

WATER RESOURCES IN ROMANIA DURING 1945-1989

Victor PLATON¹, Andreea CONSTANTINESCU²

Abstract: *This paper presents the water management during 1945-1989 in Romania, all through the communist and command economy period. It follows the investments, waterbeds management works, construction of dams and energy plants all around Romania. The extensive irrigation program as well as the forced industrial development were specific for this period. On the other hand, water supply for population and sewage network was developing strongly. Not all this development had positive follow-up, as conclusions point out in the end.*

Keywords: *water resources, water management, dam, sewage, water supply*

JEL Classification: *A10, H54, P28*

INTRODUCTION

This paper examines the evolution of water resources in Romania, during the socialist period - 1945-1989.

From a water resources perspective, 1945-1989 time period was an important one because administrative and legislative measures that were taken allowed extension of prospecting, exploration and exploitation of water resources.

Romania's water resources - reserve and structure

Romania's water resources are quite scarce, compared to other European countries, and unevenly distributed in time and space. Romania's specific water resources relative to population are 1,894 m³ / year / person. From this point of view, Romania is one of the European countries with low water resources. These theoretically represents 134.6

¹ CS I, dr., Institutul de Economie Națională, victor.platon54@gmail.com

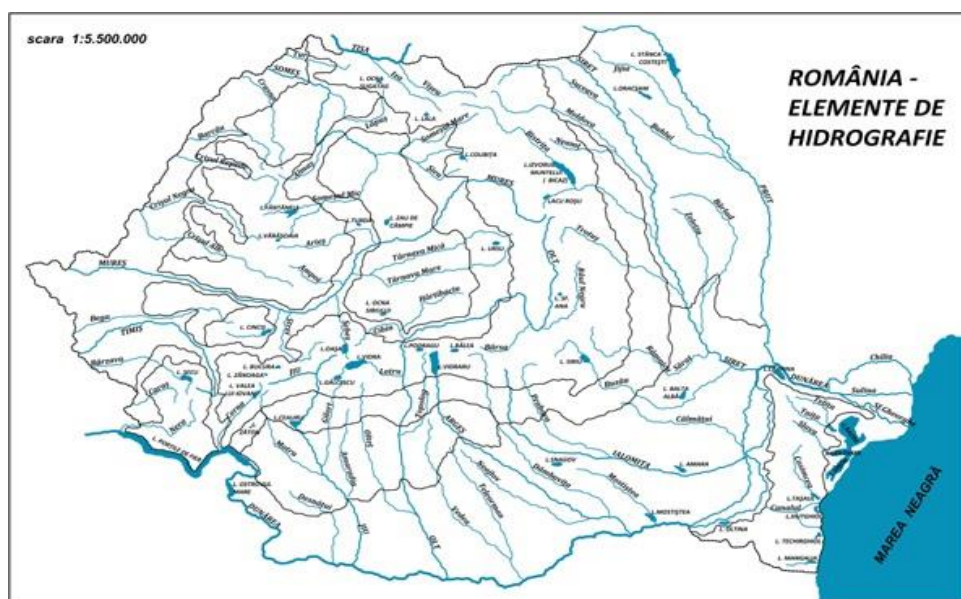
² CS III, dr., Institutul de Economie Națională, andreea_constantinescu07@yahoo.com

billion cubic meters / year (it refers to surface waters - rivers, lakes and Danube river - and groundwater), out of which the usable water resource, according to the river basin management, is about 40 billion cubic meters / year (see Annex 1). The river basins with high resources of surface water are relatively small and situated at high altitudes: Nera - Cerna and upper Tisa, followed by Jiu, Olt and Someș. The poorest in water resources are the Danube and Seaside basins.

Romanian river water resources are distributed unevenly in time, with large seasonal variations. At national level, 39.7% of the total annual leakage occurs in the spring, 14.2% in the autumn (the driest season), 26.7% in the summer and 19.4% in the winter. One factor which influences the flow and thus the volume of water resources is climate. From this point of view, the country's territory can be divided into three large areas with different climatic types, namely the western, eastern and southern regions.

Romania's water resources are also unevenly distributed in space: rich outflow is only happening in the west region, 1.36 times higher than the country's multiannual average.

