Water uses

Water consumption

Humans are particularly concerned about potable water, more and more insufficient in relation to the increase of the world population and as effect of pollution. Today are in function, especially along dry coastal regions, plants making seawater drinkable to compensate for shortage of potable water among continents.

Water in all its forms is important also because it's an essential part of Earth's landscape, infact, it contributes predominantly to the shaping of the world's surface and determines the typical climate of the region.

Variability of climate and hydrogeological conditions makes water availability extremely different from one region to another. We can talk about water scarcity when annual per capita amount of available water drops below 500 cubic metres. Even those countries with great availability of fresh water are exposed to the risk of having to face water scarcity. Water insufficiency, infact, is a relative concept as it can refer to the total lack of water or to the difficulty of acceding to safe water reserves. Water resources are more and more exploited on all continents by the growing request of irrigation interventions for agricultural purposes, for urbanization activities and for industrial use. Economic development and urban growth often cause damages to water flows due to the increase of pollution. This reduces the amount of good quality water available for primary uses as drinking, eating and personal hygiene.

In the past century world consumption of fresh water has had almost a tenfold increase and about 70% of water consumed on Earth is employed for agricultural use. This percentage is lowering as the consumption for industrial use (20%) and domestic use (10%) is increasing. In less developed regions the percentage of water destined for agricultural use proves to be greater while in most developed regions the percentage of water destined for industrial and domestic uses is higher.

Average annual per capita consumption varies substantially in the most developed regions (1200 cubic metres) from Sahel regions in Africa (120 cubic metres). An explanation given considers that a high standard of living implies high water consumption while it's not so true the opposite: infact, in less developed regions, agriculture absorbs the greatest part of available water but, due to the inefficiency of irrigation systems, about 60% is lost. Always through inadequate distribution is lost 36% of available water for industrial and urban uses. In addition to this, there are drought problems, climate changes, deforestation and pollution of groundwater.

Where does water go?

Here is how the different sectors of human activities have an impact on water consumption:

- Agriculture: 70%. Only 17% of all farmed lands is irrigated yet the latter produce 40% of all food we consume and absorb up to 2,500 km3 of water a year.
- Industry: 20%. Improvements in current technology allow to save more water in comparison to technologies applied in past years. For example, in the Thirties, to produce a ton of steel occurred between 60 and 100 tons of water, today 6 are sufficient. Aluminium, which today is often used as a substitute for steel, requires even less. We shouldn't neglect the fact that, in powerhouses, cooling water is recycled.
- Civil uses: 10%. In some industrialized countries consumption of water for drinking, cooking and personal hygiene is lowering. Before 1994, for example, WCs in US were using, in general, about 20 litres of water per flush, in comparison to 6 litres used today. Also washing machines today, those with front loading, consume 39% less water in comparison to old top loading washing machines.

Water and agriculture

Agricultural use of water to irrigate fields represents the main form of consumption of global hydric resources and involves two thirds of global availability of fresh water. Water is not evenly distributed on our planet, hence, very often, human intervention is necessary to modify the natural flows of rivers and build artificial canals to bring water where it's

needed. Hydric requirements in agriculture depend on numerous factors among which are climate, soil characteristics, crop practices, irrigation methods, type of farming and many others.
For example, intensive agriculture practised today in the world, which maximizes productivity of lands, requires much more water in comparison to traditional agriculture as also the amount of water required to irrigate fields in dry and semi-dry areas is substantially higher than the amount used in temperate areas.
Irrigation processes, especially in dry areas, can cause soil salinization, which means that they can elicit progressive increase of salts that over time prevent the use and destroy potential productivity of lands. This occurs when insufficient drainage of soil and strong evaporation of irrigated areas take place: this means that water which the soil isn't capable of absorbing evaporates immediately and leaves in the soil its mineral content. It's for this phenomenon that crops in dry or semi-dry areas of the planet have been suffering a productivity decrease in the last decades: it is estimated that 20-30 million hectares of the 270 million hectares of total irrigated areas are suffering salinization.
Crops that grow in salinized soils undergo nutritional imbalances and for this reason require the use of greater energy and substances to grow at the same pace of plants grown in normal conditions.
Only some cultivated species present high tolerance to salinity, among these, beetroot, barley, asparagus, spinach. For the main crops it's necessary to contain this phenomenon, which means lowering the excess of water that penetrates in the soil and, hence, irrigating according to the actual need of crops, not in excess as, especially in areas where natural drainage is lacking, this could determine an increase in the level of groundwater that makes subterranean water rise to the surface.
Generally, it's important to use crop and processing systems that don't deplete organic substance from the soil (as this improves salt catching and increases soil permeability) and it' s useful favouring crops that use at its best available water in the soil, maybe with roots capable of extracting water in excess in deeper layers. Perennial crops and fodder plants, especially alfalfa, are useful for this, even because they have a long growing season and remove, in comparison to annual crops, more water deeper in the soil.
Fodder plants can also increase the content of organic substance and improve the structure of the soil.
Also subterranean water coming from acquifers can face salinization, for example, due to excessive extractions undertaken by humans to satisfy the growing request of potable water for domestic uses.

