

PECULIARITIES OF FRESHWATER RESOURCES MANAGEMENT: NATIONAL AND EUROPEAN EXPERIENCE AND CURRENT TRENDS

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Abstract. *The subject* of the study is the current features of freshwater management in European countries and experience for Ukraine. *Methodology.* The study used general scientific methods, in particular: theoretical generalization; methods of positive and normative analysis and statistical analysis. The *goal* is to study the European experience in freshwater management and adapt it for Ukraine. *Research conclusion.* An analysis of the water supply of European households has been carried out and it has been found that there is no "water stress" under such conditions. However, with the global water scarcity resulting from population growth and urbanization, particularly tourism, in recent years, negative factors have particularly affected water use in small Mediterranean islands and in densely populated areas. To stabilize this situation, EU member states have been asked to report on each of the monitoring stations that have been removed from their monitoring network, the reason for such removal and the alternative stations installed in case of persistent pollution. It was found that trends can be calculated for 83% of groundwater stations (so far only 20% in Sweden) and 75% of surface water stations (but less than 50% for Greece, Hungary, Latvia, Malta, Slovakia and Sweden). The importance of freshwater and seawater remediation measures by EU Member States under Directive 24 to reduce the impact of eutrophication caused by nitrates or phosphorus is stressed. It was found that European integration strategies in the field of environmental protection are characterized by improving water quality and water management; environmental management and integration of environmental policies; ensuring air quality; waste management; reducing the use of genetically modified organisms. It is justified that to assess the effectiveness of the implementation of the environmental component (natural environment) in the Association Agreement, the authors will analyze Ukraine on the index of environmental performance (The Environmental Performance Index), which provides a quantitative basis for comparison, analysis and understanding of environmental indicators in 180 countries.

Key words: freshwater resources, management, European experience, Index of ecological efficiency.

JEL Classification: O13, O32, Q28

1. Introduction

Today, the prospect of water resources management, underlying the main strategic components of state water policy, is the introduction of an integrated water resources management system based on the basin principle, which meets the requirements of the EU Water Framework Directive (EU Water Framework Directive 2000/60/EC, 2006). Such a mechanism for water resources management is reflected in the Laws of Ukraine "On the Basic Principles (Strategy) of State Environmental Policy

until 2020" and "On the National Target Program of development of water and environmental improvement of the Dnieper River basin until 2021" (Law of Ukraine, 2012).

According to the Association Agreement between Ukraine and the European Union, Ukraine undertakes to bring its legislation closer to the EU legislation within the deadline from the date of entry into force of the Agreement (November 1, 2014) (Association Agreement between Ukraine..., 2021), on the one hand, and the European Union and its member states.

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Therefore, under such conditions there is a need to study general trends and peculiarities of freshwater management in Europe and Ukraine.

The Nitrates Directive requires Member States to develop and implement appropriate monitoring programs to assess the effectiveness of action programs. It sets out basic principles and criteria for water monitoring, but aspects such as the density of the monitoring network, stability and sampling frequency remain the responsibility of the Member States.

Despite the abundance of renewable water in Europe, signals from long-term climate and hydrological assessments, including population dynamics, show that between 1960 and 2010, Europe experienced a 24% decrease in per capita renewable water, especially among southern European populations.

At the same time, the Ministry of Environmental Protection and Natural Resources of Ukraine presented measures and strategies for European integration in the field of environmental protection. Strategies of European integration in the field of environmental protection are characterized by improvement of water quality and water management; environmental management and integration of environmental policy; ensuring air quality; waste management; and reduction of use of genetically modified organisms.

So, the purpose of the article is to study the European experience of freshwater management and adapt it for Ukraine.

2. European experience in freshwater management

Densely populated river basins in various parts of Europe, corresponding to 11% of Europe's total area, continue to be hotbeds of water stress, with 86 million inhabitants living in these areas in the summer of 2014. About 40% of the inhabitants of the Mediterranean region lived under water stress in the summer of 2014. Groundwater and river resources continue to suffer from overexploitation in many parts of Europe, especially in the basins of western and eastern Europe. On the positive side, water withdrawals decreased by about 7% from 2002 to 2014 (Indicator Assessment, 2021).

The agricultural area of the EU covers about 47% of the total area of the EU27 + the UK. From 2010 to 2019, agricultural production increased by 14.5%. It is estimated that livestock production is responsible for 81% of agricultural nitrogen entering water systems and 87% of ammonia from agricultural emissions into the atmosphere (Report from the Commission to the Council and the European Parliament..., 2021).

