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# GREEN POLICIES TO INCREASE CLIMATE RESILIENCE AND WATER SECURITY FOR RURAL DEVELOPMENT

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***Abstract***

*The paper aimed to present the research results on some environmental challenges and priorities of climate resilience. The research work was carried out in 2021 and referred to the analysis of the transcendence character corresponding to the environmental policies according to the strategic guidelines of recovery and resilience for sustainable development and green transition. Although sustainable development of the Romanian water sector has been approached in the past, the present paper has new research related to the water security and its role in building the climate resilience of agriculture and rural development in the European Union and our country. From a methodological view, there are used accumulations and outcomes from the specialty literature, from previous researches, the own data processing in figures and tables to describe some conceptual relationships, comparative analyses of the developmental state and the climatic vulnerability of the Romanian water infrastructure sector. The conclusions and recommendations highlight backlogs, needs and opportunities in the context of implementing the European Green Deal and the National Recovery and Resilience Plan.*

***Key words*****:** *climate change, resilience, water security, irrigation, adaptation*

## INTRODUCTION

The Covid-19 pandemic humanity has been facing since 2020, poses an unprecedented threat to sustainable development, especially in terms of social and economic pillars.
It is inextricably intertwined with global environmental issues such as biodiversity loss, climate change, air and water pollution and waste management, both in terms of its origin and the implications for environmental outcomes and the future well-being of societies around the world.
The policies and recovery plans currently in place aim to create a recovery that is both green and inclusive. A policy of sustainable recovery is defined by its dual potential to create activities or opportunities for income, jobs and growth and, at the same time, to accelerate the process of achieving medium- and long-term environmental objectives, both at national and global level.
The main objective of research conducted in 2021 is analysis of the transcendence character corresponding to environmental investments according to the strategic guidelines for recovery and resilience for sustainable development in Romania and in the EU.
In order to have an approach of both theoretical and practical synthesis and transcendence, based on accumulations and analyses from the past, the present research will refer to the challenges and perspectives of sustainable and resilient development in the water sector, considered both from an ecological and economic-social point of view.

## MATERIALS AND METHODS

From a methodological point of view, the following methods, tools and procedures shall be used:
-accumulations and outcomes from the specialized literature:
-results from previous research;
-own data processing, figures and tables to describe conceptual relationships;
-static and dynamic comparative analyses on the development status and climatic

vulnerability of the Romanian agricultural water security.

The period analysed in this study was 2007-2020, that is after the accession of Romania in the European Union.

The main data sources are:

-The Eurostat database [10];

-The database Tempo online database published by the INSSE (National Institute of Statistics and Economic Studies) [23];

-The relevant statistical publications on the topics approached by the United Nations, IPCC, INSSE and Eurostat [21, 23].

## RESULTS AND DISCUSSIONS

### Climate resilience - conceptual framework

Although for about 3 decades they have been analysing and building on the global, European and national levels [11], past policies and strategies on sustainable development have failed to achieve the objectives (e.g., SDGs of the UN 2030 Agenda). A reason may be insufficient awareness and addressing of the resilience of sustainable development to climate change (CC).

The joint of an economic, environmental and recent health crisis has considerably increased the sense of vulnerability at all levels, stimulating the search for new ways to assert resilience, since the integrated approach to sustainable development cantered on the concept of resilience can increase the understanding of the forces influencing both the scope and the conceptual frameworks of measures and policies [4].

The water sector, to be considered both from an ecological point of view, respectively through the available water resources but also from an economic point of view, through the way of managing and efficient use of these resources, it is of essential importance both for sustainable development and for resilience [9].

Next are resumed, presented and analysed some important concepts for any sustainable development and resilience strategy (in this case, for the water sector). These are: Water security, Hazard, Vulnerability, Resilience.

### Water security

Improving water security is essential to achieve environmental protection, economic growth, poverty reduction and public health. Water security is often presented as a predominantly technical challenge, but the decisions that define it are deeply political. Often, the risks to the poor are not even identified, not addressed.

