Global Water Issues

Sulmin Gumiri
Professor
Department of Aquatic Resources Management
Palangka Raya University - INDONESIA

Introduction

Indonesia and The University of Palangka Raya

Today's topics:

- Water and sustainable development
- Hydrologic cycle and water distribution
- Water availability and use
- Global water issues
- Dealing with global water issues

Water Resources and Sustainable Development

Development :

Development means improving people's lives

The Question :

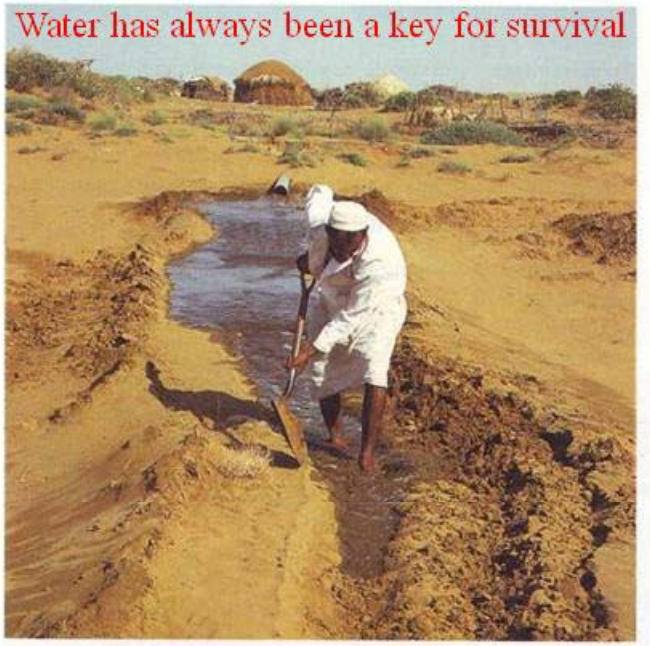
How can we continue improvements in human welfare within the limit of the earth's natural resources ?

Life supports :

Food, water, energy, fiber, waste disposal, etc.

Sustainable Development

- Meeting the needs of the present without compromising the ability of future generations to meet their own needs
- Progress in human well-being that can be extended or prolonged over many generations rather than just a few years



From Cunningham, *et.al.*, Environmental Science Text book, McGraw-Hill , NY 2007

~~No life on earth could sustain without water~~ → Water is a key element of sustainable development

World water crisis

(Cooper, 2010)

- 5-10 million people die from one or other parts of the water crisis every year
- 1.2 billion people cannot gain access to safe water
- 80% of diseases in the developing countries are caused by polluted water
- By 2025, 48 countries will be in a condition of absolute scarcity of water

Think about it !

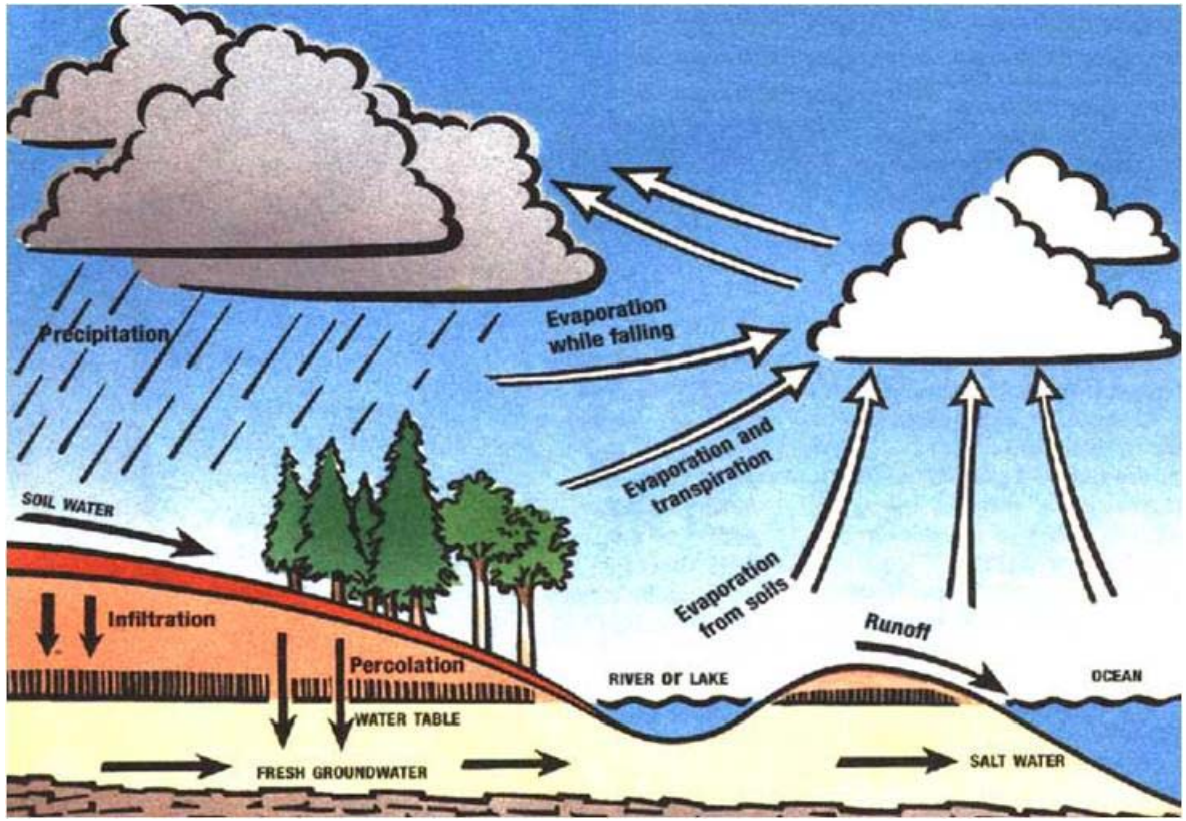
(5 min)

