

WATER SOBRIETY AS A LEVER FOR IMPROVED TERRITORIAL WATER ALLOCATION

LA SOBRIÉTÉ D'EAU COMME LEVIER POUR AMÉLIORER L'ALLOCATION DES EAUX TERRITORIALES

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ABSTRACT

The Luberon Sorgue Ventoux Canal Union abstracts and transports water from the Durance river to supply four landowners' associations irrigating nearly 20,000 ha in the Vaucluse department, France. Among these canals, the Carpentras Canal, the largest landowners' association in France, implemented a proactive water-saving policy in the early 1980s, which has contributed to a massive reduction in water abstraction. These water savings have enabled changes in the distribution and uses of water both within the Durance region and within the area irrigated by the Carpentras Canal. This paper offers a brief review of the impact that these water-saving measures have had on the concerned areas, as well as the new forms of governance that have emerged to manage the new water allocations made possible by these savings. It also highlights the limitations of this proactive water-saving policy and the fragility of the system in the face of climate change.

Keywords: canals; water abstraction; water-saving policy; climate change.

RESUME

L'Union du canal du Luberon, de la Sorgue et du Ventoux prélève et transporte des eaux de la Durance pour alimenter quatre associations de propriétaires qui irriguent près d'une superficie de 20 000 ha de terre dans le département du Vaucluse. Parmi ces canaux, le canal de Carpentras, la plus grande association de propriétaires fonciers en France, a mis en œuvre une politique proactive d'économie d'eau au début des années 1980, qui a contribué à une réduction massive du prélèvement d'eau. Ces économies d'eau ont permis des changements dans la distribution et les usages de l'eau tant au niveau du bassin de la Durance que sur le périmètre irrigué par le canal de Carpentras. Cet article propose une brève revue de l'impact que ces mesures d'économie d'eau ont exercé sur les zones concernées, ainsi que des nouvelles formes de gouvernance qui ont émergé pour gérer les nouvelles allocations d'eau rendues possibles par ces économies. Il met également l'accent sur les limites de cette politique proactive d'économie d'eau et la fragilité du système face au changement climatique.

Mots-clés: Canaux; Prélèvement d'eau; Politique d'économie d'eau; Changement climatique.

I. AN ANCIENT AND ORGANISED IRRIGATION SYSTEM

I.1 An irrigated region structured around landowners' associations

Vaucluse is a French department situated at the confluence of the Durance River to the south and the Rhône River to the west. It is bordered by the Luberon and the Vaucluse mountains to the east, and Mont

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Ventoux to the north. Under the influence of a distinct Mediterranean climate, the department's agricultural development has relied primarily on traditional Mediterranean crops.

Taking advantage of the Durance river's flow, fed by spring snowmelt, irrigation of the Comtat plain developed during the 19th century and led to unprecedented agricultural and economic growth, driven by market garden produce such as Carpentras strawberries. From the outset, these canals were organised as associations of landowners interested in benefiting from irrigation, pooling their resources to build the infrastructure and then organising themselves to levy charges to finance the maintenance of these same structures. Many of these irrigation schemes, established since the late 19th century, still exist today.

The legislative framework governing these associations was clarified in 1865 and again in 2004. The trade associations that manage these irrigation canals are public administrative bodies. They fulfil a public service mission. The members of these associations are the landowners whose land benefits from irrigation. This land constitutes a perimeter that geographically delimits the areas that can be irrigated. Member landowners contribute to the costs of these structures in proportion to their interest in irrigation, and the direct recovery of these costs by the State contributes to the long-term sustainability of these associations.

1.2 The Luberon Sorgue Ventoux Canal Union and the Carpentras Canal

It was amongst these canals drawing water from the Durance that the Luberon Sorgue Ventoux Canal Union was established. This structure emerged from several irrigation canals grouped around a shared conveyance system, which chose to pool the management and maintenance of a water transport and supply system rather than create new intakes on the Durance.

Administratively, this water management partnership became the 'Luberon Sorgue Ventoux Canal Union' in 2013. In addition to the administrative management and maintenance of the system, the organisation's role is to ensure the water supply to its system and the distribution of this water amongst its member canals in accordance with their rights. This union effectively serves as the interface between its member canals irrigating the Vaucluse region and the institutional bodies responsible for water governance and management at the level of the Lower Durance, and subsequently the Durance catchment area, that progressively emerged during the 20th century.