Improving water security requires managing complex and competing water risks to deliver sustainable and equitable results for all. For our research, it is essential to consider the water system beyond hydrology and infrastructure to include the social and political factors that influence institutions and governance [17].

### Hazard

Hazard is a phenomenon with the potential to cause damage. A water-related hazard can arise as a result of a "natural" event, such as a tsunami or extreme climate, a "human" threat caused, such as weak governance or financial instability, or a "hybrid" phenomenon resulting from natural and human interactions [26].

### Vulnerability

Vulnerability is the tendency to experience injury as a dynamic function of the ability to anticipate, cope and recover from harmful events. The approach to vulnerability is based on different disciplines, following these principles:

-Vulnerability is dynamic and placed within the broader framework of political economy, historical heritage, social norms and power relations. It should be viewed within the complex system, along with physical exposure to hazard, as well as the ability to cope with individuals, social groups and ecosystems on different scales [13];

-It involves particular forms of activity and agency [27].

### Resilience

Resilience theory is a useful concept to define persistent and emerging threats to the water system. Resilience to climate change is the process of including climate hazards and vulnerability in decisions. Resilience to climate change strengthens society's inherent capacity to mitigate, prepare for and adapt to

climate hazard risks, changing the patterns in terms of climate hazards and variability for all.

In order to strengthen climate resilience in water systems, it is imperative to understand regional climate processes and risks related to climate change, existing socio-ecological resilience, community adaptation strategies and policy processes, to strengthen the capacity to integrate climate information into water policy and practice.

As will be analysed, further for the case of Romania, obtaining and maintaining the water security in the negative context of the CC now doubled by the Covid-19 health crisis is an urgent requirement, but also a great challenge. Achieving the objective of water security was already a difficult but a vital problem of sustainable development, since in addition to the meteorological variation of the water cycle, there are many areas that compete for finite water resources. In addition, water pollution through the discharge of insufficiently treated domestic or industrial wastewater will reduce the amount of water for consumption [14].

A new approach or addition to water security has been imposed with the increasingly clear manifestation and awareness of climate change, as: "Water is the basic environment through which climate change (CC) will have an impact on people, ecosystems and economies" [30].

That is why, in the activity of water management, it is necessary to achieve adaptation to climate change as soon as possible, and water is a problem but may become a factor for solving or adapting to CC. So sustainable water management is a factor in climate resilience.

Not only does the average temperature rise, but CC brings multiple different changes in various regions that increase with subsequent warming. For example: CC intensifies the water cycle. This brings more intense rainfall and associated flooding, as well as more severe drought in many regions; CC affects precipitation patterns. At high latitudes, precipitation is likely to increase, while it is estimated to decrease for much of the subtropics, along with changes in monsoon rainfall [20].

Resilience to CC is the capacity to consider climate hazards and vulnerability in all policies. Resilience to climate change fosters the ability of the society to expect and mitigate climate hazards risks, changing the behaviour in terms of climate hazards and variability for all [25].

For the increase of the climate resilience in the water systems, it is necessary to acknowledge the regional climate hazards and vulnerability related to climate change, the socio-ecological resilience, adaptation strategies and policies, eventually integrating climate information in the water policy and practice.

**Challenges regarding water security and climate resilience in Romania**

Undoubtedly, Romania, like the entire European Union, is currently facing climate change and environmental degradation at the same time. These dual challenges require coherent national and European policies for sustainability.

Romania is among the EU countries that are most exposed to large-scale floods, since about 13% of our country's surface is represented by floodplains.

Between 2002 and 2020, unfortunately in our country there were a significant number of deaths and relatively many homes damaged or destroyed due to floods.

Extreme phenomena are more and more being felt in the last 20 years. For example, Romania was hit by significant floods in 2005 (high material damage and 76 deaths), but then in 2007 there was a serious drought. The impact of these disastrous weather events was represented by significant economic damage, especially in the agricultural, transport, energy and water management sectors.

