WATER

ARRANGEMENT BY: MOHAMMAD FARROKHI

- Importance of water
- Water in human body
- Sources of fresh water
- Water supply
- Water uses
- water scarcity
- water stress
- Changes in climate
- Protecting the Headwaters

IMPORTANCE OF WATER:

❖ Water is one of the most important substances on earth. All plants and animals must have water to survive. If there was no water there would be no life on earth.

IMPORTANCE OF WATER:

Apart from drinking it to survive, people have many other uses for water. These include:

- cooking
- washing their bodies
- washing clothes
- washing cooking and eating utensils; such as billies, saucepans, crockery and cutlery
- keeping houses and communities clean
- recreation; such as swimming pools
- keeping plants alive in gardens and parks

Water is also essential for the healthy growth of farm crops and farm stock and is used in the manufacture of many products.

IMPORTANCE OF WATER:

- It is most important that the water which people drink and use for other purposes is clean water. This means that the water must be free of germs and chemicals and be clear (not cloudy).
- Water that is safe for drinking is called potable water.
- Disease-causing germs and chemicals can find their way into water supplies. When this happens the water becomes polluted or contaminated and when people drink it or come in contact with it in other ways they can become very sick.
- Water that is not safe to drink is said to be non-potable. Throughout history there have been many occasions when hundreds of thousands of people have died because disease-causing germs have been spread through a community by a polluted water supply.
- One of the reasons this happens less frequently now is that people in many countries make sure drinking water supplies are potable. Water supplies are routinely checked for germs and chemicals which can pollute water. If the water is not safe to drink it is treated. All the action taken to make sure that drinking water is potable is called water treatment.

WATER IN HUMAN BODY

- Water serves as a lubricant
- **Water regulates body temperature**
- Water removes harmful toxins from the body
- Water transports valuable nutrients to the body

SOURCES OF FRESH WATER

- Water resources are sources of water that are potentially useful. Uses of water include agricultural, industrial, household, recreational and environmental activities. The majority of human uses require fresh water.
- 97% of the water on the Earth is salt water and only three percent is fresh water; slightly over two thirds of this is frozen in glaciers and polar ice caps. The remaining unfrozen freshwater is found mainly as groundwater, with only a small fraction present above ground or in the air.
- Fresh water is a renewable resource, yet the world's supply of groundwater is steadily decreasing, with depletion occurring most prominently in Asia, South America and North America, although it is still unclear how much natural renewal balances this usage, and whether ecosystems are threatened. The framework for allocating water resources to water users (where such a framework exists) is known as water rights.

SOURCES OF FRESH WATER

- **Surface water:**

Surface water is water in a river, lake or fresh water wetland. Surface water is naturally replenished by precipitation and naturally lost through discharge to the oceans, evaporation, evapotranspiration and groundwater recharge.

SOURCES OF FRESH WATER

❖ **Surface water:**

Although the only natural input to any surface water system is precipitation within its watershed, the total quantity of water in that system at any given time is also dependent on many other factors. These factors include storage capacity in lakes, wetlands and artificial reservoirs, the permeability of the soil beneath these storage bodies, the runoff characteristics of the land in the watershed, the timing of the precipitation and local evaporation rates. All of these factors also affect the proportions of water loss.

Human activities can have a large and sometimes devastating impact on these factors. Humans often increase storage capacity by constructing reservoirs and decrease it by draining wetlands. Humans often increase runoff quantities and velocities by paving areas and channelizing stream flow.

SOURCES OF FRESH WATER

❖ Surface water:

The total quantity of water available at any given time is an important consideration. Some human water users have an intermittent need for water. For example, many farms require large quantities of water in the spring, and no water at all in the winter. To supply such a farm with water, a surface water system may require a large storage capacity to collect water throughout the year and release it in a short period of time. Other users have a continuous need for water, such as a power plant that requires water for cooling. To supply such a power plant with water, a surface water system only needs enough storage capacity to fill in when average stream flow is below the power plant's need.

SOURCES OF FRESH WATER

❖ Surface water:

Nevertheless, over the long term the average rate of precipitation within a watershed is the upper bound for average consumption of natural surface water from that watershed.

Natural surface water can be augmented by importing surface water from another watershed through a canal or pipeline. It can also be artificially augmented from any of the other sources listed here, however in practice the quantities are negligible. Humans can also cause surface water to be "lost" (i.e. become unusable) through pollution.

