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Advancing Co-governance through Framing Processes: Insights from Action-Research in the Requena-Utiel Aquifer (Eastern Spain)

CONTESTED SOCIO-MATERIAL TRANSFORMATIONS IN IRRIGATION COMMUNITIES

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ABSTRACT

In recent years, co-management has been highlighted in the scientific literature as fundamental strategy for groundwater governance. However, the development of such an institutional architecture is complex and presents important pitfalls and challenges. Based on participatory action research, in this article we analyse the recent experience of co-management in the Requena-Utiel aquifer (Spain). We used a cognitive framing approach, developed through interviews with local stakeholders, to analyse the conflicting visions on the aquifer management. Then we developed an interactive framing approach, through workshops, to achieve a shared understanding of aquifer co-management. This was done with the aim to facilitate a consensus building process among users, as a basis on which to support future self-governance measures. The research demonstrates the usefulness of these approaches to promote collective action and co-management in groundwater. It shows the key role that information and transparency play in gaining shared understanding and improving co-management; but also the difficulties of users in establishing agreements that question the current status quo on the aquifer.

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INTRODUCTION

All over the world, the mobilization of groundwater resources has been recognised as a "silent revolution" (Llamas & Martínez-Santos, 2005; Molle et al., 2018). Groundwater users can access resources discretely and discreetly, frequently unaware of the behaviour of others and without external control. This is the classic scenario for the tragedy of the commons (Hardin, 1968), and probably one of the situations in which collective action, preventive or corrective, is most difficult to articulate (Closas & Villholth, 2020; Molle et al., 2018; Molle & Closas, 2019; Rinaudo et al., 2020; Rouillard et al., 2021). The silence of the groundwater revolution is too often broken by the noise caused by falling aquifer levels, rising pumping costs, aquifer pollution, land subsidence and impacts on the biodiversity of groundwater-dependent ecosystems. In addition, these crises generate situations of inequity, injustice or dispossession of water resources, directly or in a collateral way (Hoogesteger & Wester, 2015; Hoogesteger, 2022).

In the last decades, two perspectives have been adopted to address the control of groundwater overexploitation: State (regulatory, monitoring or economic) instruments to control abstraction, and participatory mechanisms involving stakeholders through different arrangements (Villholth et al., 2019; Petit et al., 2021). State action has focused on the implementation of a panoply of top-down strategies to control the number and extraction capacity of wells (Molle et al., 2018). These strategies have often failed, mainly due to the inability -for logistical reasons or because of user resistance- to turn plans developed on paper into real results (Molle & Closas, 2017; Hynds et al., 2018; Hoogesteger & Wester, 2017). In other cases, this failure is caused by the lack of legitimacy of the state, which acts with little transparency and harbours corrupt practices (Hoogesteger, 2022). After all, it is the state that often acts in contradictory ways, first trying to encourage water use and then, usually later, trying to control its expansion, a stance that Kuper et al. (2016) describe under the metaphor of the double face of Janus.

On the opposite side, community-based groundwater management has succeeded in numerous small rural communities. However, the success of these local communities that manage one or a few springs with simple technologies cannot necessarily be extrapolated to aquifer management by large groups and more advanced abstraction technologies. Communal resource management theory has well explained the effects and difficulties of this change of scale (Agrawal, 2001), which is prompted by the ease of access by many autonomous and unconnected users (Kemper, 2007).

In between both models, co-management has been highlighted as one of the most promising strategies to control aquifer depletion (Shalsi et al., 2019; 2022; Rouillard et al., 2021). However, even in countries such as Spain, where there is a long tradition of collective action and the state has encouraged co-management, success has been frequently elusive. According to the current water planning instruments, 44% of the Spanish aquifers are currently in bad chemical or quantitative status (Greenpeace, 2022). There are serious problems of marine intrusion in coastal areas, and severe effects on valuable ecosystems (Bea et al., 2014; Lopez Gunn & Zorrilla, 2010; Novo et al., 2015). The existence of collective action institutions does not *per se* prevent the overexploitation of aquifers. This makes it urgent to address the analysis of the experiences of collective action in groundwater management to identify which aspects of user participation contribute to improve management, and which problems or deficiencies are preventing a solution to the tragedy of the commons that still prevails in many areas.

The opportunity to investigate the factors that facilitate or hinder collective action in an aquifer that is in the initial stages of groundwater use and collective management, led us to focus on the case of Requena-Utiel (Spain). To identify which elements challenge collective action and co-management in this aquifer, we developed two tasks. First, in order to build a complete diagnosis of groundwater management, we identified the conflicting frames displayed by the agents on the aquifer (irrigation communities, individual users, industrial users, urban users, environmentalists and river basin authorities). Second, we facilitated a collective framing process of the current groundwater use in the area.

Following this introduction, the article presents a second section with a review of the literature on co-management and collective action in aquifers to establish a conceptual framework; it then (third section) describes the methodological guidelines applied during the research. The fourth and fifth sections describe the legal framework for groundwater governance in Spain and the characteristics of the study area. The sixth section presents the results of the participatory action research carried out, which are analysed and discussed in the following (seventh) section in the light of the previously described conceptual framework. Finally, the main conclusions of the research are highlighted.

COLLECTIVE ACTION AND CO-MANAGEMENT OF GROUNDWATER: THE IMPORTANCE OF A SHARED UNDERSTANDING

Partially inspired by communitarian traditions, but also by theoretical (and rationale) thinking, new governance formulas based on co-management have gained traction since they were identified by Ostrom and others in the early

1990s (Ostrom, 1990; Rica et al., 2014; Rouillard et al., 2021; Molle & Closas, 2019). Co-management is a polycentric form of governance (Ostrom, 2010; Rica et al., 2017; Thiel et al., 2017; Carlisle & Gruby, 2019), conceived as a disputed and challenging balance between state, private users and community-based institutions. In groundwater systems, co-management requires interactions at two levels. On the one hand, a horizontal level of collective action among users, sometimes organized in nested structures. On the other hand, a level of co-production (the co-management itself), where interactions take place between the administrative bodies of the state and the collective action institution(s).

Co-management entails a transformative shift towards bottom-up collective management approaches and the encouragement of collective action (Schlager & Lopez Gunn, 2006; Molle & Closas, 2020; Molle et al., 2018), which stresses the need to develop innovative ways for stakeholder participation in decision making (Wehn & Montalvo, 2018; Roque et al., 2022). The creation of collective management institutions that bring together associations of different water users, as nested institutions, which collaborate directly with state water agencies, is on paper the appropriate instrument to embed user participation in decision-making processes on aquifer management (Rica et al., 2012). It is a suitable structure on which to combine what Molle & Closas (2019) call a "shadow of hierarchy" -understood as the presence of the state and the enforcement of its laws- with the maximum autonomy of users. It also seems the place where to articulate a combined policy of "sticks and carrots", as a result of a continuous interaction between the state and users (Closas et al., 2017).

However, several authors have highlighted that these institutional arrangements do not necessarily perform well or better than other forms of governance, because there is a panoply of potential pitfalls associated with their complexity (Shalsi et al., 2019; Carlisle and Gruby, 2019). The theory of common pool resources management has provided a framework to identify and analyse these risks and shortcomings. Systematised by Agrawal (2001), based on previous research (Wade, 1988; Ostrom, 1990; Baland & Plateau, 1996), and empirically validated in different contexts (Cox et al., 2010), this analytical framework encompasses the examination of the characteristics of the resource system and the group of users, their institutional arrangements, and the external environment. Its main findings, in the case of groundwater, corroborate that the existence of too large and/or heterogeneous user groups; their lack of autonomy; the lack of transparency on the management of the resource; and the lack of understanding of the nature of the aquifer are the main constraints for successful collective action (Molle & Closas, 2019). Other social capital shortcomings – forced participation, unequal distribution of power among users – or lack of financial resources can also undermine co-management (Adams & Zulu, 2015). But in the particular case of groundwater, lack of information and transparency on aquifer management appears to be a key factor (Reddy & Syme, 2014; Villholth & Conti, 2019), because it strongly influences the perceptions that each user group has of the resource system.

Due to this lack of information and the existence of different socio-economic backgrounds, divergent conflicting visions of aquifers are frequently developed. They weaken the communication between the users themselves and between the users and the administration. In the first case, these framing processes undermine the collective action level of co-management, because the diverging visions hinder the construction of a shared understanding. It directly affects the building of trust and awareness. Both elements are essential to build robust institutions, to stimulate user participation and to facilitate the acceptance of control and self-control policies (Shalsi et al., 2019; Stones, 2019). In the second case, the co-production level is damaged by the appearance of grievances, felt and expressed as injustices by stakeholders. These collective grievances can help to generate internal cohesion within a group perceiving the same aggression -i.e. internal social capital- (Tarrow, 1994; López Gunn, 2012), but they also create a marked hostility and lack of trust towards political authority, thus weakening the potential for co-management.