Without climate change policies, the climate will change quite a lot in Romania in 50-100 years, which will cause a decrease of about 8-10 percent of GDP per capita in Romania by 2100. (European Semester - Romania country report 2020).

The total potential quantity in Romania's surface waters is 127 bn $m^3$/year, of which:

-internal river basins contribute 30 bn $m^3$;

-about 87 bn $m^3$ are available from the Danube basin;
-and the groundwater adding a potential quantity of 10 bn $m^3$ per year.
However, the part of the total water resources (surface and underground) that can be used, given by the existing water extraction and use capacity, is only 40 bn $m^3$/year (at a total demand of 8 bn $m^3$/year).
For the current population of about 19 million loc., the average available volume is over 2,000 $m^3$/inhabitant/year, so it is higher than the threshold defined for water stress (1,700$m^3$/inhabitant /year), but it is lower than the average in Europe (about 4,500$m^3$/ inhabitant/year).
This highlights the need for judicious management in the conservation and sustainable development of the Romanian water resource. In addition, there is a geo-meteorological specificity that makes available water resources to show great differences from year to year. Unfortunately, in the driest years, the available water resource has dropped by half, so only 20 bn m3/year.
On the other hand, there is also the important territorial variation of the waters in Romania, where some hydrographic basins (such as Argeș-Vedea, Buzău-Ialomița, Siret and Dobrogea-Litoral) sometimes face large water deficits.
Currently (2020) the demand for water is based on the use of the municipality or population (about 33%), in agriculture (about 48%) and industry (about 12%). Water consumption has been steadily reduced since the 1990s, due to structural changes, through:
-reduction of industrial production;
-the abandonment of economically unprofitable irrigation systems;
-introducing metering and tariffs for the supply of domestic water and reducing of losses in the system.
Thus, the general water consumption has decreased drastically since 1990 – from 20.4 (close to the country's current usable resource) to about 7 billion $m^3$ per year, for all uses (population, industry and irrigation) – registering the largest decrease in water abstraction in that period among all the 13 new entrants to the EU.
It seems that the drastic reduction of the water demand represented a temporary relaxation in the management of water resources, thus from a quantitative point of view, in Romania there is a certain hydrological security, threatened nevertheless by climate changes [31].
Thus, in order to strengthen climate resilience in the management of water resources, it is necessary to raise awareness of some of the hazards and vulnerabilities, as well as of the still high investment need for the sector. They are own summaries based on the report Rapid assessment of integrated water resources, the Agreement for consultancy services concluded between the Ministry of Environment and Climate Change and the International Bank for Reconstruction and Development, Project co-financed by FERD.
These climate water issues are primarily:
**Flooding**. Unfortunately, in Romania, a large area of the territory is floodable, respectively over 1 million ha. Important investments have been made for a specific defence infrastructure (dams of over 9,000 km, regularization of water courses of over 6,000 km, more than 1,200 storage lakes). Still, floods occur almost annually and their severity seems to be increasing. The investments of infrastructure work necessary for flood management amount to about. 17 bn. €. [15].
**Flash floods**: they are different from floods in that they are large-scale and shorter-lived overflows of water. In Romania, they have manifested themselves more and more frequently, under the influence of climate change that has led to extreme weather events such as very heavy rains. In addition, the scale of the floods is enhanced by the massive deforestation of recent decades.
If for floods, there are warning systems that can ensure the early warning of events (even 48 hours before) the anticipation time for the waters in the mountains that are exposed to floods is only 2 hours, so that downstream localities are vulnerable to risks. To increase the warning time interval to at least 5 hours, important investments are needed to modernize radars for precipitation intensity

and capacity increases at regional flood forecasting centres.

**Droughts:** due to the increase in temperature and a decrease in the flow of rivers the frequency of occurrence of droughts has risen. Although the National Meteorological Administration owns 55 agronomic tracking stations throughout making forecasts of up to 3 months on the degree of moisture in the soil, these provisions are not sufficiently seconded by other agronomic services for farmers to manage drought conditions.

