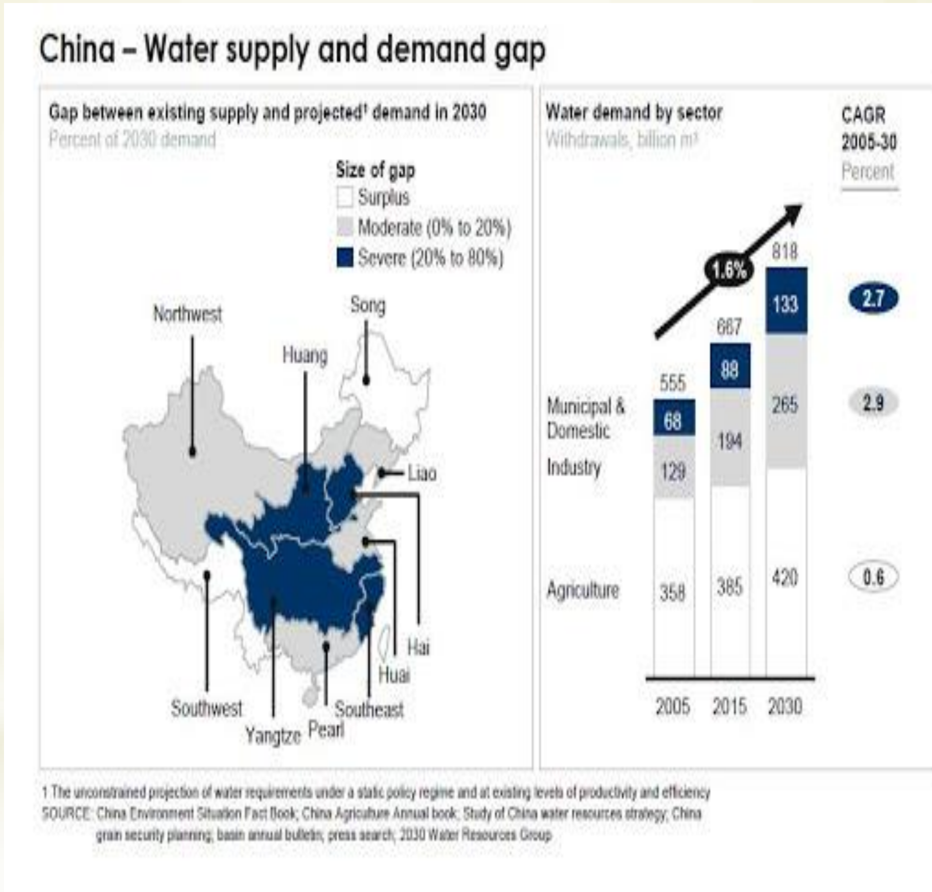
The world has lost 50 per cent of its Wetlands. In the United States, about two and a half acres of Wetlands are being lost every minute. California has lost over 90% of its Wetlands;

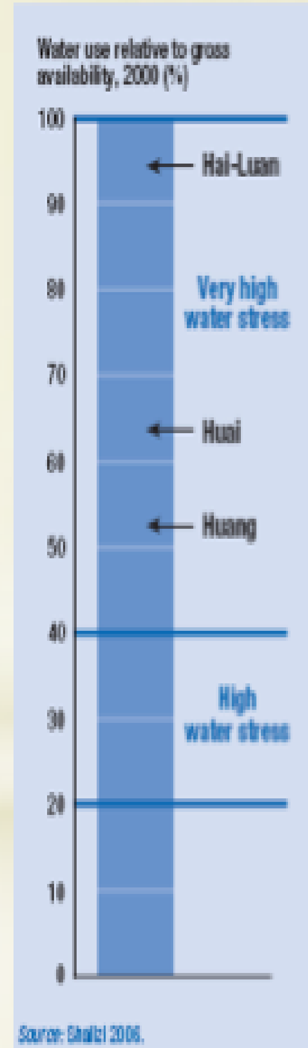
Up to 80 % of Mangroves have disappeared in some countries;

The Ocean's Marine Species has been reduced by some 90%;

20 % of the World's Coral Reefs have been destroyed and 30 % have been severely affected by pollution.