Collective action and co-management go beyond the formal construction of institutions, it requires building trust among users, and then between the government and users (Lopez Gunn & Martinez Cortina, 2006; De Vos & van Tatenhove, 2011), and it must be based on shared understanding (Ostrom, 2009). Without a vision shared by both the users and the administration, based on accurate and reliable information on the state and dynamics of the aquifer, it is very difficult for the institutions to function effectively. In institutional analysis social norms and the alignment of different value frames is fundamental for action (Lopez Gunn et al., 2021). This is not a frequent situation, since there are often conflicting visions of the same area, due to the different cultural and social backgrounds of the users, their economic motivations, and those of the users and state representatives.

Therefore, in order to design groundwater governance systems it is fundamental to understand "how people think and why they think in the way they do" (Berge, 2012).

These are complex socio-technical systems and therefore the design and performance of any organisational system can only be improved if the "social" and "technical" aspects are addressed together as interdependent parts of a complex system. This research focuses on the analysis of

these collective visions, but also addresses the challenge of co-constructing a shared vision in a space where, as in many other aquifers, there are different perceptions of the nature of the groundwater body and its evolution, and divergent framings on the present and future management of the aquifer. In these situations, converging on a shared understanding – or at least in a soft consensus -, can contribute to build a solid basis for successful collective management and co-management. The analysis of the collective frames and the construction of a shared understanding requires going through two ontological perspectives on framing processes (Dewulf et al., 2009): from a cognitive perspective, in which frames are knowledge structures developed by individuals or small groups, to an interactive perspective, in which parties negotiate meaning (framing as interactional co-constructions). The first must be addressed to achieve a conceptual mapping of the visions of the different actors or groups of actors, while the second focuses on building a shared understanding of the status of the aquifer and the management measures necessary for its conservation.

METHODOLOGY: FROM COGNITIVE TO INTERACTIVE FRAMING

This research aims to advance the co-management of groundwater, through the articulation of a consensus building process among users on which to support the measures necessary to carry out a sustainable exploitation of the aquifer. We use a cognitive framing approach to analyse the conflicting visions on the aquifer management, and we developed an interactive framing approach in order to achieve a shared understanding as a basis for co-management (Dewulf et al., 2009). The methodological process consisted of four tasks. The first two are used for the cognitive framing. These are stakeholders mapping and selection of actors and semi-structured interviews with the stakeholders, aiming at identifying the discrepancies among stakeholders and their conflicting visions. The other two are used for the interactive framing: a participatory workshop, and a return session, in order to contribute to building a shared understanding to improve co-management.

COGNITIVE FRAMING

The stakeholders mapping was carried out through the review of the activities developed in a previous project (Sanchis-Ibor et al., 2021), and after the first round of interviews with members of the Jucar River Basin Authority (CHJ) and some water users' associations. Subsequently, once the key agents had been identified –irrigation communities, CHJ, industrial users, wineries, and municipal councils– semi-structured interviews were carried out, which were held at the headquarters of these institutions and lasted approximately one and a half hours. In some cases, the interviews started with a certain mistrust, if not hostility, on the part of the interviewees because of the conflictive atmosphere of local groundwater management. This initial tension gradually faded away and turned into a strong involvement in the participatory process of diagnosis. In most cases, interviews were followed by field visits to inspect the facilities and/or irrigation systems of the stakeholders. The interviews made it possible to collect key data on the activity of the institutions and on their vision of the management and governance of the aquifer, as well as on the relationships between the different stakeholders.

INTERACTIVE FRAMING

Finally, to develop an interactive framing, a participatory workshop was held in Requena in March 2022, attended by 20 relevant actors as representatives of the irrigation communities; the municipal councils; the CHJ; the affected private entities and a representative of a local environmental organization. The participatory workshop lasted a full day and was arranged in three dynamic exercises with two heterogeneous subgroups with similar profiles who shared their views at the end of each exercise. The work sessions were recorded in audio format and later transcribed as annotations for qualitative analysis.

The first exercise consisted of the elaboration of a collective conceptual map of problems through brainstorming, which was later systematized with the MIRO digital tool. The second activity consisted of another participatory diagnostic exercise to identify important issues through highlights, prioritized with a Likert 4 scale. The last exercise consisted of the proposal and prioritization of measures identifying, by stakeholder groups (irrigation communities; public administrations -municipalities and CHJ-; affected private sector; and environmentalist organization), their effectiveness and acceptability, again using Likert 4 scales. All the results were systematized and coded. The feedback session took place in October 2022 and consisted of a brief presentation and a subsequent discussion to validate the results.

THE LEGAL FRAMEWORK FOR GROUNDWATER CO-GOVERNACE IN SPAIN

Spain has a tradition of water management and allocation based on a dual model of water rights. While surface waters are public, groundwater was a private resource until the Water Law of 1985. However, this division has lasted to the present, since special legal provision allowed the co-existence of public water concessions, temporary private rights and fully private rights (Sanchis-Ibor et al., 2022).

More recently the public administration has further clarified the operational rules for these different type of water rights, and thus has identified legitimate legal criteria to extinguish private water rights. It has also granted the river basin authorities (*Confederaciones Hidrográficas*) enforcement authority to control groundwater use and impose sanctions for illegal or excessive abstractions (De Stefano et al., 2015).

This legal framework faces enormous challenges, mostly derived from the irrigation promotion policies developed throughout the 20th century, which have led to groundwater overexploitation in some regions, generating dramatic environmental impacts and important social and territorial tensions. In most cases, the lack of effective monitoring and control systems, together with a lack of political will, has limited the capacity of the river basin authorities to stop or revert these processes (De Stefano et al., 2014; Fornés et al., 2021).

The current legal framework allows river basin authorities to officially declare that a groundwater body is overexploited or at risk of not reaching a good quantitative status. Then, the Water Law establishes that the river basin authority must constitute a community of users (Water Users Central Board, in Spanish *Junta Central de Usuarios*), or temporarily entrust its functions to an entity representing these interests. After consulting with the users' community, the river basin authority must approve, within a maximum period of one year, an exploitation plan for the recovery of the groundwater body. Although these periods have been rarely fulfilled, the approval of this action program and the creation of the community of users have taken place in the overexploited aquifers of the region. The development of these institutions and their approach to co-management is neither alien nor novel in the Spanish legal context, which acknowledges numerous historical organisations for collective, community-based or inter-community groundwater management (Sanchis-Ibor et al., 2009). However, the results in overexploited aquifers have been rather questionable (Closas et al., 2017; Rouillard et al., 2021).

THE REQUENA-UTIEL AQUIFER AND ITS CO-MANAGEMENT

In this context, the case of Requena-Utiel is of special interest. It has very recently been declared overexploited area, where users are in an initial phase of collective management. This groundwater body is located at the eastern margin of the Spanish Plateau, in the Valencia Region. The groundwater system has a surface area of 98,800 ha and its altitude ranges from 600 to 1,200 m above sea level. The climate is Mediterranean, on the border between the Köppen-Geiger Csa and Csb types. Mean annual temperature is 14° and mean annual rainfall is 323 mm. There is a marked dry season from June to August, which makes summer irrigation necessary to ensure crop productivity. Vineyards occupy 304.2 km^2 and represent 90% of cropped area. Almond trees occupy 5% and other crops 5%. The Magro River, a tributary of the Jucar River, drains this plain. It is 126 km long, has a basin of 1,543 km^2 and a mean flow of 0.91 m^3/s. It is regulated by the Forata reservoir (37 Mm^3), located downstream of this area (Figure 1).

In 1995, the irrigated area of Requena-Utiel only occupied 1,738 ha, of which 1,279 ha were forage and summer vegetables, and 449 ha of wine vineyards (GVA, 2023). Most of these areas were irrigated with water from the river Magro and natural springs, managed by small irrigation communities with a long historical tradition. The rest of the district was occupied by rain-fed crops (58,524 ha). However, after the turn of the century, the Ministry of Agriculture and the Regional Government started to encourage (and subsidize) the expansion of vineyard irrigation in the district, to ensure and increase production. This public investment was conceived (or justified) as a rural development measure, to retain and sustain the population in the area. Farmers argued –during the interviews- that this support was crucial, because they have observed a decrease in rainfall during the last three decades, which they attributed to climate change. Between 2005 and 2010, some farmers created irrigation communities to obtain these public funds, after receiving administrative licenses from the Jucar River Basin Authority (CHJ) for collective groundwater exploitation. They built wells, reservoirs, and pressurized networks. In order to join any irrigation community, farmers had to give up their rights to the individual wells, stop using them, and connect their irrigation systems to the collective network. The five largest irrigation communities expanded over 7,500 ha. Other farmers obtained private groundwater licenses for individual landholdings, without public support. As a result of this process, in 2019 the irrigated area had expanded to 14,621 ha (11,660 ha of vineyards, 1,546 ha of almond trees and 1,415 ha of other crops). In short, in 24 years the irrigated area has increased eight-fold (GVA, 2023) from 1,738 ha to 15,163 ha, from 3% to 29% of the total cultivated lands.

