BRIEFING

Irrigation in EU agriculture

SUMMARY

Irrigation is the provision of water to help crops grow when rainfall is not sufficient. While new farming methods and technologies allow some types of crops to be grown without soil, a certain amount of water is needed to grow any kind of crop. In today's economy, agriculture is one of the sectors that consumes the most water resources. Irrigation is the major cause of water consumption in agriculture. It contributes to increasing crop productivity, but it is also a threat to the preservation of water resources. Therefore, the issue of water scarcity requires careful reflection on the trade-off between higher agricultural productivity and the deterioration of water resources.

A number of elements determine the amount of irrigation water used in agriculture, from the types of crop and cropping method to the characteristics of the soil and the irrigation technique, to name just a few. Therefore, agriculture itself provides opportunities for better water management and water savings, through both traditional farm practices and new farming technologies.

Irrigation has been a feature of European agriculture for thousands of years. Not surprisingly, the majority of irrigated agricultural areas are in the EU’s southern regions, in particular in Spain and Italy. However, there are areas equipped for irrigation elsewhere, especially in the Netherlands. Over 40 % of the EU's water use is on agriculture, and most of the freshwater abstraction is for agricultural use in countries like Greece, Spain, and Cyprus.

Prolonged periods of drought in many parts of the Union, the effects of climate change and pollution, as well as competition over use add further pressure on EU waters. Ensuring food security in view of climate change requires improvement in water-management capacity, including making users (farmers) more responsible. In recent times, the environmental performance of sectoral policies, such as in the area of agriculture, is increasingly scrutinised by citizens, stakeholders, and policy-makers. Various EU policy initiatives have been launched to address the challenge of sustainable water use in agriculture, including a more integrated approach to water management, water re-use, research and innovation, and more environmental ambition in the agricultural policy. Better policy coordination between EU policies and actions is seen as key to achieving the sustainable safeguarding of EU waters.

In this Briefing

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Water use in agriculture

Water – An essential and scarce element

Water is an essential element for the growth of crops, and its scarcity is a pressing challenge of our time. The United Nations Food and Agriculture Organization (FAO) considers agriculture 'both a major cause and casualty of water scarcity'. Agriculture has impacts on water resources in terms of both quantity and quality, through the volumes of water used and polluting substances released into the environment. This briefing focuses on the quantitative aspect.

Agriculture is a major consumer of water resources, and the major cause of water consumption in agriculture is irrigation. Irrigated land represents 20 % of the cultivated land worldwide but 40 % of the food production. Farming activities account for almost 70 % of global water withdrawals, reaching as much as 95 % in some developing countries. Estimates of water needs talk about 13 000 to 16 000 litres of water to produce 1 kg of beef, depending on factors such as the production system and the feed. Yet, caution is needed when assessing water use in agriculture, due to the numerous elements involved and the use of ambiguous concepts (see Box 1).

Box 1 – Water abstraction and consumption

Water abstraction is the volume of water taken from a natural or modified (e.g. a reservoir) source. Water consumption, on the other hand, is the volume of water which is incorporated into a final product or evaporates. It does not return to a body of water after use.

Water abstracted for agricultural use is nearly all consumed by evapotranspiration (see Box 2) or stored in plants. On the contrary, water abstracted for electricity generation is nearly all returned – for example, after being used for cooling.

Source: European Environment Agency (EEA).

Water withdrawals to produce food rose throughout the 20th century. The 2018 report on the state of European waters from the European Environment Agency (EEA) indicated that agriculture and public water supply are the main source of pressure on renewable water resources. The Organisation for Economic Co-operation and Development (OECD) and the FAO foresee an increase of 15 % in the global demand for agricultural products by 2028, with an impact on natural resources (such as land and water) and biodiversity, the extent of which will depend on how this demand is addressed. Indeed, both farming choices and the climate determine the water footprint of agriculture. Over-exploitation of water resources is a threat to farming and the environment, which is why the trade-off between agricultural productivity and preservation of water resources must be seriously considered. As for the climate, depending on future socio-economic conditions, the risk of water scarcity is projected to be greater with global warming. In certain areas of the globe, governments acknowledge that current water consumption patterns are based on the idea that water is still abundant, which, due to climate change, may no longer be the case. Strong increases in dryness and decreases in water availability are expected in the Mediterranean and southern Europe, where risks related to water deficits could be substantially reduced if global warming were limited to 1.5°C.[1] The EEA expects increased temperatures to raise crop water requirements. Therefore, in the absence of alternative water management strategies and changes in food and energy consumption, water demand may outweigh supply by 2050.

Finally, efficiency in water use and distribution plays a major role. Scarcity – defined as the imbalance between demand for freshwater and available supply – poor infrastructure, and poor management capacity (i.e. water loss through leakages[2] and/or illegal water abstraction[3]) can prevent access to water even in regions where water is physically present. Therefore, bad water governance could lead to serious socio-economic consequences, even conflicts, more than water shortages.