Water/Food Nexus:
The Case of China & Brazil





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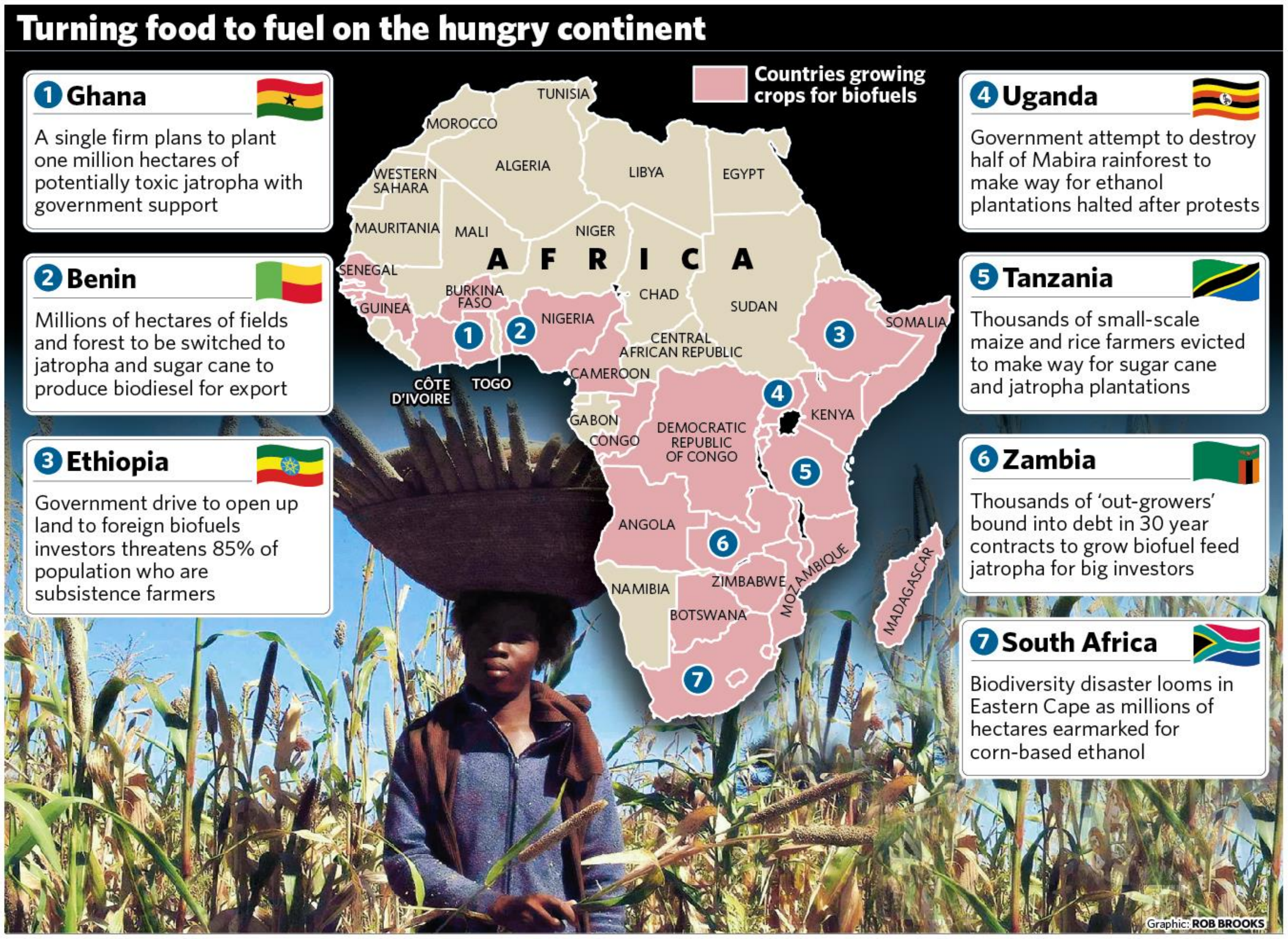
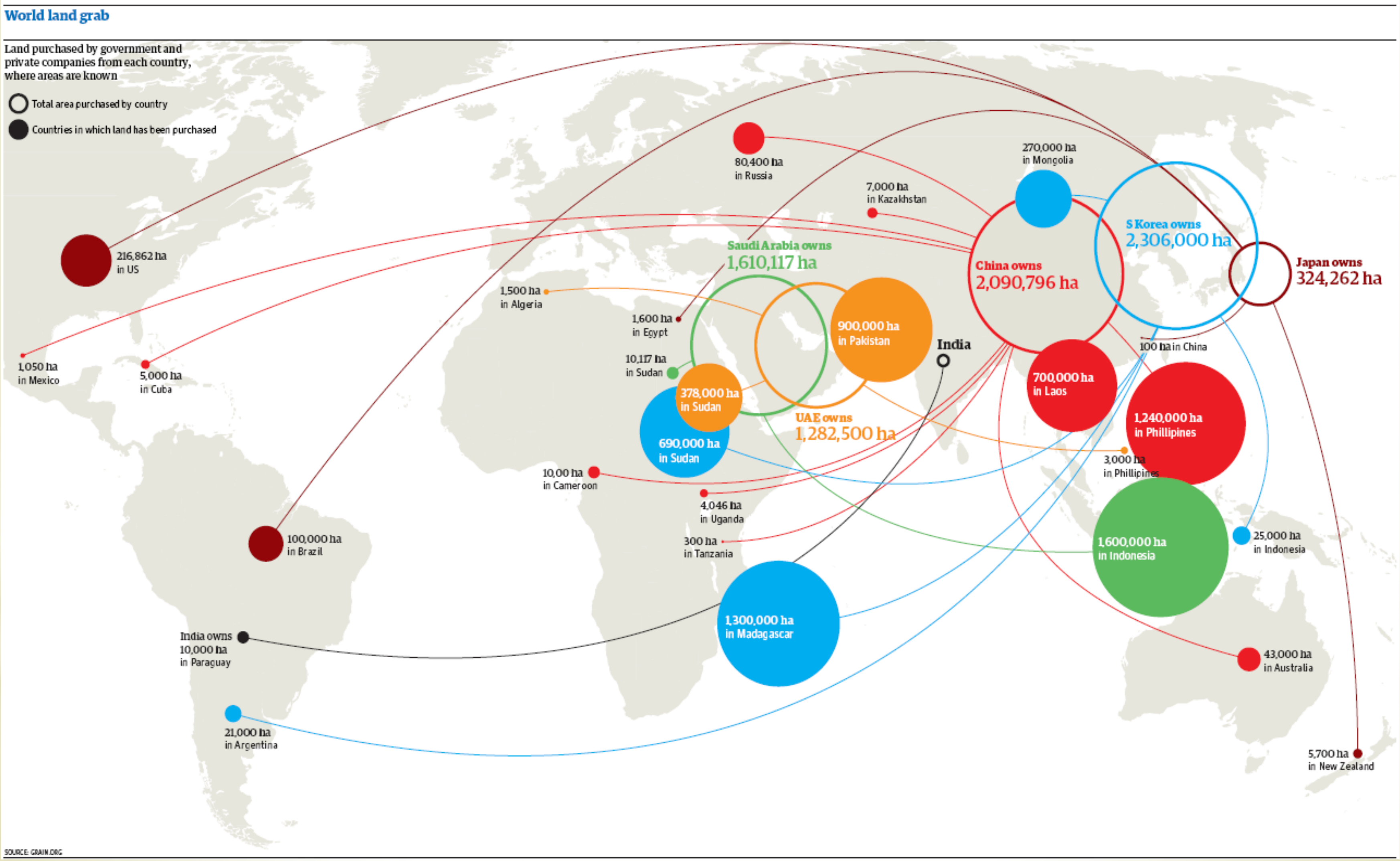
Environmental Destruction
Loss of Biodiversity