After 2010, the CHJ detected a significant decrease in the Forata Reservoir inflow, which was attributed to the intense exploitation of the Requena-Utiel aquifer. In 2015, the aquifer was declared in bad quantitative state by the CHJ, which immediately started to design measures to control abstractions for irrigation. In 2016, the CHJ approved the *Exploitation plan of the Requena-Utiel groundwater body* (CHJ, 2016), which allocated to users owning administrative

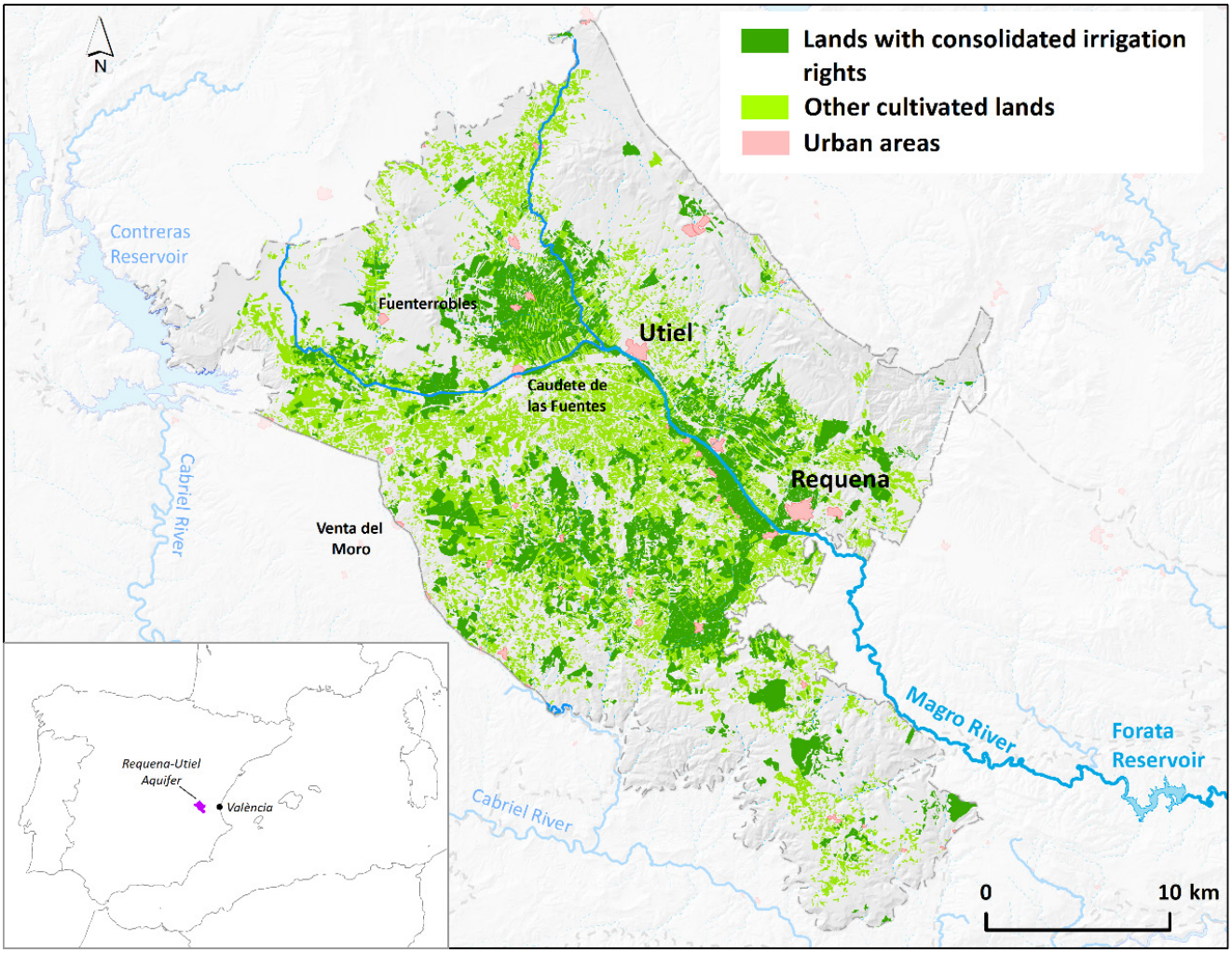

Figure 1 Map of the Requena-Utiel groundwater body.

concessions a maximum volume of 600 m^3/ha for woody crops during mean rainfall years (between 210 and 310 mm); 450 m^3/ha for wet years (>310 mm); and 900 m^3/ha for dry years (<210 mm). This Plan does not allow irrigation for those areas that did not have public administrative water concessions prior to 2016. The Plan was recently updated without significant changes (CHJ, 2020). In recent years, on the basis of the data provided by the programme for monitoring the quantitative state of the river basin authority, there has been an unsustainable downward trend in the aquifer levels, which can be seen in some of the piezometers (not in all) and in the balance of flows and outflows from the Forata reservoir (CHJ, 2020).

According to the Water Law, the river basin authority also obliged users to create a water users central board (Junta Central de Usuarios de la Masa de Agua de Requena-Utiel, JCURU), which was formally constituted in September 2018. The structure of the JCURU, regulated by the Water Law, replicates the structure of the irrigation communities. The sovereign body of the JCURU is the General Assembly, made up of all users of the aquifer. There is an executive body, the governing board, whose members (11) are elected by the General Assembly (votes are proportional to the volume of water rights) and represent the different types of uses (4 irrigation communities; 1 for individual agricultural users; 2 industrial users; 3 municipal urban supply systems; 1 for other users) (JCURU, 2017).

RESULTS

THE COGNITIVE FRAMES OF RELEVANT ACTOR GROUPS

The management of the Requena-Utiel water body involves 6 actors/groups of actors: the JCURU, the CHJ, the urban supply systems managed by the city councils, the bottling companies, the groundwater irrigation communities, and the individual users. In addition, although they are not direct users, we also consider as stakeholders the surface water irrigation communities, which are affected by the

lowering of the water table. Our interviews show that each of these actors have a particular visualisation of the conflict and the positioning of the other actors (Figure 2).

The Júcar River Basin Authority (CHJ)

The CHJ aims at controlling the expansion of irrigation, to prevent the aquifer from reaching a situation of irreversible overexploitation. It tries to promote a co-management model based a model based on the interlocution with the figure of the of the JCURU (promoting self-management mechanisms and the use of technological tools), while trying to maintain direct dialogue and mutual trust with the board of the JCURU. The river basin authority perceives that the problem is essentially a problem of agricultural use and believe that – given that the groundwater irrigation communities bring together the majority of the volume of water granted- control of the aquifer can be achieved through them.

Junta Central de Usuarios de Requena-Utiel (JCURU)

The governing board of JCURU strongly believes in the need to achieve full self-management of the system, but, as they represent different types of users (those mentioned above), they do not share a common framework. Their experience is very short (since 2018). The meetings of its governing board are a forum for debate, where each group represented defends its own interest, but they also pursue the consolidation of the institution as guarantors of the co-management of the aquifer.