SOURCES OF FRESH WATER

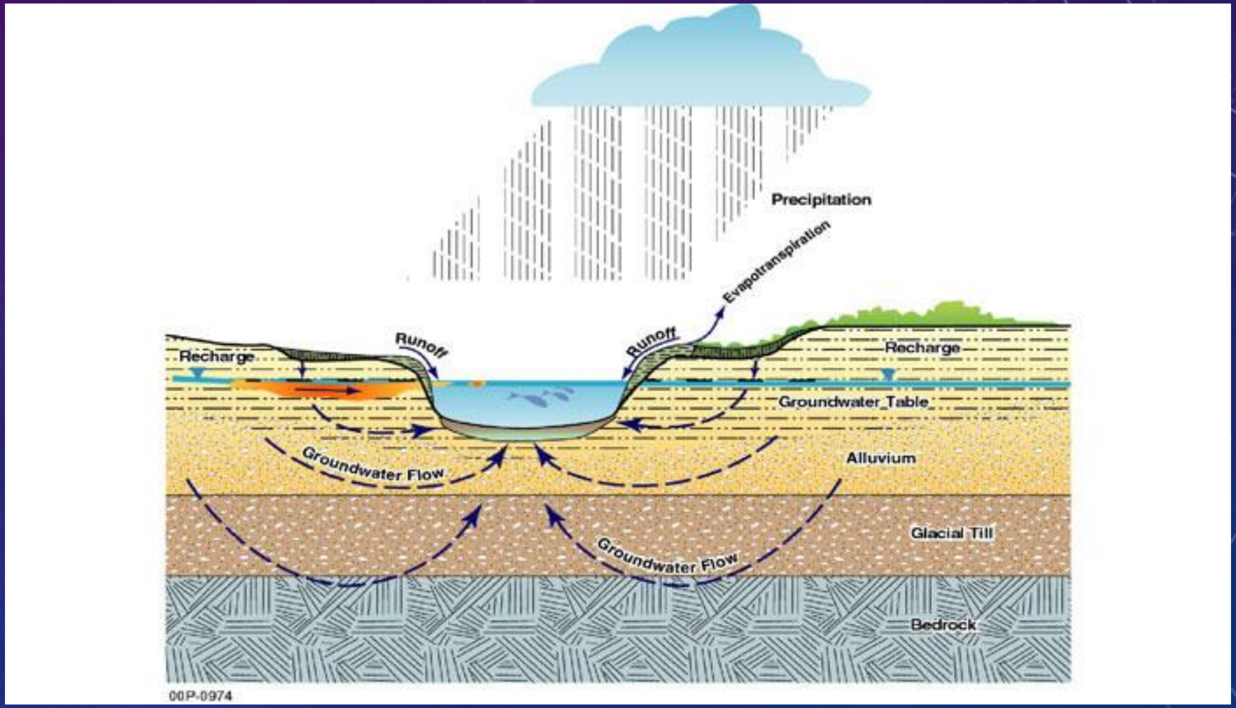
❖ **Surface water:**

Brazil is the country estimated to have the largest supply of fresh water in the world, followed by Russia and Canada.

SOURCES OF FRESH WATER

❖**Under river flow:**

Throughout the course of a river, the total volume of water transported downstream will often be a combination of the visible free water flow together with a substantial contribution flowing through rocks and sediments that underlie the river and its floodplain called the hyporheic zone.



