Water Pollution

Reference: Introduction to Environmental Engineering and Science,

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WATER POLLUTION

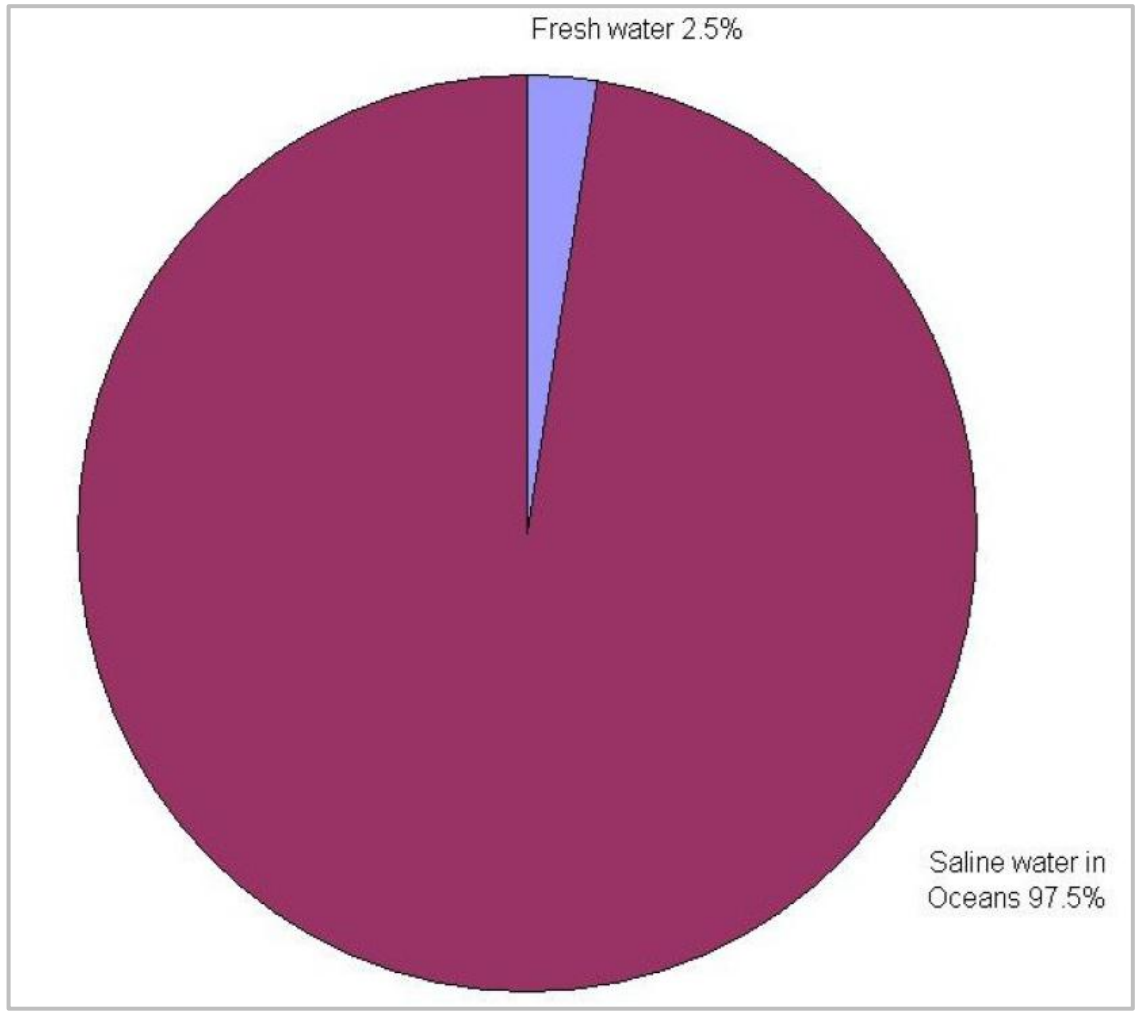
- Water pollution poses significant problems, impacting human health, ecosystems, and the economy.
- Caused by various sources: industrial wastes, agricultural runoff, and sewage.
- Leads to a range of issues: disease outbreaks, biodiversity loss, and reduced access to clean water.
- Water pollution leads to a tragic rate of morbidity and mortality