Figure 1. The hydrographic map of Romania, after 1945



Source: <http://romgeo.blogspot.ro/2012/01/apele-din-romania.html>

Romania`s lakes

Romania has around 3,500 lakes, but only 1% of them have an area exceeding 1 (one) square km. More important are the lagoons and the Black Sea coastal lakes (Razim 41,500 ha, Sinoie 17,150 ha) and the lakes along the Danube bank (Brates 2,111 ha, Bistret 1,867 ha). Glacial lakes are mostly spread in the Carpathian Mountains (Bucura is the largest of them, 10.5 ha).

If the exogenous¹ water resources are taken into account - for Romania, Danube and the watercourses in the Upper Siret basin - which amounts 170 km³ / year, the total water resources of Romania is 134.6 billion cubic meters per year (according to the data in Annex 1). Under these circumstances, it can be said that Romania depends to a large extent on the water resources coming from different upstream countries. These water resources are not entirely usable. Therefore, unlike the countries of Western and Northern Europe, the lack of sufficient water resources is likely to become a limiting factor of economic development unless an intelligent policy of rational water use is promoted.

Due to variable water resources regime in Romania, some of them are lost during the floods, while in dry periods, the flow of water bodies drops to very low values. In order to increase usable resources and limit losses, measures have been taken to regulate flows through accumulation lakes to keep surplus flows in rainy periods to make them available during periods of drought.

Water regime during 1945-1990

During the command economy, the Romanian water regime is also changing. Thus, the Constitution of 1948 states: "*Art. 6. Subsoil resources of all kinds, mining deposits, forests, **waters, natural energy springs**, railways, roads, communications on water and air, post, telegraph, telephone and radio belongs to the State as common goods of the people*". It may be noted that water resources along with other natural resources are considered common property of the people and no longer was used the term public good as before 1945. To the natural resources category are added, inexplicably, post mail, telephone and radio.

In 1965, with the adoption of the new constitution, it is mentioned in Article 7 that water resources along with other natural resources, transport infrastructure, fixed capital, etc. belong to the whole people and are owned by the state. In this case, at least it is stated who is the owner, namely the Romanian State. Thus, several normative acts that set out

¹ This represents the contribution of the rivers that form on the territory of other countries and then enter the territory of Romania

the rules for extracting and using water were promulgated. Of these, the most important is the Water Management Act (called water law) which, over time, has undergone several changes. This law included all Romanian waters: a) surface waters: natural and artificial water courses, natural and artificial lakes, ponds; (b) groundwater and deep water, including springs; (c) inland maritime waters and the territorial sea. Water management works were to be accompanied by appropriate documents approved by the competent authorities (Platon, Constantinescu, 2018).

The water law had comprehensive provisions for all water uses: industry, agriculture, water supply, discharging of polluted water, flood prevention. It can be appreciated that the law has a progressive character, although its application in practice has been less efficient in the field of pollution prevention.

It is interesting to indicate the priorities for water use in order of importance: rapid development of industry, modernization of agriculture, increasing urbanization, water pollution and, last but not least, prevention of flood damage.

During the command economy, water was regarded exclusively as a resource to be exploited without much concern for sustainable management, reduction of water consumption or pollution prevention (Iancu, 2003).

State authorities have put in place an important program for controlling water courses. Thus, between 1974 - 1990, national water management programs were developed on the medium and long term, and the river basin management plans have been drawn up. These activities were done on the basis of the Water Law no. 8 of March 29, 1974, of Law no. 1 of April 15, 1976, which have adopted the "National Perspective Program for Water Basin Management of the Socialist Republic of Romania" and Law no. 5 of 29 June 1989 on rational management, protection and quality assurance of water.