The role and effects of irrigation

In agriculture, where natural crop growing is domesticated for production needs, irrigation contributes to increasing crop productivity by supplying a controlled amount of water when rainfall is not sufficient or where solely rain-fed farming would not supply an adequate amount of water for the desired production. Irrigation systems can collect surface water (from rivers, lakes or reservoirs), groundwater (from springs or underground aquifers) or treated water (from desalination, drainage, reclamation processes, etc.), and supply this water to plants by means of various methods (e.g. flooding of fields, localised micro-irrigation, or use of sprinklers).

The amount of irrigation depends on several factors. Weather conditions play an important role, although they do not always represent the major determinant. Moreover, constraints in water availability mean that irrigation can be an emergency remedy to natural weather variability, but not the solution in case of altered precipitation trends due to climate change. According to recent research, severe precipitation changes could already affect food production in certain regions in the coming years, unless remedial measures are put in place to lower greenhouse gas (GHG) emissions. Besides weather conditions, other factors can determine the amount of water used for irrigation, such as the type and growth stage of the crop, cultivation practices and farming intensity, soil and water characteristics, the degree of modernisation of irrigation networks, and the extent of the adoption of new techniques (such as smart irrigation[4]).

Significant water savings could be achieved with improvements in irrigation infrastructure and technologies. Estimates point to savings of over 40 % of the volume of water abstracted, as a result of improving the delivery and application efficiency of irrigation systems, changing practices, planting drought-resistant crops, and reusing treated water. Moreover, farm management choices related to irrigation can contribute to enhancing soil conditions and soil resilience. However, they can also have a negative impact on the capacity of the soil to function as a carbon sink (i.e. to help remove GHG from the atmosphere). On the other hand, incorrect irrigation can lead to soil salinisation (i.e. accumulation of soluble salts of sodium, magnesium, and calcium) and eventually compromise agricultural activity. If associated with climate change, they can result in soil degradation and desertification.

Water footprint of crops and crop-growing systems

Green, blue, and grey water footprint

The water footprint of agriculture can be measured as the volume of water appropriation in terms of consumption and/or pollution. It involves all three types of water footprints: green (rainwater taken by plants – see Box 2), blue (surface and groundwater used by irrigation), and grey (freshwater required to assimilate pollutants).

A study on the global water footprint of crop production between 1996 and 2005, concluded that 86.5 % of global water consumption for crop production is green water, which often plays an important role in irrigated agriculture as well. Wheat and rice together accounted for 45 % of the global blue water footprint in that same period, although the average water footprint of any one product may turn out to be quite different for specific regions and crop categories. Not surprisingly, the share of blue water footprint was found to be the largest in arid and semi-arid regions, including in southern Europe.

Box 2 – Evapotranspiration

Evapotranspiration is the water that a crop needs to survive. It consists of transpiration plus evaporation, where:

- transpiration is the process by which most of the water absorbed by the plant's roots is released into the atmosphere as vapour through the plant's leaves and stem.
- evaporation is the process by which water from an open surface, such as the leaves and stem of a plant, escapes as vapour into the atmosphere.

Source: Food and Agriculture Organization (FAO).

Since the blue water footprint of agriculture depends on the availability of green water resources, the combined green-blue water footprint has been used to assess the potential for global water savings in crop production. One study explains that, combined, the green-blue water footprint per tonne for some crops is lower in irrigated agriculture than in rain-fed agriculture. For other crops, however, it is higher. Moreover, since marginal water productivity (i.e. the water footprint per unit of crop produced) decreases with increasing water supply, higher water productivity was observed both in rain-fed cultivation and smart irrigation. The study proposes benchmark values of water productivity to assess how techniques and practices can help reduce water footprints.

The trade-off between green, blue, and grey water footprints has been analysed for the major grain crops in case studies of regional agricultural production systems as diverse as subsistence and high-tech farming. An FAO report concludes that several trade-offs should be considered, such as that between water productivity and nutrient-use efficiency (e.g. above a certain fertilizer application rate, the increase in grey water footprint could exceed the decrease in green-blue water footprint). Thus, improvements in water productivity can be achieved by enhancing the synergy between breeding (i.e. superior crop varieties that capture more water) and agronomy (better agronomic solutions and practices), especially with scarce funds and for smallholder farmers.

Crop-growing - water needs and water savings

A report from the World Wide Fund for Nature (WWF) ranks the thirstiest crops grown in river basins in developing and industrialised countries (none of them in the EU). Food cereals (namely rice and wheat), followed by sugar crops, vegetables, and cotton are the thirstiest crops in developing countries. In industrialised countries, although these same crops also require large volumes of water, it is pasture that demands the most water, especially in the USA and Australia. For each crop analysed, the report presents a list of water-saving practices, such as shorter land preparation periods, aerobic varieties of rice, the replanting of crop die-off each year for sugar beet, water saving in non-critical growth periods, and the use of wheat varieties adapted to sub-optimal water disposal.