The Fertile Lands of Africa



Foreign Land Acquisitions



Water & Ethics

WHAT IS THE HUMAN DEVELOPMENT COST?

Over 800 Million People Have No Access To Food

Almost 800 Million People Have No Access to Clean Water

Over 1 Billion People Still Have No Access to Sanitation

Hunger, illness, and lost education opportunities in childhood, create a lifecycle of disadvantage and leads to adult poverty which affects the economics of a country.

Water Footprint

WATER FOOTPRINT =

TOTAL VOLUME OF WATER USED IN THE PRODUCTION OF GOODS AND SERVICES

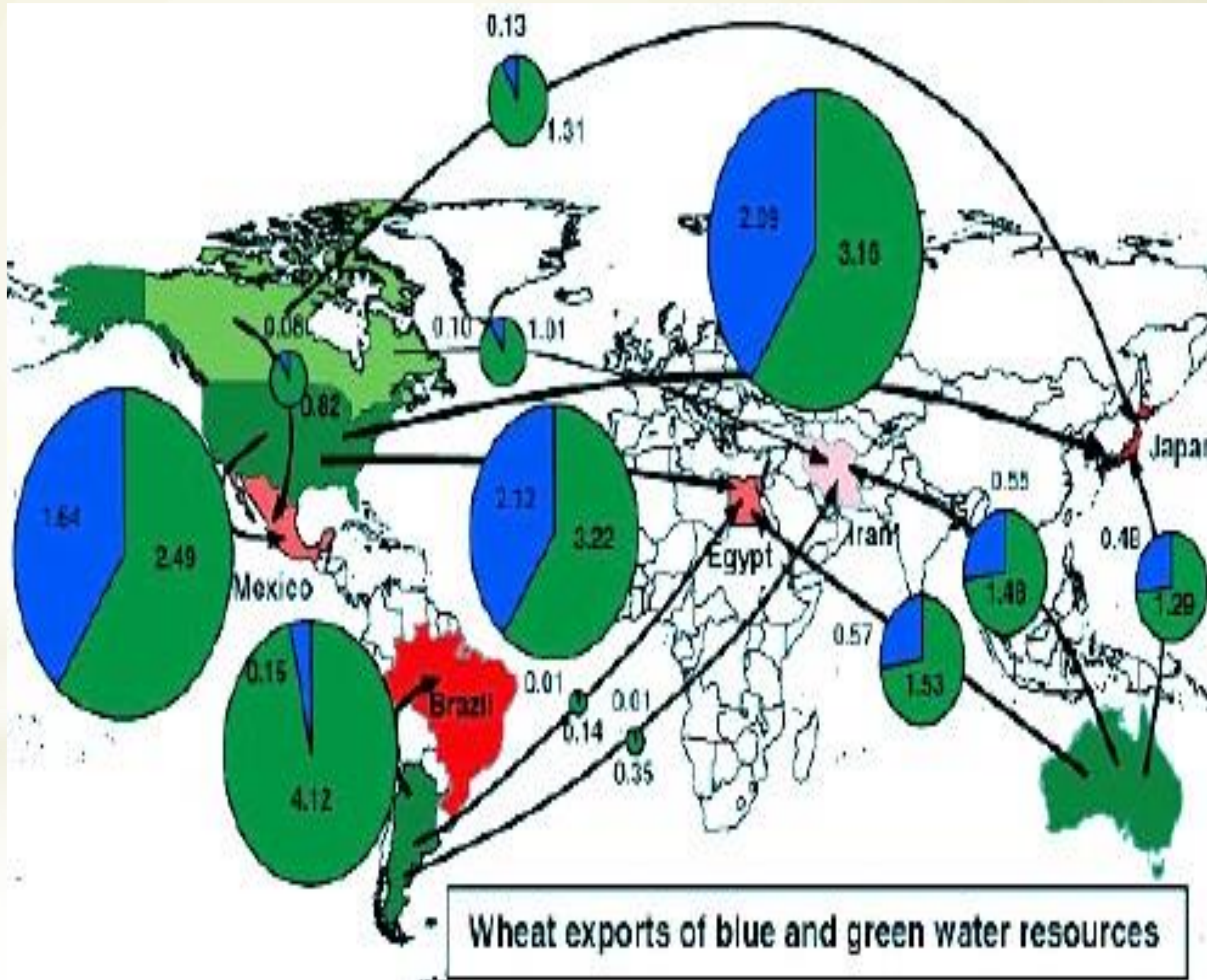
INTERNAL WATER FOOTPRINT =

VOLUME OF WATER USED FROM DOMESTIC WATER RESOURCES

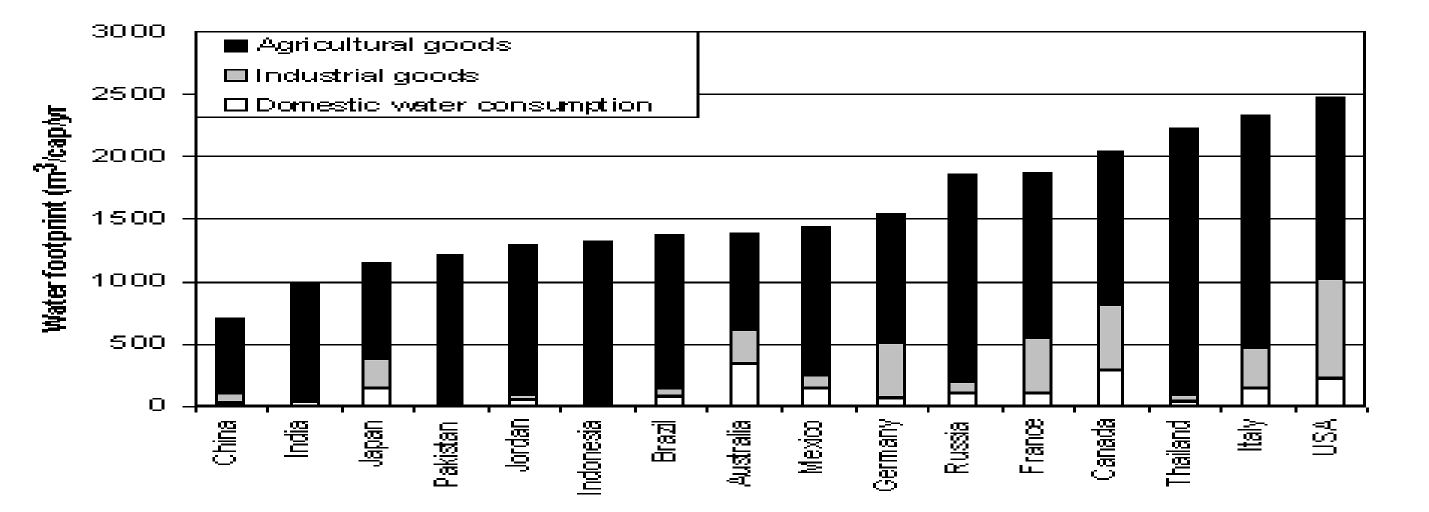
EXTERNAL FOOTPRINT =

WATER USED IN OTHER COUNTRIES TO PRODUCE THE GOODS IT IMPORTS

Global Water Trade In Wheat



Key Factors Determining a Country's Water Footprint



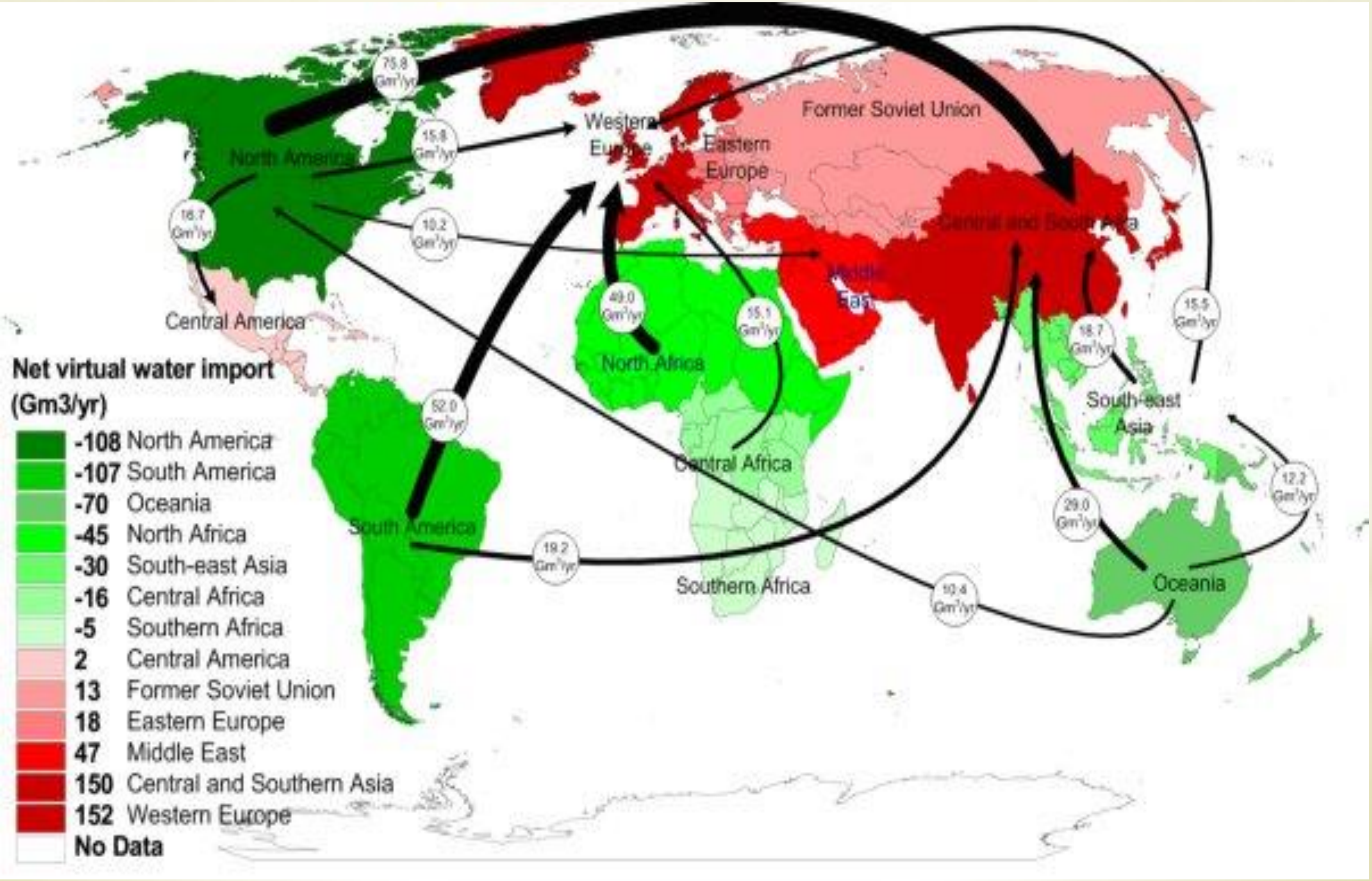
1. Volume of Consumption
2. Consumption Pattern (Vegetarian or Meat Consumption)