- What use of water for your daily life ?
- Do you need to buy waters for drinking ?

Hydrologic cycle and water distribution

Hydrologic cycle:

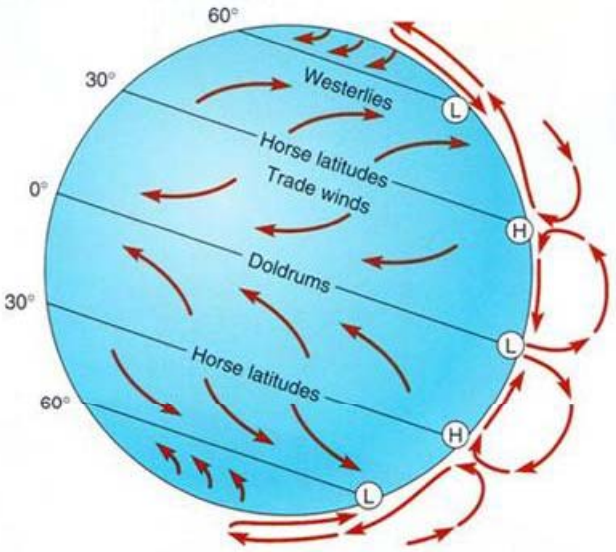
The circulation of water as it evaporates from land, water and organisms; enters the atmosphere; condenses and is precipitated to the earth's surface; and moves underground by infiltration or overland by runoff into rivers, lakes and seas.



Factors controlling global water deficits and surpluses

1. Global atmospheric circulation pattern

- Regions of 20^{o} to 40^{o} north and south of the equator have persistent high air pressure and low rainfall
- Regions near the equator and between 40^{o} and 60^{o} north and south latitude produce frequent rainfall