2030 Agenda for Sustainable Development

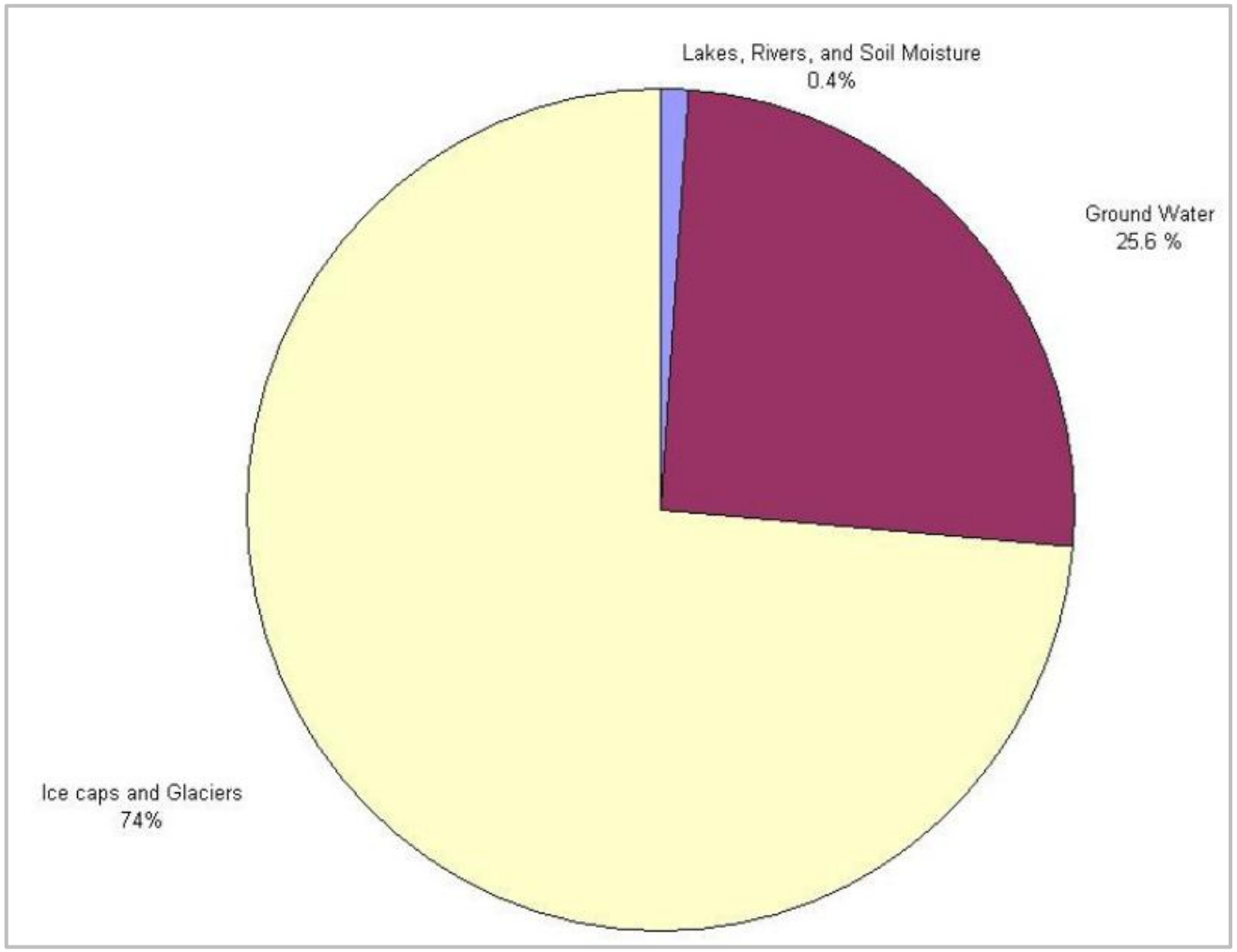
Blueprint for peace and prosperity for people and the planet