Groundwater irrigation communities

The groundwater irrigation communities perceived the mobilisation of groundwater resources as "a ray of light" for the region, as it made it possible to help agriculture, which was going through a very difficult situation due to insufficient rainfall. They do not believe that there is a problem with the sustainability of the aquifer and argue that piezometric

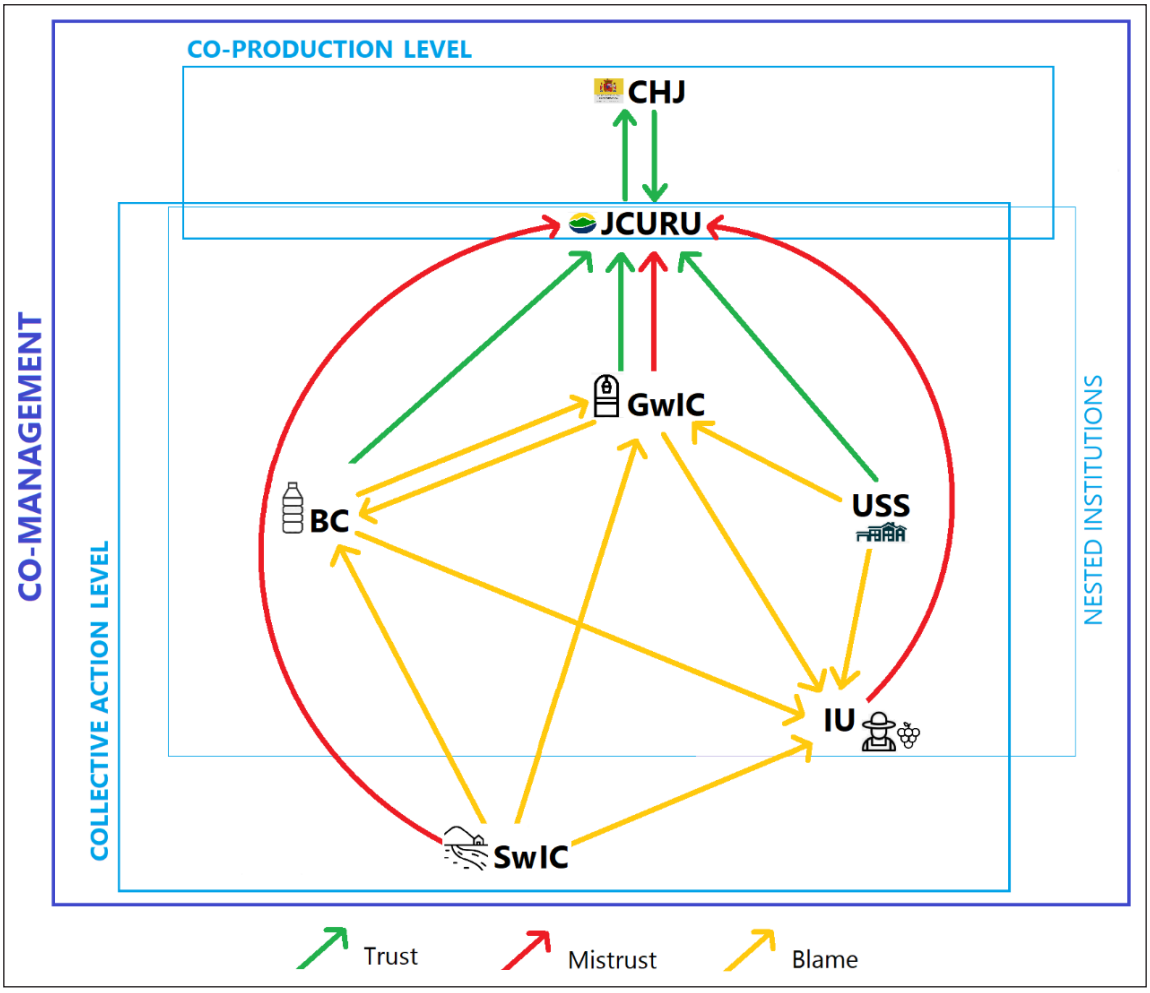

Figure 2 Actors' positions and interactions in co-management, within the co-production or collective action levels. CHJ for the Júcar River Basin Authority, GwIC for groundwater irrigation communities; USS for urban supply systems (city councils); SwIC for surface water irrigation communities; BC for bottling companies; and IU for individual users. As nested institutions we include all the organizations involved in the JCURU.

levels have been stable for several years. They claim that the CHJ is acting unfairly and arbitrarily, since it uses the inputs received by the Forata reservoir on the river Magro as the only indicator. According to their data, the only wells affected by a decrease are those of a bottling company, which some accuse of "plundering" local resources. Their view of the common water user's association, the abovementioned JCURU, is not homogeneous. Some entities consider it an "imposition" by the CHJ, which wants them to "be policemen", while others believe that the aquifer should not be controlled by the CHJ and that "the irrigation communities have to control it", which is why they perceive the JCURU as an opportunity. However, all the groundwater irrigation communities agree that the creation of the JCURU allows for (self-)monitoring of the behaviour of the groundwater irrigation communities, but leaves many individual users on the sidelines: "Who controls the small ones? No one". This is because the CHJ receives direct and reliable information from the irrigation communities, which supply large areas with very few wells (between 1 and 3 per community), but not from the small wells of individual farmers and wineries, which are not very powerful but very numerous (they account for 25% of agricultural abstractions according to CHJ representatives). Regarding the CHJ, the ICs argue that the official declaration of overexplotation was "exaggerated" and "not sufficiently proved", because they don't observe significant groundwater depletion in their wells.

The bottling company

The main bottling company perceives the JCURU as "an opportunity to self-manage" and prevent more serious future problems. The company denies the accusations from agricultural users, feeling mistreated by farmers in the past, and argue that although levels were falling previously levels are currently stable due to the effects of the heavy snowfall of 2017. The company believes that some agricultural users "think that water is infinite" and that so far there has been little control by the administration and no self-monitoring by farmers. They think that the declaration of overexploitation by the river basin authority was necessary to control the expansion of irrigation and to prevent groundwater from a critical depletion.

The city councils

The city councils agree with the company in their complaint on the lack of control and believe that the problem is not the bottling companies, which extract 7% of the aquifer's resources, but rather agricultural uses which approximately represent 80%. The city council also shares with bottling companies a firm concern for the quality of the aquifer's water. The city stressed, as did most of the agricultural users, that the origin of the problem is an agricultural model based on production and not on quality. They also share with the industry a growing concern on groundwater quality, because of the existence of some livestock farms and the use of slurry as fertilizer.

Individual agricultural users

The individual users (IUs in Figure 2) are a heterogeneous group, formed mainly by small farmers with modest wells but also by some wineries. Once an irrigation community is created in any area, all these small wells are cancelled and abandoned, and farmers obtain water from the collective network. IUs subscribe to the idea of an agricultural model excessively depending on "quantity" –the only exception are some wineries-, which is very hard to overcome for the local cooperatives. Until the agricultural model changes and the grape is valued (main crop) for its quality and not for its weight, and is paid accordingly, effective control will not be possible. Individual users distrust the JCURU as an "imposed" body. For their part, the surface water irrigation (SwIC in Figure 2) communities feel "abandoned" by the CHJ and victims of groundwater irrigation expansion. These users are not represented in the JCURU and do not believe that this can bring them anything as individual users.

INTERACTIVE FRAMING AMONGST THE DIFFERENT RELEVANT ACTOR GROUPS

The diagnosis made during the workshop was used to draw up a conceptual map that was agreed upon by the participants (Figure 3). In this conceptual map, which has been rearranged for ease of interpretation, texts, boxes, and flow lines correspond to the elements highlighted and connected by the participants. The frames have been provided by the authors to classify the information.

The central axis reproduces the common elements of the users' framing, as they were agreed during the workshop and ratified during the subsequent return session. In the first place, all of them highlighted the key role of the economic use of water in sustaining the population of the region. Following the suggestion of an individual user, this was written as "Water = Economy = Life". This triple nexus is rooted in a production system oriented to the production of wine grapes, through a model based on production in terms of quantity, highly pressurised by low prices that makes dry farming unfeasible. This conditioning factor of the production model pushes up the demand for water and, consequently, causes a drop in groundwater levels. However, some agricultural users question this decrease, because they do not perceive it in their wells. In this way, everyone unanimously highlights that the fundamental problem is the lack of information on the current state of the aquifer, a fact that favours overexploitation and generates a lack of social awareness of the problem.