From: Cunningham *et al*. Environmental Science, Mc Graw Hill, NY, 2007,

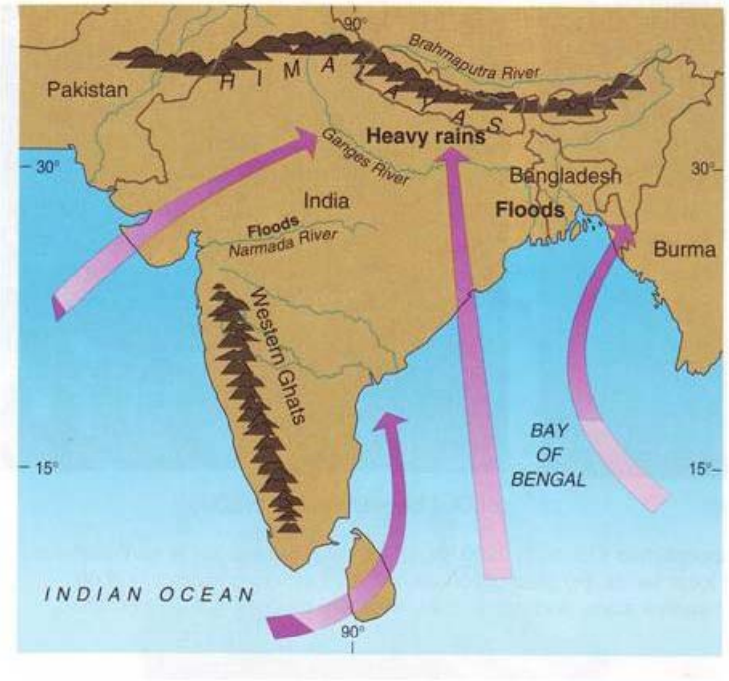
2. Proximity to water sources

- <u>Areas near oceans:</u>

  prevailing winds come over oceans, they bring moisture to land

- <u>Areas far from oceans:</u>

  In a windward direction – are usually relatively dry



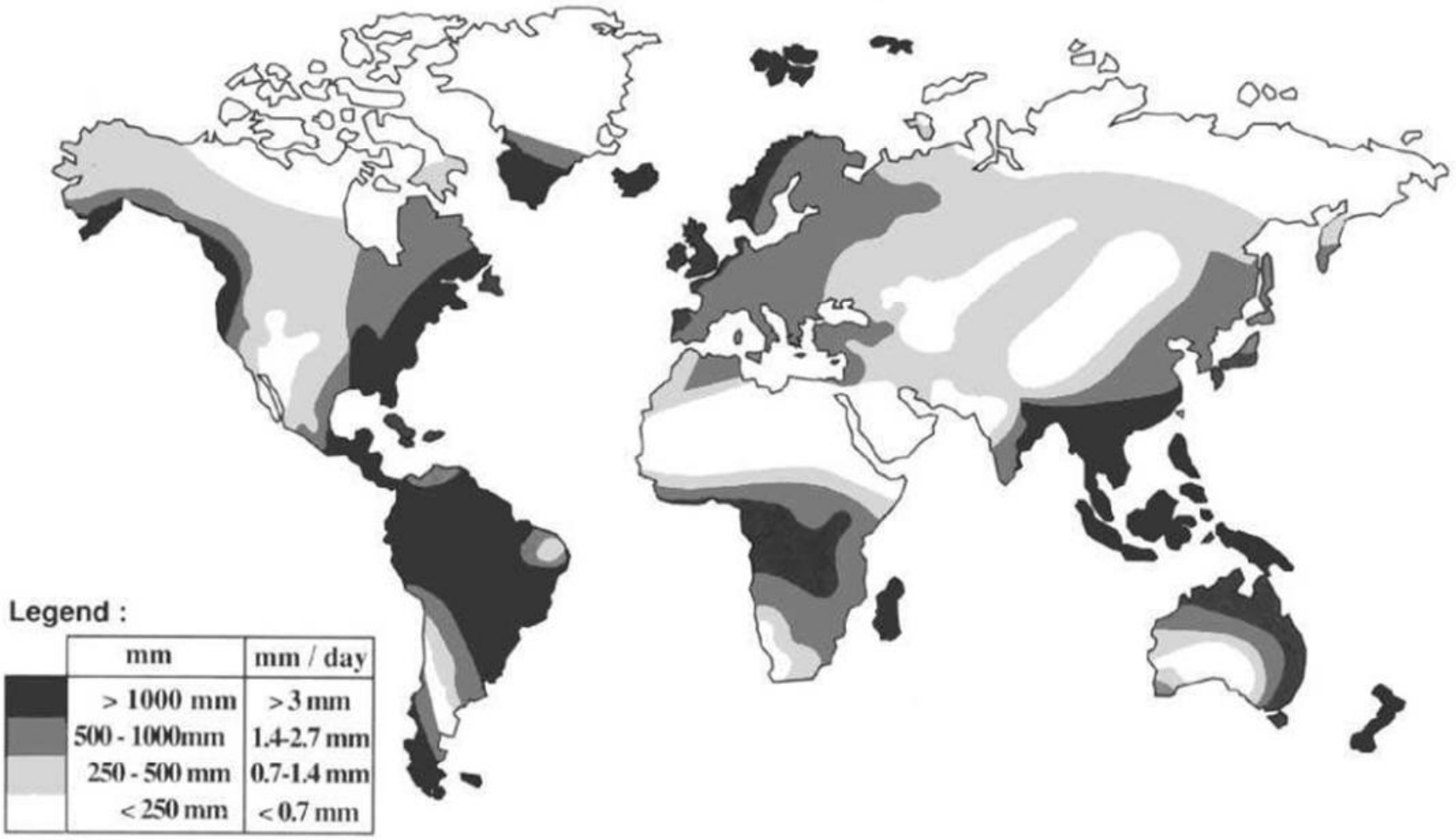
From Cunningham, *et.al*., Environmental Science Text book, McGraw-Hill , NY 2007

3. Topography

- Mountains act as both cloud formers and rain catchers
- The windward side of a mountain range is usually wet much of the year
- Conversely, places in the **rain shadow**, the dry, leeward side of a mountain range, receive little precipitation

