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The politics of defining maladaptation: enduring contestations over three (mal)adaptive water projects in France, Spain and South Africa

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ABSTRACT

In ever larger areas of the world, climate change is increasing water demand while shrinking water supplies. As a result, many efforts are underway to define whether any given water project decreases or further increases water users' vulnerability to climate change, especially in the agricultural sector. A number of challenges in making these assessments have been routinely discussed, including a lack of yardsticks, varying local circumstances, and the role of subjective judgment. However, their common assumption is that maladaptation constitutes, at least in theory, a phenomenon that can ultimately be fully objectified and agreed upon through scientific data. By contrast, our qualitative comparative analysis advances a non-positivist conception of maladaptation. By comparing three water projects aiming at climate change adaptation in South Africa (Western Cape), Spain (Andalusia) and France (Occitanie), we argue that qualifying (mal)adaptation is an inescapably political process as much as a scientific endeavour. As a consequence, we advocate for putting more scholarly emphasis on the governance of adaptation projects, especially the capacity of governance arrangements to produce legitimate compromises between multiple policy domains and actors; to enhance higher level conflict management when necessary; and to ensure regular policy evaluation with an effective bearing on subsequent policy decisions.

KEYWORDS

Adaptation to climate change, maladaptation, water policies, politics, controversies

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1. Introduction

Managing water allocation – in the face of heightened quantitative pressures and steadily rising water demand – is becoming a critical issue in ever larger areas of the Global North and South alike (IPCC, 2014). An ongoing debate hinges on the overall effects of long-standing, supply-increasing water policies on climate change adaptation. According to a number of scholars and conservationists, these policies would be intrinsically ‘maladaptive’ since increasing water supply generates its own water demand, thereby nurturing a vicious circle of increased water dependence and vulnerability (Kuper et al., 2017; Molle, 2008).

Meanwhile, the concept of maladaptation has remained thoroughly contested within scientific arenas, despite the many efforts undertaken over the last two decades to clarify and specify its meaning. It was first introduced and promoted by international organizations such as UNEP, UNDP, OECD, the World Bank and the European Environment Agency, all active in the fields of environment and international development. Their aim was to help development practitioners to anticipate and mitigate the potentially negative and unintended climate outcomes of their interventions (Barnett & O’Neill, 2013; Magnan, 2014). In the same perspective, many authors initially sought to identify recurring limitations of specific development projects. Some years later, however, maladaptation was defined more broadly, with the

IPCC Fifth Assessment Report (2014) viewing it as encompassing all ‘actions that may lead to increased risk of adverse climate-related outcomes’ and to ‘increased vulnerability to climate change, or diminished welfare, now or in the future’ (Field et al., 2015). Both definitional components refer not only to specific adaptation policies that inadvertently increase vulnerability but also, more broadly, to any policy that ultimately results in increased socio-technical vulnerabilities to climate change.

A number of inherent challenges in assessing maladaptation have been routinely discussed, including a lack of yardsticks, varying local circumstances, and the role of subjective judgment (Granberg & Glover, 2014). Some authors have insisted that, until proven otherwise, all policy instruments should be considered potentially maladaptive due to the many unintended negative impacts of adaptation policies (Adger et al., 2009; Dow et al., 2013; Juhola et al., 2016; Magnan et al., 2016). In this article, we start from the observation that, irrespective of their specific definition of maladaptation, and the level of empirical complexity that they are prepared to recognize in defining maladaptation, most contributions share a positivist outlook. Their common assumption is that maladaptation constitutes a phenomenon that can, ultimately, be fully objectified and agreed upon through better scientific data. International debates in UNFCCC deal with the evaluation of adaptive and maladaptive policies, through quantitative indicators (EEA report 2020; Adaptation committee UNFCCC, 2021). By contrast, ‘the maladaptation is not necessarily black or white as there are a number of differences in assessment criteria, framings, nuances, subtleties, valuing and other factors suggesting that maladaptation is a complex, contested and difficult phenomenon and concept’ (Glover & Granberg, 2020). From this perspective, our qualitative comparative analysis advances a constructivist and inherently political conception of maladaptation. By comparing three water projects ostensibly aiming at climate change adaptation in South Africa (Western Cape), Spain (Andalusia) and France (Occitanie), we argue that qualifying (mal)adaptation is as much a political process as a scientific endeavour. Maladaptation is laden with ever-shifting uncertainties and irreducible differences in societal values and interests, which cannot be resolved by better scientific knowledge alone. By stressing the necessarily contested nature of labelling a given project (mal)adaptive, we do not mean that maladaptation has no objective, biophysical content at all, but rather that this content is assessed by socially situated actors with specific interests, strategies, and imaginaries. More specifically, we argue that long-standing disagreements over the meaning of adaptation revolve, in all our three cases and despite their otherwise remarkable diversity, around the same three cross-cutting issues: the spatial scale to be favoured; the time horizons to be considered; and the relative appreciation of the project within a range of socially defined alternatives. We hence argue that it is now necessary to devote as much scholarly attention to the capacity of the political process to produce legitimate compromises around adaptation (policymaking) as to the specific content of ‘good’ adaptation policies (policy outputs).

The remainder of the article is organized in four parts. First, we briefly summarize the positivist search for an ever more scientifically clear-cut definition of maladaptation. Second, we introduce the three case studies and outline our methodology. Third, we present the results of our comparative investigation by analysing enduring disagreements over the meaning of maladaptation around the dimensions of space, time and policy alternatives. Finally, we advocate for further research on the governance of adaptation projects, especially the capacity of governance arrangements to produce legitimate compromises between multiple policy domains and actors; to enhance higher level conflict management when necessary; and to ensure regular policy evaluation with an effective bearing on subsequent policy decisions.

2. Literature review: the search for objective criteria of maladaptation

Much like the notion of adaptation itself, maladaptation ‘emerged from the world of evolutionary biology. Scholars have since applied it to [...] the human/environment interface’ (Magnan et al., 2016, p. 647). These roots in evolutionary biology help explain the ongoing predominance of positivist approaches to maladaptation.

Thus, in a landmark contribution, Barnett and O’Neil proposed to distinguish between five types of maladaptation effects: ultimate increases in GHG emissions; disproportionate burdens allocated to the most vulnerable sectors of society; high opportunity costs; reduction of incentives for further adaptation; and the creation of path dependencies limiting future adaptation options (Barnett & O’Neill, 2010). Afterwards, Juhola et al. (2016) defined maladaptation as the unintentional result of intentional adaptation policies that end up directly increasing vulnerability whether for the targeted or for the outside population, and/or eroding preconditions for sustainable development. They identified three types of maladaptive outcomes: rebounding vulnerability, shifting vulnerability and eroding sustainable development. Neset et al. (2019) followed up on this redefinition of the maladaptation concept. They distinguished between three types of maladaptation according to their potential negative impact on the targeted population, other social groups or sectors, or common pool resources. Importantly, Magnan et al. (2016) criticized these approaches, as they insisted that maladaptation should be construed not as a future state but rather as an *ongoing process*, constantly influenced by *multiple drivers* and involving multiple *temporal* and *spatial scales*. Generally, however, scholars have stressed the difficulty of identifying maladaptation in advance (Schipper, 2020) and the importance of local context in assessing adaptation pathways (Magnan, 2014; Pearson & Dare, 2021; Rawlins & Kalaba, 2020).