SOURCES OF FRESH WATER

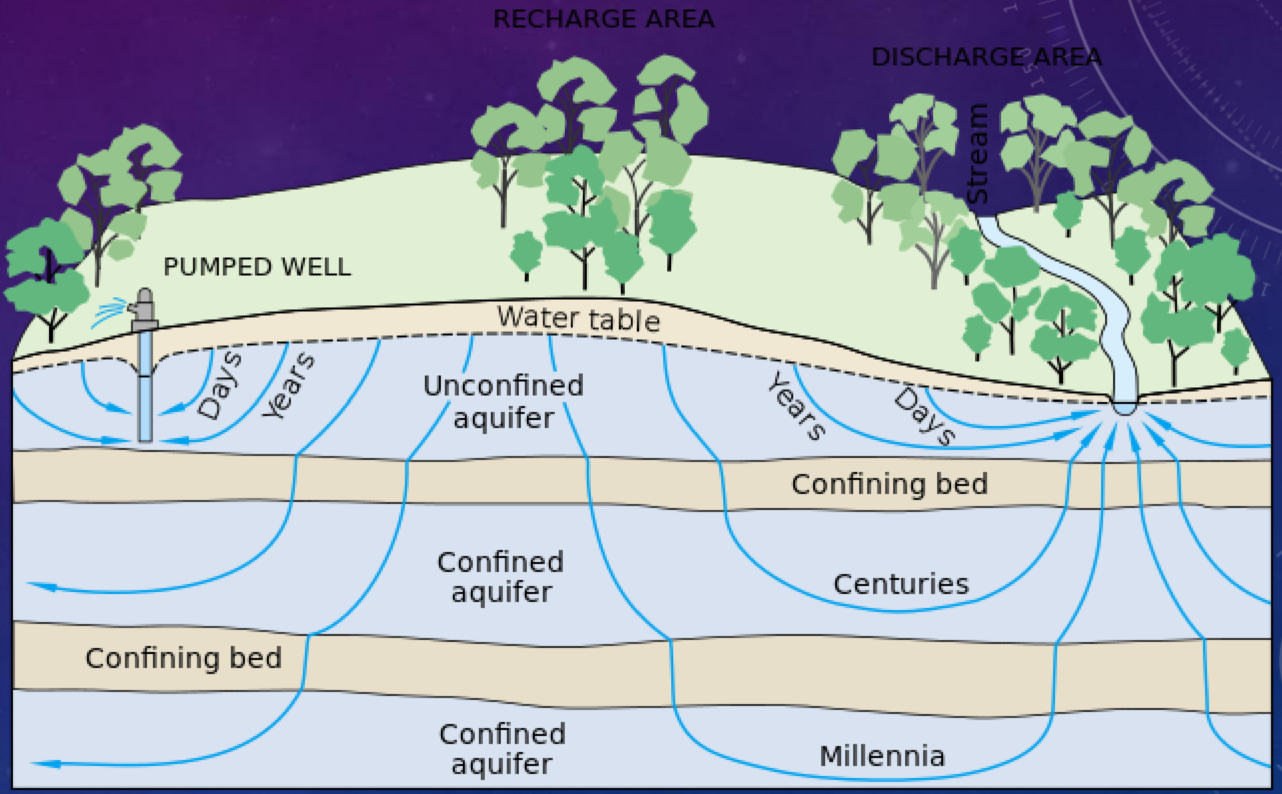
❖Under river flow:

For many rivers in large valleys, this unseen component of flow may greatly exceed the visible flow. The hyporheic zone often forms a dynamic interface between surface water and groundwater from aquifers, exchanging flow between rivers and aquifers that may be fully charged or depleted. This is especially significant in karst areas where pot-holes and underground rivers are common.

SOURCES OF FRESH WATER

❖**Groundwater:**

Groundwater is fresh water located in the subsurface pore space of soil and rocks. It is also water that is flowing within aquifers below the water table. Sometimes it is useful to make a distinction between groundwater that is closely associated with surface water and deep groundwater in an aquifer (sometimes called "fossil water").



SOURCES OF FRESH WATER

❖ **Groundwater:**

Groundwater can be thought of in the same terms as surface water: inputs, outputs and storage. The critical difference is that due to its slow rate of turnover, groundwater storage is generally much larger (in volume) compared to inputs than it is for surface water. This difference makes it easy for humans to use groundwater unsustainably for a long time without severe consequences. Nevertheless, over the long term the average rate of seepage above a groundwater source is the upper bound for average consumption of water from that source.

SOURCES OF FRESH WATER

❖Groundwater:

The natural input to groundwater is seepage from surface water. The natural outputs from groundwater are springs and seepage to the oceans.

If the surface water source is also subject to substantial evaporation, a groundwater source may become saline. This situation can occur naturally under endorheic bodies of water, or artificially under irrigated farmland. In coastal areas, human use of a groundwater source may cause the direction of seepage to ocean to reverse which can also cause soil salinization. Humans can also cause groundwater to be "lost" (i.e. become unusable) through pollution. Humans can increase the input to a groundwater source by building reservoirs or detention ponds.

SOURCES OF FRESH WATER

- **Frozen water:**

Several schemes have been proposed to make use of icebergs as a water source, however to date this has only been done for research purposes. Glacier runoff is considered to be surface water.

SOURCES OF FRESH WATER

❖ Frozen water:

The Himalayas, which are often called "The Roof of the World", contain some of the most extensive and rough high altitude areas on Earth as well as the greatest area of glaciers and permafrost outside of the poles. Ten of Asia’s largest rivers flow from there, and more than a billion people’s livelihoods depend on them. To complicate matters, temperatures there are rising more rapidly than the global average. In Nepal, the temperature has risen by 0.6 degrees Celsius over the last decade, whereas globally, the Earth has warmed approximately 0.7 degrees Celsius over the last hundred years.

SOURCES OF FRESH WATER

❖ Desalination:

Desalination is an artificial process by which saline water (generally sea water) is converted to fresh water. The most common desalination processes are distillation and reverse osmosis. Desalination is currently expensive compared to most alternative sources of water, and only a very small fraction of total human use is satisfied by desalination. It is only economically practical for high-valued uses (such as household and industrial uses) in arid areas. The most extensive use is in the Persian Gulf.