Stocks of Water on Earth

Location	Amount (10^6 km^{3-})	Percentage of World Supply
Oceans	1,338.0	96.5
Glaciers and permanent snow	24.1	1.74
Groundwater	23.4	1.7
Ground ice/permafrost	0.30	0.022
Freshwater lakes	0.091	0.007
Saline lakes	0.085	0.006
Swamp water	0.011	0.008
Atmosphere	0.013	0.001
Average in stream channels	0.002	0.0002
Water in living biomass	0.001	0.0001

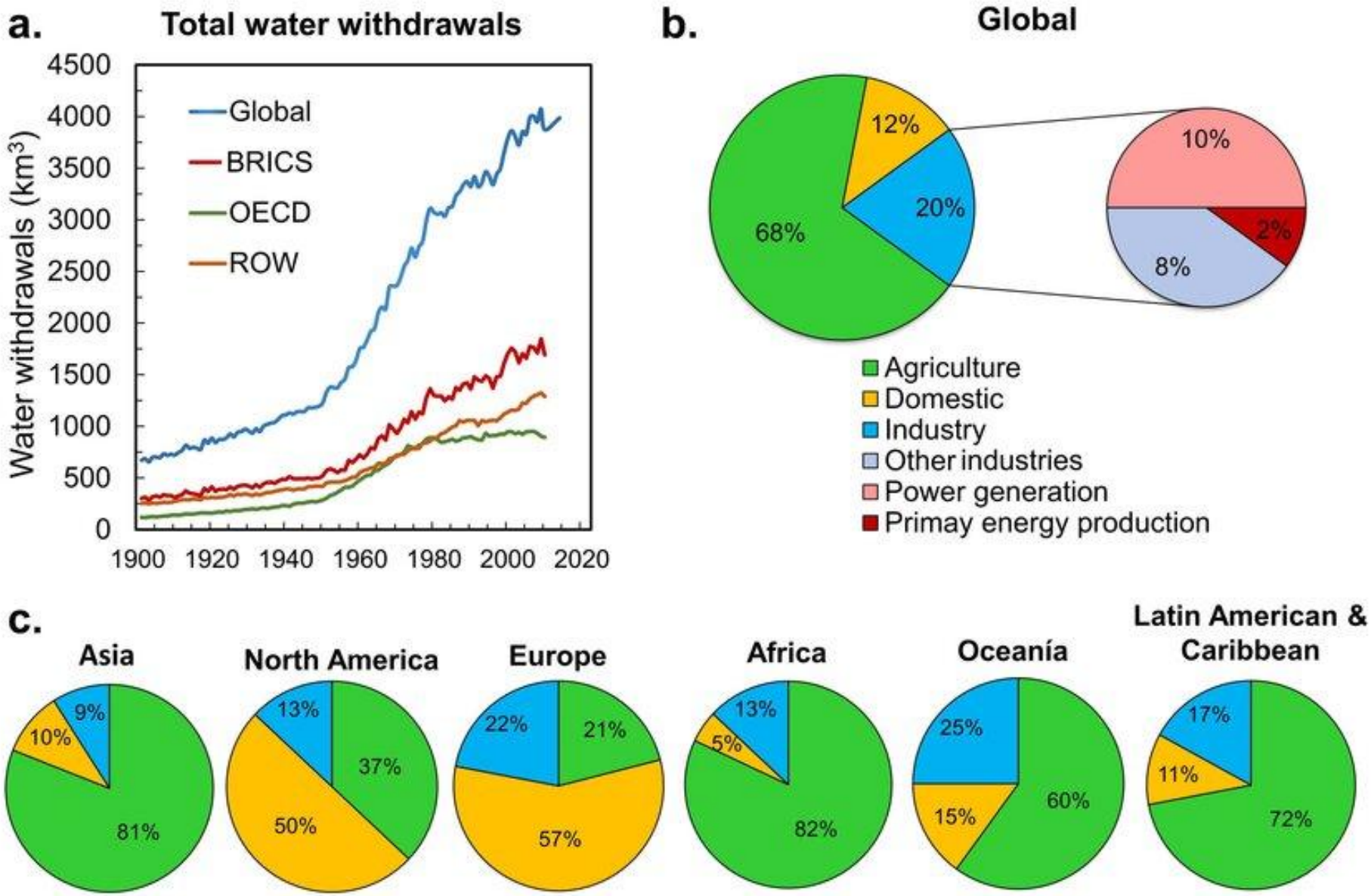


Total global water content