Although most scholars consider that maladaptation includes adaptation projects that end up increasing vulnerability, the scope of the concept still generates controversy. Authors disagree over whether labelling as maladaptation any project that would likely increase vulnerability. Some prefer to limit this notion solely to explicitly adaptation projects (Juhola et al., 2016; Magnan, 2014), while others argue that many projects not dealing with adaptation could in essence also be maladaptive (Jones et al., 2015). Dupuis and Biesbroek (2013) deplore this profound ‘ambiguity’, as ‘adaptation may refer to projects explicitly seeking adaptation, or to any action irrespective of its stated aim.

Despite these ongoing disagreements, however, most authors consider that decision-makers should theoretically be able to rank all available options according to their respective contributions to adaptation or maladaptation. If they do not choose the best option, it could only be due to some imperfect scientific knowledge (which may be remedied over time) or to unfortunate political pressures that deviate the adopted policy from its environmentally preferable target. By contrast, we argue that we should break away from this positivist assumptions by considering maladaptation as, inextricably, both a social/political and scientific process. Some scholars have begun to show the importance of framing around adaptation measures and their outcomes (Glover & Granberg, 2020; Milhorange et al., 2021). We proceed to the same with the politics of maladaptation.

In so doing, our contribution is also empirical since little scholarly research to date has been devoted to maladaptation in water projects, with the exception of a few studies on apart from studies on coastal erosion (Heydari & Morid, 2020; Macintosh, 2013), flooding (Rahman & Hickey, 2019; Schaer, 2015), maladaptation to drought in California (Christian-Smith et al., 2015) and Australia (Pearson & Dare, 2021). A few scholars have also studied desalination as maladaptive (Grasham et al., 2021; McEvoy & Wilder, 2012). This contribution – involving a comparative approach in France, South Africa and Spain – aims to further knowledge on maladaptation in water policies and instruments.

3. Materials and methods

3.1. A comparative analysis of three different cases of (mal)adaptation in the water domain

The three cases presented in this paper have all been explicitly labelled – at some point and by some actors at least – as policy instruments of climate change adaptation. More specifically, they were all designed to tackle some forms of water stress, as the three regions have recently been hampered by more frequent and severe droughts, which has been widely attributed to climate change.

Alongside the similar empirical focus, the three projects were selected for the reason that they are at very different implementation stages. This diversity allows us to effectively probe the scientific character of maladaptation. A positivist conception of maladaptation would imply that controversies should gradually decrease in intensity during the implementation process. As implementation brings a steady stream of new information and scientific evidence, a broader and more robust agreement should emerge as to whether this specific policy is indeed adaptive or maladaptive. We will see, however, that political conflicts do not tend to decrease either in scope or intensity during implementation, even though their contours may evolve [Figure 1](#).

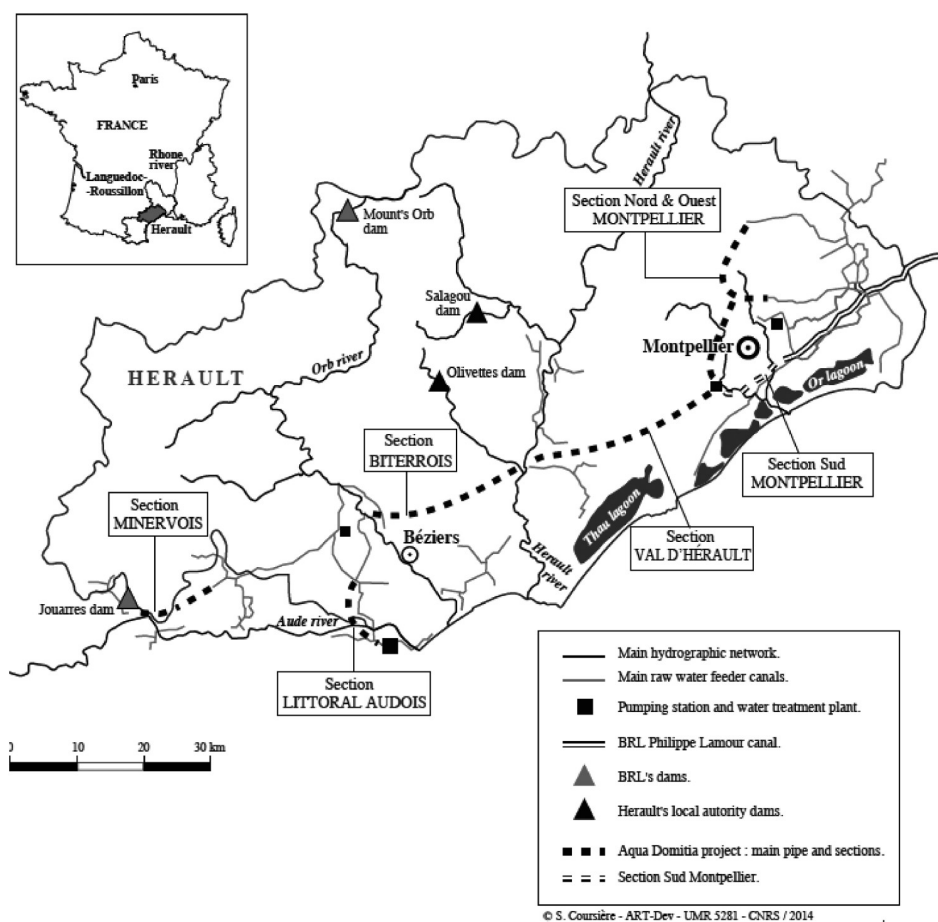


Figure 1. Map of the Aqua Domitia Network. Source: after Aqua Domitia – Région Languedoc-Roussillon, 2011.

3.1.1. Aqua Domitia – a water transfer for securing water resources in southern France

Aqua Domitia is a large infrastructure project located in southern France that aims to secure water resources throughout the Languedoc region. It emerged at the intersection of several processes. In the national and European contexts, regulations had restricted the use of the types of water supply that the region used to rely on such as groundwater (alluvial deposits of the Aude, Hérault and Orb rivers). It

constituted an incentive to diversify the sources of water supply. The project also emerged as climate issues were gaining traction on the policy agenda, at the international and national scales but also more locally following droughts episodes in the Languedoc in the 2000s.

To cope with these issues, the Region of Languedoc-Roussillon has created the canal Philippe Lamour to bring water from the Rhone. With Aqua Domitia in 2012, the region, now enlarged and re-labelled Occitanie, has decided to extend the regional water network to distribute the water from the Rhone to more distant territories. There are four official objectives to this project: to secure the Region’s drinking water system; to alleviate the pressure on groundwater reserves – where water was pumped until then – by bringing a substitutive water resource; to support the Region’s economic development while preserving the environment by reducing the pressure on local water reserves; and to maintain diversified and qualitative agriculture and competitive viticulture, despite climate change.

So far, Aqua Domitia has costed an estimated 206 M€ for the main pipe and 140 M€ for the secondary pipes (CSCBRM, 2015). Aqua Domitia is supposed to supply water for agriculture and viticulture. Beyond identity aspects inherent to agriculture and viticulture in France, these are also particularly strategic activity sectors for the Region and are consequently pivotal political and electoral foci. The project is therefore widely supported in political and economic spheres, but some public and research associations have been opposed the project [Figure 2](#).