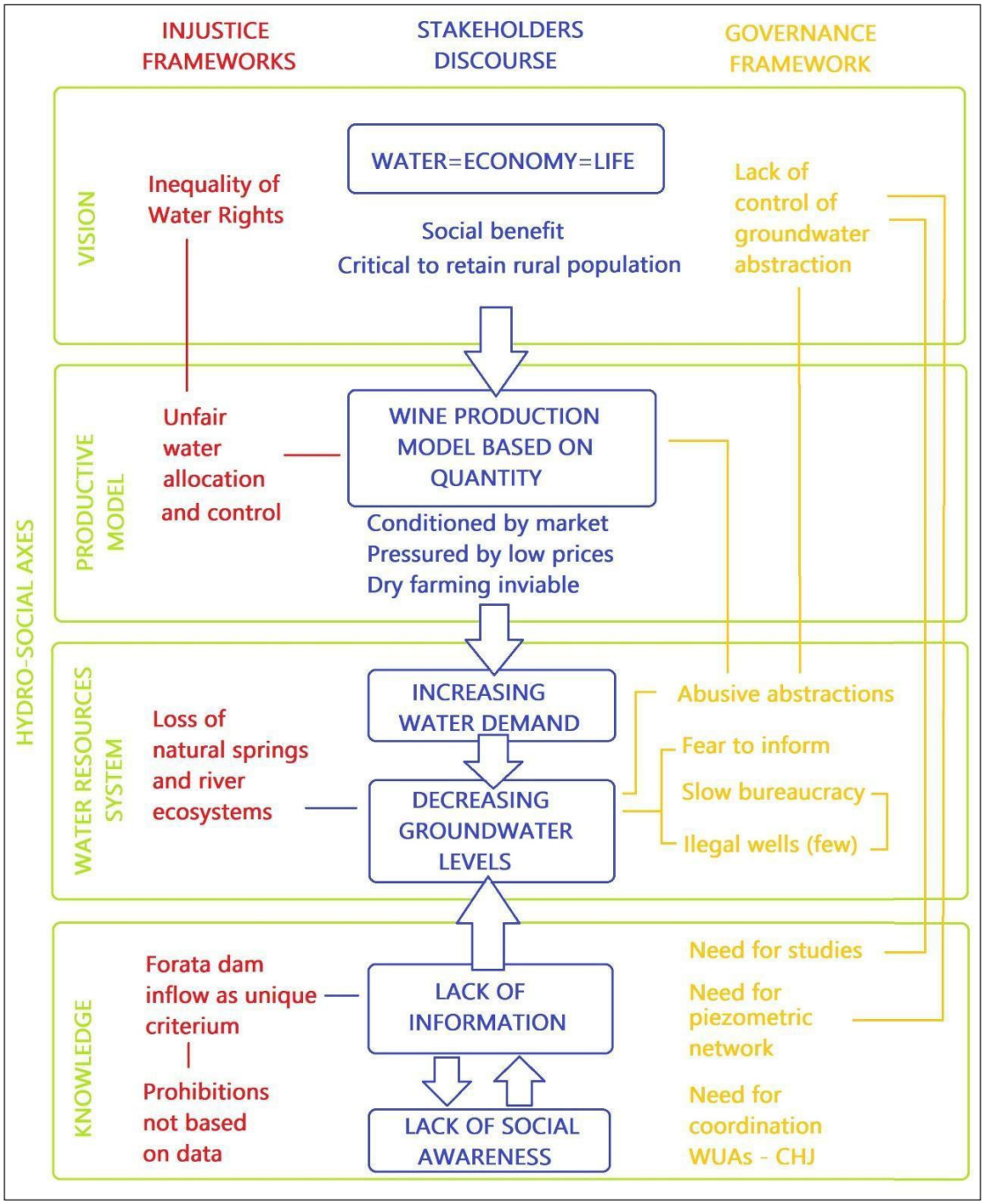

Figure 3 Conceptual map of the collective diagnosis of the Requena-Utiel groundwater body, resulting from the diagnosis and participatory framing, agreed by the participants in the workshop.

This shared and vehemently defended discourse is fuelled by four grievances or injustices connected to the arguments of this central axis (Figure 2). The first is that the CHJ imposes considerably lower (1/3) irrigation rights than in other neighbouring regions (Mancha Oriental), also affected by the intense exploitation of resources in irrigated farming. The CHJ has limited the annual irrigation allocations, which lowers vineyard production and do not consider the local variability of the soils, although they act to curb demand. The second concerns the unfairness of the fact that the CHJ can easily control the abstractions of ICs, but not the pumps of individual users, so that members of ICs feel more pressured and controlled than other users. The third, raised by ecologists and urban users, are the negative effects of groundwater exploitation on the Magro River and some natural springs that have dried up, affecting traditional uses. All the users ratified these processes, although some agricultural users described this as an unavoidable "a price to be paid".

Finally, the fourth concerns the lack of information. The agricultural users denounced that the discharge over the Forata reservoir has been the crucial criterion to control the evolution of the aquifer and to determine its overexploitation. They argue that there are many wells in the district with stable behaviour over the last decade, and that the aforementioned official limitations have been established without sufficient data to corroborate the decline in the groundwater body. None of the users questioned this fact. But their interpretation was divergent. For some agricultural users it is an unfair imposition, but for urban and industrial users, although this could be unfair, this is a fact that should not be used to deny the need for exhaustive control over water uses to ensure sustainable management of the resource over time. All agreed, as a consensus proposal, that a better knowledge of the dynamics of the aquifer is needed in order to reliably determine what the limit of abstractions should be, so as to guarantee the future use of the aquifer. Currently, the CHJ has only 7 piezometers within the aquifer, two of which are installed in the same location. The CHJ has a project in progress to improve this piezometric network.

Consequently, regarding the governance of the aquifer, the lack of information was raised by farmers and pointed out by all the stakeholders as the most fundamental element, highlighting the need to develop technical-scientific studies to better understand the piezometric evolution of the groundwater body (Figure 3). This lack of information is one of the elements that affects the lack of effective coordination between the irrigation communities and the river basin authority, an improvement which is much needed. It also limits the ability of users and the river basin authority to control the aquifer, although some agricultural users expressed a preference for the absence of external controls. In relation to this control of the aquifer, users identified three interconnected factors that contribute to overexploitation: Illegal wells and abusive extractions; users' fear of reporting; and the bureaucratic delays in the legalisation of wells. These three aspects feed into each other.

INFORMATION. GAPS AND NEEDS

Once the key problem of lack of information had been identified, the two groups were required to detail and share a diagnosis of the flow of information between users and institutions, and to identify information needs. Regarding the first task, the agricultural users described that they could obtain meteorological information and standard crop water needs prepared by various public and private institutions. In addition, the CHJ provides them with the Exploitation Plan for the Groundwater Body and the Water Basin Plan. Also, with river gauging and surface water information from the SAIH (Automated System for Hydrological Information) and SAICA (Automatic Water Quality Information System) networks. There is available information on the cultivated area and varieties provided by the Department of Agriculture of the regional government. Users, in turn, report to the river basin authority information on the volumes extracted in the wells, but these data are not shared nor discussed. Some users also have soil humidity probes whose data are handled by the technicians of each irrigation community. All the participants agreed that key information is not shared and that sometimes it is only accessible to the technicians of the irrigation communities, or it is difficult to consult.

Much of the information they demanded already exists and is public and available to citizens, but the CHJ (as one representative admitted) does not provide it in a sufficiently easily findable or comprehensible manner. Users agreed that most of the information is only accessible to expert technicians, but not to all the users. There is a clear lack of transparency since the main interested parties encounter many problems in accessing and understanding the information. It is true that the Spanish water administration has abandoned the opaque practices of the past (Martínez-Fernández et al., 2020), but this case shows that it is still at a translucent stage, as it is not able to communicate in a simple, clear and effective way to meet the information needs that are strategic for many groundwater users –as a representative of the public administration admitted during the return session.

For these reasons, all the participants called for a broader exchange of information "and for it to flow amongst all", as well as the development of joint studies to obtain new data on the state of the aquifer. Specifically, they demanded an information system shared among all users and public institutions that included: i) number of existing wells; ii) extraction data, dynamic and static level of the wells; iii) evaluation of the state of the aquifer; iv) weather forecasts that make it possible to anticipate the annual volume of extraction that will be authorized by the CHJ, through models capable of determining the degree of uncertainty; v) crop water needs and levels of water stress to be able to practice smart agriculture techniques; and vi) information on cultivation costs.

AGREED MEASURES FOR SUSTAINABLE GROUNDWATER MANAGEMENT AND GOVERNANCE

The stakeholders proposed and discussed several measures, which subsequently were evaluated by the stakeholders themselves by voting on their effectiveness and acceptability (Table 1). The most effective and acceptable measure pointed out was environmental education and social awareness. It reached almost unanimous support.