Therefore, while water is a necessary input for crop-growing, agriculture itself provides opportunities for saving water. A number of general or crop-specific on-farm practices can help to save water, both in rain-fed and irrigated agriculture. Some of these practices include reducing losses in conveyance, planting trees for shade or as a wind barrier, sowing in a timely manner, adapting crop-growing to the seasons, and properly managing nutrients, diseases, and weeds. Good agricultural practices help to enhance natural water retention by the land, so that more water is stored in the soil and is available when needed, with increased resilience to extreme events such as droughts and floods. Dryland agriculture in arid and semi-arid regions offers examples of farming practices based on the relation between rain precipitation and plant evapotranspiration.

Farming technologies, such as optimised irrigation equipment and digitally assisted irrigation,[5] provide opportunities for better water management. Examples of these technologies are a) drip-irrigation – which, compared with sprinklers, allows water savings of 10 to 35 % for arable crops, 28 to 46 % for arboriculture, and 17 to 43 % for fruits and vegetables, and b) field sensors that map irrigation needs – which allow water savings of 20 to 25 % for arable crops and arboriculture and 45 to 50 % for fruits and vegetables. Hydroponics (i.e. methods and techniques for growing plants without the use of soil) is one emerging example of higher water-use efficiency than soil-based cultivation. However, it still needs substantial initial investment capacity.

Increasing farmers' awareness of practices that can help to improve their water use, and encouraging them to adopt water-saving practices remain key issues across all countries. As demonstrated by an analysis of the nursery sector in Tuscany, different irrigation methods lead to different results in terms of water savings and costs in farms growing similar products in the same producing area. The dissemination of knowledge on the costs of using water in irrigation systems can incentivise virtuous behaviour and their voluntary acceptance. It can also help farmers to assess the cost of lowering their risks in the event of water scarcity and climate change.

Finally, although the focus of this briefing is on food production, non-food sectors that use agricultural inputs, such as cotton and biofuel industries, have a significant water footprint as well. Moreover, the total water footprint of any product (food or non-food) includes elements other than crop-growing, such as processing, trade, market, and consumption. The results of a study on the water footprint of olive oil in Spain confirm how important it is for any detailed assessment in this field to take into account the water footprint of other components of the supply chain, from growing olives to producing bottles, caps, and labels.

The importance of irrigation in Europe

Irrigated and irrigable agricultural land

Irrigation has been a feature of European agriculture for millenia. Especially in regions where access to water is a decisive factor in determining crop-production capacity, rain-fed agriculture and traditional irrigation methods have co-existed for ages. In the 20th century, water infrastructure projects intensified irrigation systems, putting more pressure on water resources. In the years to come, in particular in southern Europe, irrigation demand is projected to increase, while water availability is expected to reduce, due to climate change, pollution, and water conflicts, to name just a few reasons. In the EU, the share of the irrigated area in total agricultural area is 6 %. Spain and Italy are the EU countries with the largest irrigated areas, volumes of irrigation water, and yearly water consumption per unit of irrigated area. More than one in every five hectares were irrigated in Cyprus, Italy, Greece, and Malta in 2016. At the regional level, irrigated area as a percentage of total agricultural area was above 50 % in Madeira (Portugal) and Lombardy (Italy), and over 30 % in Malta and in various regions of Spain, the Netherlands, Italy, and Greece, as shown on a Eurostat map on regional differences in irrigation in 2016.

In 2010, there were very large irrigated areas of maize in France (about 750 000 hectares) and Italy (over 500 000 hectares), and of olives in Spain (480 000 hectares, most of which in Andalusia, in the south of the country). Further examples of crops with large irrigated areas were rice in Italy, cereals (other than maize and rice) in Spain and France, grasslands in Spain and Italy, fruit farms (including berry and citrus) and vineyards in Spain, and other crops planted on arable land in Greece and Spain. The share of irrigated areas in total EU agricultural area decreased by 6.1 % between 2005 and 2016. Despite this general decrease, the trend is very diverse at the regional level. The regions with the highest shares of irrigated land generally showed either a lower decrease between 2005 and 2016, with the exception of Lombardy (11 %), or even an increase, such as some regions of the Netherlands (50 %) and Malta (30 %).

Although irrigation needs are higher in the Mediterranean region, northern and eastern European countries have had to take emergency measures due to long periods of drought in recent years and the EU's agricultural funds have provided a safety net in several EU Member States during recent droughts. Even in regions with a humid climate, supplemental irrigation serves as a tool to address the risks and constraints in water resource availability. So, irrigation infrastructure is present across the EU, ready to be used in case of increased water demand.