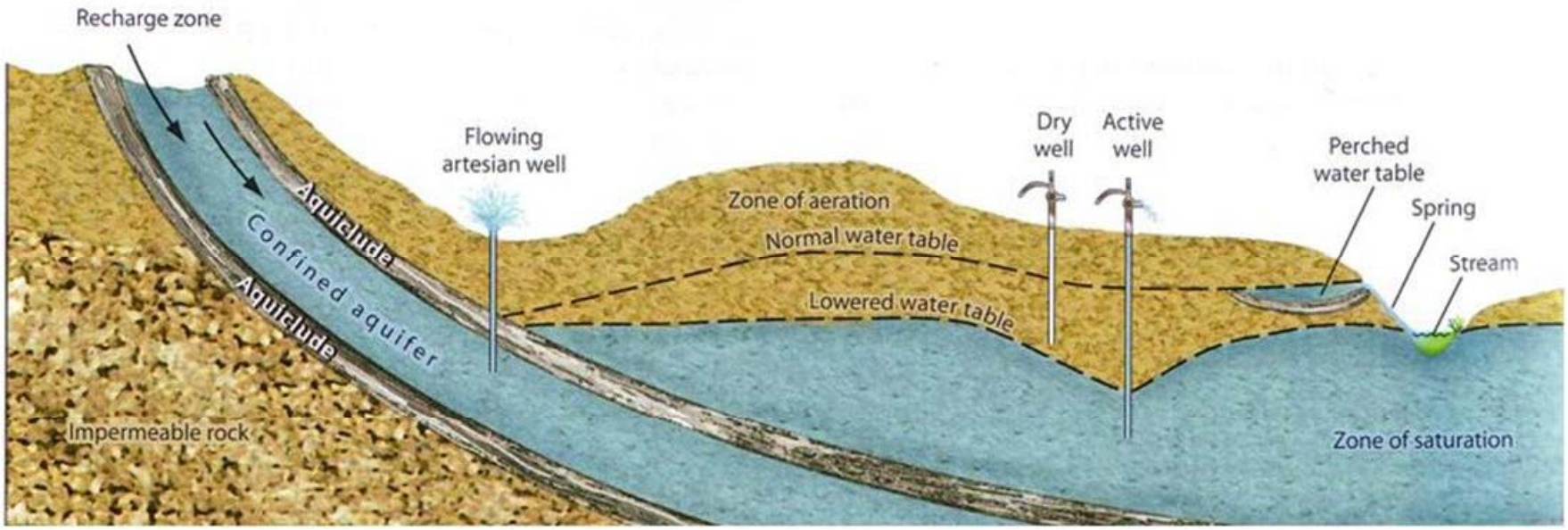
From: Cunningham *et al*. Environmental Science Text book, Mc Graw Hill, NY, 2007

Global average annual precipitation



Accessible freshwater sources

From: frrephotos.com



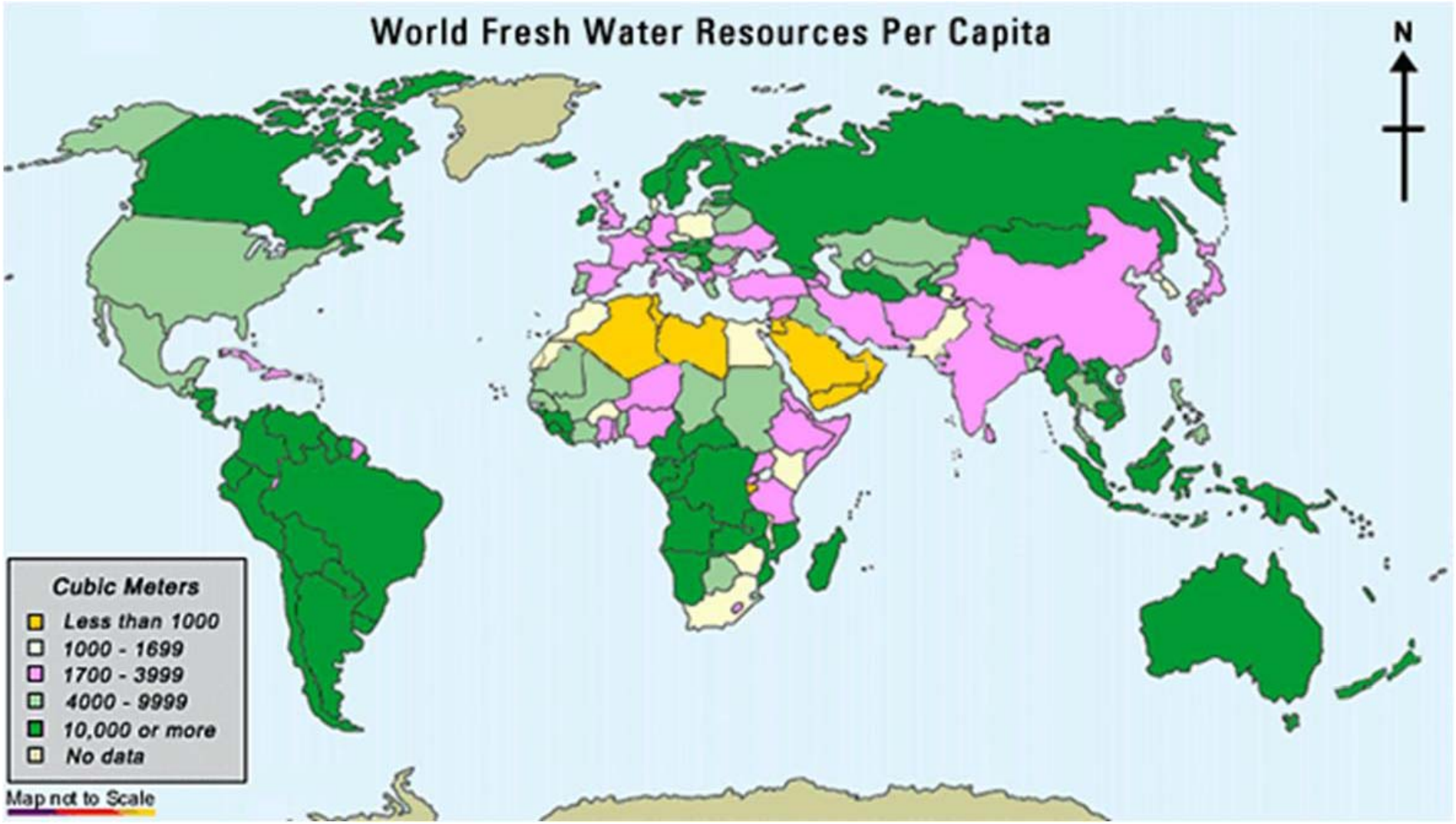
From: Cunningham *et al*. Environmental Science, Mc Graw Hill, NY,2007