In Europe, the average per capita household water supply is about 102 l/person/day, which means that there is no "water stress. However, water stress conditions created by population growth and urbanization, especially tourism, have particularly affected small Mediterranean islands and densely populated areas in recent years.

The Commission's Joint Research Center has developed an online viewer that provides access to reporting data under the Nitrates Directive. Regional and even individual station water quality reports are available, as well as agricultural data.

For the first time, Member States were asked to report each monitoring station that was removed from their monitoring network, the reason for such removal and the alternative stations installed in case of permanent pollution. Over the last two reporting periods, trends could be calculated for 83% of groundwater monitoring stations (so far only 20% in Sweden) and 75% of surface water monitoring stations (but less than 50% for Greece, Hungary, Latvia, Malta, Slovakia and Sweden).

Regarding saltwater, it is a welcome development that the sharp 29% reduction in the total number of monitoring stations observed between 2008 and 2015 has been partially corrected by additional stations. Unfortunately, however, the number of saltwater monitoring stations remains relatively low in some Member States. Saltwater monitoring is very important to determine marine pollution and impacts on marine biodiversity.

From 2016 to 2019, 14.1% of groundwater stations still exceeded an average of 50 mg of nitrate per liter, which is comparable to the previous reporting period, when 13.2% of stations exceeded 50 mg/L.

Data on nitrate concentrations at EU level show that groundwater quality has improved since the Directive was adopted, but further improvement has been very slow since 2012. This can be interpreted as the low-hanging fruit that has already been harvested, and now more extensive measures are needed to improve the positive trend. A large percentage of groundwater monitoring stations still show levels exceeding the maximum 50 mg nitrate/L in Malta, Germany, Luxembourg, Spain, Portugal, and Belgium (Flanders region) (Report from the Commission to the Council and the European Parliament..., 2021).

Member States' water quality monitoring has improved with respect to assessing eutrophication as well as saline waters. Eutrophication is a serious problem in all types of surface waters, with inland, transitional, coastal and marine waters still seriously affected. Several Member States that stand out for their abundance of eutrophic waters are the Czech Republic, Finland, Denmark, Luxembourg, Belgium, Germany, Latvia and Poland.

Despite significant efforts by most Member States and farmers, who have respectively developed and implemented measures to reduce nitrate losses in water, water quality data show that the level of implementation and enforcement is still insufficient to achieve the objectives of the Directive, 30 years after its adoption and despite some progress:

- some member states have noted poor water quality throughout the territory and a systemic problem of managing nutrient losses in agriculture: Belgium (Flanders region), Czech Republic, Denmark, Germany, Finland, Hungary, Latvia, Luxembourg, Malta, Netherlands, Poland and Spain;
- some member states have "hot spots" where pollution is not adequately addressed: Bulgaria, Cyprus, Estonia, France, Italy, Portugal and Romania.

Therefore, some member states urgently need to take additional measures to achieve the goals of the Nitrates Directive, in particular Belgium, the Czech Republic, Luxembourg, Spain, the Netherlands and Germany, which are furthest away from these goals.

While there is no timeline in the Nitrates Directive for achieving water quality goals, the WFD goals for good environmental and chemical status must be achieved no later than 2027, and observed water quality trends show that this will not be achieved without radical changes in current measures.

The Commission will strengthen its actions to improve the implementation and enforcement of the Directive to achieve its goals. This is a prerequisite for achieving a 50% reduction of nutrient losses by 2030, as defined in the context of the EU Green Deal.

In 2022, the Commission will develop an Integrated Nutrient Management 33 Action Plan, building on the Zero Pollution 34 Action Plan. This will help coordinate efforts and will aim to address nutrient pollution at source, identify nutrient load reductions needed to achieve the EU Green Deal nutrient targets, promote markets for safe and sustainable reclaimed nutrients and improve livestock sustainability.

Significant progress has been made in the development of manure treatment technologies. Reduced nitrogen, which replaces inorganic fertilizers, reduces CO₂ emissions, while reduced phosphate reduces dependence on phosphate imports, and the remaining organic fractions can be used in local deposits. However, modern technologies are not yet widely used and there are a number of economic barriers related to the high cost of these processes, transportation costs and the frequent need to pay farmers to apply these products to their fields. In addition, the maximum level of nitrogen from manure that can be applied under the Nitrates Directive also includes processed manure.

