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WATER
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ESSENTIAL RESOURCE FOR THE FUTURE OF MANKIND

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Abstract. Water is associated with life, life that has emerged in the water that gradually has diversified. In this paper are presented the water resources available on Earth and how they are used in industry, in agriculture and in the household consumption. At the same time it draws attention to the fact that water resources decrease dangerously, in the recent times. There are affected all surface water and groundwater resources. Finally, it is analysed the situation of water resources of our country. The estimates made by experts show that Romania in the near future will have no special problems.

Keywords: Water, Consumption, Resources, Life, Climate changes, Earth.

Life appeared in the water, in the planetary Ocean, billions of years ago, formed the first primitive unicellular life forms, that pulled through the bad weather and it was huge, diversified and later conquering the land. Because water is associated with life, because it is not produced by us, it's finding itself free in nature and because we humans have wasted it and throw it away even now - sometimes- wrongly, in particular water, sweet water, up to this day, raise special problems of great complexity for the future of HSS (Human-Social System).

Let us not forget one thing learned from historians, namely: all the great civilizations of the world have emerged and have developed near important water courses, such us the Babylonian civilization in the vicinity of the River Tigris and Euphrates, Chinese civilization along the Yangtze and Hnang-Ho, Egyptian civilization along the Nile River and numerous other civilizations known all over the world throughout history, as academician Christian Hera points out in a recent monographic work, published in 2013.

Table 1 The allocation of the water resoureces (from Mâşu, 2011)

Type of storage	Localization	Volum (m^3)	% of the total	Renewal times
Surface	- sweet lakes - salt lakes and inner seas	$1,3 \times 10^{14}$ $1,0 \times 10^{14}$	0,006 0,008	3 month 17 years
	- running water	$1,3 \times 10^{12}$	0,01	16 days

Underground	- waters of aeration zone - waters up to 1000 m depth - large waters depths	$3,7 \times 10^{13}$ $4,2 \times 10^{15}$ $4,2 \times 10^{15}$	0,005 0,31 0,31	1400 years
Other	- glaciers - atmosfera - Planetary Ocean	$2,9 \times 10^{16}$ $1,3 \times 10^{13}$ $1,3 \times 10^{18}$	2,15 0,001 97,2	9700/1600 years 8 days 2500 years
TOTAL		$\mathbf{1,4 \times 10^{18}}$	**100**	

Our planet Earth (seen from space) is considered "the blue planet" for that 4/5 of its surface is covered by water. The volume of water of the Earth is about. 1.4 billion km^3 and it seems that it has remained constant, despite some reduced in size fluctuations.

From the amount of 1.4 billion km^3, 1.362 billion km^3 (97.3%) is water represented by the oceans and seas and the rest, 0,038 billion km^3 (2,7%) is sweet water.

The most of the fresh water is found in the polar caps and glaciers (77,2%) (Mâşu, 2011). If the climate warming will continue and the glaciers and ice caps will start to melt, this will hit heavily in the pure fresh water reserve of the mankind.

Our country's resources of sweet water were estimated several years ago, at about 40 billion cubic meters per year. This figure includes both surface water and groundwater (aquifer and springs) resources (Negulescu et al., 1995).

The specialists estimated the water consuming from worldwide as being distributed as follows: 70% for agriculture, 20% for industry and economy, 10% for domestic consumption (Balteanu & Şerban, 2005). In this respect quite large variations are from one country to another (there are African countries which do not exceed 1% or 2% of the total intake for the industry, while in France reached 42.5%).

In the Arabian Peninsula in Southwest Asia, as well as in India and in China, agricultural water consumption represents about 90% of the total (Duma, 2006). Water is considered "the key to the vault" for agriculture. It is estimated that till 2030, the water supplement for agriculture crops should increase by 30-60% (Hera, 2013).

In 1998, Dan Cogalniceanu proposes an interesting graphic concerning the share of water use depending on the continent (Fig. 1).