Thus, the Union has been a member of the Durance Executive Commission (CED) since its creation in 1907. Established by law, the CED's mission is to ensure the distribution of water amongst the Lower Durance canals (in the Vaucluse and Bouche du Rhône departments) in the event of a water shortage by enforcing withdrawal restrictions on intake operators.

Later, a 1955 Act designated EDF (the french national electric company) as the concessionaire for the hydroelectric development of the Durance and authorised the construction of the Serre-Ponçon dam, as well as an 'agricultural reserve' intended to compensate for the insufficient natural flow of the Durance during periods of intensive irrigation of the Lower Durance canals. It was under this concession that, in 1959, EDF created a power canal running parallel to the Durance for hydroelectric generation and rebuild the intakes of the Lower Durance canals, including the historic intake of the Canal de l'Union on the Durance, in order to supply them from this hydroelectric canal.

It is within this broader structure and institutional framework that the Union still exists today. The structure transports 201,000,000 m³ (201 Mm³) (average 2015–2025) from its intake to its member canals, enabling the irrigation of nearly 17,000 ha in the Comtat plain.

As a member of the Union, the Carpentras Canal occupies a predominant position. It currently supplies 13,700 ha via a mixed gravity-fed and pressurised irrigation network. The canal's water supply network comprises:

- A historic 'gravity-fed' network of nearly 400 km comprising the main canal, five secondary canals and a network of branch canals. These canals are gravity-fed and are situated topographically below the main canal.
- A low-pressure network consisting of pipes fed directly by the gravity-fed canals. Water flows through these pipes by gravity.
- A pressurised network consisting of pipes fed by pumping stations that draw water from the canal.

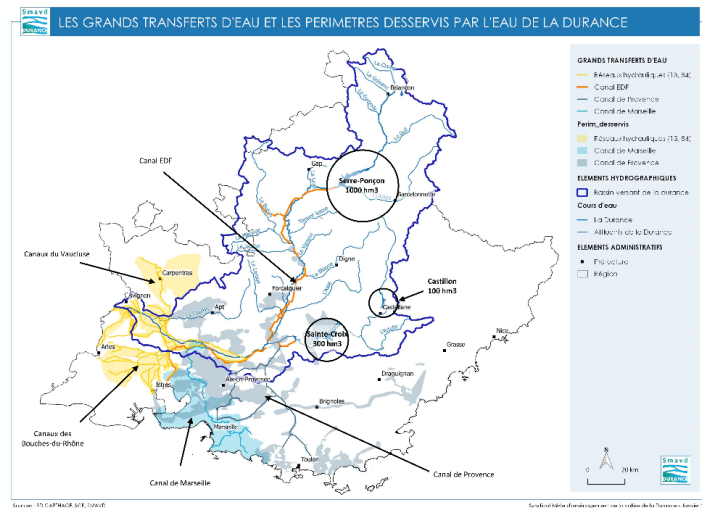


Figure 1: CED area (canals of Vacluse, Bouches-du-Rhône and the Marseille Canal) and water transfer structures – SMAVD

This network of buried pipes currently comprises 1,100 km of pipeline. It is supplied by 36 pumping stations and 25 regulating reservoirs. More than 13,000 pressure water supply points enable water to be supplied to members.

Since its inauguration in 1857, the Carpentras Canal—which originally supplied just 6,000 hectares with water from the Durance—has undergone substantial development and territorial expansion, either by extending its networks or by merging with existing irrigation systems. Today, the canal consists of three distinct sectors: its historic sector, fed by the Durance, covering nearly 12,300 hectares, and two other sectors fed by the Rhône.