3. Climate (Growing Conditions)
4. Agricultural Practices (Efficiencies

The United States has a water footprint of 2,480 m3 per capita a year

China has a footprint of 700 m3 per capital a year.

The Global Water Footprint is estimated at 1,240 m3 per capital a year

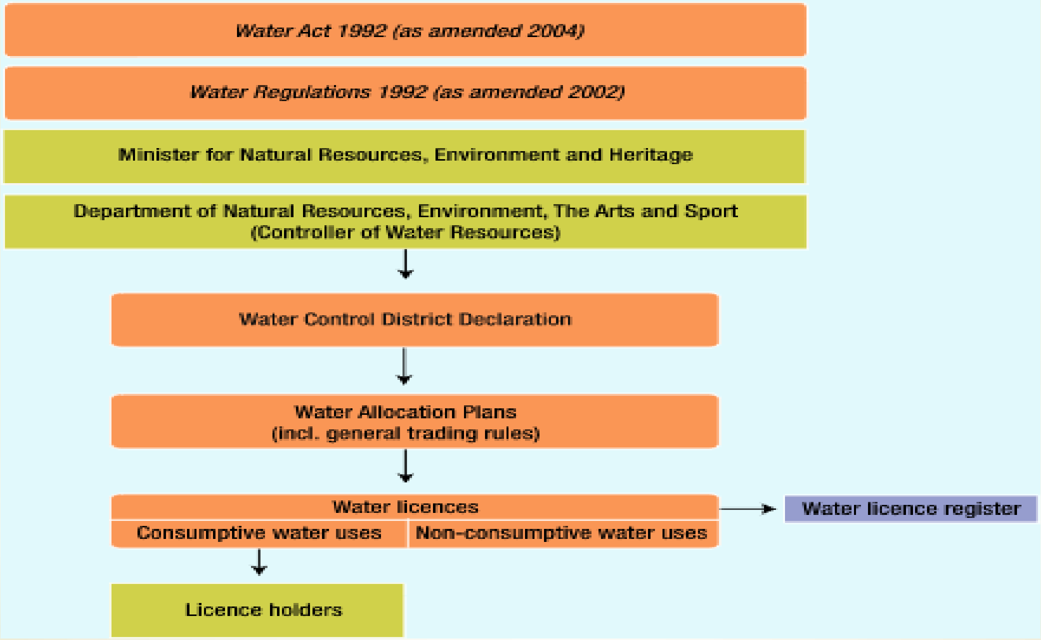
Global Virtual Water Trade



Water Markets

Australian Water Market

Water markets can serve as a mechanism to balance supply and demand and to address inefficiencies.