Water use in agriculture

In Romania after the Second World War, the irrigation program started in 1945. During the pre-war period about 200,000 ha were irrigated. Subsequently, the policy pursued by the Communist Party was to increase the irrigated areas. In this context, at the 9th Congress of the PCR in 1969, it was decided¹: "*We must consistently implement the goals we have set in the field of irrigation so that in 1975 we have about 2 million and a half irrigated hectares and in 1980 the area irrigated to reach 3 million and a half - 4 million hectares*". The inventory of agricultural land that had irrigation facilities was made in 1991 by a group of experts who identified an area of 3.1 million hectares with

¹ Source: Congresul al X-lea al Partidului Comunist Roman., 6 - 12 august 1969., Raportul tovarășului Nicolae Ceaușescu., Editura Politică, București, 1969

irrigation facilities; almost 75% of this area had as its water source the Danube river. Gravitational water-distributed to agriculture plots used to cover only a fraction of the 3.1 mil. ha (only 250,000 ha¹). This is why pumping facilities are of great importance. Approximately 830,000 hectares were allocated to irrigation sub-systems involving pumping water into the first terrace (for which the average pumping height is about 45 m). Another 860,000 hectares were irrigated by subsystems where water is pumped into the second terrace (for which cumulative pumping height is about 95 m). Eventually, the surface covered with irrigation systems of 3.1 million hectares has never been fully irrigated. The main reasons were of technical and economic nature. For example, along Danube river, were placed in service more than 90 pumping stations, through which water was pumped from the river bed up to the hills, at heights ranging from 20 to 100 m. Also, 40% of the irrigation channels were not lined / isolated, which made water losses as big as 30-60%. In addition, pumping aggregate yields were below catalog values, watering equipment had low reliability while others were morally outdated. Another factor generating losses was power cuts, involving that after each interruption of electricity, irrigation channels were emptied of water do to losses and had to be refilled later on. Specialists² have calculated that water system losses were higher than 50%, meaning the difference between water measured at source, i.e. where the water was extracted and the water measured at the recipient, that actually reached the plant.

In these circumstances, even with massive irrigation subsidies (electricity, water) the system could not operate at full capacity.

Recent studies³ show that the irrigable area, in Romania, on economic bases, is only 615,330 ha or 4% of the agricultural land.

The amount spent for the construction of irrigation systems for the 3.1 mil. ha were⁴ over \$ 7 billion USD and the results have been inadequate. The most important issue was that irrigation systems were oversized and received only a fraction of the energy they needed to function.

¹ Ministerul Agriculturii, Pădurilor și Dezvoltării Rurale, Banca Mondiala, *Proiect de reabilitare și reformă a irigațiilor*, Analiza Economică a Sectorului de Irigații, Raport Final, mai 2009.

² <http://agrointel.ro/41778/se-mai-pot-salva-sistemele-de-irigatii-construite-in-comunism-aurel-lup-are-raspunsul/>

³ Romania, Ministerul Agriculturii și Dezvoltării Rurale, Proiectul de Reabilitare și Reformă a Sectorului de Irigații, *Strategia Investițiilor în Sectorul Irigațiilor*, Fidman Merk at., București, ianuarie 2011.

⁴ Estimated amounts starting from an average investment value of 2500 USD/ha.

Water use for industrial purposes

Water use in industry (mining, chemical industry, electricity production, etc.) was extensive. Since the village electrification program was in force and electricity needed for industry, emphasis was placed on the construction of hydroelectric power stations. For example, between 1951 and 1960, the first hydroelectric power plants are built, such as: Moroeni hydropower plant on Ialomița River (started before the Electrification Plan approval), Sadu V hydropower plant on Sadu river, near Sibiu and Bicaz hydroelectric power plant on Bistrița River. However, the program was too ambitious for the technical and economic possibilities of Romania in 1950. In 1954 works were interrupted at all the hydropower plants that had begun, except for the three previously mentioned. These constructions were executed later, after 1960.

Many artificial lakes have been built for different purposes: the production of electricity, irrigation, city water supply, fish farming, recreation.

The most numerous artificial lakes are accumulating lakes, whose water is used to produce electricity in hydropower plants or to supply water to human settlements, industry and agriculture and ponds used for fish breeding. The ponds are very common in Moldavia Plateau and in the south of Muntenia. Anthropogenic lakes amount to a total of over 1270, with a total retention volume of over seven billion cubic meters / year. Although their original purpose was economic, in time, artificial lakes have become tourist attractions due to landscape value and relatively easy access.

Out of the man-made lakes, the most important reservoir lakes for power generation are those on the Danube, at the Hydro-Power Plants of Iron Gates II (40,000 ha) and Iron Gates I (10,000 ha – with a water volume of 2,400 million cubic meters, which is three times as much as that of Iron Gates II), plus the reservoir lakes of Stânca-Costești (5,900 ha) on the Prut and Izvorul Muntelui on the Bicaz (3,100 ha).