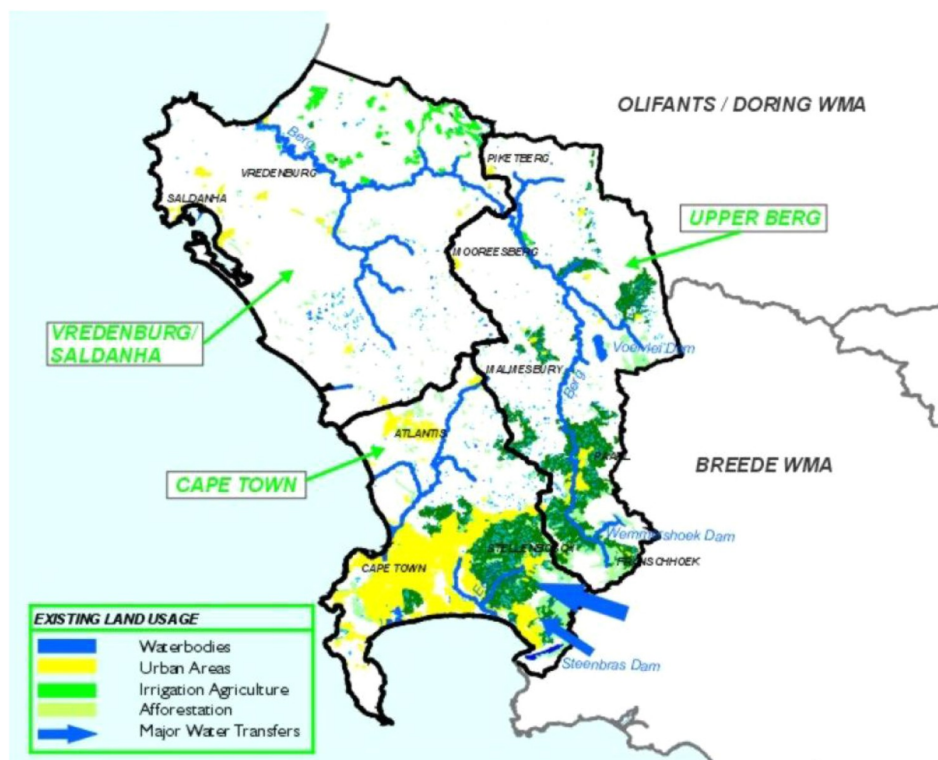


Figure 2. Berg river Water Management Area’s water resources. Source: Suzanne Carter (2006) and Department of Water Affairs (DWA) of South Africa.

3.1.2. Melting icebergs to quench South Africa’s thirst

The second case concerns the project of melting icebergs in South Africa to overcome the water scarcity that had severely impacted Cape Town, which nearly ran out of water in 2018 and had to impose major restrictions in water uses. In the aftermath of an unprecedented drought that hit Western Cape province between 2015 and 2018, a South African iceberg water harvesting megaproject generated media hype nationally and beyond. With the acceleration of global warming, thousands of icebergs break off the

Antarctic ice shelf every year, some of which reach the shores of South Africa. The fact that the first press coverage of the project appeared on April 1st – thereby resembling an April fool’s day prank – did not help raise the credibility of the project. However, the idea gained traction over time. Nicholas Sloane, a professional marine salvager, claimed that he had managed to put together a team of engineers, oceanographers, glaciologists and finance experts to develop the ‘Southern Ice project’. Its underlying idea is that the water harvested could provide drinking water to 4 million people in South Africa’s ‘Mother City’. The project is still a private initiative but a series of discussions have been engaged with public institutions, including the Water Research Commission and the Department of Water Affairs. It should also be noted that similar proposals have been put forward in Saudi Arabia, California and Arizona [Figure 3](#).

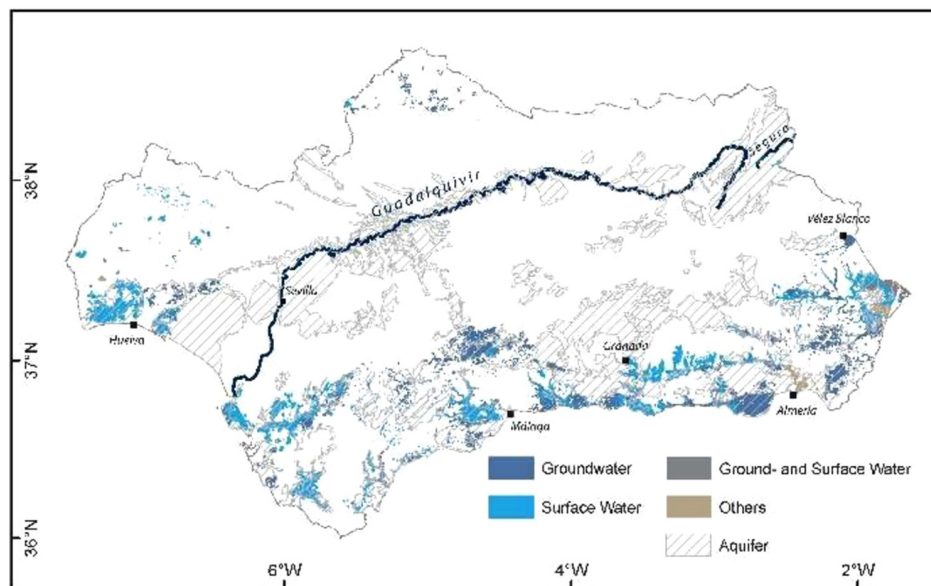


Figure 3. Map of the areas under irrigation in Andalusia, subdivided by the origin of the water. *Source:* Isselhorst et al. (2018).

3.1.3. Modernizing irrigation infrastructure in Andalusia

The Rural Development Programme (RDP) of the Region of Andalusia, in Spain, is supported by the second pillar of the European Common Agricultural Policy. RDPs in general aim to ‘contribute to the development of rural areas and to an agricultural sector that is more balanced, more climate-friendly, more resilient in the face of climate change, more competitive, and more innovative’, (<https://www.europe-en-france.gouv.fr/en/european-funds/european-agricultural-fund-rural-development-EAFRD>) thereby enhancing the climatization of agriculture policies (Hrabanski, 2020). They are jointly designed by Member States and their regional governments, in compliance with European regulations and guidelines. In the Andalusian plan, the measure 4.3.1. specifically aims to ‘modernize, transform and consolidate irrigation infrastructure’ throughout the region.

Andalusia’s first RDP covered the years 2007–2013. Irrigation was a major focus, unsurprisingly so as it accounts for a third of all cultivated land in the region, and two-thirds of the total agricultural output. However, the subsequent programme (2014–2020) marked an inflection as it simultaneously sought to encourage ‘water saving’¹ (*ahorro del agua*). Departing from a narrow focus on modernization, it stressed that ‘water is a limited resource in Andalusia (...) and one that is particularly vulnerable to climate change. Its demand will keep increasing, while its availability will keep decreasing’.