How much water is employed to farm land?

Agriculture consumes 70% of the water drawn in the whole world from rivers, lakes and acquifers; in particular, developing countries are accountable for consumption of 95% of the water overally destined to agriculture, especially since the application of irrigated agriculture techniques implemented mostly in China, India and Pakistan.
Even if per capita water consumption has lowered since 1980 from 700 to 600 annual cubic metres, water use to farm lands has doubled from 1961 to 2001 and it is expected to register an exponential growth in the coming years, also due to constant population growth, expansion of urban areas and growing industrialization in emerging countries. The area covered by irrigated land in Europe is increasing and, as a consequence, water resources are depleted and water quality deteriorates thus causing phenomenons of desalinization and soil degradation.
Currently, about 30-40% of the availability of agricultural products on a global scale originates from 16% of irrigated agricultural areas and it is estimated that in the following years the contribution of irrigated agriculture to food production will tend to grow.
Italy destines for irrigation purposes about 60% of the 56 billion cubic metres of fresh water consumed and ranks first in Europe both for water consumption per inhabitant and for the greatest agricultural irrigated area, which is equivalent to 4,5 million hectares.
Irrigation is practised with different procedures according to geographical areas and climate zones with varying degrees of sophistication and technology: irrigating is useful to stabilize the productivity of cultivations and, in tropical countries, to guarantee more crops in the same year as well as higher yields. Irrigation is important also in dry or semi-dry areas, which would otherwise be unsuitable to support some crops.

Today more than 1,2 billion people live in areas where water scarcity occurs and by 2025, according to the United Nations Development Programme (UNDP), more than 3 billion people will become familiar with water stress conditions. On the one side, therefore, irrigation is a tool that is becoming increasingly more relevant in terms of food availability, on the other side, it constitutes the first form of consumption of hydric resources on a global scale.

Water waste in agriculture

The gap between water supplies and water demand is increasing in many areas of the world: in those areas already suffering water lacking, increasing drought will be the major constraint to agricultural growth and development. Climate changes will cause, above all, a decrease in annual water availability in many areas of the world.

In Europe, especially in Southern and Central European areas, water availability will decrease more and more due to the continuous decline of summer rainfall and in the face of high water demands for cultivations.

Consider that the amount of water sufficient to irrigate one hectare of rice crop is the same that would cover the needs of 100 nomads with 450 heads of cattle over three years or 100 urban families over a two-year period.

Moreover, in southern countries of the world, water used for irrigation represents up to 91% of general water consumption (in comparison to a 39% share in high per capita income countries) but agricultural production is equivalent to a third of production in industrialized countries as half of the water destined for irrigation evaporates due to high temperatures or gets lost due to leaks in the water supply distribution networks.

To solve the problem of water waste it's necessary to introduce more modern technologies as drip irrigation and renewing distribution networks but often serious financial and political problems limit these options.

Humans draw to irrigate much more water than the amount which the planet is able to provide: withdrawal for irrigation uses, in fact, in many areas exceeds the water capacity of water flows, rainfalls and regeneration of nature reserves.

Due to these imbalances, whenever delays in the arrival of rainfall occur, in comparison to natural cycles, events as famines burst out, as the one hitting some regions in Sub-Saharan Africa some years ago or, even if catastrophic events don't take place, water reserves are slowly consumed until depletion: it is estimated that in Jordan within 35 years groundwater reserves will be completely depleted and that their renewal will take thousands of years.

In the United States, since as early as 1960, the Colorado river doesn't reach the sea anymore, save when exceptional rainfall occurs, because large quantities of water are drawn from the river before it reaches the Pacific Ocean.

In the African Sahel region, both due to extended drought and decreased inflow of rivers whose waters have been diverted for irrigation uses, the Chad lake has been reducing by 75% in the last 30 years.

But the prime example is the drying up of the Aral lake (which was the world's 4th largest lake) in the heart of Central Asia.