Global fresh water distribution

Annual global freshwater withdrawals by sector



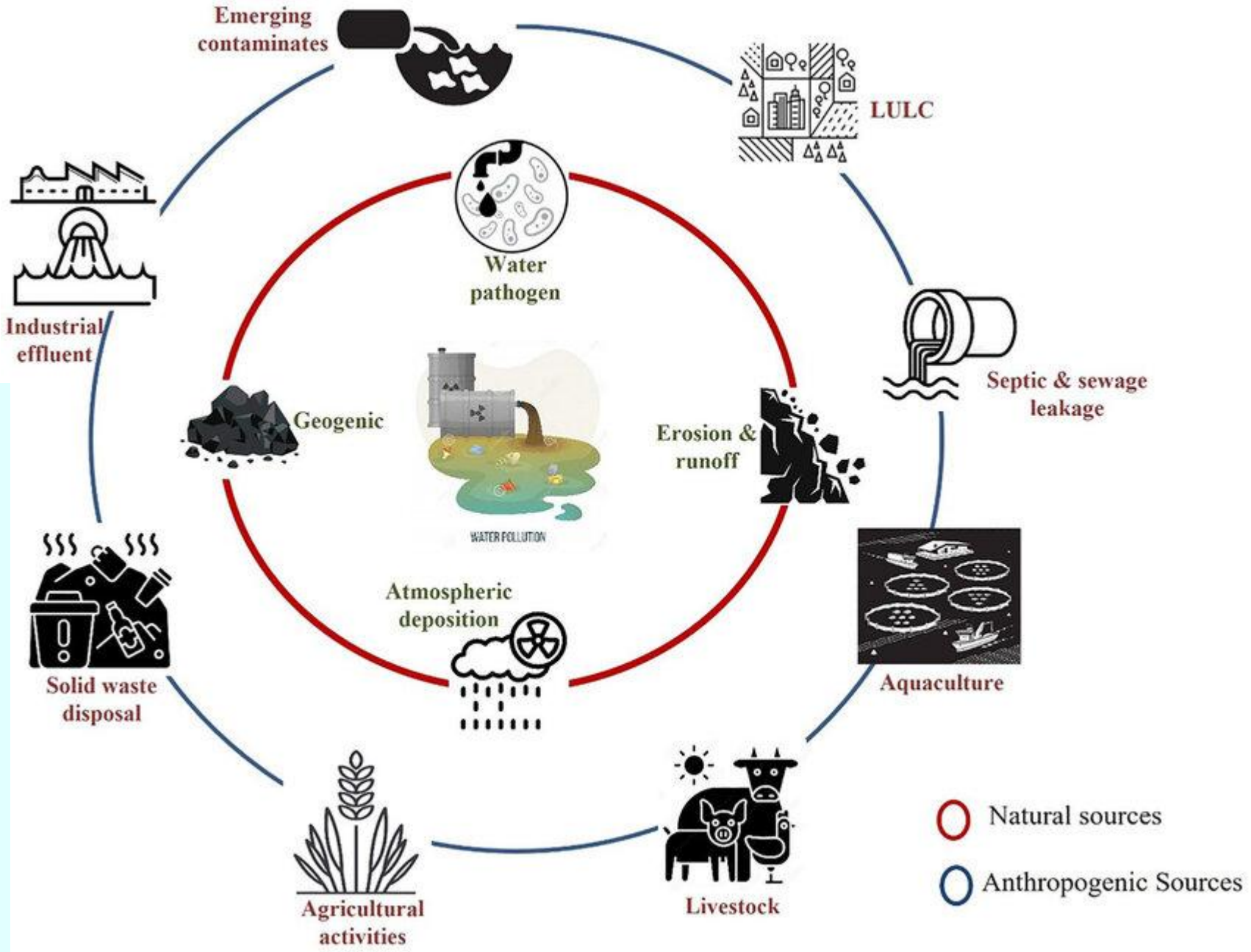
- BRICS denotes Brazil, India, China, and South Africa;
- OECD denotes the Organization for economic co-operation and development, including 38 member countries;
- ROW represents countries in the rest of the world.
- Water withdrawals for biofuel production are included in primary energy production.