Box 3 – The case of Italy

Large shares of Italian agricultural production and export come from irrigated land. An atlas of irrigation identified 23 000 km of irrigation networks (partly serving multiple functions of land reclamation and irrigation) in Italy in 2011, with 158 consortia of collective irrigation and around 3.3 million hectares of land equipped for irrigation. When broken down into terrain categories, these irrigable lands, measured as a percentage of all agricultural land in each terrain category, account for over 40 % in flat lands, 10 % in middle mountains, and 5 % in mountainous areas. Irrigation is practised all over the country. In terms of the number of farms using irrigation, the percentage is higher in the south of the country. However, in terms of total area using irrigation and volume of water, percentages are higher in the north. These differences are due to regional production specialisations and cultivation practices. In Lombardy and Piedmont, for example, where rice is widely cultivated, there is a significant concentration of large farms that use irrigation. At national level, rice fields absorbed almost 40 % of all irrigation water in 2010, followed by maize (almost 16 %), horticulture, fruit and olives.

Statistics on irrigable land (i.e. land equipped with irrigation systems that have not been used over a recent reference period) show that 29 % of agricultural area was irrigable in the Netherlands in

2016. Flevoland (the Netherlands) and Emilia-Romagna (Italy) were among the regions with the highest shares – an average of 60 % of their agricultural area. Over a longer period (1995 to 2016), shares of irrigable area have significantly increased in Spain, Italy and the Netherlands, and decreased in Denmark, Greece and Portugal.

Use of water in irrigation

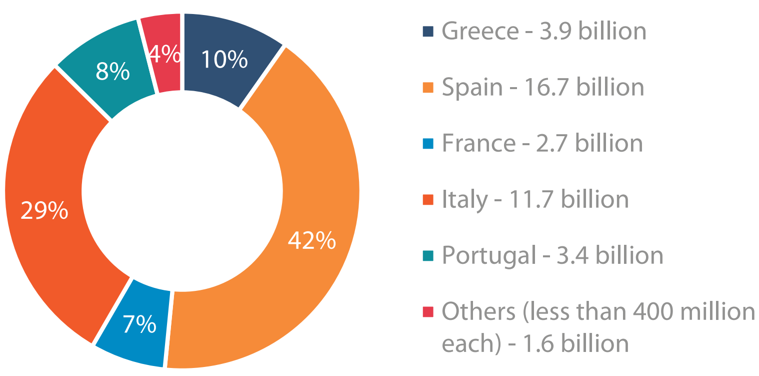
In the EU, over 40 % of total water use goes to agriculture, reaching 80 % in some regions. The main share of freshwater abstraction in countries like Greece, Spain, and Cyprus goes to agriculture. Based on data on annual and long-term freshwater abstraction by country, the water exploitation index and its newer version (WEI+) help to distinguish non-stressed regions from those affected by water scarcity (index above 20 %) or severe scarcity (above 40 %). Cyprus was the EU country with the most severe scarcity in 2015. The index shows pressure on water for specific territories (such as river basins) in a given period (such as a season of the year) and for different human activities. It shows that pressure on freshwater resources fluctuates according to the type of economic activity throughout the year (with agriculture and public water supplies putting high pressure in spring and summer) and from one year to the next.

Box 4 – The case of Spain

In Spain, many traditional irrigation systems have been substituted by more intensive ones, for example along the Mediterranean coast, where there has been an expansion of fruit groves and horticulture. One fifth of all irrigation water is used in Andalusia, followed by Aragón and Castilla y León, with 14 % each. In Andalusia, where one in every four hectares is irrigated (equivalent to almost 30 % of all irrigated land in Spain), irrigation contributes to more than 60 % of agricultural production, farm income, and agricultural employment. A paper on irrigation-intensive horticulture in Almería (province of Andalusia) identifies a high degree of over-exploitation of aquifers for the irrigation of horticultural crops in greenhouses. The paper notes that irrigation practices such as cascade cropping and wastewater treatment would lead to more sustainable water use. A study on river basins reports an estimated deficit of at least 400 cubic hectometres of water per year in eastern Spain, particularly in Alicante, Murcia, and Almería – where water scarcity is a persistent problem and where irrigation has reached high technological performance. Increasing irrigation to tackle droughts could result in a rapid decline in the level of reservoirs. Researchers highlight the need for long-term drought management strategies to avoid and to mitigate the severe impacts of drought. They also argue for sustainable water management to address the impacts of climate change on water.

The volume of water used for irrigation was slightly below 40 billion cubic metres in 2010 – 96 % of that being used in only five Member States (see Figure 1). Malta and Cyprus accounted for disproportionately high volumes of irrigation water in relation to their small areas of agricultural land.