Together with this measure, the one considered most effective was the adaptation of the water quotas allocated

MEASURES PROPOSED BY STAKEHOLDERS	EFFECTIVENESS	ACCEPTABILITY	EFFECT. + ACCEPT.
Environmental education and social awareness	57	63	120
Sustainability Seal	51	62	113
Water reuse	44	63	107
Water Allocation Adaptation	53	54	107
Smart-APP	51	54	105
Groundwater research	50	47	97
Remote Sensing	51	35	86
Review of water allocations and concessions	31	28	59
Joint groundwater studies	29	29	58

Table 1 Main measures proposed by stakeholders: Effectiveness and acceptability. The numbers represent the sum of the votes cast by the participants using the Likert 4 scale, being 1 the minimum support and 4 the maximum.

for the vineyard to the crop water requirements needs. Subsequently, three other measures of a technical nature were highly valued: the development of an app for users to exchange information on wells with the CHJ; the introduction of control methods of the irrigated area through remote sensing; and the development of hydrogeological studies on the behaviour and evolution of the aquifer. In addition, high efficiency was attributed to the possibility of creating a "sustainability" seal for wineries that would certify a sound and transparent use of groundwater, which should be granted to those who met certain requirements in the use of water resources and the provision of information. Other measures, such as the control of small private users, dissemination of information by the CHJ or mobilisation of new water resources (from neighbouring areas), were considered less effective. However, the use of treated wastewater for irrigation was positively assessed.

Discrepancies between acceptability and efficacy were of low significance. Perhaps the most important is that the reuse of wastewater and the implementation of a sustainability seal improved its position with respect to effectiveness assessments. The others obtained very similar evaluations, although it is noteworthy that those considered less efficient were also those considered less acceptable (control of small private users, dissemination of information by the CHJ or mobilisation of new water resources).

DISCUSSION

The institutional architecture of the legal framework for water in Spain seems, a priori, adequate to support collective action and co-management in groundwater governance. However, this formula has yielded different results in different hydro-social contexts (Molle & Closas, 2019). This case underlines that the key to success is not (only) in the institutional architecture, but also in the way the stakeholders produce their own collective frames, and in their capability to build a shared understanding from these.

In Requena-Utiel there are several user groups with different backgrounds and objectives, which develop conflicting collective frames, reflected in their discourses and criss-crossed blames (Figure 2). These conflicting frames are fundamentally conditioned by the economic interests of each group, but also undoubtedly by their professional and educational backgrounds. The urban and industrial water users have a greater tendency to demand a firm self-control to guarantee the sustainability and quality of the aquifer, while the different agricultural users pursue, for the most part, the expansion of agricultural water use as far as possible. Each group of users has constructed a collective frame that positions some of the other groups as being to blame for the situation of the aquifer. They also perceive the action of the CHJ differently. The interview campaign brought to light the existence of a high degree of mistrust among users and between them and the CHJ, and even between the interviewees and the researchers, who initially were seen as an extension of the action of the CHJ.

This case also shows that we should be cautious in the use of the ill-defined term sustainability, because each group embodies in it its own vision. They all claim to pursue aquifer sustainability, but in their frames, each of them shows a different perception of the term. For some, the aquifer can be exploited with the current intensity or even more intensely, and others are convinced that resource extraction must be stabilized or reduced. The trivialised use of this term can give the false impression that there is strong agreement on the principles and measures of co-management, when this word is hiding the discrepancies that really exist between users. Thus, a space remains to be explored with the users

and the regulators on what a shared understanding around sustainability could look like in the future.

But to do this, as the interactive framing exercise demonstrated, it is essential to transparently access reliable information about the nature and dynamics of the water body. In Requena-Utiel, the conflicting frames are fed back with the poor understanding of the geohydrology of the aquifer. The CHJ's piezometric network is rudimentary and does not reflect well the complexity of the water flows in the aquifer. This facilitates different interpretations of the aquifer dynamics, which fuels divergence and conflicting collective frames. The participatory work of drawing up a joint and consensual diagnosis made it possible to identify the information deficiencies that underpinned this mistrust and lack of awareness, and to reach a shared understanding of the aquifer problem and its causes. In the organizational literature this is often referred to as "sensemaking" (Weick et al., 2005). The users participating in the collective diagnosis were aware (and spontaneously highlighted) that their discrepancies were mainly caused by this badly known nature of the resource system, and consequently, detailed the studies and data that would be essential to fill this gap. They called for a better information system that could define how much water can be pumped annually without jeopardizing the future sustainability of the aquifer.

Users' demand for aquifer information transparency highlights the importance of activating participatory dynamics that facilitate bottom-up processes for co-management. The same is observed in the analysis of the measures and solutions that were proposed by users. Probably because users have previously agreed on a common diagnosis, the proposed solutions met with a broad (but soft) consensus. Five of the seven highest rated measures were directly linked to the provision of information on the status -nature and dynamics- of the groundwater body, and its use to encourage "sustainable" management practices. Users showed they wanted, paraphrasing UN Water theme on groundwater, to make visible the invisible (UNESCO, 2022), and they would want to use this visibility to increase the self-control of water abstractions and to avoid free-riding.

Social learning strategies -such as promoting education, social awareness, and responsible consumption- were the most highly rated proposals, a fact that coincides with the recommendations of some experts (Rouillard et al., 2021). Technosolutions, such as information exchange through a mobile application, and control of irrigated areas through remote-sensing techniques, received significant support. But far from being idealistic, it must be admitted that these proposals are aimed at maintaining the status quo in the aquifer, and at preventing the arrival of new users and free-riders. In short, both the proposals for social learning and technosolutions, and above all, the proposals made for improving concessions and incorporating treated wastewater, are initiatives that, in addition to protecting the status quo, do not really consider the possibility of influencing a change in the productive model, which, during the diagnostic phase, was identified as the root cause of the problem of overexploitation.

Users were unable to re-think alternative scenarios including other productive models, nor to provide solutions to what Hoogesteger and Wester (2015) call the *diffuse injustice*. With this term, we refer in this case to one of the grievances detected during the diagnosis, the impact of groundwater depletion on natural springs, the river Magro ecosystem and users. These invisible forms of dispossession related to groundwater exploitation affect large segments of the population and the natural environment, and their damage is largely irreversible in the short and medium term. Users took these losses on as irresolvable collateral damage, but also as a necessary loss or sacrifice to sustain the (inalienable or irreplaceable) productive model. This partial conception of groundwater systems frequently results in injustices at other places or stakeholders (Patrick, 2014; Jakeman et al., 2016), and too often the losers are the natural environment and the powerless groups (Neal et al., 2016).

CONCLUSIONS

The case of the Requena-Utiel aquifer shows that collective action and co-management of groundwater, even with an apparently optimal institutional framework, faces multiple challenges. These are rooted in the socio-economic and cultural heterogeneity of users, which influences their visions and objectives, but also in the information available about the resource system, as this can influence the emergence of grievances and criss-crossed blames.

From an academic perspective, our research demonstrates the need to use the analysis of framing processes to better understand the commons, and particularly the common spaces for potential collaboration and collective action. From a methodological perspective, this research also shows that the analysis of cognitive framing through interviews allows for the detection of divergent and conflicting visions, while the subsequent development of a participatory workshop for interactive framing can facilitate a shared understanding, or at least soft consensuses (a good basis on which to build co-management).

From a policy perspective, this research shows that public authorities cannot simply create the formal institutions and wait for co-management to magically work. Higher level authorities (e.g. regulators) need to negotiate to deeply engage the users in an active process of co-creation, and to develop

social learning processes that eventually can crystallize in collective action and aquifer co-management. This involves strengthening the mutual and collective understanding of the nature and behaviour of aquifers. Additionally, this change requires effort from water authorities, which must include new professional profiles or capacities, and work beyond the usual carrot-and-stick policies and administrative techniques. It also requires users' associations to step forward and be able to make sometimes difficult decisions with their own members, in pursuit of long-term goals.

For the three approaches, actions to provide and disseminate a good knowledge of the resources system, and to increase the flow of information between the water authorities and the users (and between the users themselves) are fundamental. The use of technosolutions, demanded in this case by users, can be a valuable decision support tool in achieving an enhanced information system. This can contribute to improving the quality and veracity of the data on which the process of framing is based. They are, therefore, instruments that can be extremely useful in the development of social learning processes for sustainable groundwater management. However, without accompanying processes to build up trust between the different actors, these tools are not sufficient.

Finally, governance strategies are frequently based on a social contract that leaves some victims along the way, in environmental and social terms. In the case of Requena-Utiel, the users based and protected their collective (internal) agreement under the water-economy-life principle, which implicitly entailed rejecting the revision of their productive model and the assumption of certain sacrifices, made at the cost of environmental degradation and external costs. A real shift in governance towards sustainability (Agrawal et al., 2022) involves visualising alternative scenarios, putting limits on economic growth, and redesigning economic strategies to avoid passing on costs to the natural environment and future generations.

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COMPETING INTERESTS

The authors have no competing interests to declare.