Some studies forecast that in southern Europe the annual average rainfall will decrease by 5 to 20% in southern Europe and the Mediterranean in the period 2071- 2100, compared to the average reported between 1961 and 1990. Corresponding to these changes in precipitation, the annual flows of the rivers in the north will increase but decrease to those in the south, a trend that will manifest itself more and more intensely in the future. According to the European Commission, "the extreme droughts in Central and Western Europe in 2018, 2019 and 2020 caused considerable damage. [...] With global warming of 3°C, droughts occur twice as often and, absolutely, the annual losses caused by drought in Europe would increase to EUR 40 billion per year ...'. (COM (2021) 82 final) [3] Romania's agricultural sector is facing the inevitable effects of climate change. A significant change in Romania's temperate-continental climate is expected in the coming decades, especially an increase in the annual average air temperature and a decrease in the annual amount of precipitation, on average by 10- 20%. This sector is most vulnerable to the impact of floods, droughts or other adverse events, as extreme weather events will lead to an increase in variability in agricultural production, food prices and farmers' incomes.

Previous studies have highlighted the fact that the climate vulnerability in Romania, including the one regarding the water security, has regional specificity so areas with a very high risk of drought are in the plains of Oltenia, Bărăgan and in the Moldavian Plateau. The main vulnerability is that of the decrease in agricultural productivity, generated especially by the insufficient security of the waters, respectively by the exposure to drought and desertification. [12].

Latest data on the agricultural exploitation in Romania from the National Institute of Statistics show that according to the provisional results of the General Agricultural Census (2020), the utilized agricultural area (UAA) was 12,763 thousand ha. In the last ten years, since the General Agricultural Census of 2010, the agricultural area has decreased by 543 thousand ha (4.1%). In 2020, arable land and permanent crops increased by 258 thousand ha (3.1%), respectively by 32 thousand (10.4%), while the area with pastures and meadows decreased by 783 thousand ha (Table 1).

Table 1. The main categories of utilized agricultural area in Romania (Thousand ha, %)

| | 2010 | | 2020 | |
|---|---|---|---|---|
| | Thou. ha | % | Thou. ha | % |
| Arable land, including greenhouses and solariums | 8,306 | 62.4 | 8,571 | 67.2 |
| Pastures and meadows | 4,506 | 33.9 | 3,724 | 29.2 |
| Permanent crops | 312 | 2.3 | 344 | 2.7 |
| Family gardens | 182 | 1.4 | 124 | 1.0 |
| Utilized Agricultural Area (UAA) | 13,306 | 100.0 | 12,763 | 100.0 |

Source: Own computations of data from the NIS, accessed March 2022 [23].

In the structure of the agricultural area, the share of arable land was 67.2%, which indicates an increase of 4.8 percentage points compared to 2010, the share of pastures and meadows was 29.2% down by 4.7 percentage points, while the area of permanent crops had a share of 2.7%, increasing by 0.4 percentage points.

Given the duration of droughts from one to several months, there is high volatility in crop production in the most vulnerable regions and with insufficient infrastructure or adaptation measures; due to food chains, the entire agricultural production, not just the vegetable one, will be affected, with undesirable consequences for the supply or even the food security of the national economy [16].

In the latest IPCC report the chapter on the effects of global warming in Europe signals

that Europe will warm up more than the rest of the world and southern Europe in particular will have to deal with drought [21].

There is still a significant challenge of climate change adaptation because a significant part of Romania's agricultural area experiences the negative effects of drought, insufficient water reserves and poorly functioning irrigation facilities. The absence or the high degree of degradation of the irrigation infrastructure made that approximately 48% of the total agricultural area (7.1 million ha) is affected by these CC phenomena.

Indeed, according to our own computations, as based on data from the National Statistical Institute database (Tempo-on-line) [23], the trend of nonfunction of irrigation systems in Romania has continued, so that in the period 2007-2020, (Figure 1) the share of the actually-irrigated agricultural area (at least one watering) was less than 15%.