With respect to how the instrument operates specifically, the regional government of Andalusia first

issues a call for proposals. Only irrigators' associations (*comunidades de regantes*) can apply. In their proposal, they have to demonstrate that the purported initiative will lead to a reduction of at least 5% of the total amount of water consumed in comparison to the previous infrastructure. This 'water savings potential' is estimated for the area of the projected infrastructure (i.e. not for the area covered by the water users' association as a whole). It is also estimated as an aggregate number, which means that not every single irrigator has to show a water consumption reduction. Once selected, irrigators have to manage the project on their own. They select engineering and public works companies and supervise their operations. Thereafter, over a 5-year period, the Andalusia agricultural administration has to verify – through a collective metre – that 'effective savings' are in line with the savings that were targeted at the beginning of the project. Fines are to be applied if the effective savings are below the targeted ones.

3.2. Materials

In the case of Aqua Domitia, one author attended most of the public meetings organized in 2011 and 2012, including six meetings. Forty official statements by a variety of actors² also generated insights into stakeholders' perceptions of the project, including the regional wine producers' federation, the BRL³ company, citizens' associations, drinking water union, local government (municipalities, departments, and the region), chambers of agriculture, chambers of trade and industry, farmers' federation, farmers' trade-unions and federations, water agencies, political parties and researchers. Seven additional interviews were conducted with actors with different levels of involvement in the project (one water agency delegate and one planning officer who had mixed feelings about the project, two water syndicate managers, two intercommunal syndicate officers and one irrigation association director supporting the project). Our research was supplemented by a comprehensive online press review of all articles published on Aqua Domitia over the last 15 years.

In the case of Andalusia, a three-month field investigation was conducted. In addition to a comprehensive analysis of media coverage, and the close reading of relevant bureaucratic documents, 26 interviews were conducted with Spanish and Andalusian bureaucrats, farmers' representatives, EU bureaucrats, academics and NGOs. Eight were directly exploited for this article with prominent stakeholders actively involved at different levels of governance: European (1), national (1), regional (4) and local (2).

In South Africa, the fieldwork was conducted at various points between January 2018 and February 2020. More than 15 semi-structured interviews were conducted with current and former executive managers at the national level with the Department of Water Affairs & Sanitation (DWS) at the national level in Pretoria (Chief-Engineer, Water Resources Planning-South; ex-Chief Director, Water Services; sub-director and contract staff, Macro-Planning Division); with one consultant for the DWS Water Reconciliation Strategy Study for the Western Cape; with the DWS regional office in Cape Town (DWS regional office Deputy-Director; DWS representative dealing with the agricultural sector); with the Department of Environmental Affairs (Deputy Director General for Climate Change; Director for Adaptation to Climate Change); with the Western Cape Provincial Government (Department of Agriculture, Head of Natural Resources Management; Department of Agriculture, Head of Disaster Risk Management) and with one representative of the Provincial Disaster Management Centre; with the CEO of the Breede-Gouritz Catchment Management Agency; with representatives of two irrigation boards in the Western Cape; with two representatives of the AgriSA farmer's union; with one local WWF representative.

The main characteristics of our cases are summarized in the table below [Table 1](#).

Table 1. Overview of the three case studies. ([Table view](#))

	Occitanie: new infrastructures (canals & pipes)	South Africa: new infrastructures (iceberg melting & harvesting)	Andalusia: modernization of existing infrastructures
Stated purpose	Adaptation to climate-related water stress		
Implementation stage	Early (in construction)	Not yet implemented (formulation)	Advanced
Materials	Observation of all six public meetings in 2011 and 2012. Official documentation of these meetings (40 statements of actors) Interviews (n=7) with promoters and opponents of the project Press review over 15 years (2004-2019)	Interviews with public executives in the water sector (n=15). Press review on iceberg melting (2015-2019)	Interviews with prominent stakeholders at different levels of governance (n=26) in Spain Press review over the period of the measure (2007-2020)
Case study	Aqua Domitia is a large infrastructural project located in southern France that aims to secure water resources throughout the Languedoc region. It has costed approx. 346 M€. It is meant to supply water for agriculture and viticulture	Project of melting icebergs in South Africa to overcome the water scarcity that has severely impacted Cape Town. With the acceleration of global warming, thousands of icebergs break off the Antarctic ice shelf every year, some of which reach the shores of South Africa. The water harvested could provide drinking water to 4 million people in South Africa's 'Mother City'	The Rural Development Programme for Andalusia aims to "modernize, transform and consolidate irrigation infrastructure" throughout the region. It is supported by the second pillar of the Common Agricultural Policy (CAP). The first RDP for Andalusia covered the 2007–2013 period. Irrigation was a major focus. The subsequent programme (2014-2020) marked an inflection as it also sought to encourage 'water saving'

Source: authors.

4. Enduring controversies: policy alternatives, spatial scales and temporal horizons in (mal)adaption projects

In this section, we show that disagreements over whether these projects are ultimately adaptive or not have proved remarkably enduring, and that, despite the profound differences between these projects, controversies have systematically revolved around three issues: the spatial scale to be favoured; the time horizons to be considered; and the relative appreciation of the project within a range of socially defined alternatives.

4.1. Adaptive relative to what? A project and its alternatives

Our cases all indicate that, in practice, actors do not evaluate the adaptive potential of a given project on its own. Instead, they assess it *relatively* to a range of perceived options. In other words, they consider a given project less in terms of whether it is intrinsically adaptive or not, than whether it is more or less adaptive compared with other conceivable projects.

Here, a distinction should be made between controversies over present and over future alternatives. In

the first case, a group or organization may simply argue that another project would be preferable because it is more effective, simpler to implement or less costly. In the second case, a project may be criticized for creating irreversibility (what Barnett and O'Neil call path dependencies) that reduce the possibility of taking alternative paths in the future. These two types of controversies (over the evaluation of present and future alternatives) are present in all our three cases.

Thus, in Spain, a recurring theme advanced by environmentalists is that systematic non-compliance with existing rules is a far more consequential issue than water leakages in irrigation canals. They stress that, in 2015, there were roughly a million illegal wells overall in Spain, the signal of a trend towards 'general insubordination' (Llamas et al., 2015) on the part of farmers. WWF – an environmental NGO particularly vocal on this issue – thus advocates a wholly different set of interventions than canal lining and the modernization of irrigation infrastructure, interventions geared towards increasing State capacity to monitor and punish illegal water uses. At the same time, tightening control over water consumption with legal wells appears highly hypocritical and unfair to many 'honest' farmers given the well-known existence of this massive fraud. Many farmers believe that regional authorities should control fraudsters much more strictly than voluntary participants in an EU-funded project.⁴

In a similar way, the imperative of conserving surface water in the watershed justifies the promotion of other water sources, such as desalinated seawater. It is easier, under the terms of the measure 4.3.1., to secure subsidies for a new scheme irrigated with seawater than to modernize an existing scheme. This paradox is criticized by farmers as it favours those who happen to be located in coastal regions, near the sea, as well as by environmentalists who consider it 'absurd'² from the standpoint of energy consumption and because of the risks for coastal ecosystems associated with desalination.