Within the agricultural sector, inter-farm trades can be beneficial in terms of farm productivity and result in increased crop outputs and higher incomes for farmers.

Within the urban sector, irrigation has a higher value.

Inefficient irrigation can be traded up towards higher value products for urban or industrial purposes.

The rural/urban trade can be an interesting water market, however both parties MUST be willing to trade.

Valuing Water

In considering water economics, the following basic principles apply:

1. Water rights need to be clearly defined and enshrined in legislation;
2. Water rights need to include water for human needs and also for drinking, bathing, cooking, etc;
3. Lands, oceans and ecosystems need to have the right to water and all decision should consider impacts on these resources;
4. Land and water rights should be separated in order to encourage water trading and efficiency measures
5. The cost of water should include 'ability to pay';
6. Water should be valued depending on availability of resources'
7. Water prices for provision should include the full cost – such as maintenance and expansion;
8. Water should be measured with meters, information technology platforms and other management practices.

Examples of Economic Solutions

Public Payment Schemes

Private Payment Schemes

Private Party Purchase

Water Cap & Trade

Polluter Pays

Environmental Taxes

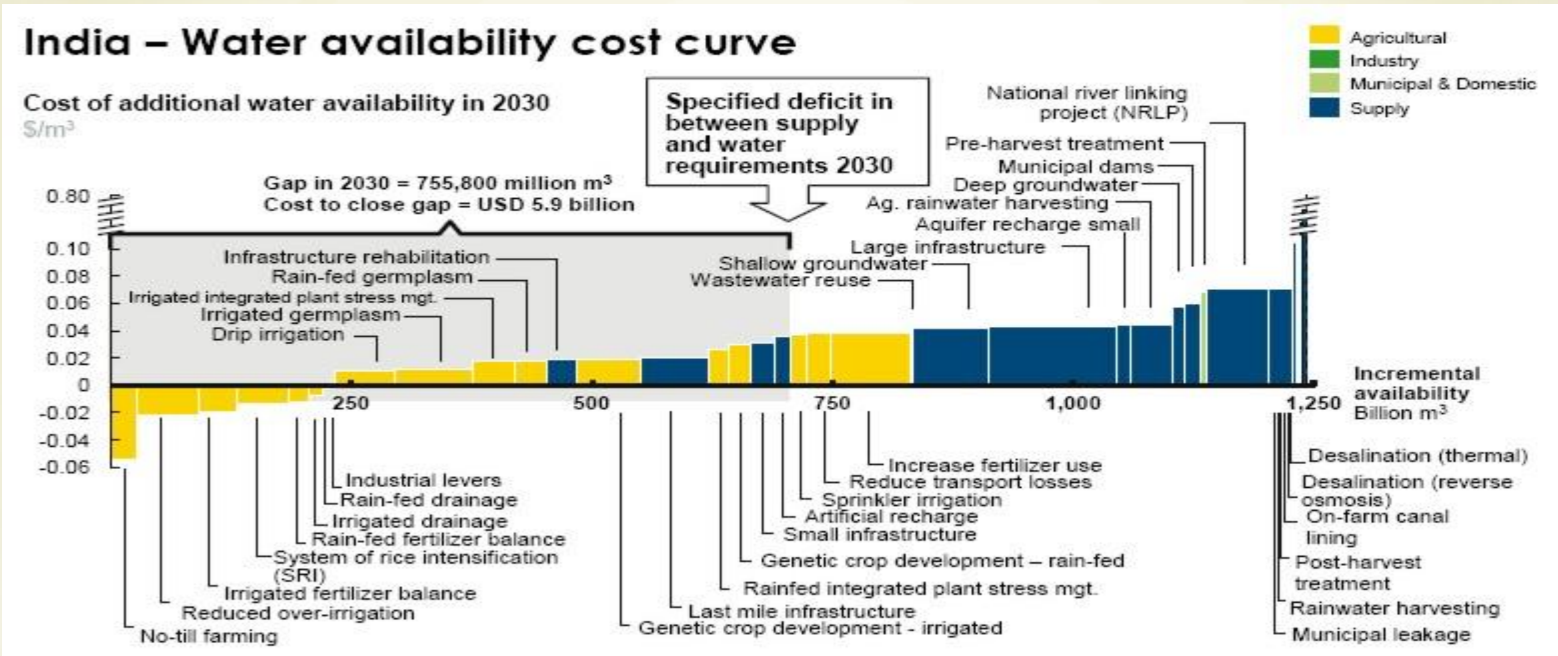
Certification

Water Labeling

Examples of Technical Solutions

-Improved maintenance of existing irrigation systems;
-Drip irrigation;
-Drought resistant seeds;
-IT Platforms to measure volumes;
-Mobile technology;
-Altered tillage and soil management;
-Changes in cropping patterns (e.g. reduce hectares cropped, and switch from rice to less water intensive crops);
-The lining of irrigation canals;
-The replacing of open canals with underground pipes;
-The switching from gravity irrigation to more efficient irrigation techniques such as drip or sprinkler irrigation systems.
-Rain water harvesting would also be another useful technique of storing water from the rain.