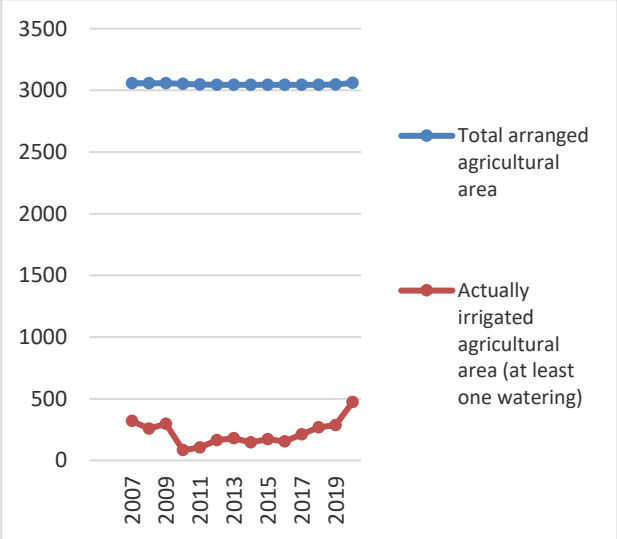


Fig. 1. Total arranged and actually irrigated agricultural areas in Romania (Thousand ha), 2007-2020
Source: Authors' own research.

However, the total amount of water abstracted by agriculture (including forestry and fishing) in Romania, although representing about 20% of the total water abstraction in Romania, is quite important, amounting to a volume of about 1,500 million cubic meters/year, which is since 2012 quite similar or even more than the amount of water abstraction for the very activity of public water collection, treatment and supply (Figure 2).

It is obvious that currently, although the risk of drought is high, the old irrigation facilities generate a high consumption of water and energy, which has a negative impact on the water reserves of Romania.

The country is classified in the category of countries with low water reserves (the average amount of water available per inhabitant is 2,660 $m^3$ water/person/year, including the Danube, just over half of the European average 4,230 $m^3$ water/person/year) [31].

In Romania, the irrigation facilities are at an advanced stage of degradation and on 75% of the area of these facilities, irrigation is not functional. The functional irrigation facilities are inefficient in terms of water and energy consumption and too costly for farmers.

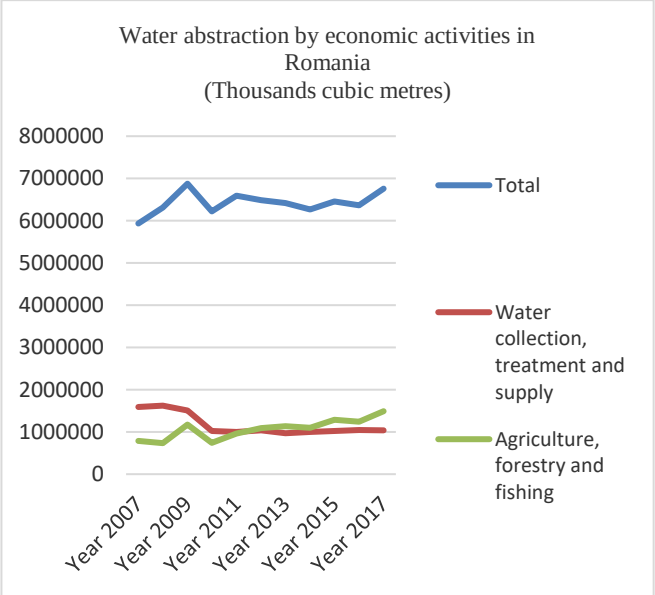


Fig. 2. Evolution of share of water abstracted, by sectors and economic activities in Romania, 2007-2017
Source: Authors' own research.

## Policies on agricultural water security and climate resilience in the EU

Romania is very keen to benefit of the European Structural and Investment Funding and other available financial instruments to at least rehabilitate the existing irrigation infrastructure. However, to implement the European Green Deal and the sustainable development strategy, the European Commission has become particularly attentive to the integration of all environmental and climate resilience considerations into

absolutely all sectoral and structural investment policies and programs [8, 2, 24].