Beyond that, the Andalusia government is seeking to shift the onus of defining and adjudicating between water alternatives to irrigators themselves. Thus, application files must contain an examination of alternatives, based on which a 'technical justification' of the targeted project is set out. This way of 'passing the buck' is contested by farmers who view it as a new burden, as well as by environmentalists who see it as a hypocritical abdication of responsibility.⁵

In a similar way, Aqua Domitia has been criticized for creating strong path dependencies and institutional lock-ins. Critics point out that it is rooted in the long-standing political vision of hydraulic planning that reaches back to the nineteenth century in France. Indeed, the construction of the Philippe Lamour Canal – also owned by BRL – preceded the construction of Aqua Domitia and hails back to the nineteenth century. According to Ruf (2015) and a French public TV documentary,⁶ the Philippe Lamour Canal brings too much water relative to the demand. The argument is that BRL's motivation to promote Aqua Domitia mainly stems from its need to find a demand matching its existing water supply. Further construction of the Aqua Domitia network would enable BRL to reach new territories and increase its water demand. Moreover, for the Region, the Philippe Lamour Canal provides opportunities for further development via the extension of existing infrastructure. This shows how powerful economic actors can work successfully to maintain and reinforce water policy lock-ins. In the future, the huge volumes of Aqua Domitia water and its high cost for the Region and departments will likely hamper any possibility of choosing other options.

Socio-technical lock-ins also prevail in the South African iceberg melting project. At first sight, the project even resembles a typical case of maladaptation as typified by Barnett and O'Neill (2010). As the idea is to steer icebergs and stall their northbound trajectory, super-tankers would be used to haul ideal-sized icebergs of Antarctic origin. Towing icebergs ashore is likely to increase GHG emissions considering the fuel required for this task. Upon reaching land, the iceberg would also have to be enveloped in a special thermal cover to protect it from external elements that could accelerate its melting.

Project promoters tend to conceal these techno-infrastructures by uttering a naturalizing discourse in which melting icebergs is framed as seizing a gift from Mother Nature. A researcher from the South African Council for Scientific and Industrial Research considers that the Operation Cape Iceberg project might allow up – or down-scaling of the number of towed icebergs just by sending more vessels to fetch icebergs. In other words, the project would fulfil the promise of being able to order icebergs *à la carte*, by parking ice blocks in Saint Helena Bay where they would be ‘mined’ for water, cut and stored before injection into the Cape Town water supply system. The rhetoric closely resonates with that of the powerful mining complex, which is pivotal in the country’s economic landscape, as well as that used in reference to the South African ‘plumbing system’ that diverted major rivers for massive inter-basin water transfers (Bourblanc & Blanchon, 2014). These technological infrastructures make it difficult to think outside the box, and further entrenches big hydraulic infrastructures and solutions of supply extension rather than a reflection on water-demand management in the agricultural sector. Yet a closer look at water source alternatives in the Western Cape reveals that there may not be many options due to temporal constraints, as we will see in section 4.3.

The cases of Andalusia and South Africa show clearly that the evaluation of a project does not depend primarily on its inherent merits but rather on how it is situated within a range of alternatives. Such appreciation tends to vary greatly according to the social standpoint from which various actors conduct the evaluation.

4.2. On what scale should we adapt? Appropriate scaling as a contentious issue in climate change adaptation

In this section, and following Norman et al. (2012), we emphasize that scales are ‘socially constructed and contingent on political struggles’ (p.1). We focus on the institutional and social dynamics that produce the politics of scale.

Thus, Aqua Domitia has raised controversies over the socio-territorial inequalities it might generate. First, due to technical constraints, the project can only convey water across plains and only to the maximum distance of 10 kms from the main pipe (Ruf, 2016). According to some participants in the public debate, this is likely to create new inequalities in water access since only the localities closest to the pipe will benefit from the water (Ruf, 2016). As Ruf puts it, Aqua Domitia is ‘a public gift to nearby farmers’⁷ (Ruf, 2016, p. 16). Thus, the touristic and urban coastal areas are likely to benefit more than rural areas. Second, Aqua Domitia threatens to unsettle local water schemes for which the departments⁸ are competent. According to Ruf (2016), the lack of coordination between Aqua Domitia and local water schemes could upset the territorial water balance by bringing large quantities of water to some specific areas. Third, the drinking water supply in coastal areas is mainly used to serve touristic and urban communities, which means that they are likely to have priority in case of shortages. This might portend future territorial conflicts over water use. The public funding of the project through taxes is also problematic as it might create socio-territorial inequalities as some localities and producers near Aqua Domitia will benefit more even though their financial contribution will not be higher.

In Spain, controversies over the modernization of irrigation schemes are largely related to the spatial scale of the adaptation objectives. The Andalusian government tends to think in terms of the six large watersheds of the region. It purports to alleviate quantitative pressures on these watersheds by improving irrigation efficiency on an area of no less than 60,000 ha.⁹ However, with only limited financial resources to achieve this goal, the Andalusian authorities have a strong incentive to develop policies that are relatively inexpensive to manage, that is, policies that are both uniform and that place the onus of as many tasks as possible on the irrigators themselves. For their part, farmers think primarily about their

individual farms. Confronted with uniform policies, they tend to blame the authorities for being insensitive to their particular situation and for the administrative burden that is placed on them. The relevant scale of the project is, therefore, a source of structural divergence: is the project fundamentally about adapting a large watershed, even at the cost of somewhat rudimentary policies, or is it about ensuring the effective adaptation of each and every farmer involved, which would imply investing much greater resources in the design, monitoring and evaluation process?

Thus, the measure 4.3.1. begins by stating that the river basin plans for the six watersheds constitute the basic framework for the measure.¹⁰ In order to be eligible, a group of irrigators must credibly argue that the modernization initiatives will lead to at least 5% water savings in comparison to their official allocation in the relevant water supply plan. It is also planned that the public subsidy rate ceiling (60%) may be increased by 5% for each additional 5% savings that are committed, up to a new 80% ceiling. These uniform figures are widely denounced by irrigators as they are easier to achieve for irrigators who were already well endowed with water before their project.¹¹ Representatives of the major agricultural unions are of the opinion that *the cases of each community of irrigators are very specific and should be supported on a more individual basis.*¹² Collective savings measurement through mega-meters is also hotly debated as it encourages free-riding, which farmers' communities fear they would have a hard time monitoring and policing.¹³ Clearly, the appropriate scale of adaptation policies is far from being consensual in Andalusia.

A politics of scale can also be observed in the disagreement over project's appraisal that can vary greatly across government levels. In South Africa, national-level water administrations and research institutions expressed an interest in the iceberg melting project, while urging decision-makers not to miss out on an opportunity to be at the forefront of an important technological innovation. However, in contrast, the Cape-Town-based Ministry of Environmental Affairs has remained unimpressed, criticizing both the financial and environmental costs of iceberg towing – as icebergs are said to have a marked impact on local weather (generating fog, climate disturbances, etc.). Locally, deterred by the potentially prohibitive cost of producing drinking water out of melted icebergs, the City of Cape Town has repeatedly said it was not interested in this innovation, claiming it was likely to be fivefold more expensive than surface water or other alternative water sources¹⁴