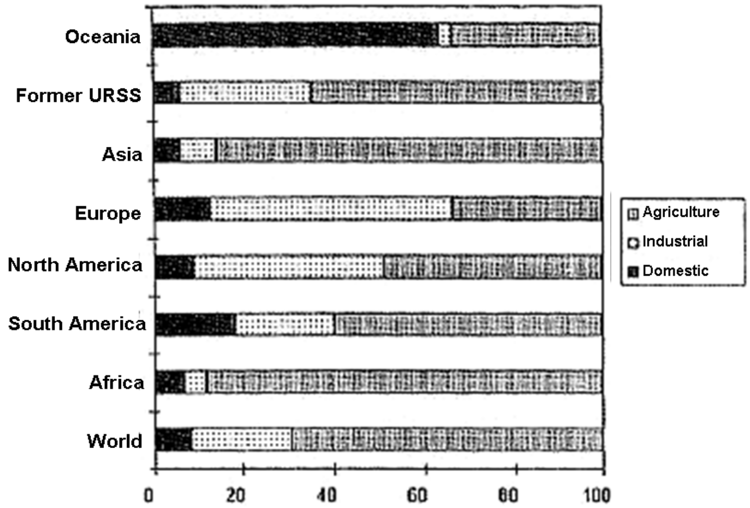

Fig. 1. The share of the main ways of water usage by geographical areas (after Cogălnicenu, A.,Cogănicenu, D., 1998).

To produce a ton of steel (worth 550 $) are required 14 tons of water, and for the production of one tons of wheat (which is worth only 150-160 dollars) are needed 1,000 tons of water (Brown, 2006). Agriculture increasingly loses ground with all that food needs are increasing in the future.

With increasing economic development, good-quality water has become one of the main requirements of all states.

Water consumption is growing as the world's population. The advised researchers from UNESCO and the United Nations believes that within 20 years, according to some of only 14-15 years, the need for water will double.

They also consider that the Earth's resources are sufficient, whether they will be used accordingly. For example, it is estimated that a population of over 8 billion inhabitants, which will arrive in the 2020-2025, the quantity of potential water is 4.760 m^3/year. But maximum water demand per person varies between 900 and 1,400 m^3/year.

However, the personal consumption grew impressively from 10-15 l/day in the Medieval Times, to over 600 l/day today. And here are the major differences between countries.

In 2002, the General Secretary of the World Meteorological Organization (WMO) said, on the occasion of World Water Day on 22 March of each year, that 10% of the third world population (especially in hot countries) is affected by diseases caused by the drinking water quality used unhygienic conditions.

A large amount of drinkable water is found in ground water approx. 8.512 million km3 per year. This quantity 1/3 is located in the underground aquifer horizons.

Deep underground water have been discovered in the Sahara and in the Arabian Peninsula, areas where there is a great need for water, but the extraction costs are still very high (Duma, 2006). How the future of domestic water consumption will be growing, will be taken large amounts of water used in agriculture, which will lead to a decrease in grain production, creating food problems in the world.

Nowadays, the water consumption is approx. 14% of existing resources and in the future it aims to reduce it (Table 2). But there are big gaps in different countries (Mâşu, 2011).

It is important to mention one thing: in the past 50 years, the water consumption has tripled (Table 2), so that the deficit of water worldwide is explainable (Brown, 2006). Lester Brown recalls as well in 2006, that the economic development and the population growth entailing a great deficit of water, which unfortunately often not visible.

Great problems are related to the access of some countries in water resources. They are very poor countries such as Sahael Countries which do not have the financial resources to be able to invest in such a thing.

OMS makes a recommendation: approx. 150 l/day per person water must be consumed. For populations of many countries this recommendation remains only a wish.

Unfortunately, water pollution is a serious thing, growing increasingly hard to control and harder to avoid. It devalues serious the water quality, with adverse effects on life in general and the people health in particular. We must be underline that the ground water has no possibility of self purification.

Ghislain de Marsily presents the water requests (1990-2050) on different levels of consumption over time (Table 2) (Mâşu, 2011).

It should be avoided in the future, "a water war". That's why, since 2006 UNDP (The United Nations of Developmental Program) has established important measures to be taken, presented in a project, as it mentions Yvette Veyret and Jacquline Jalto in their paper „Develloppment durables" in 2010.