WATER SUPPLY

- Water supply is the provision of water by public utilities commercial organisations, community endeavors or by individuals, usually via a system of pumps and pipes. Irrigation is covered separately.

WATER SUPPLY

- In 2010, about 85% of the global population (6.74 billion people) had access to piped water supply through house connections or to an improved water source through other means than house, including standpipes, water kiosks, spring supplies and protected wells. However, about 14% (884 million people) did not have access to an improved water source and had to use unprotected wells or springs, canals, lakes or rivers for their water needs.
- A clean water supply - in particular water that is not polluted with fecal matter from lack of sanitation - is the single most important determinant of public health. Destruction of water supply and/or sanitation infrastructure after major catastrophes (earthquakes, floods, war, etc.) poses the immediate threat of severe epidemics of waterborne diseases, several of which can be life-threatening.

WATER USES

❖Domestic:

It is estimated that 8% of worldwide water use is for domestic purposes.[6] These include drinking water, bathing, cooking, toilet flushing, cleaning, laundry and gardening. Basic domestic water requirements have been estimated by Peter Gleick at around 50 liters per person per day, excluding water for gardens. Drinking water is water that is of sufficiently high quality so that it can be consumed or used without risk of immediate or long term harm. Such water is commonly called potable water. In most developed countries, the water supplied to domestic, commerce and industry is all of drinking water standard even though only a very small proportion is actually consumed or used in food preparation.

WATER USES

❖Agricultural:

It is estimated that 70% of worldwide water is used for irrigation, with 15-35% of irrigation withdrawals being unsustainable. It takes around 2,000 - 3,000 litres of water to produce enough food to satisfy one person's daily dietary need.

WATER USES

❖Industrial:

It is estimated that 22% of worldwide water is used in industry. Major industrial users include hydroelectric dams, thermoelectric power plants, which use water for cooling, ore and oil refineries, which use water in chemical processes, and manufacturing plants, which use water as a solvent. Water withdrawal can be very high for certain industries, but consumption is generally much lower than that of agriculture.

WATER USES

❖Industrial:

Water is used in renewable power generation. Hydroelectric power derives energy from the force of water flowing downhill, driving a turbine connected to a generator. This hydroelectricity is a low-cost, non-polluting, renewable energy source. Significantly, hydroelectric power can also be used for load following unlike most renewable energy sources which are intermittent. Ultimately, the energy in a hydroelectric powerplant is supplied by the sun. Heat from the sun evaporates water, which condenses as rain in higher altitudes and flows downhill. Pumped-storage hydroelectric plants also exist, which use grid electricity to pump water uphill when demand is low, and use the stored water to produce electricity when demand is high.

WATER USES

❖Industrial:

Hydroelectric power plants generally require the creation of a large artificial lake. Evaporation from this lake is higher than evaporation from a river due to the larger surface area exposed to the elements, resulting in much higher water consumption. The process of driving water through the turbine and tunnels or pipes also briefly removes this water from the natural environment, creating water withdrawal. The impact of this withdrawal on wildlife varies greatly depending on the design of the powerplant.

Pressurized water is used in water blasting and water jet cutters. Also, very high pressure water guns are used for precise cutting. It works very well, is relatively safe, and is not harmful to the environment. It is also used in the cooling of machinery to prevent overheating, or prevent saw blades from overheating. This is generally a very small source of water consumption relative to other uses.

INCREASING WATER SCARCITY

❖ **water scarcity:**

Water scarcity is the lack of sufficient available water resources to meet water needs within a region. It affects every continent and around 2.8 billion people around the world at least one month out of every year. More than 1.2 billion people lack access to clean drinking water.

INCREASING WATER SCARCITY

- **water scarcity:**

Water scarcity involves water shortage, water stress or deficits, and water crisis. The relatively new concept of water stress is difficulty in obtaining sources of fresh water for use during a period of time; it may result in further depletion and deterioration of available water resources. Water shortages may be caused by climate change, such as altered weather-patterns (including droughts or floods), increased pollution, and increased human demand and overuse of water. The term water crisis labels a situation where the available potable, unpolluted water within a region is less than that region's demand. Two converging phenomena drive water scarcity: growing freshwater use and depletion of usable freshwater resources.

