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► **To cite this version:**

J. Guerrin. A floodplain restoration project on the River Rhône (France): analyzing challenges to its implementation. *Regional Environmental Change*, 2015, 15 (3), pp.559-568. 10.1007/s10113-014-0650-8 . hal-01286058

HAL Id: hal-01286058

<https://hal.science/hal-01286058v1>

Submitted on 10 Mar 2016

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A floodplain restoration project on the River Rhône (France). Analyzing challenges to its implementation

Regional Environmental Change, 2014.

Author's manuscript

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Abstract

Floodplain restoration projects are part of sustainable flood management model. However, in practice, they are rarely implemented. We analyze the failure of a floodplain restoration project that was supposed to be implemented on the River Rhône (France). Based on the analysis of floodplain restoration projects implementation literature, we identified several constraints on the implementation of the project. In accordance with the literature, institutional factors were found to have played a critical role in the failure of the project. Other factors such as opposing representations between inhabitants and river managers were also important. Moreover, the strong involvement of the State alongside river managers proved to be a major constraint on implementation.

Keywords

Floodplain restoration, Rhône, Floods, Failure.

Word count : 5798

Introduction

In accordance with current concerns about climate change, European States are reorganizing their flood management policies to incorporate practices that are consistent with sustainable development (Guerrin 2012). At regional and international levels, institutions such as the European Commission (Erdlenbruch et al. 2009), the OECD (2010), the United Nations or the WWF (2004) promote the concept of *sustainable flood management* (Guerrin and Bouleau 2014). In several countries including France (Erdlenbruch et al. 2009), the UK (Werritty 2006; Gardiner 1992), and the Netherlands (Roth and Warner 2009; Warner and van Buuren 2011; Warner et al. 2013; Wiering and Immink 2006), current norms on flood management policies focus on the importance of *managing* floods rather than *defending against* them. Public policies focusing on promoting environmentally sound and integrated measures for managing floods combine the possibility of human activity and risk occurrence (Moss and Monstadt 2008). They promote measures that enable populations to *live with floods* instead of tackling flood risk by heightening dikes. Floodplain restoration projects form part of this approach (Ververk and van Buuren 2013).

When accompanied by the construction of dikes, the development of floodplains for agricultural or housing purposes had hydrological effects (Pigeon 2012; Maltby and Blackwell 2005). Water storage areas used in the case of floods became reduced, accelerating water runoff, and increasing the risk of dike failure (Moss and Monstadt 2008). Floodplain restoration projects have been designed across Europe, especially since the 1990s, with the aim of tackling this issue. Floodplain restoration projects in general refer to “the creation of ecosystems typical of floodplains on low-lying land which exhibit a hydrological link between river and land” (Moss and Monstadt 2008). In practice, floodplain restoration projects consist of facilitating the return of water (in the case of floods) to an area that was flood prone in the past. However, two kinds of floodplain restoration project can be distinguished: i) projects whose primary aim is to recreate or enhance the ecological functions of the floodplain. These kinds of project are labeled ‘environmental restoration’ or ‘ecological restoration’; and ii) projects whose primary aim is to store water by causing the flood to flow to a protected plain, e.g. by reducing existing flood protection infrastructures, such as the dikes located upstream, to allow the expansion and storage of water in the case of flooding. These kinds of project used to be labeled ‘calamity polders’ and ‘emergency storage areas’ in the Netherlands (Roth and Warner 2008) or ‘washlands’ in the UK (Morris 2005). In our case study, we focus on the challenges involved in a project that consisted of restoring a floodplain for hydraulic purposes, called in French ‘restauration de zone d’expansion de crues’ (or ZEC).

The principle behind restoring a floodplain for hydraulic purposes is the idea of transferring flood flows from areas considered to be “highly vulnerable” (such as urban areas) to areas that are considered to be “less vulnerable” (as they are natural land and farmland) (Erdlenbruch et al. 2009). Indeed, this transfer of risk may enable highly vulnerable areas to benefit from protection when natural or agricultural land is used for water storage (usually located upstream from a vulnerable area in order to reduce the water flow). In France, the State is currently reviewing existing flood risk policies on the River Rhône. This is being achieved through a series of projects including one that aimed to lower existing dikes to guarantee more protection for towns located downstream. However, even if floodplain restoration measures are promoted in flood risk literature, in practice they are rarely implemented (Moss and Monstadt 2008).