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REFERENCES

Adams, E., & **Zulu, L. C.** (2015). Participants or customers in water governance? Community-public partnerships for peri-urban water supply. *Geoforum*, *65*, 112–124. DOI: https://doi.org/10.1016/j.geoforum.2015.07.017

Agrawal, A. (2001). Common Property Institutions and Sustainable Governance of Resources. *World Development*, *29*(10), 1649–1672. DOI: https://doi.org/10.1016/S0305-750X(01)00063-8

Agrawal, A., Brandhorst, S., Jain, M., Liao, C., Pradhan, N., & **Solomon, D.** (2022). From environmental governance to governance for sustainability. *One Earth*, *5*(6), 615–621. DOI: https://doi.org/10.1016/j.oneear.2022.05.014

Baland, J.-M., & **Platteau, J.-P.** (1996). *Halting degradation of natural resources. Is there a role for rural communities?* Rome, Italy: Food and Agriculture of the United Nations.

Bea, M., Lopez-Gunn, E., & **Vay, L.** (2014) Forensic water governance? The use of GIS for water monitoring, sanctioning and user science- towards a "lighter" side of governance in

the North- Western Doñana (Spain). *International Journal of Water Governance*, *2–3*, 133–152.

Berge, E. (2012). Comments to John R. Wagner "Water and the Commons Imaginary", Forum on Public Anthropology. *Current Anthropology*, *53*(3), 627–628. DOI: https://doi.org/10.1086/667622

Carlisle, K., & **Gruby, R.** (2019) Polycentric Systems of Governance: A Theoretical Model for the Commons. *Policy Studies Journal*, *47*(4), 927–952. DOI: https://doi.org/10.1111/psj.12212

Closas, A., Molle, F., & **Hernández-Mora, N.** (2017). Sticks and carrots to manage groundwater over-abstraction in La Mancha, Spain. *Agricultural Water Management*, *194*, 113–124. DOI: https://doi.org/10.1016/j.agwat.2017.08.024

CHJ. (2020). *Renovación del Plan de explotación de la masa de agua subterránea Requena – Utiel*. Confederación Hidrográfica del Júcar. https://www.chj.es/es-es/medioambiente/PlanExplotacion/Documents/Plan_explotación_Requena-Utiel.pdf

CHJ. (2016). *Plan de explotación de la masa de agua subterránea Requena – Utiel*. Confederación Hidrográfica del Júcar. https://www.chj.es/es-es/medioambiente/PlanExplotacion/Documents/PlanExplotacion_RequenaUtiel_33_web.pdf

Closas, A., & **Villholth, K. G.** (2020). Groundwater governance: Addressing core concepts and challenges. *WIREs Water*, *7*(1), e1392. DOI: https://doi.org/https://doi.org/10.1002/wat2.1392

Cox, M., Arnold, G., & **Villamayor-Tomás, S.** (2010). A review of design principles for community-based natural resource management. *Ecology and Society*, *15*(4), 38. [online] URL: http://www.ecologyandsociety.org/vol15/iss4/art38/. DOI: https://doi.org/10.5751/ES-03704-150438

De Vos, B., & **van Tatenhove, J.** (2011). Trust relationships between fishers and government: new challenges for the co-management arrangements in the Dutch flatfish industry. *Mar Policy*, *35*, 218–225. DOI: https://doi.org/10.1016/j.marpol.2010.10.002

Dewulf, A., Gray, B., Putnam, L., Lewicki, R., Aarts, N., Bouwen, R., & **van Woerkum, C.** (2009). Disentangling approaches to framing in conflict and negotiation research: A meta-paradigmatic perspective. *Human Relations*, *62*(2), 155–193. DOI: https://doi.org/10.1177/0018726708100356

De Stefano, L., Fornés, J. L., López-Geta, J. A., & **Villarroya, F.** (2015). Groundwater use in Spain: an overview in light of the EU Water Framework Directive. *International Journal of Water Resources Development*, *31*(4), 640–656. DOI: https://doi.org/10.1080/07900627.2014.938260

De Stefano, L., López-Gunn, E., & **Martínez-Santos, P.** (2014). Intensive groundwater use in agriculture and IWRM: An impossible marriage? In P. Martinez-Santos, M. M. Aldaya, & M. R. Llamas (Eds.), *Integrated water resources management in the 21st century: Revisiting the paradigm*. Leiden, The Netherlands: CRC Press.

Fornés, J. M., López-Gunn, E., & **Villarroya, F.** (2021). Water in Spain: paradigm changes in water policy. *Hydrological Sciences Journal*, 1–11. DOI: https://doi.org/10.1080/02626667.2021.1918697

Greenpeace. (2022). *SOS acuíferos: la grave situación de nuestras reservas de agua subterránea*. On-line report. https://es.greenpeace.org/es/en-profundidad/sos-acuiferos/

GVA. (2023). *Superficies Cultivadas por Municipios 2022*. València: Generalitat Valenciana, Conselleria d'Agricultura, Desenvolupament Rural, Emergència Climàtica i Transició Ecològica.

Hardin, G. (1968). The tragedy of the commons. *Science*, *162*, 1243–1248. DOI: https://doi.org/10.1126/science.162.3859.1243

Hoogesteger, J. (2022). Regulating agricultural groundwater use in arid and semi-arid regions of the Global South: Challenges and socio-environmental impacts. *Current Opinion in Environmental Science & Health*, 100341. DOI: https://doi.org/10.1016/j.coesh.2022.100341

Hoogesteger, J., & **Wester, P.** (2015): Intensive groundwater use and (in)equity: Processes and governance challenges. *Environmental Science and Policy*, *51*, 117–124. DOI: https://doi.org/10.1016/j.envsci.2015.04.004

Hoogesteger, J., & **Wester, P.** (2017). Regulating groundwater use: The challenges of policy implementation in Guanajuato, Central Mexico. *Environmental Science & Policy*, *77*, 107–113. DOI: https://doi.org/10.1016/j.envsci.2017.08.002

Hynds, P., Regan, S., Andrade, L., Mooney, S., O'Malley, K., DiPelino, S., & **O'Dwyer, J.** (2018). Muddy Waters: Refining the Way forward for the "Sustainability Science" of Socio-Hydrogeology. *Water*, *10*, 1111. DOI: https://doi.org/10.3390/w10091111

Jakeman, A. J., Barreteau, O., Hunt, R. J., Rinaudo, J.-D., & **Ross, A.** (2016). *Integrated groundwater management. Concepts, approaches and challenges*. Springer. DOI: https://doi.org/10.1007/978-3-319-23576-9

JCURU. (2017). *Junta Central de Usuarios de la Masa de Agua Subterránea 080.133 Requena-Utiel. Ordenanzas*. https://jcuarequenautiel.com/wp-content/uploads/2023/06/Estatutos-JCUMA.pdf

Kemper, K. E. (2007). Instruments and institutions for groundwater management. In: *Giordano and Villholth*: *The agricultural groundwater revolution: Opportunities and threats to development*, IWMI, Colombo, 153–172. DOI: https://doi.org/10.1079/9781845931728.0153

Kuper, M., Faysse, N., Hammani, A., Hartani, T., Marlet, S., Hamamouche, M. F., & **Ameur, F.** (2016). Liberation or Anarchy? The Janus nature of groundwater use on North Africa's new irrigation frontiers. En A. Jakeman et al. (Eds).

Integrated groundwater management: Concepts, approaches and challenges. Springer, 583–615. DOI: https://doi.org/10.1007/978-3-319-23576-9_23

Llamas, M. R., & **Martínez-Santos, P.** (2005). Intensive Groundwater Use: Silent Revolution and Potential Source of Social Conflicts. *Journal of Water Resources and Planning Management*, *131*, 337–341. DOI: https://doi.org/10.1061/(ASCE)0733-9496(2005)131:5(337)

López-Gunn, E. (2012). Groundwater governance and social capital. *Geoforum*, *43*(6), 1140–1151. DOI: https://doi.org/10.1016/j.geoforum.2012.06.013

Lopez-Gunn, E., & **Martinez Cortina, L.** (2006). Is self-regulation a myth? Case study on Spanish groundwater user associations and the role of higher-level authorities. *Hydrol. J.* *14*, 361–379. DOI: https://doi.org/10.1007/s10040-005-0014-z

Lopez-Gunn, E., & **Zorrilla, P.** (2010). The Western Mancha Aquifer: data mapping to provide transparency to aid stakeholder participation and decision-making. *Journal of Maps*, 302–310. DOI: https://doi.org/10.4113/jom.2010.1088

Lopez Gunn, E., Rica. R., Zorrilla-Miras, P. Vay., L. Mayor., B. Pagano., A., Altamirano, M., & **Giordano, R.** (2021) The natural assurance value of nature-based solutions: A layered institutional analysis of socio ecological systems for long term climate resilient transformation. *Ecological Economics*, *186*, 107053. DOI: https://doi.org/10.1016/j.ecolecon.2021.107053

Martínez-Fernández, J., Neto, S., Hernández-Mora, N., Del Moral, L., & **La Roca, F.** (2020). The role of the Water Framework Directive in the controversial transition of water policy paradigms in Spain and Portugal. *Water Alternatives*, *13*(3), 1–26.