Among the water management works, which are important for the period 1950-1990, can be cited Stramtori dam on Firiza river, Paltinu dam on Doftana river, Poiana Uzului dam on Uz river, Vidraru dam on Argeș river, the dam Stânca-Costești on Prut river, the Iron Gates dam and others. There were started numerous water management systems of which we can mention the system of reservoirs in the river basin Bahlui for the Protection of Iasi City.

The dams and reservoirs were built without regard to the specific biodiversity. No dam was not equipped with fish ladders so many fish migration was interrupted. The best known case is the interruption of sturgeon migration on the Danube after the construction of the Iron Gates dam.

The economic effort was very important because, along with the arrangements of the reservoirs, the rivers were regulated over 6,600 km long, more than 8,600 km of dams and a large volume of irrigation facilities, as well as hydroelectric constructions. This kind of investment is very unlikely to be match in the near future.

Water use for population (water supply and sewage)

From a legislative point of view, the water supply of towns and villages was a top priority. Law no. 5/1972 on water regime provided that the meeting of water requirements for the population is prior to any other use. It was also considered that *"Underground waters, including springs, are primarily intended for the supply of drinking water to the population and cannot be used for other purposes unless the water supply requirements of the population are not affected, except firefighting"* (Art. 34 of law).

Although declarative the importance of water supplies was stated, practice reveals a weak situation. At the same time should be mentioned efforts made to provide more drinking water, especially in cities.

Table 1. Water supply during 1950-1989

Years	Settlements		Network simple length (km)				Drinking water distributed (thou. m ³)	
	Total	Of which: towns and cities	Total	Of which: towns and cities	Urban	Rural	Total	Of which: for domestic use
1950	101	88	3,700	3,638	98.32%	1.68%	113,245	47,860
1955	118	96	4,076	3,939	96.64%	3.36%	185,441	62,309
1960	172	125	5,162	4,920	95.31%	4.69%	263,724	92,610
1965	233	152	7,239	6,865	94.83%	5.17%	458,728	159,817
1970	309	195	9,244	8,631	93.37%	6.63%	806,924	284,419
1975	739	221	12,999	10,878	83.68%	16.32%	1,361,092	483,920
1980	1,541	233	19,060	13,348	70.03%	29.97%	1,930,611	754,665
1985	2,059	237	24,750	16,280	65.78%	34.22%	2,347,394	998,665
1989	2,301	260	27,795	18,178	65.40%	34.60%	2,723,812	1,205,779

Source: data from National Statistic Yearbook 1950-1990.

In 1950 there were 101 settlements that had water supply from a total of 3200 settlements. From the Table 1 it can be seen that, in 1950, only 88 cities and 13 villages benefited of a network drinking water. In 1989, at the end of the command economy period, 260 cities and municipalities and 2041 villages and communes were receiving drinking water through pipes. It may be noted that only a part of the rural population had drinking water and a total of more than 20 cities had no drinking water network.

With the increase in drinking water consumption, the distribution network has increased more than 24 times. Thus, in 1989, more than 1.2 billion cubic meters of drinking water were distributed to the population compared to 47.86 million in 1950. The simple length of water supply network increased more than 5 times.

Table 2. Sewage network during 1950-1989

	1950	1960	1970	1980	1985	1989
No. of settlements with sewage network, Of which:	72	121	221	354	446	537
- Towns and cities	71	108	183	227	235	257
Total simple length of sewage network (km)	2.111	2.833	5.029	9.032	12.107	13.627

Source: data from National Statistic Yearbook 1950-1990.

The situation of the sewage, as consequence of the pollution produced by the discharge of used water, was extremely precarious. In 1950, only 72 localities (71 cities and one commune) had a sewerage network (Table 2).

After a period of 40 years of efforts, 537 municipalities (including 257 towns) managed to have sewerage networks. In the rural area, the sewerage situation was disastrous because less than 5% of the villages had a sewerage network, domestic waters being discharged into water bodies (rivers, meadows, lakes, etc.) with high negative effects on the quality of rivers and lakes.