In this paper, we intend to contribute to understand this low implementation. We examine the challenges to the implementation of a particular floodplain restoration project on the River Rhône. After seven years of negotiations and conflicts between state engineers and riverbank inhabitants, the implementation of the project was abandoned. The aim of this paper is to understand the reasons for this failure. Beyond denouncing the low social acceptance of a challenging environmental policy, we seek deeper causes of failure, which are structural as well as situational, and therefore comparable with failures of other projects in Europe.

This article builds on an in-depth study of flood strategy on the River Rhône that has been implemented since major floods occurred in 2002 and 2003. We analyzed the creation of an institution ("*Plan Rhône*") that provided a new model for flood risk governance at the level of the river. In particular, we focused our analysis on a project designed by the *Plan Rhône* partners to restore a floodplain in the Lower Rhône river basin. We analyzed both the local and national controversies surrounding this project involving inhabitants, elected representatives, the public administration and scientists. In this research context, we collected empirical data from several sources. We conducted 62 semi-structured interviews between 2010 and 2012 with different kinds of actor: *Plan Rhône* participants, central and local State officials and elected representatives, opponents of the floodplain restoration project (inhabitants, associations, local authorities). We reviewed the gray literature produced by *Plan Rhône* (experts' reports, information provided to the public) and other institutions on floods in general and on the River Rhône in particular. We consulted the scientific literature and experts' reports on floods. We analyzed letters exchanged between *Plan Rhône* and public officials and local governments about the floodplain restoration project. We consulted archives on the history of the Lower Rhône and the construction of its infrastructure as well as French historical literature on flood management of the River Rhône. We then conducted a qualitative analysis of this empirical material to propose an interpretation of the failure of the floodplain restoration project.

The paper is organized as follows: In the first section, we review the literature on floodplain restoration policy and the potential driving forces behind, and constraints on, implementation. In section two, we present the case study. In section three we analyze the challenges faced by engineers who supported the floodplain restoration project by comparing the literature and the case study.

1. Identifying the driving forces behind, and constraints on implementation of floodplain restoration projects

In this section we present the scientific literature dealing with the implementation of floodplain restoration projects. We analyzed this literature in order to identify the main driving forces behind the implementation of such projects, and their constraints.

In selecting the literature, we considered floodplain restoration in its broad sense. However, we limited our selection to scientific articles and book chapters dealing with the implementation of floodplain projects in Europe and written in French or in English. We chose articles that tackled social and political aspects of project implementation (i.e. we did not focus on technical aspects). We selected documents using the snowballing method starting with core articles and using the list of references to identify others. We stopped our search when the information we were finding in the articles appeared to be covered by those we had already read. We finally selected 14 articles. The small number of articles is due to our strict selection criteria.

The literature analysis revealed five categories of driving forces behind, and constraints on the implementation of floodplain restoration projects: institutions, participation, science and policy, socio-physical features, and economics. The results of this analysis are summarized in table 1.

2. Floodplain restoration, from Europe to the Rhône

The River Rhône has been considerably modified throughout history. After major floods in 1856 the Emperor Napoleon III constructed large dikes along the delta (Picon et al. 2006). More recently, after World War II, the government undertook an extensive river taming project with the aim of promoting river transport and generating hydraulic power (Pritchard 2004). The public National Rhône Company CNR (*Compagnie Nationale du Rhône*), partly privatized in 2001, was dedicated to the development of the River Rhône. It received specific missions of public interest: developing navigation, hydroelectric power and irrigation systems in the Rhône river basin (Giandou 1999). The CNR undertook major works on the river and constructed several dams and levees (Pritchard 2011). Later nuclear power plants were built on the banks of the newly channeled river. These works deeply changed the river landscape, and influenced its hydraulic regime (Pritchard 2011), but the inhabitants only noticed many years after the works were completed.

Between the 1950s and the 1990s, no major flood event occurred on the Rhône (Picon et al. 2006). Based on these forty years, one could have concluded that the CNR works had a beneficial impact in terms of flood protection. However, following the first major flood event in 1993, floods found their way back onto the political agenda. In fact, CNR infrastructures, including levees, were not intended to protect riverbank inhabitants from floods but to channel the river for hydropower and navigation purposes. Where hydropower plants were built, houses located behind the levees were protected *de facto* against 1000-year flood events. But other houses, located in areas that were not concerned by hydroelectric power, were subject to intense flooding events.