Figure 1 – Volume of water used for irrigation in the EU in 2010 (% of total cubic metres)



Source: Eurostat, Farm structure, 2010.

In most of the EU Member States, the main source of irrigation water is on-farm groundwater, except for Italy, Cyprus, and Greece, where supply networks are the predominant source, and Malta, where on-farm surface water prevails. Water is poured onto the land by means of surface, sprinkler or drop irrigation systems, with differences between countries being explained by their different agricultural products and cultivation practices. Generally speaking, sprinkler irrigation is more predominant in northern EU Member States, whereas southern Member States use all methods, with drop irrigation being predominant in Cyprus, Malta, and Spain, sprinkler irrigation being more widely used in France, and surface irrigation being most popular in Portugal. Overall EU water abstraction for irrigation has fallen by 22 % since the 1990s, with a significant decline in eastern and western Europe and a much smaller reduction in southern Europe.

EU action and legislative framework

Some initiatives on water and agriculture

Whether by regulating water use in agriculture (including charging for water) or addressing subsidies to positively impact water resources, a reform towards sustainable agricultural water use needs to be prepared through research, education, and governance efforts. It should help to take advantage of reform opportunities when the timing is right, an OECD report suggests. In recent years, various EU initiatives have been launched to address the challenge of sustainable water management, including in agriculture.

Taking stock of previous achievements, the Commission's 2012 blueprint to safeguard Europe's water resources underlined the need for further action to tackle the multiple and interlinked causes of negative impacts on water status, including climate change, land use, and economic activities such as agriculture. It stressed the need for increased integration of water policy objectives into other policy areas (from the CAP, to EU regional, energy and transport policies) and recommended concrete actions to implement such integration. The blueprint is closely linked to the implementation of EU water legislation and, despite their non-binding requirements, the blueprint's objectives can serve as references for reviewing the implementation of this legislation.

The European innovation partnership on water (EIP water) is an initiative started in 2013 with a view to facilitating the development of innovative solutions to address water challenges. It supports collaborative processes through the establishment of action groups and the creation of market opportunities for innovations in the water sector, both inside and outside Europe. Moreover, it creates fora for the exchange of views on how innovation can help to address water-related issues.

The Commission recently established a task force on water, followed shortly afterwards by the creation of a scientific knowledge hub, within the Commission's Joint Research Centre, whose purpose is to support the integration and functioning of the EU's agriculture and water policies. These initiatives aim to raise awareness of the interconnectedness between water and agriculture and of the importance of a multi-sector approach to enhance water management in the agricultural sector. Moreover, the task force organises exchanges among stakeholders in which they can share experiences of good governance that can lead to enhancing water management in the agricultural sector – through research, innovation, and investment.

Water Framework Directive

The EU Water Framework Directive (Directive 2000/60/EC) was adopted in 2000 after a process of rethinking European water policies, that led to a new global approach based on water management by river basin and integrated objectives for all waters. The objectives set out in the directive are to be reached by 2015 and 2027. The directive puts forward qualitative targets for the protection of surface water, while for groundwater the focus is on protection from contamination and over-abstraction. On this latter point, to achieve a good groundwater quantitative status, the directive limits abstraction to the portion of the annual recharge that is not needed to support aquatic ecosystems. Moreover, other related directives deal with more specific issues – often closely related to agriculture and forming an integral part of the EU water legislative framework, such as the Nitrates Directive and the Groundwater Directive (stemming from Article 17 of Directive 2000/60/EC).

An EPRS in-depth analysis observed delays in the implementation of the EU Water Framework Directive with regard to the 2015 deadline, and an EPRS Cost-of-Non-Europe report on water legislation highlighted the lack of coherence among EU water-related sector-specific policies, such as the CAP. In a 2018 paper on agriculture and water policies, the OECD noted that conditions were not always in place for effective implementation in the EU Member States, thus undermining the policy objectives (such as for water pricing, heavily affected by local circumstances).

In February 2019, the Commission adopted the fifth implementation report on the Water Framework Directive and the management plans prepared by the EU Member States for the 2015-2021 period. The report mentions that compliance with the objectives of the directive is gradually increasing, although much remains to be done by the Member States to fully achieve them. In most cases, Member States identify the impacts of agriculture as posing the most significant pressures and potential risks, both in terms of over-abstraction and pollution. This report feeds into the fitness check of EU water legislation, which started in 2017 and whose results are expected by the end of 2019. It aims to gather evidence to assess the effectiveness, efficiency, coherence, relevance, and added value of the EU legislation, according to the better regulation guidelines. The 2018 European Water Conference, organised by the Commission and the Austrian Presidency of the Council, concluded that, despite some progress, structural problems in water management remain, including pollution from agriculture and over-abstraction. Therefore, more work is necessary to improve and preserve water, through integrated water management and reinforced efforts in policy, law, and investments.