In July 2022 the new Fertilizer Regulation 35 will expand the scope of the existing Fertilizer Regulation 36 from purely inorganic fertilizers to organo-mineral

and organic fertilizers, opening the way for the marketing of these treated organic fertilizers in the EU internal market.

Therefore, analysis of household water supply in Europe has shown that there is no "water stress" under such conditions. However, with global water scarcity resulting from population growth and urbanization, particularly tourism, in recent years, negative factors have particularly affected water use on small Mediterranean islands and in densely populated areas.

3. Personal management of freshwater resources in Ukraine

According to the Ministry of Environmental Protection and Natural Resources of Ukraine, cooperation between Ukraine and the EU is aimed at:

- preservation, protection, improvement and reproduction of environmental quality;
- protection of public health;
- reasonable and rational use of natural resources;
- encouraging measures at the international level aimed at solving regional and global environmental problems (Report from the Commission to the Council and the European Parliament..., 2021).

Because of the enormous volumes of water withdrawn for hydropower and cooling, the hydromorphology and natural hydrological regime of rivers and lakes continue to change.

The implementation of the Agreement will take place through the creation of a strategy, and then the necessary laws and regulations through national reforms, not the other way around, and their implementation is carried out through the prism of the implementation of the Agreement, where the main focus is on the environmental component.

Given the need for a major overhaul of the legal framework to develop a new EU water policy, and based on consultations with a wide range of specialists, the Economic Commission for Europe proposed a new framework directive called Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy (before that and in the future – the Water Framework Directive, WFD). The WFD establishes river basin areas defined not by administrative or political boundaries, but by the boundaries of the river basin as a natural hydrographic holistic entity.

European integration strategies for environmental protection are the ecological component (natural surroundings) in the Association Agreement with the EU.

Kovshun N. E., Piatka N.S. consider that "in Ukraine it is unpromising to be guided by budgetary funds in financial provision of environmental protection

measures. In addition, enterprises carry out environmental measures only if it is economically profitable for them. In Ukraine in the field of environmental protection, in order to meet international obligations, enterprises that need to bring their activities to high European standards, which requires significant costs, expect assistance from the state. That is why the legislative consolidation of economic incentives is the development of appropriate means, which would allow to solve the problem of financial provision of environmental protection through the diversification of funding sources." (Kovshun, Piatka, 2019)

To assess the effectiveness of the implementation of the environmental component (natural environment) in the Association Agreement, the authors will analyze Ukraine according to the Environmental Performance Index.

The Environmental Performance Index (EPI) provides a quantitative framework for comparing, analyzing and understanding environmental performance in 180 countries. The EPI evaluates and ranks these countries according to their environmental performance, using data from the last year, and calculates how these indicators have changed over the previous decade (The Environmental Performance Index, 2020).

The EPI Environmental Performance Indicators are a data-driven summary of the state of sustainability around the world. Using 32 EPI performance indicators, the EPI covers 11 categories of environmental and ecosystem resilience issues in 180 countries. The indicators provide a national measure of how close countries are to meeting policy goals. EPI offers a scorecard that identifies leaders and laggards in environmental performance and provides practical recommendations for countries seeking to move toward a sustainable future. The rankings are based on various sources and represent the most recently published data, often for 2017 or 2018.

Thus, the analysis does not reflect recent events, including the drastic reduction in air pollution in 2020 due to the COVID-19 pandemic or the extensive greenhouse gas emissions, Amazon fires in 2019. These indicators help identify issues, set goals, track trends, understand outcomes, and identify best policy practices. Good data and evidence-based analysis can also help government officials improve their policy programs, government communications with key stakeholders, and maximize the return on regular investment. EPI offers a powerful policy tool to support efforts to achieve the UN Sustainable Development Goals.

Development Goals and the movement of society toward a sustainable future. EPI's overall rankings show which countries are best at responding to environmental issues, chronic challenges facing each

country. Going beyond the overall scores and delving into the data to analyze performance by category of issues, policy goals, peer group proposals, and countries provides even more value for policymakers. Such a detailed view and a comparative perspective can help to understand the drivers of environmental progress and clarify policy choices.

Figure 1 analyzes the ranking positions of Ukraine and some countries of the world on the Environmental Performance Index in 2020 (The Environmental Performance Index, 2020).