Natural and Anthropogenic sources of pollutants

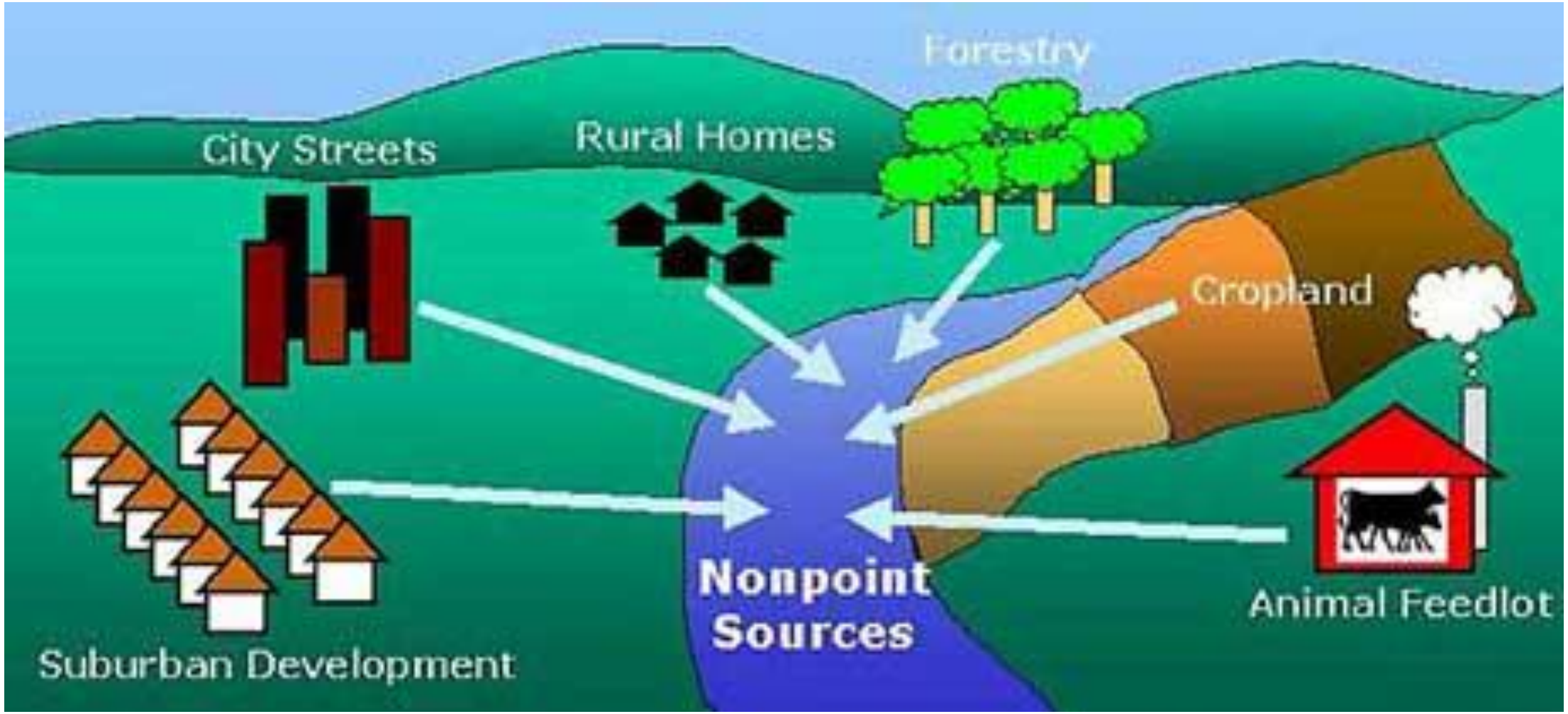
LULC: Land use and Land Cover

Land cover describes what is physically present (forests, water bodies, or built-up areas)

Land use describes how humans are using that land, such as for agriculture, urban development, or recreation