The current CAP

The CAP promotes and supports sustainable water use in agriculture through measures in both pillar I (farmer support and markets) and pillar II (rural development). Some of them are compulsory for farmers, while others depend on farmers' voluntary participation. Some others require adoption and implementation at the national or regional level.

Under pillar I, cross-compliance rules establish a relationship between environmental requirements and farming activity. This is achieved through the 13 Statutory Management Requirements (the first one of which relates to water) that are compulsory for exercising farming activities and the 7 Standards for Good Agricultural and Environmental Condition of Land (the first three of which relate to water) that are compulsory for farmers receiving CAP payments. Non-compliance could then result in the reduction of EU support (see Table 1).

Table 1 – Rules on cross-compliance related to water

Requirements and standards	
Statutory management requirement No 1	Articles 4 and 5 of Council Directive 91/676/EEC concerning the protection of waters against pollution caused by nitrates from agricultural sources.
Standard for good agricultural and environmental condition of land No 1	Establishment of buffer strips along water courses. These buffer strips must respect certain requirements pursuant to Council Directive 91/676/EEC.
Standard for good agricultural and environmental condition of land No 2	Where use of water for irrigation is subject to authorisation, compliance with authorisation procedures.
Standard for good agricultural and environmental condition of land No 3	Protection of ground water against pollution: prohibition of direct discharge into groundwater and measures to prevent indirect pollution of groundwater through discharge on the ground and percolation through the soil of dangerous substances, as listed in the Annex to Directive 80/68/EEC in its version in force on the last day of its validity, as far as it relates to agricultural activity.

Source: Annex II to Regulation (EU) No 1306/2013.

Other opportunities for improving water management stemming from the CAP – pillar I are:

- mandatory practices that benefit the environment in order for farmers to receive the green direct payments (greening), which cover 30 % of the CAP income support;
- environmental actions that go beyond mandatory environmental standards – to be included in a national framework for such actions in the fruit and vegetable sector.

Under pillar II, improving water management and increasing efficiency in water use by agriculture are amongst the thematic objectives established by Article 5 of Regulation (EU) No 1305/2013 on support for rural development. Specific targets have been set out in terms of switching to more efficient irrigation systems and agricultural (and forest) land under contracts improving water management. Various measures can contribute to achieving these targets, from knowledge transfer and information actions to investments in physical assets, such as infrastructure related to the supply and saving of water under the conditions specified in Article 46 of Regulation 1305/2013 for investments in irrigation. Moreover, other measures related to the protection of ecosystems and biodiversity (such as agri-environment-climate commitments from Article 28 of Regulation 1305/2013) contribute to more sustainable water management. Finally, under specific circumstances, farmers may receive rural development payments to compensate for the costs arising from the implementation of the Water Framework Directive (Article 30 of Regulation 1305/2013).

In 2014, a European Court of Auditors' report noted that the potential of rural development policy in relation to water was not fully explored due to deficiencies in planning and implementation of measures and considerable amounts of unspent funding targeting water. The adoption of options available in the national and regional rural development programmes, the lack of coordination between measures, the deficiencies in the systems of water abstraction permits, and the water pricing system were among the implementation challenges highlighted in a 2017 Commission staff working document. Recent implementation data highlight that in most cases the target for investments aimed at saving water is far from being reached. Nonetheless, there are many examples of completed projects that have targeted water management (such as the modernisation of irrigation networks involving hundreds of thousands of hectares in Andalusia in the last programming periods) or agri-environment (such as measures financing the replacement of crops with less water-intensive plants, and the adoption of production methods that reduce water use).

To provide continuous monitoring of CAP implementation, the common monitoring and evaluation framework (CMEF) helps to assess policy performance at different stages, from its context and impact (such as measuring the volume of water applied to soils for irrigation purposes) to the output (such as measuring the areas where investments in water-saving have been made). Some of its indicators are also included in the sets of indicators developed to monitor the environmental performance of agricultural policies, both within the EU (such as the 28 agri-environmental indicators developed by the Commission services with national authorities and the EEA) and in wider regional contexts (such as the 62 agri-environmental indicators developed by the OECD).

The CAP post-2020

In June 2018, the Commission put forward three legislative proposals to reform the CAP for the years 2021-2027. Besides budgetary, subsidiarity, and simplification challenges, increasing the level of environmental ambition of the CAP is one of the major debates around the reform, involving institutional players (EU and national policy-makers), and other stakeholders and citizens.