4.3. Contested temporal horizons

Wary of keeping drinking water at an affordable price to avoid fostering inequality, the City of Cape Town (CoCT) initially agreed with the national Department of Water & Sanitation to invest in an augmentation scheme for the Berg River Dam, considering that surface water would be the cheapest source of water. However, water prices skyrocketed during the multi-year drought when drastic water restrictions had to be put in place alongside steep water tariff hikes. Undoubtedly, the 2017–2018 water crisis in Cape Town took a bigger toll on poor families than on more affluent ones who could still resort to buying bottled water at times of drastic water restrictions.¹⁵ Resorting to surface water does not mean that drinking water will remain cheap at any given time – prices do fluctuate because of limited resources during drought periods when there is scant rainfall. Water is also a resource that can be depleted: in the middle of the crisis, to avoid *Day Zero*, i.e. the day when city taps would have run dry, the CoCT had to switch to more abundant resources and had to install – at a huge cost – three temporary desalination plants. More concerning is the fact that after 2 years of good rainfall which filled the dams, various senior authorities tended to become quite complacent about the threat of water demand again outstripping supply availability in the near future. CoCT's current strategy is to increase its available water supply by 300 million l/day over the next 10 years¹⁶ to be able to supply the growing population in the area. It will

have to diversify its water sources to achieve this.¹⁷ Metropolitan CoCT is now planning on investing in a permanent desalination plant (*Water & Sanitation Africa*, January-February 2021) that is scheduled for completion by 2026/27. Considering the amount of energy needed for desalination production, tapping ocean resources (perceived as being infinite) might be ill-advised in a country such as South Africa, which is already hampered by a crisis of electricity production. Researchers working on desalination in Israel have already observed this – such solutions tend to transform vulnerability in terms of water resources into vulnerability associated to the costs of electricity production. The option was already amongst those supported by the Western Cape Water Supply System Reconciliation Strategy study back in 2007, but disagreements between the local government and the national Department of Water over who had to pay for it had delayed decisions on the project.¹⁸ The current cost of the plant, which will produce 50 million l/day, is estimated at approximately R1.8 billion. In the late 2000s, the City of Cape Town instead decided to adopt a water demand and conservation management approach with the aim of controlling the continuous population growth and the high influx of tourists in Western Cape province. Although it reaped good results, which were quite noticeable in the South African landscape, it also doomed urban water users when fate struck. Indeed, the CoCT was caught unprepared when a drought of a magnitude that nobody could have anticipated hit the city. Depending on the context, water-demand management is not always the best way to go. Some water experts strongly criticized this decision (or lack thereof) as being a ‘fatal mistake’ that could have led to devastating consequences (Muller, 2017).

Hence, time is of the essence here. A long-term perspective is needed with respect to producing drinking water, especially during drought episodes, the CoCT could well repeat past mistakes as big water infrastructures take years to plan and build. Against this backdrop, the ice melting project could prove to be not so unbearably costly compared to other alternatives (Muller, 2018). It could actually be easier to operationalize in case of an emergency when it is necessary to adapt to a prolonged drought.

In Andalusia, the most controversial dimension of measure 4.3.1 also concerned the time horizons of adaptation. From the outset, the Andalusian government was concerned about the sustainability of water savings achieved by farmers, as the measure only provides for monitoring ‘actual savings’ over a mere 5-year period. Authorities feared that a large-scale rebound effect would occur after this date, whereby farmers would have reallocated their saved water to intensify their production and expand their irrigated area. This fear was also voiced by the European Court of Auditors, which had criticized the fact that in the previous RDP (2007–2013), the same measure ‘had not prevented important negative side effects such as the extension of the irrigated area or the approval of projects that imply an overall increase in water consumption¹⁹’. Consequently, the initial version of the measure mandated that water savings be protected by irrevocably lowering water rights allocated by the hydrographic confederations, by the corresponding percentage.

This measure was met with massive opposition from virtually all agricultural unions and associations. Beyond self-interest in preserving their existing water rights, farmers expressed a different conception of the future in their understanding of maladaptation. To them, adaptation consisted of preserving their room for manoeuvre so as to maximize their responsiveness to climate-related uncertainty. They felt that the water saved should be stored for use in a dry year. Saving should be for their benefit, allowing them to constitute a water reserve that may help them adapt in the future. Making their commitments more rigid would have been detrimental to them and unfair. As one of them explained, referring in an exasperated tone to the main author of the measure:

“So, what I have not succeeded in doing as a commissioner, that is, depriving communities of water, now I will be able to do it! And whoever wants some help, well, I will take away his water instead! We haven't had any luck with this individual whom I don't even want to name²⁰”.

The water rights revision was ultimately abandoned in 2018.

Finally, the Aqua Domitia project also crystallises controversies over the temporal horizons of adaptation. One key point for discussion is the future water demand. This assessment of the future demand is deeply political and influences the conception of future horizons of adaptation.

BRL opposed the Scientific Council of the *Bassin Rhone Méditerranée* Committee on the future water demand through a series of reports (CSCBRM, 2014, 2015). The future demand is a focus of tension partly because BRL has a commercial interest in anticipating a high water demand in order to justify the project. The Committee contested BRL's prevision of increased demand, which they used as a main hypothesis to justify Aqua Domitia. The Council judged BRL's water demand forecasts 'optimistic', insufficiently justified and not grounded in the experience of the existing network (CSCBRM, 2015).

Ruf (2015), together with consumer associations²¹ and the Scientific Council (CSCBRM, 2014, 2015) highlighted that apparently less expensive options existed and that their cost should have been compared to that of Aqua Domitia, but it never was. A first cheaper option to increase the available water was to ration the water demand. In the region, domestic consumption is above the national mean, i.e. 70 m³ per annum and per inhabitant, compared to the national mean of 54 m³ (Da Costa et al., 2015). Modernization could also have been a cheaper option, as urban leakages are responsible for a water volume loss of up to 40-45% (Ruf, 2015). Water management delegation does not encourage research of all possible water savings but rather favours water supply options and solutions to increase the amount of water consumers.

This case shows that the temporal horizons of water demand are the focus of political struggles. Evaluation of the future water demand is therefore a subject of political discussion and cannot be strictly measured technically and declared as maladaptive or not.

The main controversies shaping our three cases are summarized in the table below [Table 2](#).

Table 2. Summary of the main controversies on the three cases. ([Table view](#))

Elements of controversy	Occitanie: new infrastructures (canals & pipes)	South Africa: new infrastructures (iceberg melting & harvesting)	Andalusia: modernization of existing infrastructures
Controversies over policy alternatives	Consumption restrictions could be implemented Costly project that creates path dependency	Policy alternatives are already implemented (consumption restrictions, price increases, desalination), but deemed insufficient to cover the water demand of the city of Cape	Lack of enforcement of existing regulations. Environmentalists argue that it should be a priority over modernization

Elements of controversy	Occitanie: new infrastructures (canals & pipes)	South Africa: new infrastructures (iceberg melting & harvesting)	Andalusia: modernization of existing infrastructures
Controversies over spatial scales	The project benefits more coastal and urban areas than rural ones Threatens to upset existing territorial water schemes	Town National level administrations show interest in the project, but locally the city of Cape Town finds its cost too high	The project covers a wide territory. Farmers would have preferred more targeted propositions that would have taken into account the specificity of each farm
Controversies over temporal horizons	Projections over the future water demand crystallise controversy. BRL foresees an increased demand to justify the project Opponents advocate for consumption restrictions and question the prevision of a future increase in demand	Climate-related droughts creates increasing pressure on water supply. The city plans to invest in desalination, but also faces a crisis of electricity production. In this context of uncertainty over water supply in the long term, iceberg melting might be easier to implement than alternatives	Controversy over the meaning of adaptation in the long term. For the European Commission, adaptation means consumption reduction. For farmers, it means preserving their flexibility to adapt to future situations.