Since the 1990s, several dramatic floods have occurred on the Rhône: in 1993, 1994, 2002, and 2003. Hundreds of houses were impacted by the Rhône and its tributaries and sometimes even lives were lost. This troubled period obliged the State to take measures. In 2003, a major study on the Rhône floods was released in an attempt to understand the river basin system and make proposals for policies (Territoire Rhône 2003). In 2004, the Prime Minister asked the Prefect (the State's representative in the Rhône-Alpes Region whose responsibility covers the whole Rhone river basin) to design a new flood management strategy for the River Rhône. In collaboration with the Prefect, State representatives, and the elected presidents of the administrative Regions, a contract called "*Plan Rhône*" was drawn up. This contract, which concerns the period 2007 to 2013, financially linked the French State, the European Union, the CNR and the main towns concerned as well as the Regions bordering the Rhône in order to address flood issues at the level of the river basin. This contract entailed a multilevel and multi-sector policy on the scale of the River Rhône. Indeed, *Plan Rhône* combined policies concerned with flood management but also with tourism, culture, energy, water quality and transport.

One of the main aims of *Plan Rhône* was to produce a new strategy for flood management. Part of this plan, namely the flood theme, was piloted by a team called "*Mission Rhône*" comprised of State engineers. *Mission Rhône* is part of the Ministry of the Environment's decentralized regional services (called the Regional Direction of the Environment, Planning and Housing or DREAL). Between 2005 and 2013, *Mission Rhône* engineers proposed and started to implement a flood management strategy. To that end, *Mission Rhône* separated the river into three geographical entities: Upper Rhône, Middle Rhône and Lower Rhône (Figure 1). For each sector,

public consultations took place and a local strategy was created. Here we focus on the strategy designed for the Lower Rhône, that included floodplain restoration projects.

Figure 1: Map of Plan Rhône territory. It represents the River Rhône, the administrative Regions surrounding the River (Plan Rhône partners), the sub-basin areas (Upper, Middle and Lower Rhône) as well as the area concerned with the floodplain restoration project.

The strategy proposed by *Mission Rhône* for the Lower Rhône followed a particular rationale. It aimed to address the risk of dike failure (which had happened in the Rhône delta in 1993, 1994 and 2003) by modifying the distribution of risk they considered unequal. Some plains were frequently flooded whereas others were protected behind CNR dikes. What is more, several towns of high economic and demographic importance located downstream were deemed overly vulnerable, and under too much water pressure in the event of flooding. The strategy consisted of several actions aimed at “controlling the overflow” (DREAL Rhône Alpes 2009; Territoire Rhône 2003) in the case of flooding through a *Floodplains Optimization program*. This program was planning on one hand, to improve flood protection of certain rural floodplains subject to frequent flooding (on average once every ten years, highlighted in blue in Figure 1), and on the other hand, to increase the water storage capacity in two floodplains by lowering existing flood-defense infrastructure (highlighted in red in Figure 1). The larger is a 1,300 ha plain located behind a major CNR dike and therefore protected against Rhône floods up to 1,000 year return period. Land use is agricultural plus residential areas (40 farms and homesteads as well as residential houses) (BRL Ingénierie 2008). This project also provided for the reinforcement of dikes around the Rhone river delta and around major towns. This program was justified by the need to improve solidarity among the sections of the river, between upstream and downstream inhabitants, as well as between the two banks (DREAL Rhône Alpes 2009).

The floodplain restoration project met with the disapproval of local representatives. In 2012, after seven years of public consultation, negotiation, and production of experts’ reports, the floodplain restoration project was abandoned. Was this failure due to local resistance or to other constraints? In the next section we compare the driving forces cited in the literature and failures of project implementation with our case study.