The proposals include several elements that could have an impact on future water management in agriculture. As in the current legislation, a system of conditionality would penalise beneficiaries who do not comply with statutory management requirements and standards for good agricultural and environmental condition of land, listed in Annex III to the proposal for a regulation on support for CAP strategic plans drawn up by Member States under the 2021-2027 CAP. These rules on conditionality would address various aspects of the climate and the environment, from soil to biodiversity safeguards, and include specific rules on water, such as the protection of water against pollution by phosphates and nitrates, and the establishment of buffer strips along water courses. Furthermore, other parts of the proposed reform could indirectly enhance water management. Member States would have to set up voluntary eco-schemes for farmers aimed at incentivising, remunerating, or compensating for cost or income loss resulting from the adoption of agricultural practices beneficial to the environment and the climate, which go beyond the mandatory requirements of conditionality. Under rural development interventions, Member States would grant payments for agri-environment-climate commitments, area-specific constraints (such as those resulting from river basin management plans pursuant to the EU Water Framework Directive), investments (except investments in irrigation inconsistent with the achievement of good status of water), knowledge exchange, and information. Lastly, given the performance-based approach of the proposed new policy evaluation, indicators have been put forward to evaluate pressure on EU water and its quality status, including previously cited water exploitation index plus.

Whatever shape these proposals might take at the end of the legislative process, creating synergies among the different elements of the green architecture of the post-2020 CAP – and between those elements and EU water legislation – remains a key issue for better water use in EU agriculture.[6]

Water reuse for irrigation

Increasing water reuse is a means to alleviate the impact of agriculture on water resources. In May 2018, the European Commission put forward a proposal for a regulation on the EU-wide standards that reclaimed water (i.e. water that has been used once, subsequently undergone treatment processes, and is then intentionally used again) would need to meet to be used in agricultural irrigation. It builds on various supporting analyses conducted in this area, such as a) a technical proposal for minimum quality requirements for water reuse in irrigation and aquifer recharge, prepared by the Joint Research Centre (JRC) in 2017, and b) initiatives put in place in some EU countries that support the idea and indicate a potential for more widespread adoption in the future. The proposal aims to exploit the potential of reclaimed water as a safe irrigation practice, thus possibly increasing water reuse in agricultural irrigation in the EU from 1.7 billion m^3 to 6.6 billion m^3 per year. An assessment of the impact of treated water has concluded that water reuse may play an important role as an alternative supply source in a context of climate change, particularly in case of increased water scarcity.[7]

In 2018, the European Economic and Social Committee welcomed this proposal and the Committee of the Regions proposed to enlarge its scope, albeit with some technical adjustments. In the first half of 2019, Parliament adopted its first-reading position and the EU Council agreed on a general approach on the proposal, so that trilogue negotiations are now under way.

Research and innovation

In the face of the threats presented by endemic water scarcity in certain regions of the EU, the prolonged periods of drought in many parts of the Union, and the exacerbated effects of climate change, researchers are called upon to explore innovative and sustainable solutions for water management in agriculture. EU funds support a wide range of projects aimed at developing sustainable adaptation strategies that involve efficient water and energy use in irrigation, and multidisciplinary and integrated water management approaches. The vast catalogue of EU-funded projects includes the promotion of lower water and energy consumption practices, such as the use of sensor-supported irrigation, precision irrigation, photovoltaic irrigation systems, wastewater treatment, and agronomic practices that prevent pollution and increase organic matter in the soil.

The impact of research projects on water savings depends on many factors. Farmers' adoption of new technologies and practices requires extensive information and training as well as financial assistance. It has also been noted that changing behaviour is a way to avoid the rebound effect that would lead to increased water consumption following the introduction of innovation. Moreover, appropriate legislative measures should accompany such introduction. Spain provides evidence of increased water consumption by irrigation after the adoption of modern technologies – findings of a number of studies suggest that other elements contributed to increased water consumption in the post-investment period (from changes in rainfall to the adoption of more water-demanding crops and cropping patterns), so that even with increased irrigation efficiency as a result of the adoption of modern irrigation techniques, water use in agriculture had increased.

Stakeholders

Stakeholders' views on water management range broadly. Some emphasise the key role of irrigation in making farming viable, increasing crop yields, and providing food. Others stress the primary need to protect water resources from over-abstraction and pollution. While this section is not intended to be an exhaustive account of all different views on the topic, it aims to provide a broad picture of different positions regarding the question of whether EU water and agricultural policies can help to bring together these apparently conflicting interests.

In their feedback on the Commission's proposal on water reuse for irrigation, Copa and Cogeca – the union of EU farmers and their cooperatives – recognise the importance of water reuse as a reliable and alternative water source for irrigation, seeing it as part of an integrated and participatory water management approach that should involve water savings and water use efficiency. Irrigants d'Europe – the union of national associations in charge of irrigation water management – issued its opinion on the next CAP, for 2021-2027, in July 2018. Besides the prominent role of irrigation in providing food security and guaranteeing the viability of the farming business, the opinion stresses the contribution of irrigation to making agriculture more adaptable to climate change and protecting biodiversity in irrigated landscapes. Recognising the importance of responsible water use in irrigation, Irrigants d'Europe calls for a change in perception and attitude towards irrigated agriculture, and for CAP measures to address the costs and risks involved in taking up new technologies to modernise irrigation systems, making it easier for farmers to embrace innovation that makes irrigation more sustainable.