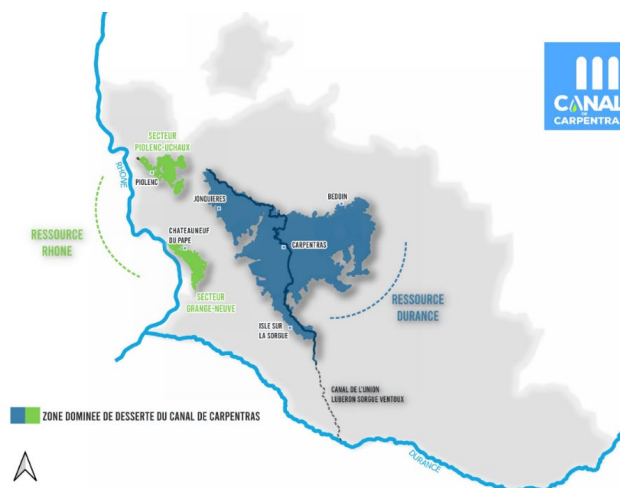


Figure 2: Area served by the Carpentras Canal Water Authority

II WATER SAVINGS AIMED AT IMPROVING WATER SHARING ACROSS THE REGION.

II.1 *Water abstraction halved on the Carpentras Canal*

The Carpentras Canal has been particularly concerned with flow management and improving the efficiency of its irrigation network. As the last canal served by the Union, it is in fact more exposed to water shortages and has always had to cope with situations of scarcity. For many years, there were frequent major problems with the water supply to the downstream section of its service area. Consequently, this 'unfavourable' position prompted the canal's managers very early on to attempt to improve flow management in the gravity-fed network and to save water at the source in the upstream section.

This culture of conserving water was established through two main types of action: flow regulation and pressurising the gravity-fed networks.

Regulating the flow entering the main canal is the primary source of water savings. This regulation first requires an understanding of the flow rates and the installation of measuring instruments along the canal. Thus, just before the First World War, flow regulation in the canal was significantly optimised through the introduction of an initial regulation system. Gauge stations were installed along the entire length of the canal to monitor the flow rates passing through the main canal. Since then, the canal's regulation system has continued to evolve, requiring increasingly sophisticated instrumentation, the construction of control structures (such as constant upstream level gates and motorised gates with set points, etc.) and staff dedicated to regulating the structure 24 hours a day.

Despite efforts to regulate water flows, water supply problems in the downstream section of the canal persisted. In the early 1970s, managers therefore decided to carry out the first pressurisation projects on the gravity-fed networks. These works involved replacing the existing gravity-fed network with buried pipes and on-demand supply points in the upstream sections of the canal where there was a significant difference in elevation between the main canal and the agricultural land being served.

These initial experiments in pressurising gravity-fed networks proved extremely successful. Not only did they generate significant water savings, but they also met the expectations of irrigators in the early 1980s, who wished to be able to implement new irrigation techniques in market gardening, such as drip irrigation.

Since then, the pressurisation of gravity-fed networks has continued, often requiring, depending on the topography, the construction of pumping stations to provide the necessary pressure. Currently, 2,500 ha of the 6,000 ha originally served remain on gravity-fed systems. During the canal's first decades of operation, the canal managers had to draw the full water allocation granted to the canal from the Durance, amounting to nearly 154 Mm³ per year, to supply irrigators. The canal's current withdrawals from the Durance now average 75 Mm³ per year. This approach adopted by the Carpentras Canal, which began in the mid-1970s, has also been implemented by other canals belonging to the Union. These efforts to regulate and increase pressure have had significant repercussions on the Union's water abstractions from the Durance.

II.2 *On the Durance, nearly 200 Mm³ of savings per year since 1980*

This deliberate sobriety and water saving policy on the part of the Union's member canals has an impact across the Durance catchment. The water savings achieved by certain member canals of the Union, such as the Carpentras Canal, have led to such a reduction in water abstraction from the Durance resource that their effect became significant at the scale of all lower Durance canals. This trend is clearly illustrated by the water abstractions by CED canals compiled from 1980 to 2021 (source: SMAVD (1)). These fell from around 1,900 Mm³ per year over the 1980–1990 period to around 1,500 Mm³ in 2021.