The deficit stems, first, from the excessive pumping of groundwater and the lowering level of the groundwater is detected only when the wells have dried up and no longer have what to pump. Excessive pumping has exceeded the capacity of groundwater regeneration. This is even more noticeable in those countries that shelter to more than half of the world's population and is the result of the Governments concerned failure, who did not understand that the natural resources have a limit of exploitation.

Table 2. The evolution of water demand in the period 1900-2050 (by Ghislain de Marsily, from Mâşu, 2011)

Years	**1900**	**1950**	**2000**	**2025**	**2050**
Population (milions)	2 000	2 542	6 181	8 000	9 200
Agricultural water					
Irrigated areas (million hectares)	47,3	101	264	307	331
Samples of water for irrigation (km^3/year)	513	1 080	2 605	3 053	3283
Water consumption for irrigation (km^3/year)	321	722	1 834	2 143	2 309
Consumer/sampling report	63%	67%	70%	70%	70%
Agriculture area rainfall network (million hectares)	600	700	1 300	1 700	2 170
Pluvial crops consumption (km^3/year)	2 500	3 000	5 500	7 500	9 500
Consumption of grassland systems (km^3/year)	300	350	840	900	1 000
Industrial water					
Industrial sampling (km^3/year)	44	204	776	834	875
Industrial consumption (km^3/year)	5	19	88	104	116
Consumer/sampling report	11%	9%	11%	13%	13%
Wastewater					
Household sampling (km^3/year)	21,5	86,7	384	522	618
Household consuption (km^3/ year)	4,6	16,7	52,8	73,6	86,4
Consumer/sampling report	21%	19%	14%	14%	14%
The evaporated water in dams (km^3/year)	0,3	11,1	208	302	362
Total					
The total annual samples (km^3/ year)	579	1 382	3 973	4 710	5138
Total consumption without dams, crops and grassland systems	330	758	1 975	2 321	2 511
Consumer/sampling report	57%	55%	50%	50%	49%

In 2002, Lester Brown presented, in a very suggestive table, some cases of depletion of groundwater reserves in some geographic areas of the world (Table 3).

All these intensive exploitation of groundwater exceed the capacity of aquifer replenishment in that area. How this lack of water increases the more will enhance the industry/agriculture conflicts, between cities/irrigation even disputes between neighboring countries in the relation to water management in different river basins (the case of disputes, over the waters of the Tiger and Euphrates between Turkey, Syria and Iraq).

Table 3. Some cases groundwater depletion (after Brown, 2002, modified)

The country	The region	Description of the situation
China	The North China plain	- Underground water level descend with 2-3 m/year. By increasing prices of pumping water, the peasants abandon their land
United States	Southern Great Plains	- The fossil Ogallala Aquifer is almost exhausted; as a result the irrigated surfaces of 3 US States retrench
Pakistan	Pundjabul Plain	- In 3 large agricultural provinces the ground water level was going down extremely fast
India	In at least 7 countries predominantly agrarian	-The underground water level descend with 1-3 m/year, the water extraction has twice overturn the capacity of the aquifer restoration
Iran	Chenaran Plain	- The underground water level descend with 2.8 m/year (near the city of Mashad in 2001 went down with 8 m)
Yemen	All over the country	- The underground water level descend with 2 m/year, and in the capital Sanaa area with 6 m
Mexic	Guanajuato State	- The underground water level descend with 1.8-3.3 m/year

It is normal that this water shortage to affect food production. Specialists consider that every person uses 4 liters of water every day, in one form or another, whereas the amount of water used to produce our daily food requirement is about 2,000 liters of water with 500 times more. This is why 70% is used for irrigation and agriculture (Brown, 2006).

There are many countries that can be given as an example in the sense that groundwater lowering affects the grain harvest. Let's take the example of China, which at present is the largest grain producer in the world.

The North China plain, where they produce mostly grain, thanks to the massive pumping of water, the shallow aquifer has greatly depleted and the wells have had to drill deeper and deeper, penetrating the deep aquifer layer that cannot be naturally filled, fell by over 3 m (not renewable).