3. Constraints on the implementation of the floodplain restoration project on the Rhône

Institutions

The floodplain restoration project was led by a young institution (*Plan Rhône*) that lacked power and legitimacy. *Plan Rhône* was created in 2007 to design a new flood management strategy. It brought together actors who previously had conflicting relationships and opposing interests, in particular the Regions, the State, and the CNR (Bethemont 1997). The team supporting the project, *Mission Rhône*, had no power to decide whether to raise or to lower a dike (since this is subject to State regulation and concerned the CNR). Therefore it was obliged to negotiate with the CNR and local authorities. The CNR and *Mission Rhône* had conflicting priorities: electricity production versus flood management. *Mission Rhône* had limited power to negotiate with the local inhabitants since neither urban planning nor property rights issues fell within its authority. Moreover, it was not responsible

for project implementation nor could it pay financial compensation to the local stakeholders. *Mission Rhône* could only encourage local authorities to implement the project and negotiate compensation between territories at the local level.

This absence of leadership was combined with little support from local stakeholders, local authorities, the central State and the CNR. In particular, the representatives of the two local municipalities of the floodplain supposed to be restored were concerned with the project's impact on economic development of the area. The two mayors raised concerns about the impact of floods on farms and houses. They firmly opposed the project's implementation. Although they belonged to opposing political parties (right-wing and left-wing), they joined forces to oppose the project. This union was illustrated by newspaper articles entitled "The Rhône battle" or "A mayoral coalition against *Plan Rhône*", picturing the two mayors standing side by side next to the river (*Dauphiné Libéré*, June 12, 2008). In addition, together they hired the services of a hydrologist and an urban-planner to produce a counter evaluation.

As well as meeting opposition from the local municipalities, the project also raised concerns among inhabitants and elected representatives of other floodplains. Associations, inhabitants and representatives expressed their fears concerning the consequences of future Rhône floods at public meetings. The Lower Rhône flood management strategy revealed that the flood-prone character of rural floodplains was beneficial for urban areas. As a result, inhabitants raised concerns about insurance cover, arguing that flooding triggered by human activities might not be covered by insurance policies, since it was not comparable to a natural flood. Inhabitants of several floodplains along the Lower Rhone felt concerned by the situation of the floodplain intended for restoration. They grouped together, along with flood victim associations, to claim for the recognition of a special status for inhabitants living in areas allowing for flood expansion. This claim was later endorsed by elected representatives at the regional and departmental levels. In 2005 and in 2010 a group of deputies presented two legislative proposals before the French National Assembly to grant particular benefits to inhabitants in "flood expansion" areas, in particular through tax exemption (Law proposal N° 2739 (2005) and Law proposal N° 2596 (2010): « visant à accorder un statut particulier aux communes et aux administrés situés dans les champs d'expansion de crues »).

However, these claims were refused by the Ministry of the Environment. A letter from the Ministry to a Deputy (April 24, 2007) stated that the Rhône River floodplains called "ZECs" were "naturally" flood prone, and as such, were not eligible for compensation since the dikes did not worsen their flood character in comparison to a *natural* situation. In 2010, a meeting was organized between elected representatives from the Lower Rhône and the Office director of the Ministry of the Environment in which the latter declared that granting a particular status to all the ZECs would be excessive since, in general, floodplains were naturally flood prone (from the minutes of this meeting, June 17, 2010). Granting a particular status to the inhabitants of restored floodplains could have facilitated local acceptance of the floodplain restoration project, as a local newspaper pointed out: "Rhône. Flooding, okay, but only with a particular status" (*Midi Libre*, June 19, 2010).

In addition, only limited support for the project came from the water institution, the CNR. Restoring the floodplain meant modifying a CNR dike by lowering it. Since the flood events in the 1990s, the CNR had been constantly accused by flood victims' associations and inhabitants of being responsible for the floods. Even though such responsibility has never been acknowledged by experts (Picon et al. 2006), the CNR position

regarding flood management was not proactive, but rather defensive. Since flood management is not part of its mandate, the company was not particularly willing to modify its dikes not only for financial reasons but also because of the political stakes involved.

In addition, little support came from the central government. As part of the Ministry of the Environment regional office, *Mission Rhone* depends on decisions made by the central government. In 2009, the Ministry expressed doubts about the feasibility of the project, in particular from the result of an expert evaluation made by Central State engineers criticizing the feasibility of the floodplain restoration project (Creuchet et al. 2009). *Mission Rhône* conducted many feasibility studies for the floodplain restoration project but had no power of decision regarding its implementation. Even if *Mission Rhône* was in favor of its implementation, as civil servants and State administrators, they did not have the right to implement the project as commissioners. Local authorities (an association of towns, or Departments) could have been commissioners but they did not wish to take responsibility for the project. Just before the decision to abandon the project was made public (in 2012), the last chance the project had of being implemented depended on the drawing up of a new law enabling the State either to take responsibility for the project or to oblige actors such as the CNR to take over project implementation. The Ministry did not choose this regulatory path and the project was officially abandoned in 2012 (a letter from the Prefect, dated 17th April 2012, announced the decision by the *Plan Rhône* partners to abandon the floodplain restoration project).