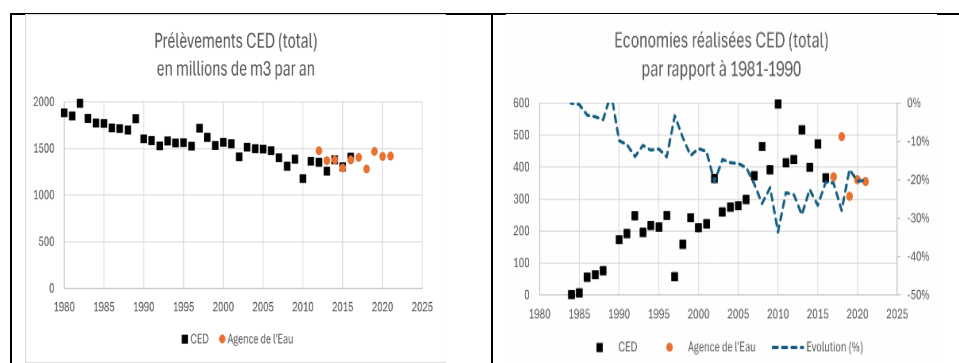


Figure 3: Trends in total water abstraction from the Lower Durance canals (CED area) and savings achieved since the 1980s – SMAVD analysis based on CED data (black squares) and Water Agency data (orange)

Looking solely at the intakes of the Vaucluse canals, the efforts undertaken have reduced water abstraction by nearly 200 Mm³ compared to the 1980–1990 period, out of a total of 500 Mm³ of abstraction. Of these 200 Mm³ saved, 90% (180 Mm³) is attributable to the canals served by the Union.

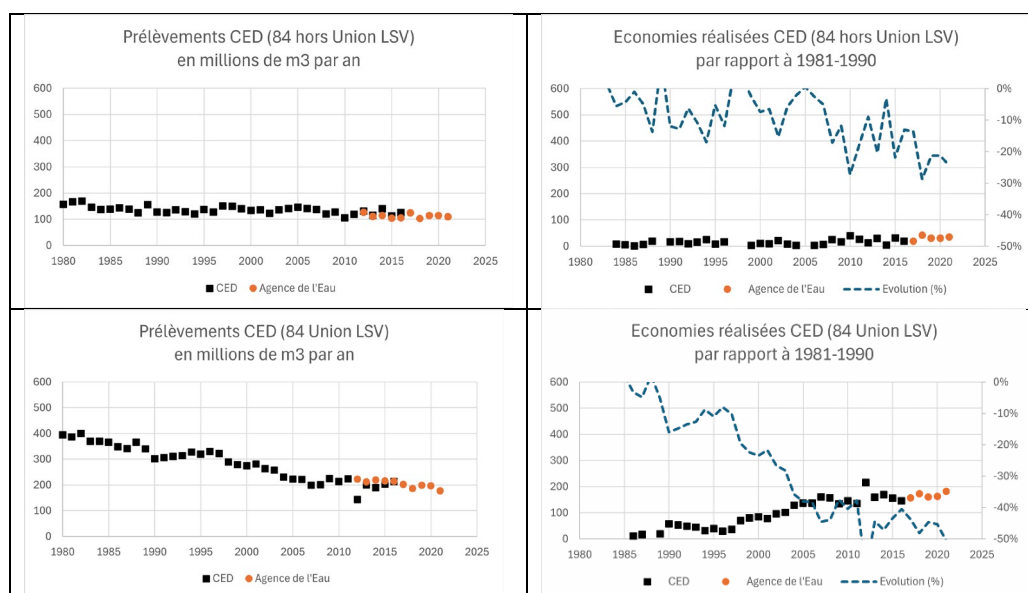


Figure 4: Trends in total water abstraction and savings achieved by the Union Canal among other CED canals in the Vaucluse

In the Bouches-du-Rhône department, a reduction of 250 Mm³ in water abstraction was recorded, out of a total abstraction of 1,250 Mm³. Across the CED's member canals, the efforts undertaken by the canals served by the Union alone therefore account for 40% of all savings recorded over the period 1980–2020.

II.3 Better water sharing

II.3.1 Within the Carpentras Canal

The significant water savings achieved by the Carpentras Canal initially made it possible to significantly improve the water supply to all its irrigators. These newly available water volumes have made it possible to extend the pressurised network to new areas, particularly on land situated upstream of the canal water level. The irrigable area has thus more than doubled, rising from 6,000 ha to 12,300 ha in the section supplied by the Durance. At the same time, total water abstractions from the Durance were

reduced by half against the backdrop of climate change, characterised by increasingly hot and dry summers, there has been a sharp rise in requests from farmers for access to the canal network, particularly in areas that were previously not served.