Point and non-point source of pollution

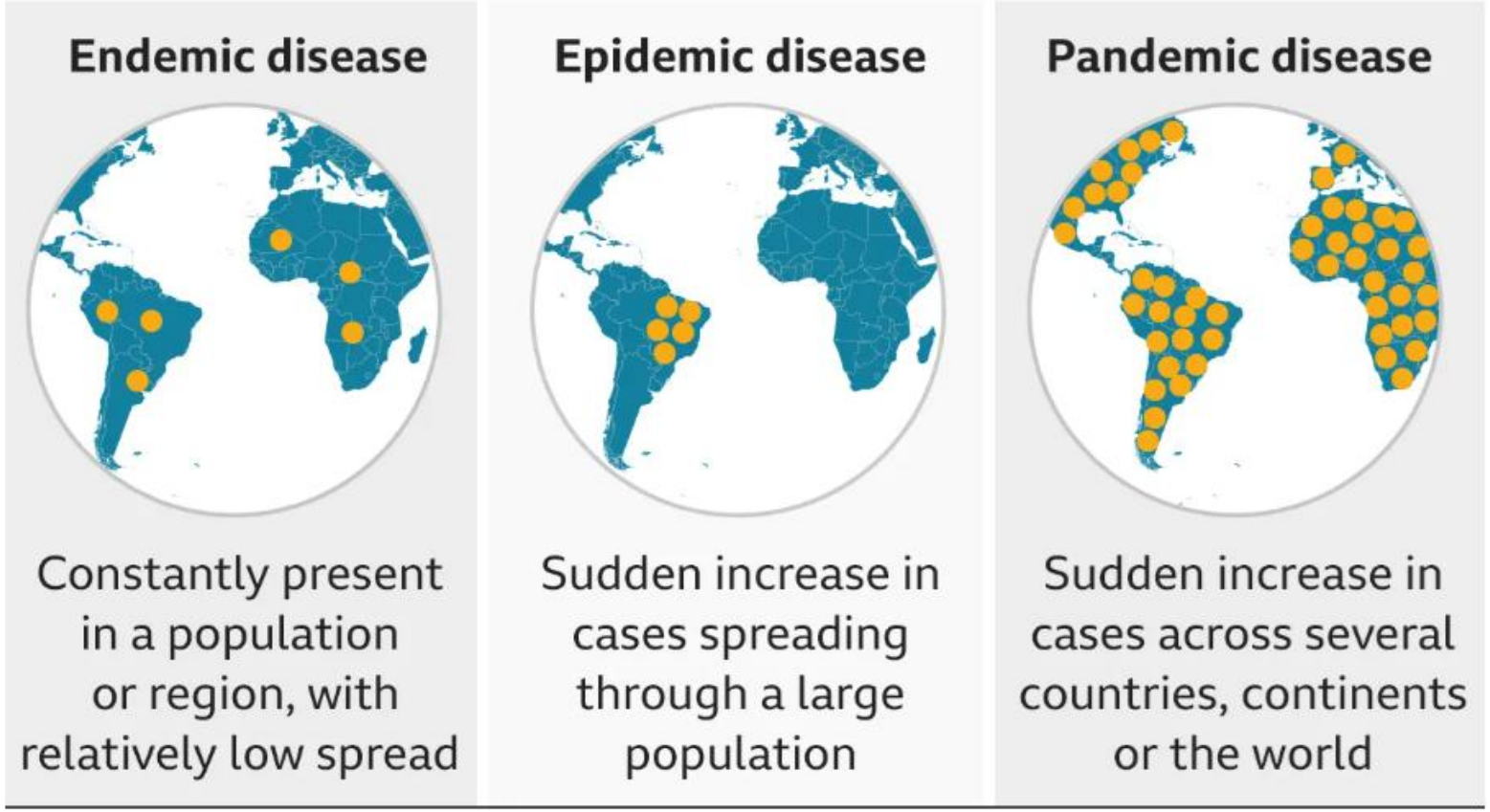


KEY WATER POLLUTANTS

I. PATHOGENS

- Pathogens are disease-causing organisms that grow and multiply within a host, causing a disease.
- **Contaminated water** is responsible for the spread of many contagious diseases.
- Contamination by **human feces** is the most important source of pathogens.
- The intestinal discharges of an infected individual, **a carrier**, may contain billions of these pathogens. If they are allowed to enter the water supply, they can cause **epidemics** of immense proportions.
- Carriers may not even necessarily exhibit symptoms of their disease, which makes it even more important to carefully protect all water supplies from any human waste contamination.

What's the difference between an endemic, epidemic and pandemic disease?



The WHO defines pandemics, epidemics, and endemic diseases based on a disease's **rate of spread**. Thus, the difference between an epidemic and a pandemic isn't in the severity of the disease, but the degree to which it has spread. A pandemic cuts across international boundaries, as opposed to regional epidemics.

- Epidemics of infectious diseases periodically emerge in areas where crowded conditions and poor sanitation enable the microbes to reach new victims at a rapid rate.
- With international travel now commonplace, local epidemics can become global pandemics.

- ***Waterborne* diseases**, such as cholera and typhoid, are spread by ingestion of contaminated water.