Source: authors.

5. Discussion – maladaptation as a governance deficit

We showed that disagreements over maladaptation in all of our three cases were structured around three cross-cutting issues: the spatial scale to be favoured; the time horizons to be considered; and the relative appreciation of the project within a range of socially defined alternatives. Acknowledging the irreducibly political nature of characterizing (mal)adaptation should lead us to devote as much attention to the governance framework of climate decision-making as to the specific content of adaptation policies and projects. We argue that it is essential to assess how policymaking arenas and procedures facilitate performance of three key functions. First, to equitably represent the varied social interests and viewpoints around adaptation. Second, to foster the reasoned confrontation of all existing scientific arguments, reinforcing an evidence-based (albeit not evidence-settled) process. And third, to maximize the future adaptability of current decisions in order to reflect changes in actors' positions as well as the emergence of new information. The specific characteristics of climate maladaptation thus give rise to challenges to its governance that should be taken into account to secure better outcomes for climate change adaptation. Avoiding maladaptation is above all a matter of improving the policymaking process. We argue that this process could be enhanced by designing a governance framework that favours a cross-sectoral and territorial approach, while also allowing for regular re-assessments.

5.1. Multi-sectoral and territorial approaches to extend representation to all agricultural and non-agricultural stakeholders

The CoCT relies on a complex water supply system of inter-linked dams, pipelines and tunnels, some of which are owned by DWS, some by the Metropolitan CoCT. This water supply system is operated by DWS and also serves the Western Cape agricultural sector. During the water crisis, when water restrictions were the most severe (no more than 50 l/capita/day), urban water users harshly criticized the

Department of Water Affairs for failing to curtail irrigators fast enough, despite this being the standard procedure in the case of a drought since domestic water use has priority over irrigation use (National Water Act, 1998). At first, CoCT was unwilling to further curtail its water allocation and wanted the agricultural sector to make additional efforts. However very soon, at bi-monthly meetings led by the Department of Water Affairs to re-evaluate water restrictions for each sector, CoCT changed its confrontational strategy with the agricultural sector. The agricultural sector managed to convince CoCT that their interests were not at odds with those of the city. The argument was that when the agricultural sector was imposed a historical 60% curtailment of its water allocation, this also had a spill over effect on Metropolitan CoCT: without water, production had to be stopped, thereby throwing 30,000 farm workers out of their jobs, unemployed staff moved to informal settlements in the Mother City, which then had to provide extra free water to fulfil the basic needs of its growing population. Additional water sources provided by melting ice could relieve the pressure on the limited resources across sectors in the Western Cape Water Supply System and thereby enable the agricultural sector to benefit from full water allocation even during recurring drought episodes. Meanwhile, there are no plans to switch to less water-demanding crops either, as export-oriented high-value fruits account for a major share of the Western Cape GDP, while its winelands contribute to Cape Town's attraction for tourists from around the world. Moreover, throughout South Africa, water is pivotal to economic development and job creation for low-skilled people. The irrigated agricultural economy hence remains a cornerstone of the national government poverty alleviation strategy (National Development Plan 2030).

For its part, Aqua Domitia does not have any public governance body,²² so by default its governance is handled solely by BRL. This context raises questions about the inclusion of different sectors and scales in governance arrangements. As we have shown, the Aqua Domitia project affects different sectoral interests, including agriculture and tourism. Yet, no representative of these sectors participates in the governance mechanisms. Also, the BRL governance is a multilevel scheme, with the Region accounting for almost half of the capital of BRL (49.9%, see [Figure 1](#)). The departments also account for more than a quarter of the capital (27%) in diverse shares, e.g. the department of Lozère owns 0.37%, while the Gard owns 13%. This translates into different numbers of seats at the table, which in turn puts potential user departments on uneven ground for negotiations. This system also excludes mayors and other local authorities who are not represented in the BRL governance scheme from the decision-making process. Overall, the Region maintains a major role in deciding on how the project addresses the different actors' interests. BRL and the Region sporadically issue reports, but ultimately, they make decisions on the project jointly with a restricted circle composed of department and bank representatives. The project is publicly funded, so the absence of multi-sectoral or – level representatives in its governance raises questions about the capacity of the project to fulfil future users' needs.

In Spain, the modernization instrument was designed and adopted in restricted circles by public actors from the agricultural sector: EAFRD agents at the European level, the Spanish Ministry of Agriculture (who provided the general framework for the plan) and the Agricultural Council of Andalusia. This strong sectorization has not enabled the formulation of legitimate compromises with environmental actors, who feel that they have no meaningful voice in the decision-making process. PDRA governance – officially labelled the *partenariado* (partnership) – formally includes two environmental associations, i.e. SEO Birdlife and WWF. However, according to the Head of WWF, this partnership is merely an 'orchestrated theatre'²⁵ in which environmental arguments have no real impact. Conversely, as we have seen, the federation of irrigators (FERAGUA) has been able to make its grievances heard by obtaining the withdrawal of certain controversial measures. For the *partenariado* to play its role in formulating intersectoral compromises, it would be necessary to institutionalize its decision-making process by

establishing more transparent procedures for amending the plan, organizing (super)majority decisions and setting up a general secretariat that could provide expertise to all members. It would also be important to extend representation to all non-agricultural stakeholders: food policy-makers in large municipalities, drinking water managers, representatives of the tourism industry, etc.

5.2. Regular and transparent re-assessments to balance diversified interests

In the Aqua Domitia project, four years of relative discretion followed the public debate in 2013 and 2014, with little public communication from BRL and the Occitanie Region.²³ In 2018 and 2020, however, the consultative body organized meetings to convey news about Aqua Domitia. The Prefect and President of the Region presided over this body, while representatives of BRL (the concession holder) and the Region (owner of the water network) were the main communicators. Several other actors also intervened in both instances: the regional directorate for the environment, planning and housing (DREAL) and the water agency. The public could ask questions and express doubts. Yet, these meetings were the only places where actors could express reservations and it did not affect decisions directly. We observe that although BRL (the concession holder) and the Region provided information about the project every two years, they did not publicly inform any other stakeholders in the meantime. Ruf, therefore, advocates for a more inclusive water governance scheme toward citizens as water should be conceived as a common good (Ruf, 2012). He also promotes collective and territorial management of water in agriculture including both rich and poor citizens, rather than having an approach that particularizes the water supply and fosters territorial disparities. Multilevel governance that include all stakeholders could provide better and more regular information on the project.

Likewise, in Andalusia, to avoid getting caught up in the endless debates on credible vs. flexible commitments, the *partenariado*'s deliberations should be regular (more than once a year at least) while providing the most recent information available: weather and climate forecasts, estimates of agricultural water consumption, economic situation of farms. Commitments of water savings may be flexibly adjusted every year, but should still be debated after the 5-year period currently mandated by the measure. Furthermore, individual farmers could be designated to participate in the *partenariado*, possibly by sortition, so that grassroots actors can have a direct voice without FERAGUA enjoying its current representation monopoly.