According to the index of environmental efficiency in 2020 Ukraine ranks 60th, while in 2018 on this indicator Ukraine was in 109th place, which confirms the correctness of the course and policy on resource conservation. The ranking according to the index of environmental efficiency allows to determine the effectiveness by categories of problems, policy goals, which can be used for proposals to improve the management of ecosystems.

EPI 2020 comes in the midst of the COVID-19 crisis, which has challenged health systems and disrupted economic activity around the world. The global pandemic has clearly demonstrated the interdependence of all countries and the importance of investing in sustainability. The unintended consequences of stopping economic activity in many countries include drastic reductions in pollution and the return of wildlife. The EPI team hopes that this unexpected look at what a sustainable planet can look like from an environmental perspective-albeit at a terrible cost in terms of health and economic damage-will inspire the political change needed for a sustainable future that is both economically vibrant and environmentally sound.

The values of the 10 major categories of The Environmental Performance Index 2020 are shown in Figure 2.

As one can see, the values of the 10 major categories of the Environmental Performance Index in 2020 (The Environmental Performance Index 2020): agriculture is in the first position; climate change – 26; heavy metals – 42; biodiversity – 45; water resources – 60; pollution emissions – 64; sanitation and drinking water – 66; fishing – 71; air quality – 86; ecosystem services – 139.

So, as can be seen, Ukraine has the worst positions in emissions, drinking water, fisheries, air quality and ecosystem services. Consider the economic instruments to stimulate green modernization of industrial enterprises (Figure 3).

The main environmental tools to stimulate green modernization of enterprises in the EU include: state aid, environmental taxation, tax incentives, soft loans, collateral system, grants, special funds. For Ukraine, promising tools are environmental taxation, the creation of a special

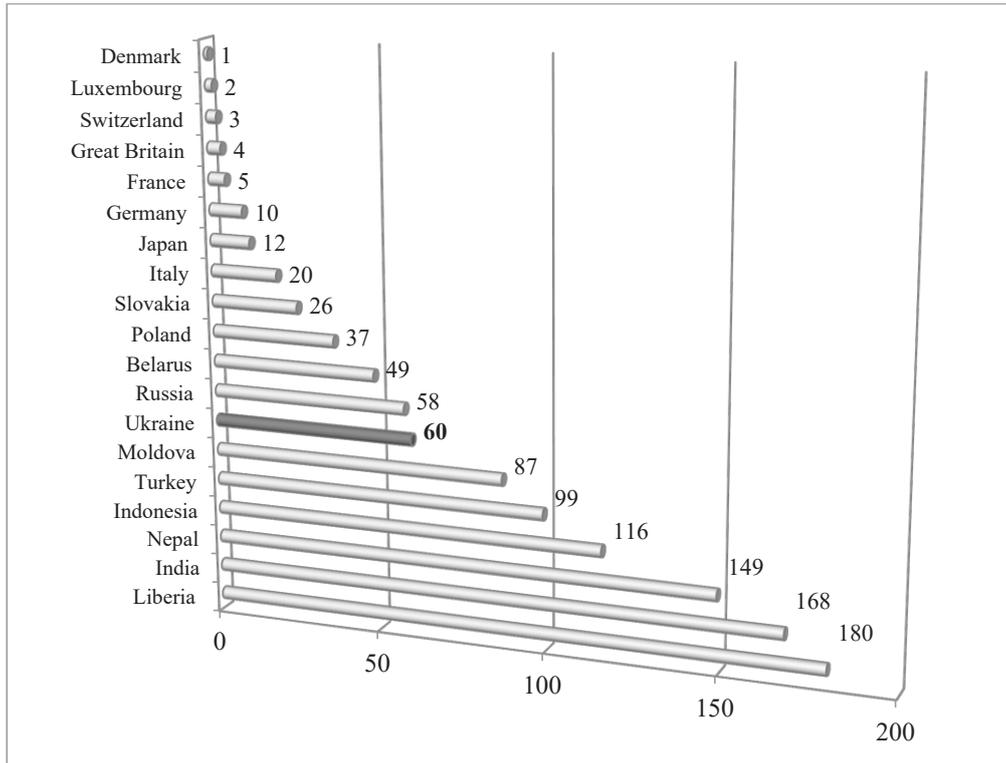


Figure 1. Ranking positions of Ukraine and some countries of the world on the index of environmental efficiency in 2020 (The Environmental Performance Index 2020)