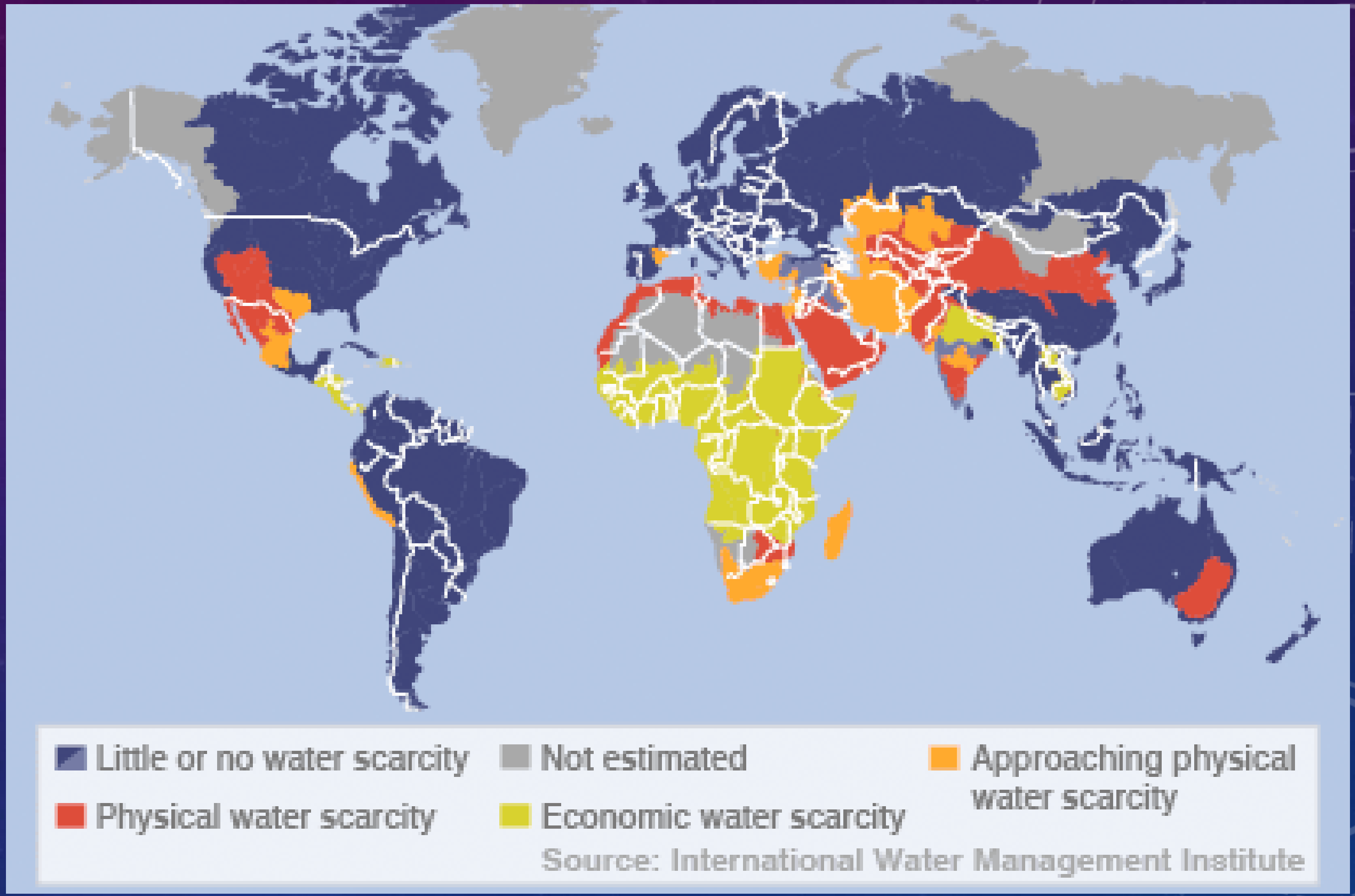
INCREASING WATER SCARCITY

❖ **water scarcity:**

Water scarcity can result from two mechanisms:

❑ physical (absolute) water scarcity

❑ economic water scarcity



INCREASING WATER SCARCITY

❖ water scarcity:

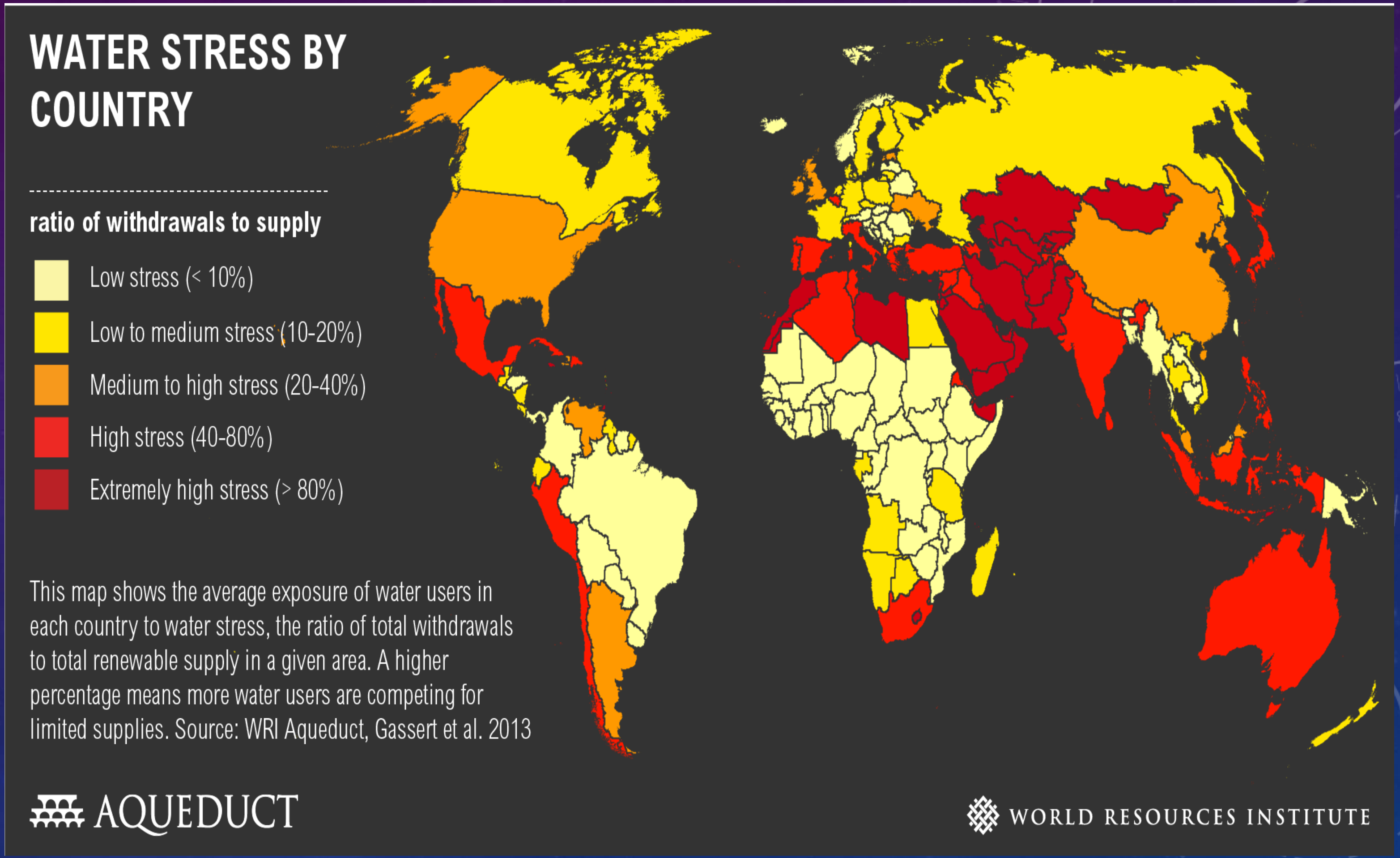
Physical water scarcity results from inadequate natural water resources to supply a region's demand, and economic water scarcity results from poor management of the sufficient available water resources. According to the United Nations Development Programme, the latter is found more often to be the cause of countries or regions experiencing water scarcity, as most countries or regions have enough water to meet household, industrial, agricultural, and environmental needs, but lack the means to provide it in an accessible manner.

Many countries and governments aim to reduce water scarcity. The UN recognizes the importance of reducing the number of people without sustainable access to clean water and sanitation. The Millennium Development Goals within the United Nations Millennium Declaration aimed by 2015 to "halve the proportion of people who are unable to reach or to afford safe drinking water

WATER STRESS

❖ **Water stress:**

The United Nations (UN) estimates that, of 1.4 billion cubic kilometers (1 quadrillion acre-feet) of water on Earth, just 200,000 cubic kilometers (162.1 billion acre-feet) represent fresh water available for human consumption.



WATER STRESS

More than one in every six people in the world is water stressed, meaning that they do not have access to potable water. Those that are water stressed make up 1.1 billion people in the world and are living in developing countries. According to the Falkenmark Water Stress Indicator, a country or region is said to experience "water stress" when annual water supplies drop below 1,700 cubic metres per person per year. At levels between 1,700 and 1,000 cubic meters per person per year, periodic or limited water shortages can be expected. When a country is below 1,000 cubic meters per person per year, the country then faces water scarcity . In 2006, about 700 million people in 43 countries were living below the 1,700 cubic metres per person threshold. Water stress is ever intensifying in regions such as China, India, and Sub-Saharan Africa, which contains the largest number of water stressed countries of any region with almost one fourth of the population living in a water stressed country. The world's most water stressed region is the Middle East with averages of 1,200 cubic metres of water per person. In China, more than 538 million people are living in a water-stressed region. Much of the water stressed population currently live in river basins where the usage of water resources greatly exceed the renewal of the water source.