Lets Think !!

- The readily accessible, renewable water supplies are very large, amounting to some1,500 km^3 (about 400,000 gal) per person per year worldwide
- Why do we still need to worry on the availability of our freshwater resources?

Water availability and use :

- Freshwater is essential for nearly every human endeavor
- The availability of water determines the location and activities of human on earths
- Water-poor countries have low rainfall and large population

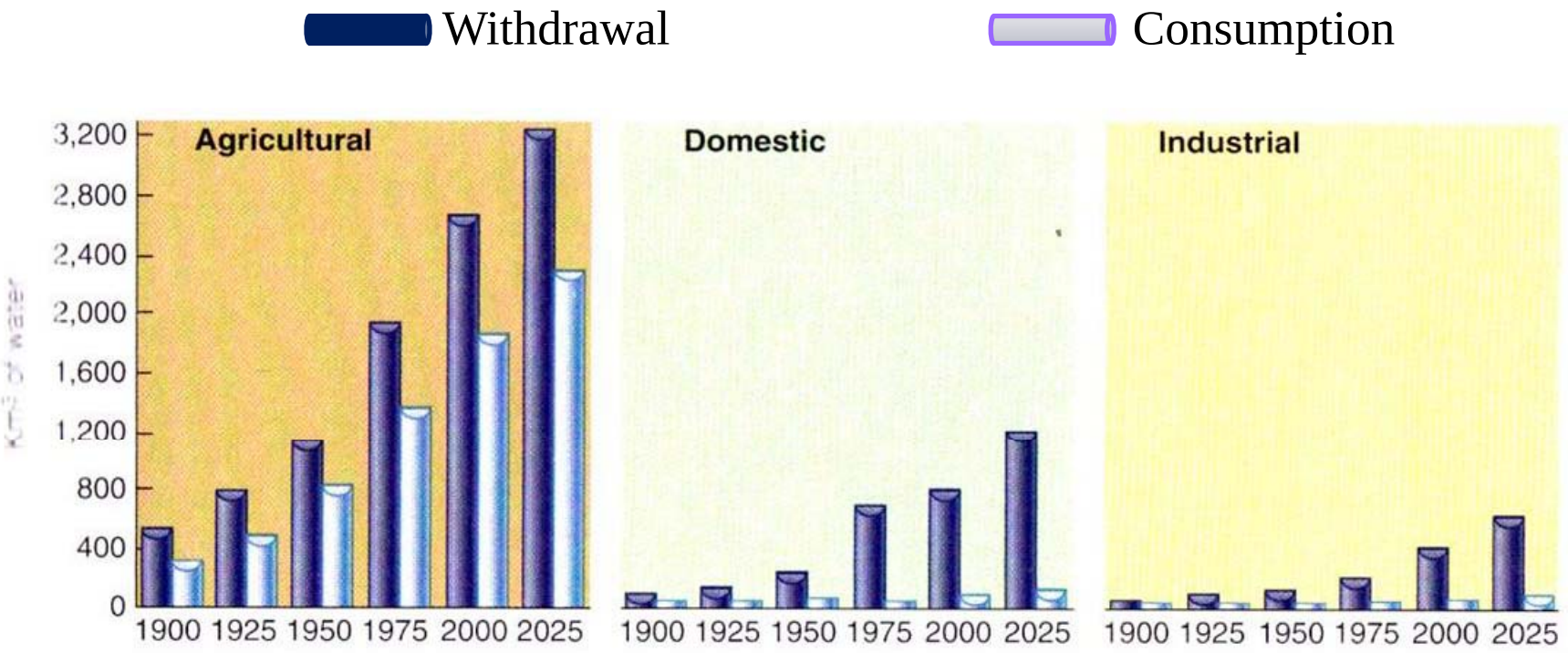

World Fresh Water Resources Per Capita
N
Cubic Meters
Less than 1000
1000 - 1699
1700 - 3999
4000 - 9999
10,000 or more
No data