In a World Bank report it is shown that the drilling water wells must arrive now to 1,000 m deep, the freshwater supply cost increasing greatly. As a result, the rice production as well has declined due to the lack of water; if the 1997 production was 140 million tones in 2005 has reached to 127 million tones.

Otherwise, all China's grain production has declined from a peak of 392 million tons in 1998, to 358 million tons in 2005, while China's population was growing.

In 2004, China had to import 7 million tons of cereals-absolutely necessary for population (Brown, 2006).

In the southern U.S. in drought regions, related to ground water used for irrigation, arise such problems. The same problems are in Mexico, where the water demand far exceeds the resources of the country.

There are many areas in Asia: China, India and especially the Arabian Peninsula countries where the irrigation wells, landed in the aquifers, are depleted or exhausted, taking into account that here lives half of the world's population.

Among the first affected countries are Yemen, Syria, Iraq and Israel. As a result, the irrigation in agriculture can no longer be made and must be imported grains. In these areas we have a fast growing population, while water resources decrease continuously. Normally, here arise problems for the production of feed because here every day adds a number of approx. 10,000 people in need of water and food.

We stop only in Yemen which has the fastest demographic growing. In Yemen it was pumped water from aquifers deep fossil, far above the allowable quotas, being quickly exhausted. In the last 40 years, the cereal production was greatly reduced and it currently imports 80% of necessary grain. Here, approx. 60% of malnourished children grow up and are stunted. The country's capital Sanaa – with two million inhabitants– receives water from the faucets in 4 days, and in the South of the country, the cities such as Taiz, once every 20 days. The future of this country is questioned. As Yemen's population is steadily increasing (approx. 3% per year), the quantity of groundwater extracted annually exceeds 5 times the capacity of groundwater remediation, which leads to an annual decrease of groundwater with 6 m. In the future – not over many years – the water reserves of this country will be completely depleted without the possibility of recovery. The solution is high – water desalination for even drinking water – but the costs are very high (Brown, 2011).

The **"SURFACE WATERS"**, along with climate change, have also big problems which are as clear and visible, this time.

The streams and rivers of flowing waters, from different geographical areas, have large debt decreases as well as the lakes.

Today there are many rivers that no longer reach the outfall and the best examples is the Colorado River in the southwestern of United States (Fig. 2) and the Yellow River, the largest river in northern China (Fig. 3), which during the hot and dry seasons, or dries up or turns into a brooklet, which seeps into the sea. Similar problems have the Ganges River in India and some rivers in Iran, Iraq and Pakistan. But there are rivers that have gone missing, remaining only on the geographic maps.

Fig. 2. The Colorado River
(South-East of US) (Web 1)

Fig. 3. The Yellow River
(The North of China)(Web 2)

The substantially increasing and uninterrupted water consumption is a natural consequence of the permanent water requirements, which not always can be satisfied by the natural water sources. For this reason it has imposed the realization of many dams, deflection of reservoirs, thoroughfare canals, derivatives, etc. (Rojanschi & Bran, 2002).

From the 1950s until 2005 the number of dams, higher than 15 m, has grown from 5,000 to 45,000 (Brown, 2006).

In the dam Lakes, the degree of evaporation of water is high water losses annually, mostly in arid areas, amounting to 10% from the storage capacity of the Lake. These dams on rivers put to advantage those people from the upstream, whereas those from the downstream of the dam will suffer.

In the southeast of Asia the Mekong River flow has been reduced in the past 10 years, by the Chinese-made dams, in the upper basin of the latter, which is found in China. Countries in the lower basin of the River: Cambodia, Laos, Thailand and Viet Nam (approx. 300 million people) complain that it has been greatly reduced the flow rate and have no enough water available and the examples may continue (Brown, 2006).

Earlier we mentioned that it has been reduced the groundwater level as well. The result is the lowering of springs that feed the river and streams, helping to reduce their flow.

Fig. 4. The Aral Sea
(The Russian Federation) (Web 3).

The lakes, an important source of sweet water, have a similar situation with the groundwater's and the surface waters that have begun to disappear or to reduce a lot their surface.

You can't give a precise number for the disappeared Lakes over the past 50-60 years, many of them still appears on older maps, without the reality. Some of these are known all over the world: the case of Lake Chad in Africa, Central Asia's Aral Sea or Galilees Sea of Israel, as was the situation presented by "The World Lakes Network".