Nevertheless, irrigation has a high potential impact on regional hydrology and water management [7].

Thus, it is increasingly important to balance the benefits of irrigation water abstraction to increase crop production against the negative environmental impacts and water demands from other sectors, such as public water supply and sanitation, or energy production [32].

In fact, the EU has many policies in place to improve water safety by ensuring the quality and quantity of water (the Urban Waste Water Treatment Directive and the Nitrates Directive) since 1991. In 2000, the Water Framework Directive (EC/60/2000) introduced policies that promote an ecosystem approach to water management.

Unfortunately, by now, the Common Agricultural Policy (CAP) has not been particularly effective in promoting the sustainable use of water in agriculture, since ”CAP income support does not promote efficient water use or water retention” [6].

Besides, climate change studies suggests that: “Drought leads to the construction of more irrigation systems, but those systems attract new agriculture. As a result, water demand continues to increase, while less and less water is available. That is why irrigation is not a sustainable investment” [21].

The further analysis made by the European Commission on the effects of the CAP on water has identified several issues, especially related to irrigation support, as to guarantee that supported investment will not rise pressure on water resources with the irrigated area increase. For instance, there are some conflicts to be solved:

-sectors with high impact on the water quality and quantity (fruits, wine) are not always eligible for direct payments thus not subject to corresponding greening criteria;

-greening practices do not apply on permanent crops;

-support for water-related practices may be contrary to climate objectives (support to irrigated sectors in areas where water resources are already overexploited). (EC-DGARD, 2020).

The Common Agricultural Policy has among its objectives the sustainable management of natural resources (including water) in the period 2014-2020 but also post-2020.

In addition, the application of the rules of the "Do No Significant Harm" (DNSH) analysis and taxonomy regulation to all investment and development measures financed in the future by the EC strongly penalizes projects that although they have positive effects for a certain area may have a negative impact on another environmental factor.

One of the biggest projects that Romania has tried unsuccessfully to impose in the National Plan of Recovery and Resilience (PNRR) is that of irrigation. The project was rejected because the Romanian authorities, namely the Ministry of Agriculture, failed to prove to the Commission that it does not endanger Romania's natural water resources.

In the initial version of PNRR (the National Plan of Recovery and Resilience, in the form subjected to informal discussions of European and Romanian experts), Romania proposed to allocate 2 billion euros for the restoration of the national irrigation system in the southern area of the country, an area that, under the effect of climate change, registers the decrease of the water reserve in the soil [22].

Nevertheless, there are some EAFRD-funded investments aimed at adapting to climate change to modernize secondary irrigation infrastructure; 463 contracts are financed, out of which 69 contracts transferred from the NRDP 2007 - 2013 to the NRDP 2014 - 2020. [28].

It is also important to know that by rural development policies and projects the national or regional authorities may support:

-agricultural practices or green infrastructure with a positive effect on water availability in agricultural soils (water retention measures, applied in Belgium Flanders, Spain, Hungary, Italy and Portugal;

-the farmers for the additional costs and lost income stemming from implementing WFD requirements (policy not applied yet in any EU member state ;

-waste water treatment plants or networks for water reuse in irrigation, this being already implemented in Cyprus and Belgium [6].
In order to comply with the Water Framework Directive (EC/60/2000) the green irrigation projects that may be funded under the European AFRD should comply with the conditions and criteria described in Figure 3.