Map not to Scale

Water withdrawal and consumption:

Since water is a one of the renewable resources, it is very important to distinguish between withdrawal and consumption of water.

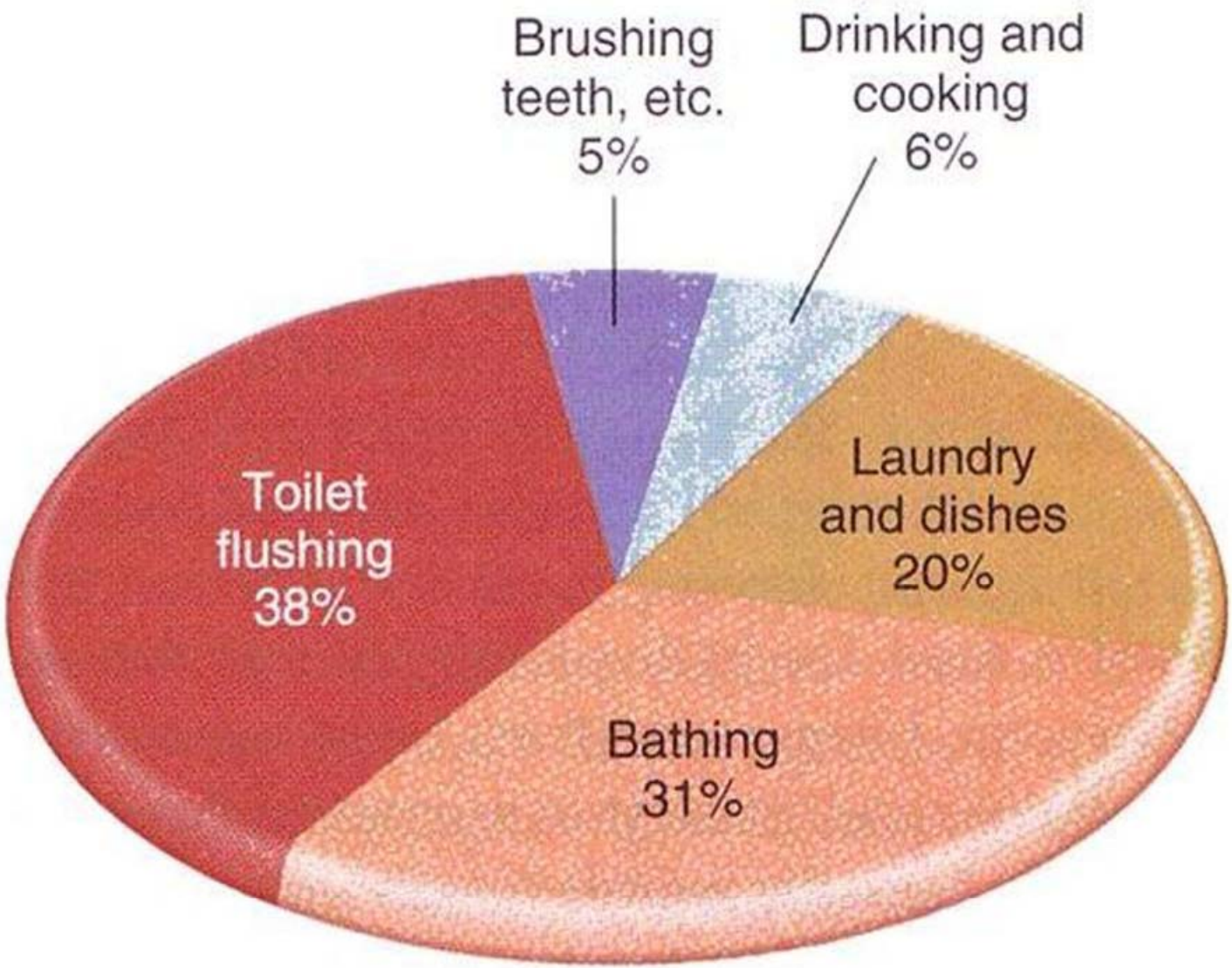
- **Withdrawal** is the total amount of water taken from a lake, river or aquifer for any purpose. Much of this water is employed in non destructive ways and is returned to circulation in a form that can be used again.
- **Consumption** is the fraction of withdrawn water that is lost in transmission, evaporation, absorption, chemical transformation, or otherwise made unavailable for other purposes as a result of human use