Source: compiled by the authors (The Environmental Performance Index, 2020)

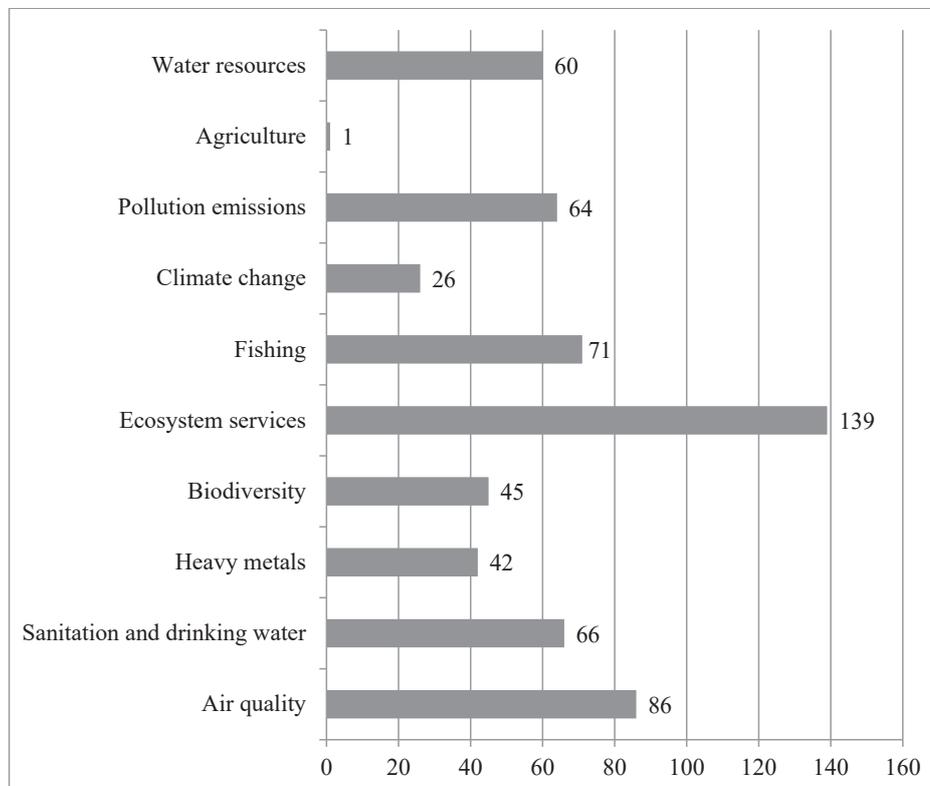


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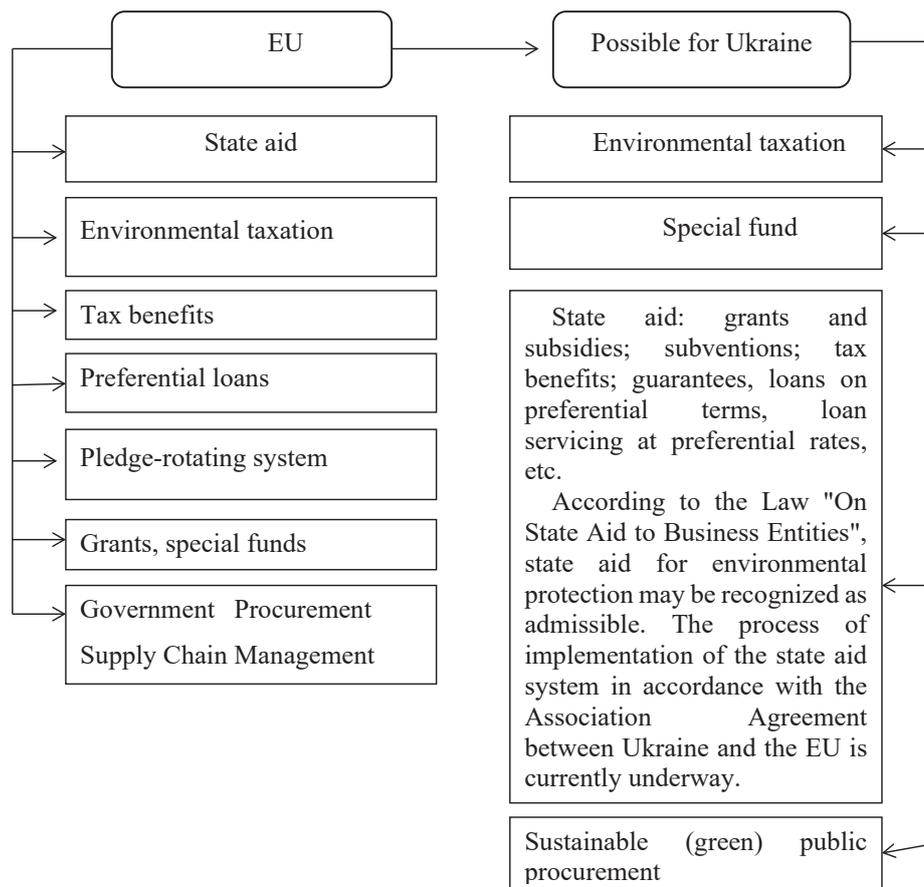