Environmental organisations have also called for supplementary measures – such as consultancy, training, and proportionate penalties – to foster the adoption of sustainable water management in agriculture. Considering the current policy implementation inadequate, they recommend better use of existing funding and measures to reduce agricultural pressure on water resources. The position of the Worldwide Fund for Nature (WWF) on the post-2020 CAP considers urgent action on climate change among the primary objectives of a modernised EU agricultural policy, with a governance system that goes beyond agricultural stakeholders, to encompass the interconnectedness between agriculture and many other policy areas. Until now, the CAP reform proposals have not set 'a strong EU framework which would obligate Member States to fully integrate sustainable water management in their CAP strategic plans', according to a WWF representative. With droughts becoming increasingly common and severe in many parts of Europe, a recent WWF paper argues that, despite some progress, the EU Member States have not done enough to ensure that their water resources are resilient enough to cope with drought, heat, and floods. It stresses that healthy freshwater ecosystems adapt more easily to climate change, arguing that over-exploitation and poor management of water resources are more harmful than low rainfall.

European Parliament

Besides its role as co-legislator in shaping EU water legislation, Parliament has engaged in various initiatives aimed at enhancing water management in the EU, including in the agricultural sector. In its resolution of 9 October 2008 on the challenge of water scarcity and droughts in the EU, Parliament acknowledges that significant progress towards more efficient use of water can be achieved in the agricultural sector, for example through incentives for the best available practices and technologies, the application of 'the polluter and user pays' principles, and the modernisation of irrigation systems. The call for more efficient water management in agriculture is echoed in Parliament's resolution of 5 May 2010 on EU agriculture and climate change, where actions to help farming adapt to global warming include measures such as enhancing irrigation systems, using recycled water, and choosing crop varieties that are more resistant to extreme weather conditions. New techniques and practices, together with water reuse, are also at the core of other 'proposals by Parliament on irrigation, such as the resolution of 3 July 2012 on the implementation of the EU water legislation and that of 7 June 2016 on technological solutions for sustainable agriculture. While the legislative process for the post-2020 CAP is still ongoing, Parliament expressed its views on the future CAP in its resolution of 30 May 2018 on the future of food and farming. As regards water and agriculture, it calls for better policy coordination between the CAP and other EU policies and actions, with a view to achieving the sustainable protection of water resources that are negatively impacted by agriculture in quantitative and qualitative terms.

MAIN REFERENCES

From scarcity to security – Managing water for a nutritious food future, The Chicago Council on Global Affairs, March 2019.

Water for agriculture, EPRS, European Parliament, May 2015.

Sustainable management of natural resources with a focus on water and agriculture, Science and Technology Options Assessment (STOA) Panel, European Parliament, May 2013.

ENDNOTES

1 These are among the findings of the Special Report Global Warming of 1.5ºC, published in 2018, by the Intergovernmental Panel on Climate Change (IPCC), the United Nations body responsible for assessing the science related to climate change. The report analyses the impacts of a global warming of 1.5ºC above pre-industrial levels and related global greenhouse gas emission pathways.

2 A Parliament report (2009/2157(INI)) recalls that almost 20 % of water in the EU is lost due to inefficiency and stresses the need for investments to improve technical progress, especially in sectors with high water-saving potential.

3 In Spain, official controls by the Ministry of Ecological Transition detected a constant average number of illegal drillings of aquifers from 2014 to 2018, resulting in more than 1 200 illegal appropriations of underground resources per year.

4 Smart irrigation techniques make it possible to automatically start and stop water pumps based on the actual conditions of the irrigation site, such as monitoring weather conditions, soil moisture, plant water use, or water level in the reservoir.

5 The improvement of geographical information and satellite imagery will make digital technologies more efficient and relevant. New applications based on Galileo and Copernicus are being developed to measure crop irrigation needs.

6 Commission services have provided examples of how Member States can combine different elements of the new CAP (and the requirements of the Water Framework Directive) that relate to water issues. A diagram is found on page 13 of the publication: The post-2020 common agricultural policy: environmental benefits and simplification.

7 This assessment investigates water reuse as a viable cost-effective policy measure for agriculture and its role in mitigating water scarcity and reducing fresh water abstraction in the EU. Researchers suggest that treated water can help mitigate the effects of climate change, especially if legislation requires a mandatory minimum use of treated water or coverage of water price to reflect treating cost. In: Addressing water scarcity in agriculture with water reuse as alternative supply option, paper presented at the 172nd seminar of the European Association of Agricultural Economists, Brussels, May 2019.

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