These requests now concern crops which, as recently as twenty years ago, did not require irrigation in the region, such as wine grapes, olive trees and truffle cultivation. Extending the Carpentras canal network to these areas is now a major challenge for the sustainability of agricultural activities. It also represents a strategic lever for crop diversification, which is essential for strengthening the resilience of farms in the face of growing instability in agricultural sectors and the successive crises affecting them.

Beyond its direct effects on agriculture, this optimisation of water use has profoundly contributed to the transformation of the region, by promoting the development of intensive production systems such as market gardening and greenhouse cultivation. It has also enabled the canal to significantly increase its irrigated area, whilst halving the volumes withdrawn. These developments play a key role in strengthening the region's resilience to climate change.

However, the benefits of these water savings are not limited to the agricultural sector alone. Aquatic environments and associated ecosystems also benefit directly from them. These resources can be mobilised to support certain vulnerable water bodies. In this regard, the Carpentras Canal has, for several years, provided low-water flow support to the Auzon, a Mediterranean river flowing through the town of Carpentras. During low-water periods, this river did not have sufficient flow to ensure adequate dilution of the effluent treated by the wastewater treatment plant. To address this situation, water was supplied via the canal, ensuring conditions compatible with maintaining the good ecological status of the environment. This initiative was governed by an agreement between the canal and the City of Carpentras, approved by the government authorities.

Finally, the principle of sharing water resources across the region is now being incorporated into larger-scale projects. A major resource substitution project is therefore under consideration: it would involve using water from the Carpentras Canal to replace withdrawals from the Ouvèze Ventoux Canal, currently taken from the Ouvèze, a watercourse identified as being severely depleted. Implementing this project would involve extending the pressurised network, as well as reallocating part of the water savings achieved. This approach illustrates a scaling-up of resource sharing, now envisaged within an inter-territorial framework and with a view to preserving the most sensitive water bodies.

II.3.2 Within the Union and the Durance basin

Given the savings achieved across the Union, it is fair to say that these savings help to ease pressure on overall water uses across the Durance catchment.

This primarily concerns the sharing of water between the lower Durance canals. The CED, of which the Union is a member, manages, in conjunction with EDF, an 'agricultural reserve' of 200 Mm³ per year available at the Serre Ponçon dam. This strategic reserve for irrigation ensures a secure water supply to the canals by compensating for the insufficient natural flow of the Durance.

From July to September, this reserve is thus released if the needs of the CED's canals exceed the natural flow of the Durance. Without reducing it to this single factor, water savings in the Union canal have the direct effect of delaying the need to use the 'agricultural reserve', but also of reducing the volume released. Consequently, they reduce the risk of exceeding the use of this reserve (which occurred only twice, in 1989 and 2007) and contribute to meeting irrigation needs on the Lower Durance.

Secondly, it is reasonable to assume that the water savings achieved at the Union Canal scale contribute to helping EDF meet its targets for filling the Serre Ponçon dam to a level compatible with touristic activities. They may also provide greater flexibility in balancing energy production with EDF's legal obligations to maintain a minimum flow in the Durance riverbed.

III. TOWARDS EMERGING OF NEW FORMS OF GOVERNANCE

III.1 The Water Savings Management Commission: COEC'EAU

From 2005 onwards, the Carpentras Canal, alongside the other canals belonging to the Union, embarked on a process of drawing up 'canal contracts'. This innovative approach aimed to strengthen the links between hydraulic structures, the services they provide, and the territories and populations concerned, based on a comprehensive and shared vision of water resource management at the regional level.

This initiative has received crucial support from the Rhône-Méditerranée-Corse Water Agency, a state-owned public body whose mission is to protect water resources and aquatic environments. As such, since 2005 the Agency has been co-funding the network pressurising and regulation of canals to achieve water savings, with the aim that all or part of these savings be allocated as a priority to natural environments.

This fundamental requirement led to the establishment of a specific governance mechanism to define, in a concerted manner, the allocation of the volumes saved: "the water management protocol". To ensure its operational implementation, a dedicated body was created: the COEC'EAU. The COEC'EAU is responsible for reviewing all requests relating to the needs of local aquatic environments, as formulated by the relevant managers. These requests are analysed and prioritised according to their environmental value and expected benefits, as part of a transparent consultation process.