Figure 3. Economic instruments to stimulate "green" modernization of industrial enterprises

fund, permanent (green) public procurement and state aid.

In general, the main stimulating tool in the EU member states is tax policy (reducing the tax burden) when introducing resource-saving technologies.

Vdovenko N. M. and Korobova N. M. consider that "it is basic for all countries possessing biological resources to strive to establish various forms of payment for the extraction of biological resources in their waters, certain volumes of such resources by other countries, subject to mandatory environmental protection measures, and having a reproductive nature. At the same time, in the case of developed countries, monetary license fees are the main form of payment. In developing countries, there are other trends in the forms of payment for biological resources in their zones, which are directly related to solving socio-economic problems. It speaks about the development of coastal areas, employment level, development of national economy sectors, and improvement of protein balance of population's nutrition by taking water from natural water bodies. In some countries, there is an in-kind form of license payment)." (Vdovenko, Korobova, 2019)

During 2010–2020, the reduction of water intake from natural water bodies decreased by

4,894 million m³, the largest volume of fresh water was 4,457 million m³ from surface sources. Also, the use of fresh water (including seawater) decreased from 9,817 million m³ in 2010 to 7,238 million m³ in 2020, or by 2,579 million m³.

In 2020, the largest volumes of water were used for industrial needs – 4,532 million m³, drinking and sanitary – 1,169 million m³, and irrigation – 1,452 million m³. The capacity of treatment facilities decreased from 7425 million m³ in 2010 to 5142 million m³ in 2020, or 2283 million m³.

In 2020, the largest volume of clean water discharged into surface water bodies without treatment was 3,216 million m³, treated according to standard – 1,426 million m³, polluted return water – 518 million m³, insufficiently treated – 418 million m³, without treatment – 100 million m³.

Hrabovska L. L. and Yefremova O. O. consider that "despite the significant economic downturn observed in Ukraine in recent years and accompanied by a general reduction in the use of fresh water, the volume of polluted (untreated and insufficiently treated) wastewater flowing into surface water bodies of the Dnieper basin has not virtually decreased – 1.82 billion m³, that is, their share in the total flow has increased by almost 1.15 times." (Hrabovska,

Yefremova, 2011) Under the conditions of Russia's war against Ukraine, the effective management of fresh water resources has become an acute problem precisely because it is important to develop an effective organizational and economic mechanism that will ensure access to water (Irtysheva, and etc., 2022).

Thus, the general trends and features of freshwater management in Europe and Ukraine, which determine the prospects for the use of European experience and its adaptation in modern conditions were identified.

4. Conclusions

An analysis of the water supply of European households has been carried out and it has been found that there is no "water stress" under such conditions. However, with the global water scarcity resulting from population growth and urbanization, in particular tourism, in recent years negative factors have particularly affected water use in small Mediterranean islands and in densely populated

areas. In order to stabilize this situation, EU Member States were asked to report each monitoring station that was removed from their monitoring network, the reason for this removal and the alternative stations installed in case of sustained pollution. It was found that trends could be calculated for 83% of groundwater monitoring stations (so far only 20% in Sweden) and 75% of surface water monitoring stations (but less than 50% for Greece, Hungary, Latvia, Malta, Slovakia and Sweden). The importance of EU member states adopting freshwater and seawater remediation measures in accordance with Directive 24 to reduce the impact of eutrophication caused by nitrates or phosphorus is stressed.

It was found that European integration strategies in the field of environmental protection are characterized by improving water quality and water management; environmental management and integration of environmental policies; ensuring air quality; waste management; reducing the use of genetically modified organisms.

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