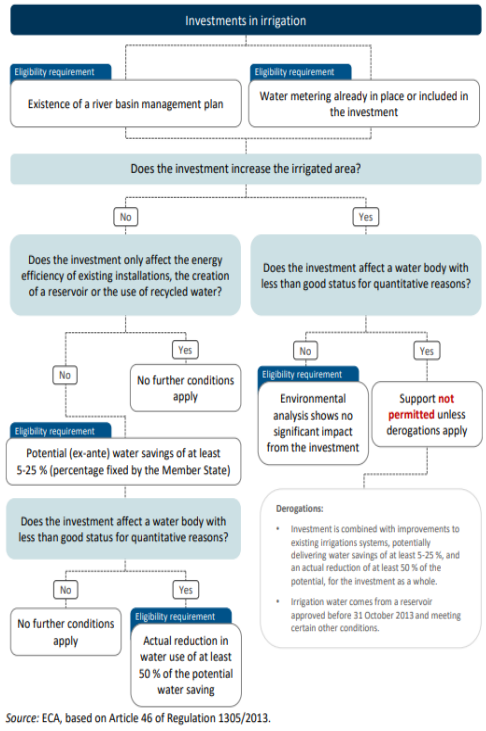


Fig. 3. Conditions for irrigation projects under rural development
Source: [6].

The most advanced trend analysed [12, 16] is that for transition to a green economy (circular), investments in water security systems (WSS networks, including wastewater treatment plants and irrigation facilities) in Romania are of crucial importance.
Properly treated wastewater can be reused for a variety of applications: aquaculture, industry, irrigation, reuse in residential areas, for recreation and swimming, or regeneration of water resources [19].
The reuse of treated wastewater is a practice that is part of the circular economy. According to a study carried out in 2015 for the Commission, around 100 million m³ of waste water is reused annually in the EU in the EU (equivalent to around 0.4% of annual freshwater abstractions in the EU)) [1].
In May 2020, the EU adopted a regulation on the reuse of waste water for agricultural irrigation. It sets minimum requirements on water quality, monitoring, risk management and transparency and will apply from June 2023 [29].
The Regulation (EU) 2020/741 will allow for the reuse of 'more than 50% of the total volume of water theoretically available for irrigation from EU waste water treatment plants and could avoid more than 5% of direct abstractions from water bodies and groundwater, which would overall lead to a reduction of more than 5% in the water stress'.
The CAP can finance water treatment infrastructure that could enable waste water reuse for irrigation [5].

## CONCLUSIONS

Climate change is a long-term crisis and has a particularly severe impact on the countries in the southern part of the Eastern and Central European region, including Romania. This research has emphasized some water security and climate resilience vulnerabilities .
The conclusions are not yet too optimistic, since there are quite obvious issues and challenges of climate change adaptation.
Water security and, implicitly, climate resilience are still relatively fragile or insufficient in Romania, due to the increased vulnerability to drought or floods, but also to the almost perpetual deficit of water/ wastewater including irrigation infrastructure.
Still important investments are needed in Romania for water infrastructure, but also for strengthening the capacity for sustainable water management.
A paradigm shift in water policy is also needed, not only to prevent environmental pollution, but to emphasize that wastewater is a resource (of water and nutrients for agricultural use) whose effective management is essential for future water security.
Although Romania lost the minimum 2 billion. euro for irrigation investments required in the National Plan for Recovery and Resilience (PNRR), a rehabilitation of the

main and secondary channels, is one of the investment priorities of the sector according to the representatives of the companies in the field. The needs are obvious since in 2020 the drought affected one fifth of the areas cultivated with cereals (over one million ha, out of about five million ha cultivated), being effectively irrigated only about 500 thousand ha (less than 20%).

Currently, there is quite a lack of integration of water policies with other sectors, strategies and plans, for example, water and land use management. It is important to be aware that the plans to relaunch the economy do not aim to bring back the previous status quo, but look to the future, to the improvement of water security, climate resilience and transcendence.

Although in the National Reform Program 2021 there are useful and welcome strategic measures to adapt the agricultural sector in Romania to the CC, in the future it will be possible to achieve and obtain more investment grants, including from the CAP or private financing for the irrigation infrastructure in Romania only if and to the extent that these projects will be truly "green" and/or integrated with the national network of water and wastewater infrastructure, in order to promote the transition to circular economy and comply with the taxonomy regulation or the DNSH (Do No Significant Harm) principle.

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