WATER STRESS

❖Changes in climate:

Another popular opinion is that the amount of available freshwater is decreasing because of climate change. Climate change has caused receding glaciers, reduced stream and river flow, and shrinking lakes and ponds. Many aquifers have been over-pumped and are not recharging quickly. Although the total fresh water supply is not used up, much has become polluted, salted, unsuitable or otherwise unavailable for drinking, industry and agriculture. To avoid a global water crisis, farmers will have to strive to increase productivity to meet growing demands for food, while industry and cities find ways to use water more efficiently.

WATER STRESS

❖Changes in climate:

A New York Times article, "Southeast Drought Study Ties Water Shortage to Population, Not Global Warming", summarizes the findings of Columbia University researcher on the subject of the droughts in the American Southeast between 2005 and 2007. The findings published in the Journal of Climate say that the water shortages resulted from population size more than rainfall. Census figures show that Georgia's population rose from 6.48 to 9.54 million between 1990 and 2007. After studying data from weather instruments, computer models, and tree ring measurements, they found that the droughts were not unprecedented and result from normal climate patterns and random weather events. "Similar droughts unfolded over the last thousand years", the researchers wrote, "Regardless of climate change, they added, similar weather patterns can be expected regularly in the future, with similar results." As the temperature increases, rainfall in the Southeast will increase but because of evaporation the area may get even drier. The researchers concluded with a statement saying that any rainfall comes from complicated internal processes in the atmosphere and are very hard to predict because of the large amount of variables.

PROTECTING THE HEADWATERS

- **HEALTHY HEADWATERS ARE ESSENTIAL TO PRESERVE OUR FRESHWATER RESOURCES:**

Scientific evidence clearly shows that healthy headwaters tributary streams, intermittent streams, and spring seeps areessential to the health of stream and river ecosystems.

The evidence demonstrates that protecting these headwater streams with forested riparian buffer zones and protecting and restoring the watersheds in which they arise will provide benefits vital to the health and well-being of Pennsylvania’s water resources and its citizens.

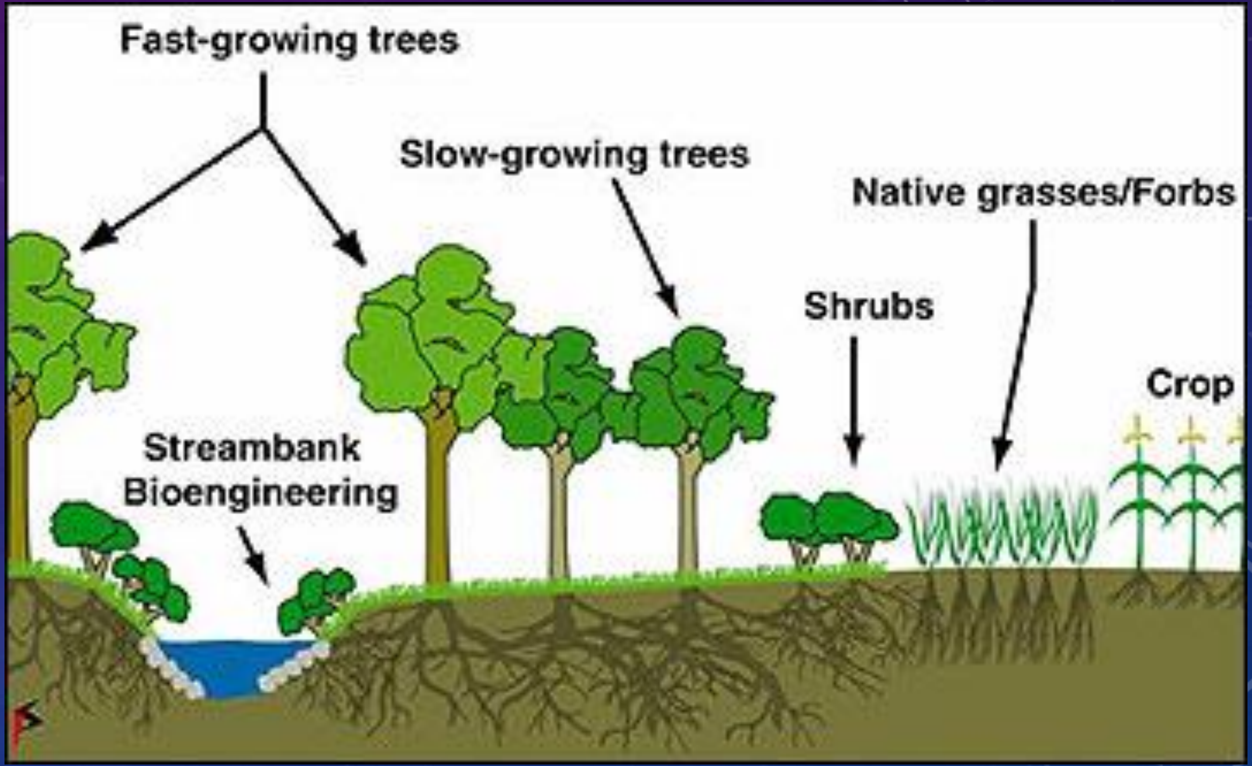
Healthy, undisturbed headwaters supply organic matter that contributes to the growth and productivity of higher organisms, including insects and fish.