Flood protection system

During 1945-1990 period, several severe floods occurred. For example, the floods of spring/ summer of 1970 are even today included among the most serious natural disasters that hit Romania in the 20th century. Heavy rains and sudden melting of snow in the mountains have caused flooding on Somes, Mures, Olt and Siret rivers and their tributaries. As a result, flash floods emerged at that time affected 12 counties, flooding 1,500 villages, 721,000 hectares of farmland, 85,000 houses of which 62,387 were completely destroyed, causing 1,760 dead and 200,000 distressed people. Natural disaster damages were estimated¹ at 10 billion lei at that time. Other major floods are represented in the following figure (Figure 2).

¹ <http://www.romanalibera.ro/actualitate/eveniment/document-top-secret-din-arhiva-cia-despre-inundatiile-devastatoare-din-romania--438604>

Authorities' actions were designed in two directions: construction of flood protection and draining wetlands to make the land suitable for intensive agriculture.

Figure 2. The largest floods produced in Romania during 1960-1985 and the affected regions



Source: <http://www.creeaza.com/legislatie/administratie/ecologie-mediu/VIITURI-Ş-INUNDATII293.php>

As a result of the floods of 1970, a greater emphasis was placed on flood control works, by constructing dams on the main internal rivers including Someş, Crişuri, Mureş, Argeş, Ialomiţa, Bârlad and Prut. Besides embankments, in many basins including that of Târnave and Timis-Bega basin, were executed polders for flood control. It also were built a series of reservoirs or enclosures to combat flood on Târnave rivers, Bârlad river basin and other river basins. The water management studies have been amplified. In this area, methods have been sought to define the minimum flow rates of river beds, based on more scientific methods, instead of considering those flows equal to the etiage flow rates, as was the case in the landscaping plans. Thus it was first made the Upper Mureşbasin information system, followed by the Arges, the Upper Siret and sub basins Putna and Buzau.

Actions and measures for flood protection have continued the work done in Romania for more than 200 years. Many population protection systems were commissioned, materialized mainly by:

- dams, with a developed length of 9920 kilometers;
- regularization of river beds, totaling 6300 km;
- 217 non-permanent lakes and ponds located in all river basins, with flood control volumes of 893 mil. cubic meters;
- 1,232 permanent storage reservoirs that, besides the volumes necessary to meet the water requirements of the utilities, also have volumes for mitigating the floods, amounting to 2,017 mil. cubic meters.

The policy to get more arable land through draining continued the ideas and methods used in the interwar period: draining of wetlands and transformation into agricultural areas with the acceptance of increased flood risk. It is estimated that in the Danube-Carpathian region over the past 150 years, more than 80% of the wetlands have been lost and, together with them, the ecosystem services they provided.

The most visible changes have occurred in the flood plain of the Danube where in the period 1950-1989 the Romanian government has started a program to expand agricultural land in the floodplain, which has extremely fertile soil due to nutrients brought by Danube silt. The land was dammed and drained, the natural vegetation has been replaced by crop plants, specific fauna disappeared, and non-arable portions were processed in industrial areas or pastures. During heavy rains, the flood plain wetlands of the Danube offered large water overflow space.

Between 1964 and 1966, a total of 53 enclosures in the Danube Meadow on an area of 432,000 ha out of a total of 570,000 hectares were dammed for 1,200 kilometers for agricultural cultures in protected areas. Overall, 80% of the floodplain area of the Danube has been hampered to practice agriculture.

Following a very large human and financial effort, in the late 1970's and early 1980's flood defense works were commissioned, totaling 1181 km of Danube dikes and 1080 Km of inland rivers, plus the agricultural enclosures dams and 143 flood mitigation dams.

Water consumption

As shown before, priorities outlined in the Water Management Act (industry, agriculture, population, other destinations) are reflected in the extraction and consumption of water.

Although there is no reliable data on water consumption in the command economy, we can get an idea of this if we analyze water consumption in 1990. Although 1990 is not characteristic for the communist period, because industrial and agricultural production had fallen and drinking water supplies reached their maximum, the water consumption situation was the one presented in Table 3.

In 1990, a total water consumption of 20.4 billion cubic meters was distributed, out of which: 11.02% for domestic use, while industry and agriculture consumed almost equal amounts of water (44%). It can be estimated that in the 80's the water consumption exceeded the level of 20 billion cubic meters, most of which was consumed in industry and agriculture.