The best known example is the case of the Aral Sea (Russian Federation) (Fig. 4). Who was due to "The Scientific Project" of the politicians of the old Soviet Union which by the 1960s decided to divert the two rivers that provided the Aral Sea with fresh water, Amu Darya and Syr Darya to the plains of the South, where mostly cotton were cultivated. As the cultures extended was in need a larger quantity of water because the area was an arid zone with little rainfalls. The annual water intake of the two rivers was reduced to 65 billion cubic meters. The sea has much decreased and the ships lay in the sand on it bottom.

Its ports, major commercial centers, were abandoned, and winds up tons of sand and salt, that you go on the vicinity farmlands (Brown, 2006).

The intake of fresh water has been turned off and the area's strong evaporation resulted in increased concentration of salt from the Aral Sea, the fish have died. On the good times, here were fishing about 50,000 tones of fish per year and so the fishermen become unemployed.

The same thing happened with many lakes in the United States. Here's the example case of Owens Lake in California, which had an area of 200 square miles and has disappeared by 1925, after Owens River that supply was diverted to the city of Los Angeles, the city with a great need of water.

Such examples can you give in China, where in the past 30 years have disappeared over 2,000 fresh-water lakes, in India, Pakistan and Iran and the case of Mexico as well. Here the largest lake of the country, the Chapala Lake, which is the main source of drinking water for the city of Guadalajara (5 million inhabitants), decreased by 80% the volume of water, due to the expansion of irrigation in the surrounding regions (Brown, 2006).

It becomes increasingly clear the need to create large storage pools of rain water, over long periods of time, to have the necessary water for irrigating agricultural crops in dry periods (Brown, 2006).

The experts say that the melting of **Greenland glaciers** (Fig. 5), **the polar icecaps** and the **mountain glaciers** would raise the sea water level and of the world ocean, with water at least 2 meters (Brown, 2011). But there are other authors which relate a double increase of the ocean waters as a result of these melting.

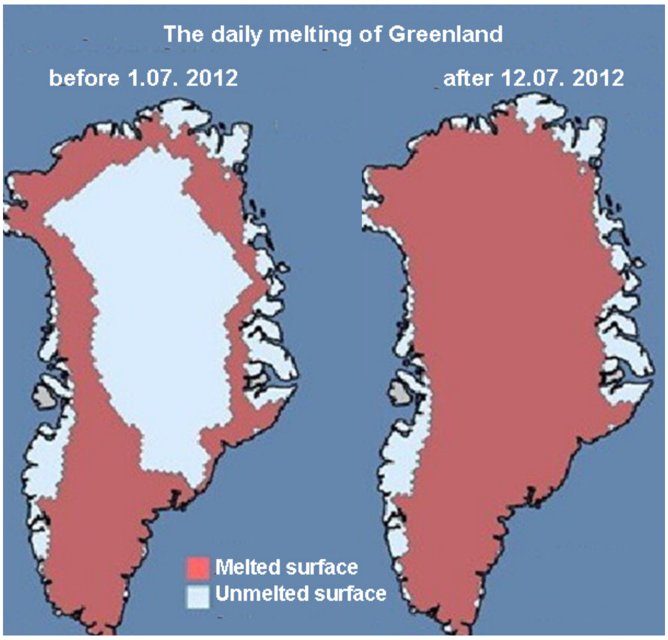

Fig. 5. The evolution of Greenland melting ice surface, especilly in 1-12 July 2012 range, at an extraordinary rate, produced it decrease to 55% (Detected with Special Sensor Microwave Imager - SSM/I) (Tedesco, 2007).

The higher temperatures in the recent years make the two **polar caps** to start to melt. The same situation happens with the **glaciers from the mountains**, which are important sources of water for the many streams and rivers from which water is used for irrigation.

The harvests will be affected by the flooding Plains, particularly rice, in the low area of Asia, where lives most of the world's population (mostly from Bangladesh, the Mekong River delta) and which produces half the rice yields of southern Asia.

Anyway, the fresh water – the drinking water - from these ice formations will be lost, mingling with the salty water of the seas.