Global water use :



Example of water lost due to agricultural consumption (The Aral Sea case)

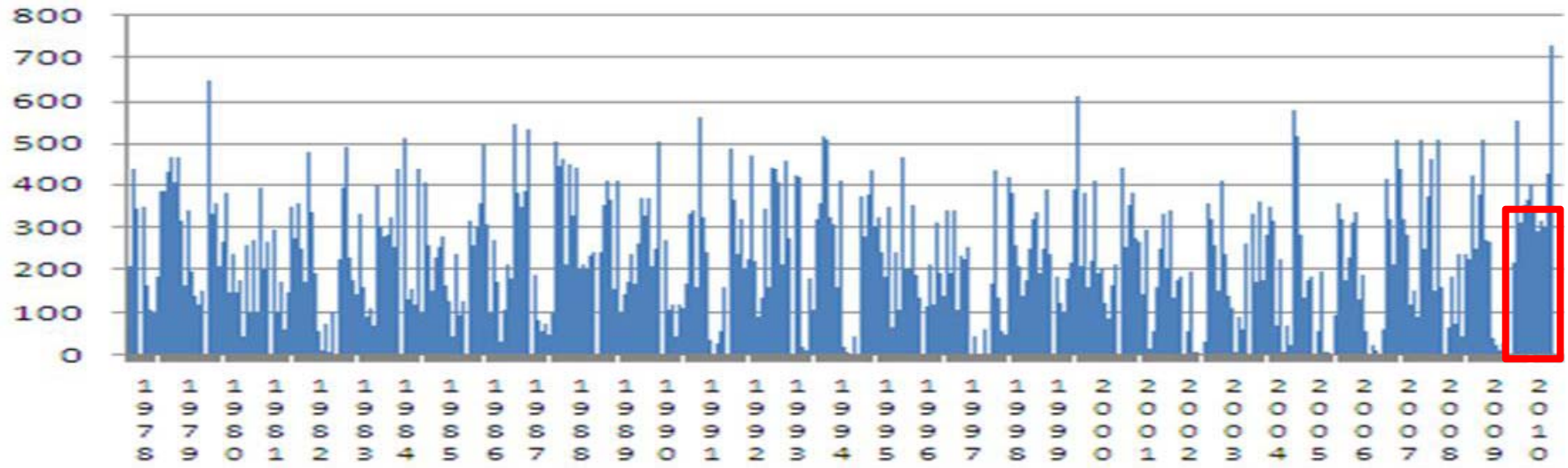
Domestic withdrawal in developed country



Global water issue 1:

TOO MUCH OR TOO LITTLE WATER

Changing of rainfall pattern (*Due to Global Warming?*)



Distribution of water supply

- Worldwide, water consumption has increased sixfold over the past century or about twice as fast as population growth
- With easily accessible water already exploited in most places, the World Bank estimates that the financial and environmental cost of tapping new supplies will be two or three times more expensive than current water projects
- If present trends continue, the UN cautions, two-thirds of the world population will live in countries experiencing water shortages in 2025.

Reasons for water shortages

Natural forces :

- The rains fail; hot winds dry up reservoirs that normally would carry people through the dry season
- River change their courses, leaving villages stranded

Human origin :

- Too many people compete for the resource; urbanization, overgrazing, and inappropriate agricultural practices allow water to run off before it can be captured
- Lack of adequate sewage system causes contamination of local supplies