- ***Water-washed* diseases**, such as trachoma and scabia, are associated with lack of sufficient water to maintain cleanliness;
- ***Water-based* diseases**, such as schistosomiasis and dracunculiasis, involve water contact but don't require ingestion;
- ***Water-related* diseases**, such as malaria and dengue, involve a host that depends on water for its habitat (e.g., mosquitoes), but human contact with thewater is not required.

Typical Pathogens Excreted in Human Feces

Pathogen Group and Name	Associated Diseases
Virus	
Adenoviruses	Respiratory, eye infections
Enteroviruses	
Polioviruses	Aseptic meningitis, poliomyelitis
Echoviruses	Aseptic meningitis, diarrhea, respiratory infections
Coxsackie viruses	Aseptic meningitis, herpangina, myocarditis
Hepatitis A virus	Infectious hepatitis
Reoviruses	Not well known
Other viruses	Gastroenteritis, diarrhea
Bacterium	
Salmonella typhi	Typhoid fever
Salmonella paratyphi	Paratyphoid fever
Other salmonellae	Gastroenteritis
Shigella species	Bacillary dysentery
Vibrio cholerae	Cholera
Other vibrios	Diarrhea
Yersinia enterocolitica	Gastroenteritis
Protozoan	
Entamoeba histolytica	Amoebic dysentery
Giardia lamblia	Diarrhea
Cryptosporidium species	Diarrhea
Helminth	
Ancylostoma duodenale (Hookworm)	Hookworm
Ascaris lumbricoides (Roundworm)	Ascariasis
Hymenolepis nana (Dwarf tapeworm)	Hymenolepiasis
Necator americanus (Hookworm)	Hookworm
Strongyloides stercoralis (Threadworm)	Strongyloidiasis
Trichuris trichiura (Whipworm)	Trichuriasis