India & Irrigation Gains



In India, aggregate agricultural income could increase by $83 billion per year by 2030.

Drip irrigation alone has an aggregate potential to increase revenues by $30 billion annually and create net savings for India's farmers.

Reducing the amount of fertilizers required by up to 40% and increasing yield by up to 60 % .

The use of better seeds on both rain fed and irrigated land, can increase Indian agricultural incomes by $5-30 billion annually.

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Investment in Agriculture

The development of the agriculture sector is an effective instrument to alleviate poverty:

From 1993 to 2002, fall of rural poverty rate from 37 to 29 percent;
Decrease in rural poverty is highly attributed to better rural conditions through infrastructure developments and improvements in agricultural productivity and technology standards.

Agriculture is a significant source of economic growth:

In developing countries, agriculture generates on average 29 % of GDP and employs 65 % of labor force;
Agriculture also plays an important role in transforming and urbanized economies, where industries and services linked to agriculture account for more than 30 % of GDP.

A more developed agricultural sector enhances food security:

Agriculture is often characterized by undercapitalization, low technology, poor market access, and underutilized or degraded land.
These factors increase transaction costs that weaken the production and sale of agricultural commodities.
By investing in agriculture and addressing the deficiencies of the sector, food supplies are secured and trade, greater productivity and economic growth.