Global water issue 2:
WATER POLLUTION

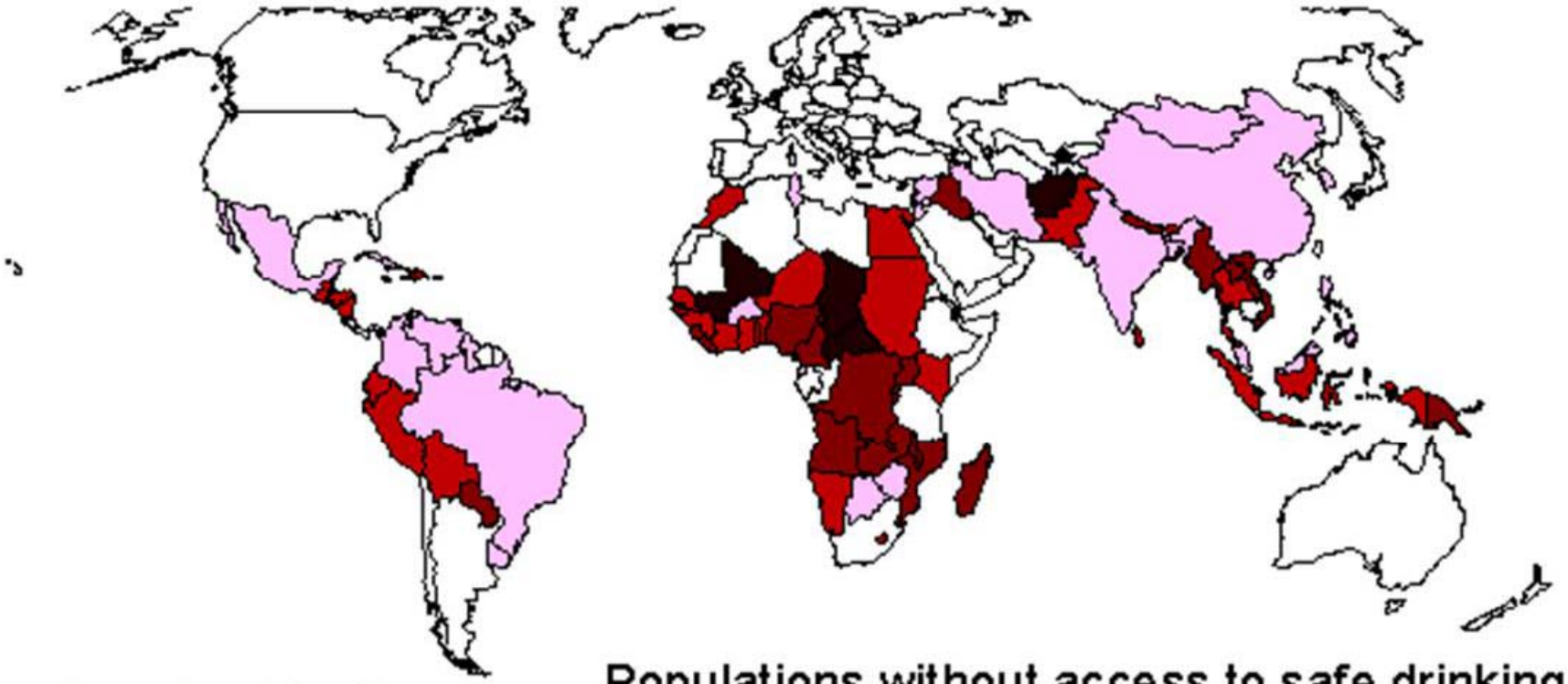
Water Pollution :

Any physical, biological and chemical change in water quality that adversely affect living organisms or makes water unsuitable for desire uses.

- **Point Source**: originating at a specific location such as a drain pipe, ditch, or sewer outfall
- **Non point source** : no specific location, widespread runoff from fields, street or cities.

Major categories of water pollution

Category	Examples	Sources
A. Cause Health Problem		
1. Infectious agents	Bacteria, viruses, parasites	Human and animal excreta
2. Organic chemicals	Pesticides, plastics, detergents, oil and gasoline	Industrial, household, and farm use
3. Inorganic chemicals	Acids, caustics, salts, metals	Industrial effluents, household cleansers, surface runoff
4. Radioactive materials	Uranium, thorium, cesium, iodine, radon	Mining and processing of ores, power plants, weapons
B. Causes Ecosystem Disruption		
1. Sediment	Soil, silt	Land erosion
2. Plant nutrients	Nitrates, phosphates, ammonium	Agricultural and urban fertilizers, sewage, manure
3. Oxygen demanding wastes	Animal manure and plant residue	Sewage, agricultural runoff, paper mills, food processing
4. Thermal	Heat	Power plants, industrial cooling



Populations without access to safe drinking water

from The World's Water
The Biennial Report on Freshwater Resources
(Gleick 1998)

Global water issue 3 :
WATER CONFLICTS

Occur because the demand for water resources and potable water extend far beyond the amount of water actually available.

- 1.2 billion people are without adequate drinking water

- Water is also needed for proper sanitation, commercial services, and the production of commercial goods.

Conflict levels:

- **Local** : corporate entities may pollute water resources shared by a community, or
- **International** governments may argue over who gets access to a river used as an international or inter-state boundary.

Addressing global water issues

1. Increasing water supply:

- *Watershed management* – coordinative planning to improve resource allocation and reduce water loss
- *More efficient household appliances*: toilets, shower heads, laundry machines
- *Drip irrigation* and other agricultural practices
- *Price mechanisms* – provide incentive for more efficient water use
- *Water policy* – laws regarding water rights and use

2. Reducing water pollution

- *Source reduction*
- *Sewage treatment*
- *Water legislation*

3. Mediating water conflicts

Training water professionals to encourage cooperation between nations in dealing with conflicts:

- *Diplomat*
- *Law makers*
- *Civil society*
- *Students of water studies*