After 1990, water consumption has dropped drastically in Romania. At the level of 2011, the water requirement in Romania decreased by 12.7 billion cubic meters of water compared to 1990, from 20.4 billion cubic meters of water (as it was in 1990) to 7.7 billion cubic meters of water (as it was recorded in 2010). All users (industry, agriculture, population) recorded significant reduction in water consumption.

Table 3. Water consumption in 1990 and 2011 (billion cubic meters)

Year	MU	Population	Agriculture	Industry	Total
1990	Billion mc	2,3	9,1	9,1	20,4
	%	11,02	44,59	44,39	100
2011	Billion mc	1,2	1,3	5,2	7,7
	%	15,58	16,88	67,53	100

Source: ANAR, www.rowater.ro.

Conclusions

During the command economy there have been some changes in the water sector. First, water is no longer public good, but it belongs to all people, being owned by the state. This confusing formulation was one of the causes that led to the waste and degradation of water resources in Romania. Water has been regarded mainly as a production factor with priority being given to industry and agriculture.

In agriculture, the absence of any economic mechanism of water use, despite massive investments and subsidizing of electricity and water, led to lack of irrigation for more than 3 million hectares of agricultural land with irrigation installation in place.

In industry, as a result of the electrification program, many hydroelectric installations have been built on the most of rivers and the contribution of renewable energy to the national electricity demand has been increased. The financial effort was extremely high, but reference to investment cost for hydroelectric plants for Romania (Iron Gates, Bicaz,

Vidraru, etc.) are scarce. The negative effects of dams were related to the lack of concerns about maintaining and protecting biodiversity. The way the dams were built, it did not allow the fish to migrate.

In the case of water supply and sewerage, we can see great efforts of quantitative growth of the water supply network, but not of the sewerage network which has been completely neglected. The major issues of water and sanitation in Romania at the end of the communist period, were the next: insufficient or damaged infrastructure in urban areas, almost nonexistent in rural areas; inappropriate maintenance and operation services; non-invoiced of large water volumes caused by network leakage; low billing, lack of individual metering; lack of funds for infrastructure rehabilitation investments; lack of experienced staff to promote and manage large investments; inadequate institutional framework.

During the command economy, the trend of over-damming and draining of large areas from the Danube meadow was promoted, which had a number of negative effects on the protection of floods and fish resources.

Flood protection and massive drainage to obtain arable land continued the interwar period and drainage policy and did not provide the necessary protection despite the huge amounts invested. On the contrary, ecosystems and incomes that could be obtained from ecosystem services, fishing, etc. were lost and the flood risk was not diminished.

The following table summarizes the main features of the domain, between 1945-1989.

Sub-domains	Features of the period 1946-1989
Juridical Status	Waters are goods of the whole nation in state ownership
Legislation	Water laws and mode of operation and management
Institutions	Ministry, National Water Council, basin management
Investments	Large-scale investments for water management; all the dams in operation today have been completed in that period.
Water consumption	Water consumption reaches maximum values of over 20 billion cubic meters or 2,65 times higher than in 2011.
Water supply	At the end of the period (1990) over 260 cities had water supply systems and 235 of them had sewerage systems. In rural areas, sewerage covered less than 5% of the population. High water consumption (approx. 350-400 l/person/day) and losses of over 40%.
Irrigations	Written statistics reached 3.1 million ha of irrigated agricultural land but this area was not fully irrigated. Large losses and poor yields of irrigation systems.
Industry	Most of the hydro potential is reached. Complex water management constructions
Flood protection	Large-scale flood protection works, drainage, coastal erosion protection, etc.
Ecology, pollution	Significant industrial and agricultural pollution, lack of containment and pollution reduction facilities, lack of sewerage (especially in villages, lack of fish ladders to allow fish migration..