Plan Rhône was defined at the level of the river but was led by the State. In the discourses of local representatives as well as inhabitants, the State did not have the legitimacy to organize implementation of a floodplain restoration project. Moreover *Plan Rhône* and *Mission Rhône* were young institutions with no proven record of expertise. However the case of the Rhône is particular in the sense that a major part of the river is managed by the CNR, as the company is in charge of hydropower production but also deals with channels and dikes. The CNR had an interest in following a path of dependency. No formal association at the level of the river links local authorities or municipalities together (Pigeon 2012). This kind of association could have enabled a real decentralized flood policy at the level of the river and overcome local opposition. Such an institution existed on the River Rhone but was never recognized officially by the State. The State did not leave room for truly decentralized flood management.

Participation

On the Rhône, the participation of local representatives and inhabitants was organized through consultation committees. However, the extent of participation was limited. This participatory approach was introduced quite early in the process, but the idea of restoring a floodplain came from an expert evaluation that was commissioned by the State before the participation committees started (Territoire Rhône 2003). Sites had already been selected when local representatives learned about the project. The committees were organized by the institution in charge of the project implementation: *Mission Rhône* itself. In the participation committees, experts and representatives who supported the project presented their ideas to the public who generally raised concerns. Experts gave usually technical answers aimed at convincing the public of the project's advantages. But views and values regarding the project were also conflicting. Inhabitants and local representatives denounced power and territorial inequities (urban and downstream interests over rural upstream interests), and the responsibility of the State and the CNR

regarding the last floods. But this kind of participation was not considered to be constructive or legitimate by *Mission Rhône*.

The organizers were not obliged to take public participation into account since the assembly had no decision-making power. Moreover since 'the public' represented a broad, heterogeneous audience, it was difficult to consider that it carried a clear message and unified interests. In practice, inputs from the public did not help build the project design.

What is more, the two mayors concerned by the floodplain restoration project proposed an alternative project, which consisted of creating several water storage tanks in many plains along the Lower Rhône, in order to distribute the burden of water storage among more municipalities. The idea was to turn the *calamity* polders, which were considered to be 'passive', into 'active' polders. However, according to *Mission Rhône* engineers, this project was not feasible since it would not deliver sufficient storage capacity.

A real communication strategy was developed by *Mission Rhône*. A full-time post in *Mission Rhône* is dedicated to communication. Before each public committee meeting, invitations and summaries of previous meetings were sent to the participants. Workshops and conferences were organized by *Plan Rhône* about several of their projects. However regarding the negotiations about the floodplain restoration project, nothing really constructive was achieved. *Mission Rhône* engineers did not have enough power to respond to the stakeholders' demands. In addition, they tried to educate the inhabitants and political representatives rather than to construct a shared view of the project. They did not incorporate public inputs in the project; they were not powerful enough to negotiate with the local representatives, and their decision-making process was not sufficiently transparent.

Science and Policy

In this project, few links were created between science and policy. Expert evaluation was produced by research consultancy and studies were commissioned and coordinated by *Mission Rhône*. The results were presented in consultative meetings but there was a knowledge gap between the experts and the public. No particular social science expert evaluation was commissioned in order to include social and political issues in the project design. *Mission Rhône* did regularly consult a "scientific committee", however this was mainly limited to technical issues, and did not grant the committee decision support.

Scientific uncertainty was high regarding the water storage capacity of the floodplain as well as the potential water level in the plain in the case of floods. This uncertainty about the behavior of water flow, along with the uncertainty about the impact of the project on downstream water levels, contributed to the prevention of support among local stakeholders.