Headwaters also help to keep sediment and pollutants out of the stream system’s lower reaches. In addition, they enhance biodiversity by supporting flora and fauna that are uniquely acclimated to this habitat.

PROTECTING THE HEADWATERS

- **FORESTED BUFFER ZONES PROTECT VULNERABLE HEADWATERS:**

Forested buffer zones protect these headwaters in a variety of ways. They promote broad, shallow streams with a greater total area of aquatic habitat and a broader diversity of habitats. They help protect headwaters from both point-source and non-point-source pollution.



PROTECTING THE HEADWATERS

❖ **FORESTED BUFFER ZONES PROTECT VULNERABLE HEADWATERS:**

Forested buffer zones slow erosion from flooding and help to keep water cool, a critical factor in streams that support trout and other cold-water species. These types of protections will grow more important as climate change raises average temperatures, and if the frequency and severity of storms increases.

The small size of these headwaters and their integration into the landscape makes them exceedingly vulnerable to degradation when those landscapes are altered by construction or agriculture. Their small size also means that the degradation of just one headwater may escape detection downstream, but cumulatively the destruction of many small headwaters would have negative impacts on water resources.

PROTECTING THE HEADWATERS

❖ **FORESTED BUFFER ZONES PROTECT VULNERABLE HEADWATERS:**

Headwaters are not as resilient as larger streams when disturbed because they lack sufficient flows to transport sediments associated with erosion and sedimentation, and animal life in them is usually coldwater adapted and thus sensitive to temperature increases associated with forest removal.

PROTECTING THE HEADWATERS

❖ **FOREST BUFFERS ARE EFFECTIVE IN PROTECTING HEADWATER STREAMS:**

It has been known for some time that some of the excess sediment, nutrients, and other pollutants associated with human land use can be kept out of small streams by the presence of a riparian forest or “buffer” zone along its length .

PROTECTING THE HEADWATERS

❖ **FOREST BUFFERS ARE EFFECTIVE IN PROTECTING HEADWATER STREAMS:**

The magnitude of the in-stream benefits provided by streamside trees extends beyond pollutant control. These benefits include maintaining temperature control, providing food resources and habitat for aquatic organisms, promoting broad, shallow streams that possess a greater total area of aquatic habitat and a broader diversity of habitats, and assisting in bank stabilization. Unfortunately, a focus on the importance of the riparian area to intercepting pollutants, combined with existing political, social, and even aesthetic ideas, gradually led to grass becoming the vegetation of choice for riparian buffers in many geographic areas and, in the process, pushed out of sight those additional and perhaps more important benefits provided to small streams by riparian forests mentioned above.

Important aspects of stream ecosystem structure and function are influenced by forested buffers, as small stream reaches bordered by forest have more macroinvertebrates, total ecosystem processing of organic matter, and nitrogen uptake per unit channel length than contiguous deforested reaches.

PROTECTING THE HEADWATERS

❖ **FOREST BUFFERS ARE EFFECTIVE IN PROTECTING HEADWATER STREAMS:**

Largely overlooked was the fact that while buffers are a headwater stream's first line of defense against nonpoint-source pollutants, they were less than 100 percent effective.

SOURCES:

- **Article :**
- Stroud Water Research Center :Protecting Headwaters: THE SCIENTIFIC BASIS FOR SAFEGUARDING STREAM AND RIVER ECOSYSTEMS
- **Web sites:**
- http://www.freedrinkingwater.com/water-education/water-health.htm
- https://www.health.gov.au/internet/publications/publishing.nsf/Content/ohp-enhealth-manual-atsi-cnt-l~ohp-enhealth-manual-atsi-cnt-l-ch6~ohp-enhealth-manual-atsi-cnt-l-ch6.1
- https://en.wikipedia.org/wiki/Water_resources
- https://en.wikipedia.org/wiki/Water_supply
- https://en.wikipedia.org/wiki/Water_scarcity