Molle, F., & **Closas, A.** (2017). *Groundwater governance: A synthesis*. Report submitted to USAID (vol. 6). IWMI. http://gw-mena.iwmi.org/outputs/

Molle, F., & **Closas, A.** (2019). Comanagement of groundwater: A review. *WIREs Water*, *7*, e1394. DOI: https://doi.org/10.1002/wat2.1394

Molle, F., & **Closas, A.** (2020). Why is state-centered groundwater governance largely ineffective? A review. *WIREs Water*, *7*, e1395. DOI: https://doi.org/10.1002/wat2.1395

Molle, F., López-Gunn, E., & **Van Steenbergen, F.** (2018). The local and national politics of groundwater overexploitation. *Water Alternatives*, *11*(3), 445–457.

Molle, F., & **Sanchis-Ibor, C.** (2019). Irrigation Policies in the Mediterranean: Trends and Challenges, In: F. Molle, C. Sanchis-Ibor, L. Avellà-Reus (Eds.), *Irrigation in the Mediterranean: Technologies, Institutions and Policies*. Springer, 279–313.

Neal, M. J., Greco, F., Connell, D., & **Conrad, J.** (2016). "The Social-Environmental Justice of Groundwater Governance". In: Jakeman, A. J., Barreteau, O., Hunt, R. J., Rinaudo, J.-D., Ross, A. (Eds.), *Integrated groundwater management. Concepts, approaches and challenges*. Springer, 253–272. DOI: https://doi.org/10.1007/978-3-319-23576-9_10

Novo, P., Dumont, A., Willaarts, B. A., & **López-Gunn, E.** (2015). More cash and jobs per illegal drop? The legal and illegal water footprint of the Western Mancha Aquifer (Spain). *Environmental Science and Policy*. DOI: https://doi.org/10.1016/j.envsci.2015.04.013

Ostrom, E. (1990). *Governing the commons: The evolution of institutions for collective action*. Cambridge, UK: Cambridge University Press. DOI: https://doi.org/10.1017/CBO9780511807763

Ostrom, E. (2009). A general framework for analyzing sustainability of social-ecological systems. *Science*, *325*(5939), 419–422. DOI: https://doi.org/10.1126/science.1172133

Ostrom, E. (2010) Polycentric Systems for Coping with Collective Action and Global Environmental Change. *Global Environmental Change*, *20*, 550–57. DOI: https://doi.org/10.1016/j.gloenvcha.2010.07.004

Patrick, M. J. (2014). The Cycles and Spirals of Justice in water-allocation decision making. *Water International*, *39*(1), 63–80. DOI: https://doi.org/10.1080/02508060.2013.863646

Petit, O., Dumont, A., Leyronas, S., Ballin, Q., Bouarfa, S., & **Faysse, N.,** et al. (2021). "Learning from the past to build the future governance of groundwater use in agriculture". *Water International*, *46*(7–8), 1037–1059. DOI: https://doi.org/10.1080/02508060.2021.2006948

Reddy, R., & **Syme G. J.** (2014). Social sciences and hydrology: An introduction. *Journal of Hydrology*, *518*(A), 1–4. DOI: https://doi.org/10.1016/j.jhydrol.2014.06.022

Rica, M., Dumont, A., Villarroya, F., & **López-Gunn, E.** (2014). Whither collective action? Upscaling collective actions, politics and basin management in the process of "legitimising" an informal groundwater economy. *Water International*, *39*(4), 520–533. DOI: https://doi.org/10.1080/02508060.2014.928447

Rica, M., Lopez-Gunn, E., & **y Llamas, M. R.** (2012). An analytical framework on the emergence and evolution of collective action: an empirical case of Spanish groundwater user collective associations. *Irrigation and Drainage*, *61*(1) 115–125. DOI: https://doi.org/10.1002/ird.1663

Rica, M., Petit, O., & **López-Gunn, E.** (2017). Understanding Groundwater Governance through a Social Ecological System Framework – Relevance and Limits. *Advances in Groundwater Governance*. CRC Press. DOI: https://doi.org/10.1201/9781315210025-3

Rinaudo, J.-D., Holley, C., Barnett, S., & **Montginoul, M.** (Eds). (2020). Sustainable groundwater management: A comparative analysis of French and Australian policies and implications to other countries. *Global Issues in Water Policy* 24, Springer.

Roque, A., Wutich, A., Quimby, B., Porter, S., Zheng, M., Hossain, M. J., & **Brewis, A.** (2022). Participatory approaches in water research: A review. *Wiley Interdisciplinary Reviews: Water*, *9*(2), e1577. DOI: https://doi.org/10.1002/wat2.1577

Rouillard, J., Babbitt, C., Pulido- Velazquez, M., & **Rinaudo, J.-D.** (2021). Transitioning out of Open Access: A closer look at Institutions for Management of Groundwater Rights in France, California, and Spain. *Water Resources Research*, *57*, e2020WR028951. DOI: https://doi.org/10.1029/2020WR028951

Sanchis-Ibor, C., García-Mollá, M., Calafat, C., & **Vega, V.** (2009). Las entidades de riego en común. Aspectos institucionales. In Gómez-Limón et al., (Eds.), *La Economía del Agua de Riego en España*. Cajamar.

Sanchis-Ibor, C., Ortega-Reig, M., Guillem-García, A., Carricondo, J. M., Manzano-Juárez, J., García-Mollá, M., & **Royuela, Á.** (2021). Irrigation Post-Modernization. Farmers Envisioning Irrigation Policy in the Region of Valencia (Spain). *Agriculture*, *11*, 317. DOI: https://doi.org/10.3390/agriculture11040317

Sanchis-Ibor, C., Pulido-Velázquez, M., Valero de Palma, J., & **García-Mollá, M.** (2022). Water allocation in Spain. Legal framework, instruments and emerging debates. In Rouillard J. et al., (Eds.), *Water Resources Allocation and Agriculture: Transitioning from Open to Regulated Access*. IWA Publishing. DOI: https://doi.org/10.2166/9781789062786_0093

Schlager, E., & **López-Gunn, E.** (2006) Collective systems for water management: is the Tragedy of the Commons a myth? In: Rogers et al., (Eds.), *Water Crisis: Myth or Reality?* Taylor & Francis Pub. DOI: https://doi.org/10.1201/9781439834275.ch3

Shalsi, S., Ordens, C. M., Curtis, A., & **Simons, C. T.** (2019). Can collective action address the tragedy of the commons in groundwater management? Insights from an Australian case study. *Hydrogeology Journal*, *27*, 2471–2483. DOI: https://doi.org/10.1007/s10040-019-01986-1

Stone, A. (2019). Groundwater governance – impact of awareness-raising and citizen pressure on groundwater management authority in the United States. In Villholth, K. et al., (Eds.), *Advances in Groundwater Governance*. CRC Press.

Tarrow, S. (1994). *Power In Movement: Social Movements, Collective Action and Politics*. Cambridge: Cambridge University Press. DOI: https://doi.org/10.1017/CBO9780511813245

Thiel, A. (2017). The Scope of Polycentric Governance Analysis and Resulting Challenges. *Journal of Self-Governance and Management Economics*, *5*(3), 52–82. DOI: https://doi.org/10.22381/JSME5320173

UNESCO. (2022) *Groundwater: making the invisible visible* (campaign for the 2022 UN Water theme) https://www.unesco.org/en/articles/groundwater-making-invisible-visible-2022-and-beyond

Villholth, K., & **Conti, K.** (2019). Groundwater governance: rationale, definition, current state and heuristic framework. In Villholth, K. et al., (Eds.), *Advances in Groundwater Governance*. CRC Press.

Wade, R. (1988). The management of irrigation systems: How to evoke trust and avoid prisoner's dilemma. *World Development*, *16*(4), 489–500. DOI: https://doi.org/10.1016/0305-750X(88)90199-4

Wehn, U., & **Montalvo, C.** (2018). Exploring the dynamics of water innovation: Foundations for water innovation studies. *Journal of Cleaner Production*, *171*, S1–S19. DOI: https://doi.org/10.1016/j.jclepro.2017.10.118

Weick, K., Sutcliffe, K. M., & **Obstfeld, D.** (2005). Organizing and the process of sensemaking. *Organization Science*, *16*(4), 409–421. DOI: https://doi.org/10.1287/orsc.1050.0133

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