The reason used to justify the restoration of the floodplain was primarily hydrological. However, detailed hydrological studies concluded that this narrative was questionable. Indeed, the rationale of the Lower Rhône flood management strategy was constructed on a study that included the whole Rhône (Territoire Rhône 2003). In this study, the principle of restoring a floodplain was considered to have potentially positive hydrological effects on downstream plains and towns. However, later, more detailed studies revealed that the water storage capacity was not as high as planned. A micro-scale study revealed that, due to the slope of the land and the existence of an urban neighborhood, the floodplain could store less water than originally envisaged (BRL Ingénierie 2008). Indeed, one of the first scenarios planned to achieve a water storage capacity of 67 million cubic meters (under 3.75 meters of water) in the case of an 'generalized exceptional flood' (greater than the 400-

year flood) on the whole river and its tributaries (DREAL Rhône Alpes et CNR 2010). This 3.75 meter water level was considered to be socially and politically unacceptable by the central State engineers. To reduce the impact of the flood, the following scenario reduced water storage capacity to 32 million cubic meters (under 2.2 meters of water). For this kind of flood, the decrease in the water level downstream would be 10 to 15 centimeters, whereas with the previous scenario it was 20 to 25 cm (DREAL Rhône Alpes et CNR 2010).

Although the hydraulic benefits were limited, interviews with the *Mission Rhône* engineers revealed that the floodplain restoration project was advantageous for other reasons. Indeed, the flood management activities of Plan Rhône were partially funded by the European Union through the European Regional Development Funds (ERDF), which could be used for flood prevention but only under certain conditions: to implement measures consistent with the approach of the European Directive, i.e. environment-friendly measures and not dike heightening. Moreover, an existing water planning document on the Rhône prevented the construction of dikes when no hydraulic compensation was planned to store the extra water (SDAGE 2010-2015). As such, the floodplain restoration project was a necessary condition to allow the heightening of dikes on the River Rhône.

Socio-physical features

Another problem with project implementation was defining a *natural* flood. Restoring the flood-prone character of a plain implies referring to a time when the plain used to be flood prone. In the Lower Rhône flood management strategy, the reference used for floodplains to be restored is the “ZEC”. *Plan Rhône* participated in the publication of a book in which the ZEC concept is defined thus:

“A ZEC (...) is a floodplain subjected to **natural** floods. This expression is used to designate ‘areas with little or no urbanization and development, where a flood can store a large amount of water, such as natural areas, farmlands, urban and peripheral green areas, sports fields, car parks” (Bravard, J.-P. and A. Clémens, Eds. (2008). *Le Rhône en 100 Questions*. Lyon, GRAIE).

Behind this acronym are entangled ideas about the naturalness of a risk as well as the utility of a flood, expressed by the idea that a ZEC is supposed to be undeveloped and is useful to store water in the case of flood.

Several rural areas were identified as ZECs on the Lower Rhône by the hydrological study (Territoire Rhône 2003). This study reported that the CNR constructed 150 km of dikes on the Rhône banks (or 35% of its course), transforming 120 km² of floodplains into flood protected areas, which represented 18% of the land that was impacted by the 1856 flood. The study underlined the artificial nature of flooding due to the CNR hydraulic infrastructure, and distinguished between the current flood-prone areas, called “*natural flood expansion fields*” and the former floodplains now protected by CNR dikes. However, under the Lower Rhône river flood management strategy, even the former floodplains were labeled ZECs.

Designating former floodplains as ZECs actually refers to natural flooding. However, the Rhône hydrological regime was modified by CNR works. The term ZEC today designates plains that are considered to be flood prone based on the modeling of a past event in a currently urbanized context. This fuzzy definition of a ZEC led to discontent among the inhabitants of those areas. Some inhabitants realized that their area’s flood-prone character was useful to downstream towns, and consequently claimed compensation or at least the recognition of a particular status. Others (who lived in the floodplain that was supposed to be restored) discovered that after fifty years of being protected they might again become flood prone. Given the urban development that has

occurred in the last fifty years in rural areas, as well as changes in agricultural practices, restoring flooding in the territory led to a considerable degree of local discontent.

Economics

The floodplain restoration project was not a “low-cost project”. The cost of the works to allow the restoration of the floodplain was estimated at 10.4 million Euros, not including the cost of the downstream floodplains whose protection was supposed to be enhanced. In total, the cost of the project was estimated at 54 million Euros (Egeo Solutions and Ledoux 2011).