Some Asian republics of the former Soviet Union diverted the flow of two rivers that fed the lake to cultivate rice and cotton, two crops requiring large amounts of water, especially when grown in very dry lands.

This choice has reduced the surface of the Aral Lake by 70%; causing further salt concentration increases in its waters – which in the past were salty but very rich in fish – worsened by the presence of pollutants and pesticides that have been carried for years into the lake by rivers or drained from cotton fields and are now concentrated at the highest levels.

Pollution is generating, besides the destruction of the lacustrine ecosystem, also serious health problems for local populations: anemia, infant mortality, rheumatoid arthritis, allergic reactions.

Water employed for breeding

By 2025 more than 60% of the world population will live in water-stressed conditions.

The zootechnical sector substantially contributes to water consumption and its pollution both directly and indirectly: 8% of world hydric consumption concerns the zootechnical sector that employs water mainly to irrigate fields farmed to produce fodder.

Just think that 15 thousand litres of water are required to produce 1 k of beef!

To produce 1 k of chicken we need 3,500 litres of water whereas the production of cereals requires less water, that is 3,400 litres for rice, 2 thousand for soy, 1,400 for wheat, 900 for corn and 500 for potatoes.
Animal production represents, moreover, one of the major sources of pollution of waters that entails: eutrophication that alters the balance of acquatic ecosystems; pollution of aquifers by nitrogen and phosphorus, organic and antibiotic micro-polluting agents with consequent risks for human and environmental health.
Eutrophication is generated by zootechnical waste, chemical pollution of aquifers is caused by excessive use of fertilizers and pesticides in crops used to feed cattle.
Liquid and semi-liquid cattle shedding contain levels of phosphorus and nitrogen above the average because animals can absorb only a small part of the amount of these substances contained in their fodder, the rest is released through their faeces.
When animal manure filters in water flows, nitrogen and phosphorus contained in it in excess, alter water quality and damage acquatic ecosystems in damp areas.
Just think that up to 70-80% of nitrogen provided to bovines, pigs and laying hens through nutrition and 60% of nitrogen given to broilers is eliminated through faeces and urine and ends in water flows and underground aquifers.
Think that an adult pig produces 4 times as many faeces as a human being and that in an industrial plant can live about 50 thousand pigs with a very high production of daily shedding!
When agriculture and breeding are balanced (as occurred before intensive breeding and partly still takes place), a cycle is created in which agricultural production is limited by the amount of manure needed to fertilize fields and manure in turn depends on how much fodder is available to feed animals.
The coming of chemical fertilizers has allowed to free agriculture from breeding and the rhythms of industrial production create so much manure that farmed fields aren't sufficient to absorb it all: for this reason, shedding in excess must be disposed as waste.
Finally, we shouldn't forget that zootechnology prevents water from playing its crucial role of penetrating into land and reuniting with underground waters (that are drawn by humans) as this activity compacts soil, reduces infiltration capacity, dries damp areas and deforests to introduce crops.

Water and industrial activities

Man uses water also for industrial activities. The amount of water used in industrial activities depends on many factors, such as the kind of activity and technology used. Generally speaking, the uses you can make of water can be grouped into three types: for production (used as a raw material in the production process: for instance, the water required to make pasta or fruit juices), to cool machinery (basically, just like the radiator of our cars) and finally to wash equipment.

Water and energy

In addition, water is a renewable source of energy: the production of energy in hydroelectric plants does not involve real water consumption, but reduces the availability of water in other sectors (such as farming or civil sectors).
Water is also used in thermoelectric plants, where it is not directly used to produce energy, but only to cool machinery.
Water from industrial uses can also be polluted, even if now many industrialised countries have issued strict laws that limit the concentration of pollutants in waste water, obliging the companies to send it first to special depurators that remarkably reduce its pollutants and send it back to lakes, rivers and seas when they are compatible with.

Water, sea and fish

Oceans are important not only for the plentiful food they can offer to man through fishing. From an ecological point of view, they provide over one half of the goods and services required to maintain the vital balance of the planet and host more animal species than any other system on Earth. In addition, through their volume and density, they absorb, store and carry large amounts of heat, water and nutritional substances. Fishing covers on average 16% of the world's requirement of animal proteins. Underwater deposits supply one fourth of the oil and gas requirement, and over one half

of trade goes by sea. Over two billion people live within the 100 km of the coastal stretch, sometimes in heavily urbanised areas; not to mention the tourists that crowd the beaches every year. Our well-being also depends, therefore, on the well-being of the oceans and seas.