For most commentators on the Cape Town water crisis, the unprecedented drought was difficult to foresee. Moreover, the usual mechanisms in place to manage the recurring droughts in South Africa surely did not pick up the early signs of this historical drought, hence explaining the delay in curtailing irrigation in the agricultural sector. This raises questions regarding the overall predictability of these new drought patterns in a climate change setting in South Africa, while indicating that more responsive and reactive decision forums would be warranted: 'with climate modelling as we know it no longer being a reliable metric on which to predict the availability of water in terms of rainfall, the CoCT has affirmed its dedication to building on the resilience and partnerships that saw Team Cape Town avert Day Zero'.²⁴ In this context, forms of participation including the various stakeholders concerned should be put in place to progressively evaluate each alternative and the related environmental, economic and political issues.

6. Conclusion

By comparing three cases of water supply instruments for drought adaptation in the regions of Western Cape (South Africa), Andalusia (Spain) and Occitanie (France), we showed that the politics of qualifying maladaptation revolve around three core dimensions: the spatial scale to be favoured; the time horizons to be considered; and the relative appreciation of the project within a range of socially defined alternatives.

These uncertainties cannot be resolved with better knowledge alone. Even the most technical activities such as cost predictions, when they are detailed and publicly available, seldom garner consensus. The cost of alternatives in the future is all the more uncertain. Moreover, in all our three cases, we observed processes of path dependency that encouraged supply-oriented solutions, and identified socio-technical and political locks-in that hampered thinking about alternatives.

In practice, maladaptation is assessed only relatively to a range of alternatives. Alternatives can be evaluated with regard to GHG emissions, their economic or political cost and inequalities created. For example, even if we might spontaneously consider the South African case as an emblematic case of maladaptation, some actors, by changing the temporal focus and examining alternatives actually contend that it is the preferable option even in terms of adaptation. For its part, the Aqua Domitia project is emblematic of path dependency in large water infrastructure. Although some cheaper, more territorially balanced, and environmentally friendly alternatives seem to exist, they are routinely dismissed by decision-makers who are part of local and national political networks that sidestep discussions on these possible options. In Spain, the discussions are mainly in the grips of agricultural trade unions, thereby preventing many alternatives from being discussed.

Far from identifying quantitative indicators, we thus recommend paying close attention to the governance arrangements shaping climate decision-making as much as to the specific content of adaptation policies. Based on the three case studies, we showed that a cross-sectoral and more territorial approach governance framework might be a way of avoiding maladaptation and advancing proactive adaptation. We also demonstrated that a mid-term reassessment should be developed to avoid maladaptation and limit the path dependency effects. In addition, substantial administrative and political resources (with its corresponding political risks) are required for articulating the different scales and temporalities of adaptation, so that large watersheds will not be adapted without the recognition of individual specificities. Adaptation to climate change needs to be intensive in terms of administrative input while being ambitious in political terms to ensure its social acceptability.

Finally, while paying attention to the governance framework is of paramount importance, it is also important to bear in mind that for technical subjects such as water, policy alternatives are often not publicly deliberated but tackled in more discreet arenas wherein a minimum level of expertise is necessary to partake in the debate. Sometimes too, policy options expressed in technical terms are constrained by previous policy choices such as the type of crops being grown, the market for which they are produced or even land-use policy choices that tend to be kept out of the discussion. Policy alternatives can also be limited by factors such as the technical capacity required to fully consider options like water re-use in South Africa for instance, the level of decay of existing water treatment plants being a major concern already in the country. Above all, paying attention to an analysis in terms of co-production between water knowledge and society can prove critical as well in a bid to be able to re-examine potential policy alternatives. Works around the Spanish waterscape (Swyngedouw, 1999) or the South African plumbing system (Bourblanc & Blanchon, 2014) have shown how infrastructures building lock in potential solutions on certain pathways. Hence, such a co-production framework helps us understand how policy alternatives get side-lined and how controversies are muted. Unravelling the concealed choices behind water saving technologies is a first step to engage with a more open political debate on (mal)adaptation.

Notes

1. Programa de Desarrollo Rural de Andalucía 2014-2020. Version 6, p. 369.
2. The statements are pooled at this address : https://cpdp.debatpublic.fr/cdpd-aquadomitia/site/DOCUMENTS/CONSULTATION_CAHIER_ACTEURS.HTM (accessed on 25 Jan. 2021).

3. The Compagnie d'Aménagement du Bas-Rhône et du Languedoc or BRL Group is the concessionaire of the large hydraulic network owned by the Occitanie Region.
4. Interview, Secretary General of the *Comunidad de Regantes Los Llanos de Dalias*, 3 April 2020.
5. Interview, WWF Agriculture Coordinator, Spain, 30 March 2020.
6. Documentary of the French TV channel *Public Sénat* 'Attention grands travaux. Canal Philippe Lamour' (27 min.).
7. *Un cadeau public aux agriculteurs qui se trouvent à proximité du tuyau principal* (in French).
8. In France, departments correspond to the administrative scale below regions.
9. This importance attributed to watersheds was probably reinforced by the fact that the Director of the Irrigation and Infrastructure Service of the Andalusian Agriculture Council, who coordinated the drafting of the regulations, was a former Water Commissioner of the Guadalquivir River Basin.
10. Plan, version 6, p. 370.
11. Interview, Director of the Cuevas del Almanzora Community of Irrigators, 15 May 2020.
12. Interview, Expert at the regional office of COAG Andalusia, 16 April 2020.
13. Interview, Secretary General of FERAGUA, 13 May 2020.
14. The self-estimated cost of the project is approximately \$200 million.
15. *Le Cap à sec*, Arte TV documentary, Dorothe Dörholt & Antje Christ, 2019.
16. New Water Programme, CoCT
17. The business case built by The Nature Conservancy NGO points out: "More than R8 billion (US\$540 million) in public funding is being considered for augmenting water supply through investments in deep aquifer drilling, desalination, water reuse and increased surface water storage to meet the required demand." (Nature Conservancy, NatureConservancy-CatchmentRestoration-WaterFund.pdf)
18. Interview Chief-Engineer, Department of Water & Sanitation, June 2018, Pretoria.
19. *Tribunal de Cuentas Europeo* (2014). *La integración de los objetivos de la política del agua de la UE en la PAC: un éxito parcial. Informe especial. Oficina de Publicaciones de la Unión Europea.*
20. Interview, Secretary General of FERAGUA, 13 May 2020.
21. Source: *Cahier d'acteur n°37 : "Ce projet pharaonique est-il bien raisonnable dans le contexte actuel de crise économique dont le coût exorbitant est supporté par un financement essentiellement public ?"*, UFC QC Lunel, available at: https://cpdp.debatpublic.fr/cdpd-aquadomia/site/DOCUMENTS/CONSULTATION_CAHIER_ACTEURS.HTM (accessed on 10/02/21)
22. Once every two years, BRL organizes meetings with all stakeholders, but these meetings, besides being rare, are merely consultative. Decisions regarding the daily life of the project are taken outside of these meetings. As such, these meetings cannot be considered as a governance body.
23. This paragraph was sourced from the project website: <https://www.reseau-hydraulique-regional.fr/fr/linstance-de-concertation>.
24. According to CoCT Executive Mayor, Alderman Dan Plato (Water & Sanitation Africa, Jan.-Feb. 2021)

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