Locally, no economic incentive was available to local stakeholders. No direct financial compensation was proposed to the inhabitants of the plain for the water storage its restoration would allow. This was because of the idea that the Rhône floodplain is *naturally* flood prone. Indeed, the law does not permit the payment of compensation to inhabitants for reducing flood protection but only for an increase in flood risk. Since Rhône floodplains were considered naturally flood prone, the floodplain restoration project was still improving the situation in comparison with a no-dike situation. As such, State officials were not allowed to pay compensation. Such financial incentives could have been funded by downstream plains that were supposed to benefit from the project. However, the downstream plains did not consider the potential benefit high enough to take responsibility for implementing the project and organizing compensation locally. This is also explained by the scientific uncertainties surrounding the project findings that were expressed in public meetings. *Mission Rhône* had no power to suggest purchasing the land belonging to farmers and inhabitants or to pay them direct financial compensation. Farmers were consequently not economically motivated to accept a project that as far as they were concerned, above all represented constraints. *Mission Rhône* was proposing to let the flood enter a plain where land was particularly good for growing crops, where houses were built and where life had developed behind large dykes for 40 years, with no financial compensation in return. Farmers -more than anyone else- recall the times when the plain used to be flood prone. They believe that farming techniques and life style have changed too much for agriculture to be adapted to flooding.

Conclusion

Restoring a floodplain of a modified and channeled river such as the Rhône proved to be a challenge. The project we analyzed came up against a number of difficulties and was finally abandoned. To understand the reasons for this failure, the indicators identified in the literature proved to be particularly accurate. However, some could be added to the list. The literature recognizes that above all institutional factors explain the failure or success of floodplain restoration projects. On the Rhône, the leading institution in charge of the project implementation was created at the river-basin level, supposed to be the right scale to tackle ‘wicked problems’ such as flood risk (Varone et al. 2013). However, this institution was not legitimate and sufficiently powerful support the project. Moreover, it impeded local elected representatives from organizing and taking over the implementation process. The lack of legislative flexibility impeded negotiation with the inhabitants who claimed their special status should be recognized. The artificial character of a flood provoked by a floodplain restoration project created insecurity among the inhabitants who feared losing insurance cover. Regarding participation, the project did not empower local actors sufficiently to reinforce the legitimacy of the leading institution and to enable local support. The fact that the participative committees were organized by the institution in charge of the project implementation was not adequate. As regards science and policy indicators, the project suffered from hydraulic

uncertainty that provoked concerns among the local actors, largely because the interactions between state engineers and local actors were mainly technical. Other institutional reasons lay behind the reasons for restoring the floodplain, but hidden by hydraulic narratives that suffered from scientific uncertainty. The proponents of the floodplain restoration project committed to its implementation before carrying out detailed studies. We did not observe opposing representations regarding restoration between local actors and *Mission Rhône* engineers, but rather, opposing representations about the objectives to be pursued: the engineers gave greater importance to flood-risk sharing whereas local actors gave greater importance to keeping their flood security standards. Another difference of standpoint concerned local actors' view of the correct reference to use when considering the flood-prone character of a plain: proponents of the project, along with the central administration, considered the time when the plain was not protected by dikes, whereas the local actors took as a reference the 'protected' situation. No social science study had been carried out at the design stage of the project to identify those differences of standpoint. Physical and sociological features identified in the literature did not play a large role in the project failure, except the fact that the floodplain intended for restoration had in the past benefited from a high flood defense strategy that proved, indeed, difficult to challenge. Regarding the economic indicators, what played a role in the failure of the project was the absence of compensation funds granted to the local actors. This is linked to what the law considers to be a *natural flood*, and is another illustration of opposing terms of reference between project proponents and local actors. Maybe those conflicting representations could have been identified, and tackled, through a sociological study.

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Table 1: Potential constraints on and driving forces behind implementation of floodplain restoration projects according to the literature