Risks in Investing in Agriculture

PRODUCTION RISK

MARKET RISK

FINANCIAL RISK

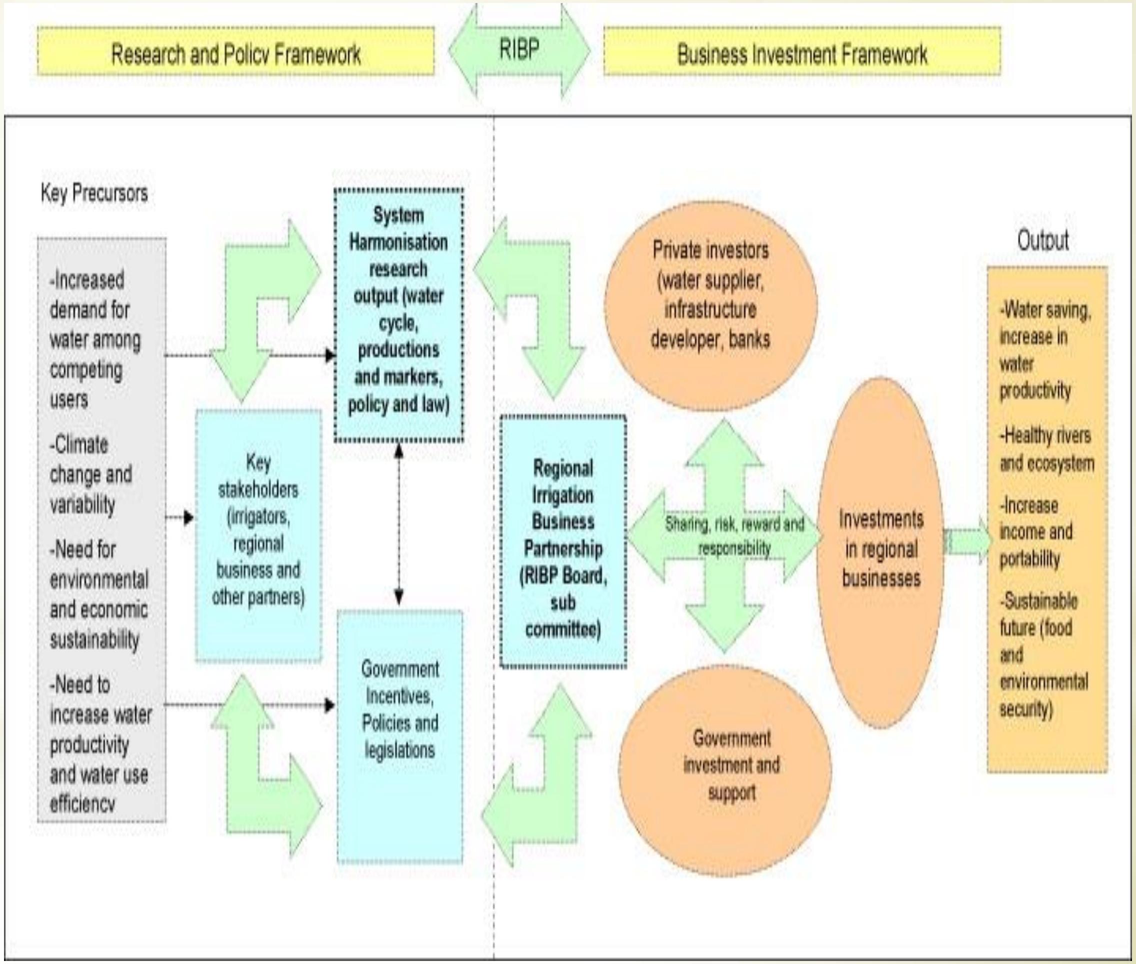
INSTITUTIONAL RISK

SYSTEMIC RISK

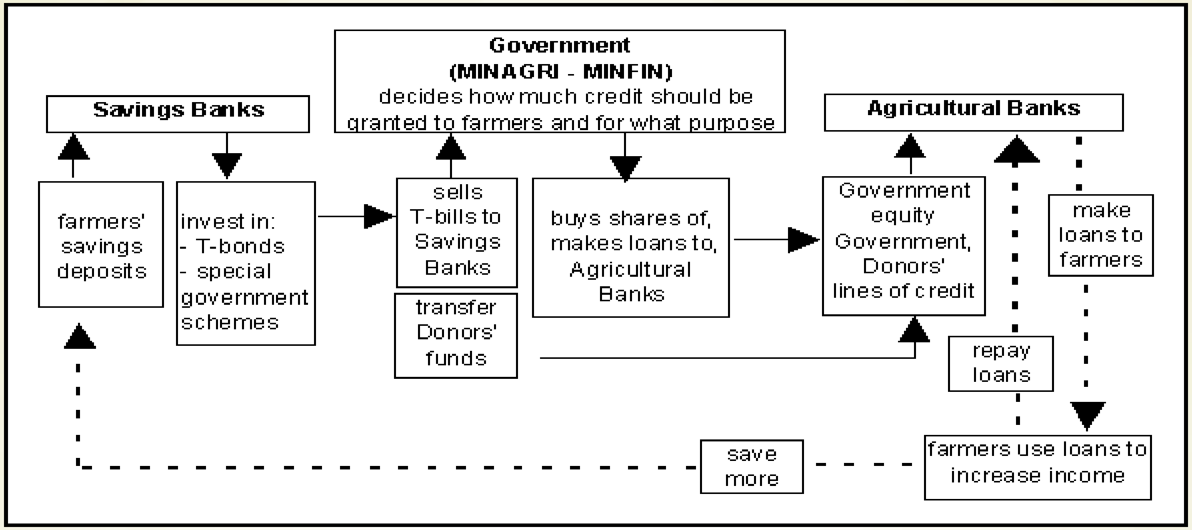
MARKET DISTORTIONS

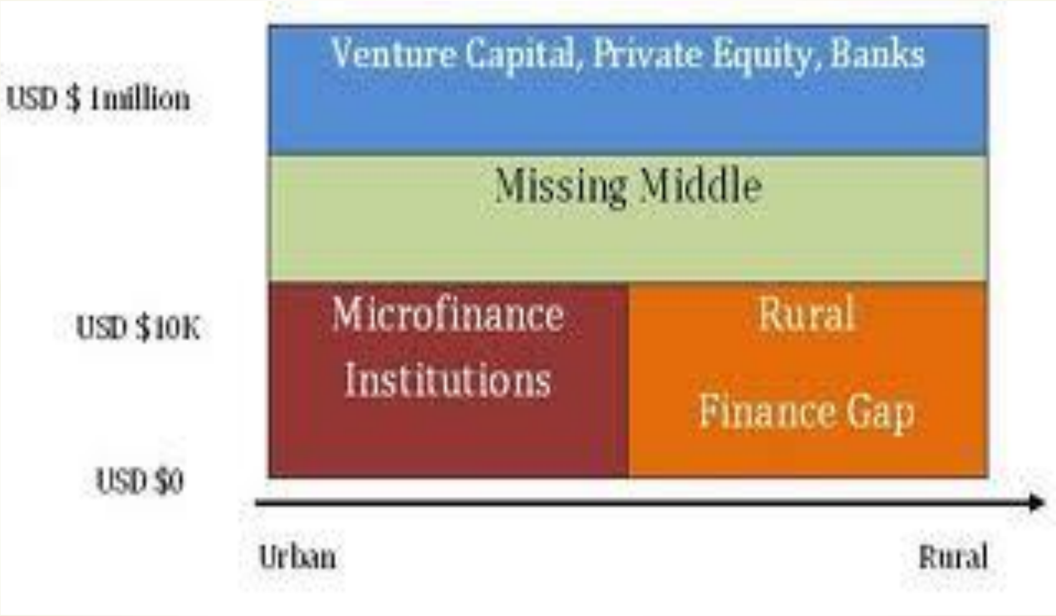
TIME HORIZONS

POLITICAL RISK



Rural Finance Gap





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The 21st Century Water Challenge must involve a Multi-Stakeholder Approach



Political/Economic Choices

- Regulations
- Define Water Rights
- Develop Markets
- Incentive Mechanisms
- Agency Involvement
- Governance Reform

Invest/Business Choices

- Corporate Social Responsibility
- License to Operate
- Bottom of Pyramid
- New Markets
- New Leadership

Technology Choices

- Innovative Financing Schemes
- New Efficient & Low Carbon Technologies
- Public-Private Partnerships

Social Choices

- Indigenous Solutions
- Best Local Practices
- Understanding Realities on Ground