The melting of the polar ice caps, associated with the decrease, even the wear out of the ground water, with decreasing flow of surface waters, represent a big threat to humanity now. One example is in India, the great Gangroti glacier is retreating today (Fig. 6). It is the source of the water for the Bhagirarth River, the main affluent of Gange River, the main source of surface water for irrigation and drinking water for 400 million people from this river basin area (Brown, 2011). The examples may continue.

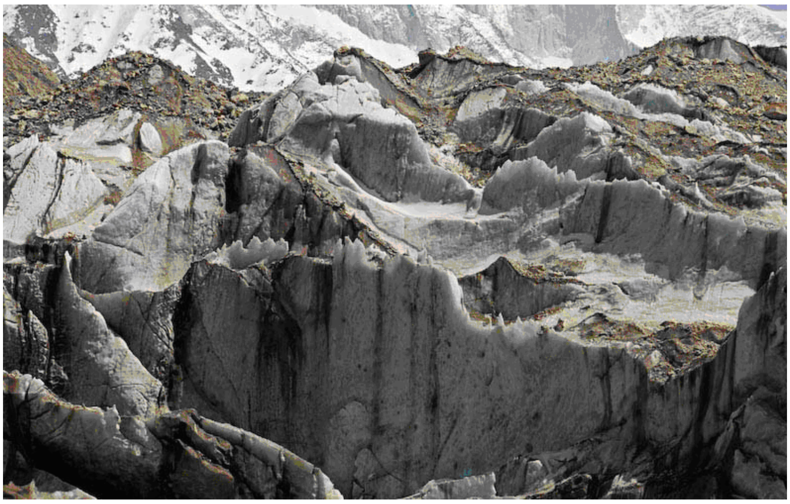

Fig. 6. The Gangotri glaciers (Himalaya Uttaranchal, India) (Web 4).

The estimates made, consider that Romania will not have problems with water in the near future. Problems can arise in the South of the country, more arid area, dry and more especially, to the inhabitants of rural areas. The health of our waters is relatively satisfactory in comparison with other countries. By lowering the massive industrial activities in recent years, the pollution was reduced as well. To this has also contributed the applying of the new legislation in 2002; already

62% of the amount of surface water is used in power centers but it must reach to 90%.

In order to ensure a sustainable and efficient management of water resources, at the Conference "Water and Environment" in January 1992 taken in Dublin (Ireland) and the United Nations Conference "The environment and development" in Rio de Janeiro, July 1992, the participants have made - at the end of the conferences - some recommendations to all Governments of the world concerning the use and preservation of water quality and taking it as an economic good.

In brief we enumerate these recommendations:

a. the principle of the basin. Water resources are formed and used on river basins.

b. the principle of uniform quantity - quality management.

c. the principle of solidarity. The Collaboration is required for all factors involved in the use of water.

d. the principle of "the polluter pays"- all expenses necessary for routine cleaning of affected water resources shall be paid by the one who produced the water pollution. Perfectly logical ...

e. the principle of "beneficiary pays". In all its forms to use there is a certain amount, a specific cost. Water is an "economic good" and therefore it must be paid.

We can say without fail, that water has both an integrative function but also for stimulating international cooperation through funds provided by the EU, through the cooperation with neighboring countries.

In this respect, Romania has concluded international agreements with various countries, aimed at the Danube and the Black Sea, which are factors of cohesion and understanding with the countries in our region (Mâşu, 2011).

Thus, the academician Christian Hera underlines that: "in the context of the European Strategy for the Danube and the Danube Region, the Danube cover 1,075 miles (48% of its length) on the Romanian territory, featuring 432.000 ha of dammed portion of which 390.000 ha arrange for irrigation and drainage, which entails the rebuilding and upgrading of the existing systems, in order to ensure agricultural production" (Hera, 2013).

To add one thing: Romania had in 2009 of 760,000 hectares of irrigable land but only 217.000 ha have been irrigated (Hera, 2013).

Earth and water are high-priced goods for any nation. They ensure our daily bread every day. Here's what it takes to hold both of them a sustainable health for the benefit of the future generations.

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