<i>Potential driving forces for implementation</i>	<i>Potential constraints on implementation</i>
Institutional	
Strong, legitimate, large, well-funded lead organization, with clear remits and proven ability to work with other stakeholders and with charismatic individuals (Adams et al. 2005)	Small or young lead organization with lack of secure core funding, no proven track record in project management or substantial planning capacity, weak leadership (Adams et al. 2005)
Institutional structure appropriate for the multiple objectives of floodplain restoration (Hodge and McNally 2000), concerning not only water but also property right issues (Roth and Winnubst 2009) Small number of partners (Adams et al. 2005)	Issues of coordination between sector-based public agencies and between administrative levels ; conflicting priorities between partners (Turner et al. 2000; Adams et al. 2005; Moss and Monstadt 2008; Adams and Perrow 1999);
Support from and/or partnership with NGOs and local associations (Adams et al. 2005; Pedroli et al. 2002)	Design not led by grassroots local needs (Adams et al. 2005)
Local communities value the environment (Adams et al. 2005) Water institutions that participate in the implementation are friendly to environmental issues (Hodge and McNally 2000)	Local communities value flood defense goals over environmental concerns (Adams et al. 2005; Moss and Monstadt 2008; van der Werff 2004). Restoration interests opposed to flood defense goals of planning organizations ; inertia of the traditional flood defense and river regulation regimes (Adams et al. 2005; Moss and Monstadt 2008) Policy and planning controls unable to limit urbanization of floodplains (Moss and Monstadt 2008)
Participation	
Participation organized at an early stage of the implementation process (Eden and Tunstall 2006), active (Maltby 1991), including all stakeholders (Morris 2005), enabling open discussion of a range of views and values (Warner 2010).	Implementation models that develop a ‘deficit model’ of public understanding (i.e. technocratic environmental management, top-down approaches, expertise monopolized by the scientific community and policymakers) are more likely to fail (Eden and Tunstall 2006; Roth and Warner 2007; Adams et al. 2005; Roth and Winnubst 2009)
Identification of local people's aspirations and priorities for a river site and incorporate them in the design of the project (Eden and Tunstall 2006) Consider alternatives to the project proposed by local actors (Warner 2010)	Mismatch between the expectations of restoration and policy workers and those of their local publics (Eden and Tunstall 2006) Concerned population learns about the project plans when the sites have already been selected (Roth and Warner 2007) No link between participation and decision-making (Warner 2010)
Negotiation skills of river managers (Adams et al. 2005; Roth and Warner 2007; Maltby 1991). Education programs, management training within water management institutions (Maltby 1991) Identify the needs and aspirations of local inhabitants and link the restoration project to their interests, in particular regarding flood risk concerns (Adams et al. 2005; Nedelcu et al. 2007; Eden and Tunstall 2006).	Top-down management style (Roth and Winnubst 2009) Landowners’ concerns with flood safety and flood risk (Eden and Tunstall 2006)

Science and Policy	
Incorporating social science at the design stage of the project (Eden and Tunstall 2006; Brouwer and van Ek 2004; Turner et al. 2000)	Failing to consider the sociopolitical issues at play can exacerbate conflicts (Eden and Tunstall 2006).
Making complex issues comprehensible to stakeholders (Adams et al. 2005) Shared vision of flood storage objectives (Moss and Monstadt 2008)	Scientific uncertainties, e.g. behavior of flood waters (Adams and Perrow 1999; Turner et al. 2000). Opposing representations of restoration that can lead to misunderstandings and conflicting interests (Eden and Tunstall 2006; Adams and Perrow 1999; Morris 2005).
Socio-physical features	
Small sites and limited number of stakeholders (Adams et al. 2005; Roth and Winnubst 2009) ; Flexibility of property rights (Roth and Winnubst 2009)	Fragmented holdings ; large-scale projects (Adams et al. 2005)
Relatively stable lowland rivers (Adams et al. 2005)	Bank erosion and unplanned hydraulic effects (Adams et al. 2005) ; High uncertainties about effects of restoration (Eden and Tunstall 2006)
Land already managed for wildlife (Adams et al. 2005)	River that was previously the subject of flood defense strategy (Adams et al. 2005; Moss and Monstadt 2008)
Economics	
'Low-cost' projects (Adams et al. 2005; Pedroli et al. 2002) Funds available to support restoration (Adams et al. 2005), targeting landholders (Hodge and McNally 2000)	No funding dedicated to restoration (Eden and Tunstall 2006)
Land where the profitability of agriculture or soil quality is already declining (Adams et al. 2005)	High economic value, arable or built-up land (Roth and Winnubst 2009; Moss and Monstadt 2008; Adams et al. 2005).
Flexible and negotiable compensation or agreements offered to farmers, fitting a maximum of individual situations (Hodge and McNally 2000; Roth and Winnubst 2009; Pedroli et al. 2002).	Adverse economic incentives for farmers and landowners to land use change (Moss and Monstadt 2008)