On this basis, the commission may propose the allocation of all or part of the available volumes for the benefit of the natural environment, taking into account both technical feasibility and expected environmental impacts. The low-water support for the Auzon river, mentioned earlier, is a concrete example of the proposals put forward by the COEC'EAU.

Furthermore, the COEC'EAU is also exploring the possibilities of using water from the canal as an alternative to existing abstractions from natural environments. As with low water flow support, these projects are assessed and prioritised based on their environmental relevance and their contribution to water resources preservation.

Meeting at least once a year, the COEC'EAU is chaired and coordinated by the Carpentras Canal. It brings together all the major stakeholders in the region involved in the management of aquatic environments and development: government departments, the Water Agency, local authorities, river associations from the relevant catchment areas, as well as representatives of civil society such as the Fishing Federation or France Nature Environnement.

III.2 The Inter-municipal Commission

Established in 2002, the Carpentras Canal Inter-municipal Commission is a concrete expression of the close partnership between the Canal and the municipalities it serves. It reflects both the mutual trust between these stakeholders, the local authorities' commitment to supporting the development and modernisation of the networks, and the Canal's commitment to more open and shared governance.

This body enables municipalities and inter-municipal bodies to be closely involved in projects that have a direct impact on their local areas. It is particularly involved in the following areas: defining areas for the expansion of the irrigation network, developing uses for untreated water at the local authority level (watering of green spaces, supplying stadiums, street cleaning), enhancing the canal banks for recreational purposes, and mobilising water resources for firefighting.

This commission remains an advisory body. It nonetheless serves as a key forum for dialogue, ensuring the coherence of actions undertaken at the regional level, particularly regarding extension projects or the water needs of local communities. The majority of the municipalities concerned have formally joined

this body and agreed to contribute financially to its operation, so that the canal can carry out the tasks associated with this expanded governance.

III.3 At the Durance basin level: a protocol for the reallocation of water savings led by the Water Agency and EDF

In the absence of water requirements for the local aquatic environment within the COEC'EAU framework, the saved water volumes must benefit the Durance ecosystems. The Water Agency has worked with EDF to establish a mechanism to ensure that all water savings made possible by the works it has co-financed across the Durance catchment since 2015 can effectively benefit the Durance aquatic environment and its tributaries. A very large proportion of the water savings achieved by the Union canals since 2015 is incorporated and accounted for in this pilot mechanism, which is scheduled to run from 2023 to 2032.

IV FROM VOLUNTARY WATER SAVINGS TO FORCED INTAKE RESTRICTIONS

The effects of global warming on the Durance water resources are described in the baseline assessment report of the SAGE Durance (SMAVD (2)). These can be summarised as greater seasonal variation in rainfall, reduced snow cover, increased soil drought and more pronounced summer low water levels periods. This leads to more severe droughts, and possibly the occurrence of successive dry years. It can therefore be considered, at the very least, that the consequences of climate change for the canals dependent on the Durance system will be a greater need for water, coupled with a reduction in available resources and increased pressure on major infrastructure such as the Serre Ponçon dam and the 'agricultural reserve', which until now have secured irrigation for the Lower Durance canals.

However, the situation of the Union's canals is atypical within the Lower Durance region. The massive investments made to reduce water abstraction from the Carpentras Canal and other member canals began nearly 50 years ago. Today, they enable a substantial area to be served with a very low level of water abstraction. Existing mechanisms for sharing water use, particularly in the Lower Durance region, whether long-standing (agricultural reserve) or more recent (inter-department drought decree by the state authorities), were not designed for canals that have already achieved such significant water savings.

The effects of climate change will increase the frequency of periods of tension and crises regarding water resource. They will force all stakeholders involved in water management in the Durance region, and particularly the irrigation canals, to reduce their water abstraction during periods of stress and to seek further water savings. These restrictions and new savings will be difficult to achieve without jeopardising the operation of the concerned canals, which are already operating at the technical limits of their infrastructure. More broadly, without a re-examination of water sharing within the existing framework, the benefits of reallocating the water volumes saved by the canals across its territories may ultimately be compromised. From the perspective of the Union's member canals, genuine recognition by the stakeholders in the Durance system of the efforts already undertaken is imperative for the overall fairness of the system.

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