Annexes

Annex 1. Romania water resources in 2016

Water source/Characteristic Indicator	Total thou mc
A. Inland rivers	
1. Theoretical resource	40,000,000
2. Existing resource according to the degree of river basin management *	13,679,121
3. Requirement of water for use, according to capacities in operation	3,226,333
B. Danube (Direct)	
1. Theoretical resource (in section when entering the country)**	85,000,000
2. Resource usable under current arrangement	20,000,000
3. Water demand for uses according to capacities in operation ***	28,211,179
C. Underground	
1. Theoretical resource, out of which:	9,600,000
- groundwater	4,700,000
- deep water resource	4,900,000
2. Usable resource	4,667,639
3. Water demand for uses according to capacities in operation	644,158
D. Black Sea	
Water demand for uses according to capacities in operation	11,863
Total Resources	
1. Theoretical resource	134,600,000
2. Resource usable under current arrangement	38,346,760
3. Water demand for uses according to capacities in operation	6,703,534

Source: Synthesis of water quality in Romania in 2015 (extras), ANAR, 2016.

Note: * It also includes the network of coastal lakes as well as the resource provided by direct external reuse along the river; ** ½ of the multiannual average stock on entry into the country; *** including volumes transferred to the Seaside.

References

- Iancu A. (coord.), (2003), *Dezvoltarea economica a României*, Editura Academiei Române, ISBN: 973-27-1041-1.
- Ielenicz M., (2007), *România. Geografie fizică*, Editura Universitară, ISBN: 978-973-749-190-9.
- xxx - ANRM, (2014), *Strategia Energetică Națională pentru perioada 2015-2035 și perspective pentru 2050*, decembrie 2014.
- Platon V., Constantinescu A., (2018), *Water Resource In Romania Between 1st and 2nd World War (1918-1940)*, ESPERA 2018, Bucuresti, Ed. Springer, 2018.

- Platon V., Frone S., Constantinescu A., (2018), *Challenges and Innovations to Sustainable Forest Management, Caring and Sharing: The Cultural Heritage Environment as an Agent for Change*, Springer.
- Platon V., Constantinescu A., Frone S., (2015), *New developments in assessing forest ecosystem services in Romania*, *Procedia Economics and Finance* 22, 45-54.
- xxx - Sinteza calității apelor din România în anul 2015 (extras), ANAR, 2016.
- xxx - Anuarul Statistic al Republicii Socialiste România, 1979, 1983, 1990, Direcția Centrală de Statistică, București.
- xxx - Anuarul statistic al României, 1948, Direcția de Statistică, București.
- xxx - Anuarul Statistic al României, 2016, Direcția Centrală de Statistică, București.
- xxx - Constituția Republicii Populare Române din 1948, Textul actului publicat în M. Of. nr. 87 bis/13 aprilie 1948.
- xxx - Universitatea București, Institutul de Geografie, Geografia României, vol. II *Geografia umană și economică*, Editura Academiei RSR, 1984.
- xxx - Constituția Republicii Socialiste România din 1965, Textul actului republicat în Buletinul Oficial nr. 65/29 octombrie 1986, Art. 7.
- xxx - Legea nr. 5/1972 privind gospodărirea apelor în Republica Socialistă România, text publicat în Monitorul Oficial al României, 24.05.1972.
- xxx - Congresul al X-lea al Partidului Comunist Român, 6 - 12 august 1969, Raportul tovarășului Nicolae Ceaușescu, Editura Politică, București, 1969.
- xxx - Ministerul Agriculturii, Pădurilor și Dezvoltării Rurale, Banca Mondiala, *Proiect de reabilitare și reformă a irigațiilor, Analiza Economica a Sectorului de Irigații*, Raport Final, mai 2009.
- xxx - Romania, Ministerul Agriculturii și Dezvoltării Rurale, *Proiectul de Reabilitare și Reformă a Sectorului de Irigații, Strategia Investițiilor în Sectorul Irigațiilor*, Fidman Merk at., București, ianuarie 2011.
- xxx - ANAR, www.rowater.ro
- xxx - <http://www.romanioliberal.ro/actualitate/eveniment/document-top-secret-din-arhiva-cia-despre-inundatiile-devastatoare-din-romania--438604>
- xxx - <http://romgeoo.blogspot.ro/2012/01/apelle-din-romania.html>
- xxx - <http://www.creeaza.com/legislatie/administratie/ecologie-mediu/VIITURI-ȘI-INUNDATII293.php>
- xxx - <http://agrointel.ro/41778/se-mai-pot-salva-sistemele-de-irigatii-construite-in-comunism-aurel-lup-are-raspunsul/>